ANTIBODIES AGAINST SARS-COV-2 AND USES THEREOF

FIELD OF THE INVENTION

The present invention relates to antibodies that bind the spike protein (S) of Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) the strain of coronavirus that causes pandemic coronavirus infectious disease 2019 (COVID-19), and their use in diagnosis, prevention and treatment of SARS-CoV-2 related diseases, particularly COVID-19.

BACKGROUND

The new pandemic coronavirus, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) emerged into humans in China sometime between October to November 2019, and the disease Coronavirus Infectious Disease-2019 (COVID-19) was identified in China in December 2019. SARS-CoV-2 causes COVID-19 in humans. Although an asymptomatic or mild infection in many people, the virus can cause severe respiratory disease and death in a significant number of people, especially in the elderly and in those with underlying co-morbidities. Initial recognition of a new human pneumonia, negative for all known human respiratory pathogens, occurred by recognition of related symptoms in hospitals in Wuhan, China, together with a common epidemiological link to a 'wet market' in Wuhan. Rapid identification of a new coronavirus genome, and the development of specific and sensitive virus detection diagnostics lead to the recognition of the explosive spread of the virus in Wuhan, followed by other regions of China and surrounding neighbouring countries.

As of 2 September 2020, SARS-CoV-2 has spread throughout the world infecting an estimated ~25 million people, resulting in 861,000 deaths, yielding a nominal infection fatality rate (IFR) of ~3%. This number is likely an overestimate, due to hidden, asymptomatic or mild, and non-diagnosed cases. Although the true infection fatality rate is difficult to calculate, current estimates range from 0.1-1%.

COVID-19 can be a mild to moderate self-limiting disease in about 80% of infected people. These people experience symptoms of fever, myalgia, dry persistent cough and shortness of breath. This disease course is usually complete in 7-10 days, but recovery to full health may take longer. However, in ~20% of cases, a more aggressive and severe disease occurs, either with rapid progression from symptom onset or a rapid decline from the initial 7-10 days of moderate infection when recovery was apparently beginning. Such serious disease is associated with lymphopenia, elevated troponin and D-dimer levels in the blood and both consolidated or diffuse bilateral (both lungs) 'ground glass' pneumonia. Many of these cases require breathing support and ~20-25% of the serious cases become critically ill. The IFR for critical patients is historically ~40%-50%, consistent with the overall IFR of 1-2 people per 100 diagnosed as infected. Recently, the long-term consequences of infection by SARS-CoV-2 are becoming apparent, so-called Long-COVID, characterised by recurring symptoms experienced by patients, regardless of whether they

were hospitalised, affecting the respiratory system, the brain, cardiovascular system and heart, the kidneys, the gut, the liver, and the skin. The symptoms can range in intensity and duration and are estimated to affect 10-15% of people recovered from their initial infection.

SARS-CoV-2 is a beta coronavirus, closely related to the 2002 SARS-CoV. SARS-CoV of 2002 infected 8,098 people causing 774 deaths (IFR 9.5%). SARS-CoV has not been seen since 2004 and was controlled by aggressive infection control measures and quarantining.

The more distantly related beta coronavirus Middle East Respiratory Syndrome coronavirus (MERS-CoV), emerged in Saudi Arabia in 2012. Infections with MERS-CoV continue to occur in the Middle East, as a result of ongoing zoonotic (animal to human) infection from camels, the reservoir animal species, to humans. MERS-CoV as an IRF of 35% and since April 2012, more than 2,400 cases of Middle East respiratory syndrome coronavirus (MERS-CoV) have been detected in 27 countries.

SARS-CoV-2, SARS-CoV and MERS-CoV represent epidemic/pandemic coronavirus. However, four endemic coronaviruses (NL63, 229E, OC43 and HKU1) also infect humans in childhood and throughout adult life, causing mild upper respiratory tract infections but occasionally causing severe life-threatening disease. Current opinion suggests SARS-CoV-2 is on the path to becoming the 5th seasonal endemic human coronavirus.

The major components of the SARS-CoV-2 virus particle are its externally-oriented spike protein and its virus RNA genome which is wrapped in nucleocapsid proteins. The spike protein is a trimeric virus protein embedded in the lipid membrane of the virus particle. Viral infection is initiated when the spike protein binds to the cellular Angiotensin Converting Enzyme 2 (ACE2) receptor resulting in internalisation of the virus into the cell. The most likely path for the viruses into the cell is via receptor mediated cellular uptake into the endosomal pathway of the cell, where the virus encounters an activating cellular protease (cathepsin). This cell enzyme proteolytically cleaves the spike triggering a membrane fusion event between the virus lipid envelope and the lipid shell of the endosome, resulting in the entry of the virus genome into the cell cytoplasm. Once in the cell cytoplasm, the virus begins the process of making multiple new copies of its genome, whilst simultaneously making new copies of virus proteins. These new proteins and genomes assemble into virus particles where they bud into a structure of the cell called the endoplasmic reticulum, which pinches off into small vesicles for transport to the cell surface where new virus particles are released to the outside of the infected cell. These new virus particles are then free to infect more cells. In addition, the presence of TMPRSS2 on the cell surface can proteolytically cleave the spike after ACE-2 binding triggering a membrane fusion at the plasma membrane.

The virus life cycle provides points of chemotherapeutic intervention. Currently the only directly acting antiviral (DAA) is remdesivir (Gilead), an adenosine nucleotide analogue which inhibits the virus RNA

dependent RNA polymerase, the enzyme that replicates the virus genome. The clinical utility of remdesivir is not clear and experience with antiviral drugs to other respiratory pathogens such as influenza A virus and respiratory syncytial virus (RSV), suggest that drugs like remdesivir have restricted use, being optimal in efficacy if taken very early in infection. This is almost impossible to achieve in practice with SARS-CoV-2 as the person is not symptomatic at the time of infection when this drug will have greatest impact. Therefore, potentially remdesivir's activity profile will prove to be similar to the influenza A drugs, oseltamivir and zanamivir, where their effect on severe disease is limited, and the chemoprophylaxis of case contacts is limited without mass deployment into people's homes, something unlikely to happen with a new drug like remdesivir, with a limited safety profile. Other small molecule antiviral drugs are expected to emerge as research proceeds. In particular, the virus protease is an attractive target. However, such inhibitors are all likely to suffer from a restricted optimal efficacy window, which in most case occurs before or at the time of symptom onset.

Clinical management of serious disease is the subject of ongoing and planned clinical trials, which have already shown a number of failures and one success. For example, hydroxychloroquine, an anti-malarial drug similar to chloroquine, has failed to show clinical effect in a number of clinical trials. In addition, the anti-IL6 receptor antibody tocilizumab (Genentech), used for the treatment of cytokine release syndrome (CRS) and of sarilumab (anti-IL6 receptor antibody, Regeneron) have failed to show clinical efficacy. However, dexamethasone, a steroidal anti-inflammatory drug has shown clinical efficacy in treating severe COVID-19.

Changes in the critical care of patients will also have effects, either through the scaling of access to ventilators (surge capacity) or the provision of continuous positive airway pressure (CPAP) as a form of respiratory support. CPAP is reported to have a positive clinical effect on the ability of people to survive severe COVID-19 without the need for full ventilation. Further, the proning of ventilated patients improves the clinical course of disease.

The normal course of an infectious disease process is:

1. Infection,
2. Virus replication in the body with the innate immune response providing the system that non-specifically attempts to limit early uncontrolled replication,
3. Initiation of the adaptive immune response that drives within the body the production of B cells and T cells specific to the new virus infection,
4. Virus specific B cells expand in the body and secrete antibodies, their effector molecules.
5. Virus specific T cells expand in the body to kill infected cells,

Infection by SARS-CoV-2 results in an adaptive immune response, with induction of antibodies and T cells which specifically bind virus proteins. The adaptive immune system begins to have a meaningful effect on

controlling the infection within about 7-10 days from the point of virus replication in the body, reaching its peak activity around 10-14 days.

Spike protein

The spike protein is a trimer of three monomers. Each monomer is about 180 kDa, and contains two subunits, S1 and S2, mediating attachment and membrane fusion, respectively. The N- and C- terminal portions of S1 fold as independent domains, the N-terminal domain (NTD), the receptor binding domain (RBD) and the C-terminal domain (C-domain) which associates with the S2 subunit. Figure 1 depicts a single monomer of the trimeric spike protein. The monomer is translated as a single polypeptide which is proteolytically cleaved into the subunits S1 and S2 which non-covalently associate. The amino acid sequence of the wild-type SARS-CoV-2 spike protein is provided in Figure 2A and the amino acid sequence of the SARS-CoV-2 spike protein containing double proline (PP) mutations (K986 and V987) (as compared to wild-type) is provided in Figure 2B.

Coronavirus S proteins are typical class I viral fusion proteins, and protease cleavage is required for activation of the fusion potential of the S protein. In a two-step sequential protease cleavage model, as is thought to occur for SARS-CoV-2, a priming cleavage occurs between S1 and S2 and activating cleavage occurs at the S2' cleavage site. Further the RBD of each trimer is dynamic, existing in either an 'UP' or 'DOWN' configuration. The UP state is required for ACE2 receptor binding. Therefore, a trimeric spike can exist with all 3 RBD DOWN, 2 DOWN and 1 UP, 1 DOWN and 2 UP or all 3 RBDs UP. Each RBD in the trimer is able to bind ACE2 in its UP state and initiate infection.

SUMMARY OF THE INVENTION

We have discovered monoclonal antibodies that bind the spike protein of SARS-CoV-2 and have properties suitable for development as medicaments for treating or preventing viral infection. Monoclonal antibodies of the invention demonstrate a combination of advantageous properties, including binding location on the spike protein of SARS-CoV-2, binding affinity to the spike protein of SARS-CoV-2 and/ or potency of neutralisation of SARS-CoV-2. We demonstrate herein that exemplary antibodies neutralise SARS-CoV-2, particularly in vitro in pseudovirus assays and/ or in live virus assays. Neutralising antibodies described herein, i.e. antibodies that neutralise SARS-CoV-2, will generally be understood to inhibit or prevent SARS-CoV-2 entering cells expressing the ACE2 receptor, e.g. lung epithelial cells. Antibodies might neutralise SARS-CoV-2 e.g. by competing with ACE2 for binding to SARS-CoV-2.

We further demonstrate herein that exemplary antibodies neutralise SARS-CoV-2 and specifically bind to the receptor binding domain (RBD) of the S1 subunit of SARS-CoV-2. Such antibodies may or may not

compete with ACE2 for binding to SARS-CoV-2 and thus may or may not directly inhibit binding of SARS-CoV-2 to its receptor ACE2.

We further demonstrate herein that exemplary antibodies preferentially bind to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, S1 subunit and S2 subunit of the SARS-CoV-2 spike protein. Such antibodies generally do not compete with ACE2 for binding to SARS-CoV-2.

We further demonstrate herein that exemplary antibodies neutralise SARS-CoV-2 and specifically bind to the S2 subunit of SARS-CoV-2. Such antibodies generally do not compete with ACE2 for binding to SARS-CoV-2.

We further demonstrate herein that exemplary antibodies neutralise SARS-CoV-2 and specifically bind to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein. Such antibodies generally do not compete with ACE2 for binding to SARS-CoV-2.

We further demonstrate herein that exemplary antibodies have high affinity (such as a KD of 10^{-9} M or lower or even a KD of $5x10^{-10}$ M, $1x10^{-10}$ M (0.1nM) or lower) for SARS-CoV-2, particularly when measured using a surface plasmon resonance (SPR) assay (e.g. a Biacore SPR assay).

We demonstrate herein that exemplary antibodies neutralise SARS-CoV-2 with high potency (such as with an IC50 of 1nM or lower, an IC50 of 100pM or lower, an IC50 of 50pM or lower, an IC50 of 10pM or lower, or even an IC50 of 5pM or lower) particularly in vitro in pseudovirus assays.

An aim of the present invention is to reduce the incidence of severe and critical disease and death through the administration of such monoclonal antibodies.

Administration of monoclonal antibodies of the invention may be used either as a prophylactic or as a therapeutic. Monoclonal antibodies of the invention may also be used in diagnosis.

GROUP A - COMPETING RBD BINDERS:

In a first aspect, the present invention provides an antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody competes for binding to the SARS-CoV2 spike protein with the human ACE2 receptor.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10^{-9} M or lower (e.g. as measured by surface plasmon resonance (SPR)).

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay).

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10^{-9} M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody neutralises SARS-CoV2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the HCDR3 is the HCDR3 of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, IMPI-0060, IMPI-006, IMPI-037, or IMPI-028.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein HCDR3 is the HCDR3 of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10^{-9} M or lower (e.g. as measured by surface plasmon resonance (SPR)) and HCDR3 is the HCDR3 of antibody IMPI-004, IMPI-006, IMPI-029, IMPI-056, IMPI-055, or IMPI-059 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10^{-9} M or lower (e.g. as measured by surface plasmon resonance (SPR)) and HCDR3 is the HCDR3 of antibody IMPI-004, IMPI-006, IMPI-029, IMPI-056, IMPI-055, or IMPI-059.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and HCDR3 is the HCDR3 of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, or IMPI-059 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and HCDR3 is the HCDR3 of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, or IMPI-059.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and HCDR3 is the HCDR3 of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059, or IMPI-017 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and HCDR3 is the HCDR3 of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059, or IMPI-017.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and HCDR3 is the HCDR3 of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and HCDR3 is the HCDR3 of antibody IMPI-004, IMPI-029, or IMPI-055.

In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-029.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-056.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-005.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-012.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-052.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-002.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-041.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-036.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-055.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-054.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-042.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-021.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-004.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-047.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-017.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-059.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-060.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-006.

In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-037.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-028.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, IMPI-060, IMPI-006, IMPI-037, or IMPI-028.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody which competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, IMPI-060, IMPI-006, IMPI-037, or IMPI-028.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody which competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

In one embodiment of the first aspect, the CDRs are those of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, IMPI-060, IMPI-006, IMPI-037, or IMPI-028.

In one embodiment of the first aspect, the CDRs are those of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the CDRs are those of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, IMPI-006, or IMPI-059 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the CDRs are those of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, IMPI-006, or IMPI-059.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the CDRs are those of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, or IMPI-059 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the CDRs are those of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, or IMPI-059.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and the CDRs are those of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059, or IMPI-017 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and the CDRs are those of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059, or IMPI-017.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and

the CDRs are those of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and the CDRs are those of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059.

In one embodiment, the antibody has the CDRs of antibody IMPI-029.
In one embodiment, the antibody has the CDRs of antibody IMPI-056.
In one embodiment, the antibody has the CDRs of antibody IMPI-005.
In one embodiment, the antibody has the CDRs of antibody IMPI-012.
In one embodiment, the antibody has the CDRs of antibody IMPI-052.
In one embodiment, the antibody has the CDRs of antibody IMPI-002.
In one embodiment, the antibody has the CDRs of antibody IMPI-041.
In one embodiment, the antibody has the CDRs of antibody IMPI-036.
In one embodiment, the antibody has the CDRs of antibody IMPI-055.
In one embodiment, the antibody has the CDRs of antibody IMPI-054.
In one embodiment, the antibody has the CDRs of antibody IMPI-042.
In one embodiment, the antibody has the CDRs of antibody IMPI-021.
In one embodiment, the antibody has the CDRs of antibody IMPI-004.
In one embodiment, the antibody has the CDRs of antibody IMPI-047.
In one embodiment, the antibody has the CDRs of antibody IMPI-017.
In one embodiment, the antibody has the CDRs of antibody IMPI-059.
In one embodiment, the antibody has the CDRs of antibody IMPI-060.
In one embodiment, the antibody has the CDRs of antibody IMPI-006.
In one embodiment, the antibody has the CDRs of antibody IMPI-037.
In one embodiment, the antibody has the CDRs of antibody IMPI-028.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, IMPI-060, IMPI-006, IMPI-037, or IMPI-028, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, IMPI-006 or IMPI-059 or an antibody in the same cluster as one of these antibodies, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, IMPI-006 or IMPI-059, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, or IMPI-059 or an antibody in the same cluster as one of these antibodies, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, or IMPI-059, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059, or IMPI-017 or an antibody in the same cluster as one of these antibodies, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059, or IMPI-017, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody neutralises SARS-CoV2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059 or an antibody in the same cluster as one of these antibodies, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody neutralises

SARS-CoV2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-029, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-029, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-056, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-056, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-005, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-005, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-012, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-012, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-052, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-052, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-002, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-002, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-041, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-041, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-036, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-036, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-055, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-055, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-054, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-054, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-042, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-042, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-021, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-021, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-004, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-004, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-047, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining

regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-047, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-017, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-017, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-059, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-059, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-060, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-060, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-006, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-006, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-037, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-037, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-028, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-028, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052,

IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-060, IMPI-006, IMPI-004, IMPI-047, IMPI-037, IMPI-017, IMPI-059, or IMPI-028,
provided that the antibody has the CDRs of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-060, IMPI-006, IMPI-004, IMPI-047, IMPI-037, IMPI-017, IMPI-059, or IMPI-028.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028,
provided that the antibody has the CDRs of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-006, IMPI-055, or IMPI-059 or an antibody in the same cluster as one of these antibodies,
provided that the antibody has the CDRs of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-006, IMPI-055, or IMPI-059 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-006, IMPI-055, or IMPI-059,
provided that the antibody has the CDRs of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-006, IMPI-055, or IMPI-059.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the

variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, or IMPI-059 or an antibody in the same cluster as one of these antibodies,
provided that the antibody has the CDRs of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, or IMPI-059 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, or IMPI-059,
provided that the antibody has the CDRs of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, or IMPI-059.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059, or IMPI-017 or an antibody in the same cluster as one of these antibodies,
provided that the antibody has the CDRs of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059, or IMPI-017 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059, or IMPI-017,
provided that the antibody has the CDRs of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059, or IMPI-017.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody neutralises SARS-CoV2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and

the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059 or an antibody in the same cluster as one of these antibodies,
provided that the antibody has the CDRs of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody neutralises SARS-CoV2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay) and the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059,
provided that the antibody has the CDRs of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-029 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-029, provided that the antibody has the CDRs of antibody IMPI-029.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-056 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-056, provided that the antibody has the CDRs of antibody IMPI-056.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-005 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-005, provided that the antibody has the CDRs of antibody IMPI-005.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-012 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-012, provided that the antibody has the CDRs of antibody IMPI-012.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-052 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-052, provided that the antibody has the CDRs of antibody IMPI-052.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-002 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-002, provided that the antibody has the CDRs of antibody IMPI-002.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-041 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-041, provided that the antibody has the CDRs of antibody IMPI-041.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-036 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-036, provided that the antibody has the CDRs of antibody IMPI-036.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-055 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-055, provided that the antibody has the CDRs of antibody IMPI-055.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-054 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-054, provided that the antibody has the CDRs of antibody IMPI-054.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-042 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-042, provided that the antibody has the CDRs of antibody IMPI-042.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-021 and the variable light (VL) domain sequence

comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-021, provided that the antibody has the CDRs of antibody IMPI-021.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-004 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-004, provided that the antibody has the CDRs of antibody IMPI-004.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-047 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-047, provided that the antibody has the CDRs of antibody IMPI-047.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-017 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-017, provided that the antibody has the CDRs of antibody IMPI-017.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-059 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-059, provided that the antibody has the CDRs of antibody IMPI-059.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-059 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-060, provided that the antibody has the CDRs of antibody IMPI-060.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-059 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-006, provided that the antibody has the CDRs of antibody IMPI-006.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-059 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-037, provided that the antibody has the CDRs of antibody IMPI-037.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-028 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-028, provided that the antibody has the CDRs of antibody IMPI-028.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-060, IMPI-006, IMPI-004, IMPI-047, IMPI-037, IMPI-017, IMPI-059, or IMPI-028.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

In one embodiment, the present invention provides an antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein,
wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-060, IMPI-006, IMPI-004, IMPI-047, IMPI-037, IMPI-017, IMPI-059, or IMPI-028.

In one embodiment, the present invention provides an antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein,
wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-029.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-056.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-005.

In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-012.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-052.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-002.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-041.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-036.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-055.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-054.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-042.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-021.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-004.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-047.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-017.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-059.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-060.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-006.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-037.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody IMPI-028.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody IMPI-037.

In one embodiment, an antibody is provided which binds to the same epitope as antibody IMPI-037.

In one embodiment, the antibody comprises VH and/or VL domain framework regions of human germline gene segment sequences.

In one embodiment, the antibody comprises an antibody VH domain which
i) is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein
the V gene segment is IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01;
and/or
the J gene segment is IGHJ6*02, IGHJ4*02 or IGHJ3*02, or
ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein
FR1 aligns with human germline V gene segment IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,
FR2 aligns with human germline V gene segment IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR3 aligns with human germline V gene segment IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGHJ6*02, IGHJ4*02 or IGHJ3*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VH domain which
i) is derived from recombination of a human heavy chain V gene segment IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01, a human heavy chain D gene segment and a human heavy chain J gene segment, or
ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1, FR2 and FR3 each align with human germline V segment IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the J gene segment is IGHJ6*02, IGHJ4*02 or IGHJ3*02, or the VH domain framework region FR4 aligns with human germline J gene segment IGHJ6*02, IGHJ4*02 or IGHJ3*02 with 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain which
i) is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein

the V gene segment is IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01, and/or

the J gene segment is IGKJ5*01, IGKJ4*01, IGKJ3*01, IGKJ2*04 or IGKJ1*01; or
ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations

FR3 aligns with human germline V gene segment IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGKJ5*01, IGKJ4*01, IGKJ3*01, IGKJ2*04 or IGKJ1*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein:

the V gene segment is IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01, and optionally

the J gene segment is IGKJ5*01, IGKJ4*01, IGKJ3*01, IGKJ2*04 or IGKJ1*01.

Example combinations of v and j gene segments for heavy and light chain variable domains are shown in Table 3, and these represent preferred combinations. The heavy and light chain variable domains may optionally be derived from the v and j gene segments identified in Table 3 for any one individual IMPI antibody identified in this Group A section.

Further competing RBD binders

According to the first aspect of the invention, further antibodies are provided herein which specifically bind to the RBD of the SARS-CoV-2 spike protein and compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor. For example, antibodies YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, and YANG-2111 as exemplified herein have been found to specifically bind to the RBD of the SARS-CoV-2 spike protein and to compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the HCDR3 is the HCDR3 of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein HCDR3 is the HCDR3 of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111.

In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1101.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1103.

In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1105.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1106.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1107.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1108.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1109.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1110.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1112.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1113.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1114.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1115.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1116.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1117.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1118.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1119.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2101.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2102.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2103.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2104.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2105.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2106.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2107.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2108.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2109.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2110.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2111.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, and HCDR3 is the HCDR3 of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and competes for binding

to the SARS-CoV-2 spike protein with the human ACE2 receptor, and HCDR3 is the HCDR3 of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111.

In one embodiment, the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and HCDR3 is the HCDR3 of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein and neutralises SARS-CoV-2 with at least 60% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and HCDR3 is the HCDR3 of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and neutralises SARS-CoV-2 with at least 60% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and HCDR3 is the HCDR3 of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111.

In one embodiment, the antibody has the CDRs of antibody YANG-1101.
In one embodiment, the antibody has the CDRs of antibody YANG-1103.
In one embodiment, the antibody has the CDRs of antibody YANG-1105.
In one embodiment, the antibody has the CDRs of antibody YANG-1106.
In one embodiment, the antibody has the CDRs of antibody YANG-1107.
In one embodiment, the antibody has the CDRs of antibody YANG-1108.
In one embodiment, the antibody has the CDRs of antibody YANG-1109.
In one embodiment, the antibody has the CDRs of antibody YANG-1110.
In one embodiment, the antibody has the CDRs of antibody YANG-1112.
In one embodiment, the antibody has the CDRs of antibody YANG-1113.
In one embodiment, the antibody has the CDRs of antibody YANG-1114.
In one embodiment, the antibody has the CDRs of antibody YANG-1115.
In one embodiment, the antibody has the CDRs of antibody YANG-1116.
In one embodiment, the antibody has the CDRs of antibody YANG-1117.
In one embodiment, the antibody has the CDRs of antibody YANG-1118.
In one embodiment, the antibody has the CDRs of antibody YANG-1119.
In one embodiment, the antibody has the CDRs of antibody YANG-2101.
In one embodiment, the antibody has the CDRs of antibody YANG-2102.
In one embodiment, the antibody has the CDRs of antibody YANG-2103.
In one embodiment, the antibody has the CDRs of antibody YANG-2104.
In one embodiment, the antibody has the CDRs of antibody YANG-2105.
In one embodiment, the antibody has the CDRs of antibody YANG-2106.
In one embodiment, the antibody has the CDRs of antibody YANG-2107.
In one embodiment, the antibody has the CDRs of antibody YANG-2108.
In one embodiment, the antibody has the CDRs of antibody YANG-2109.
In one embodiment, the antibody has the CDRs of antibody YANG-2110.
In one embodiment, the antibody has the CDRs of antibody YANG-2111.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, and the CDRs are those of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-

2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, and the CDRs are those of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, and the CDRs are those of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, and the CDRs are those of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor and neutralises SARS-CoV-2 with at least 60% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and the CDRs are those of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor and neutralises SARS-CoV-2 with at least 60% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and the CDRs are those of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences

of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111, YANG-2111a, YANG-2111b, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111 optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1101, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1101 optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1103, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1103, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1105, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1105, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1106, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1106, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1107, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions

(CDRs), and a variable light (VL) domain sequence of antibody YANG-1107, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1108, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1108, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1109, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1109, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1110 optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1110, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1112 optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1112, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1113 optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1113, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1114 optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1114, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1115 optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1115, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1116 optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1116, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1117 optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1117, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1118 optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1118, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1119 optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1119, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2101, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2101, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2102, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2102, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2103, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2103, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2104, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2104, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2105, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2105, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2106, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2106, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2107, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2107, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2108, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions

(CDRs), and a variable light (VL) domain sequence of antibody YANG-2108, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2109, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2109, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2110, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2110, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2111, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2111, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, and
the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111, YANG-2111a, YANG-2111b, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, and
the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104,

YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111, YANG-2111a, YANG-2111b, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, and
the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, and
the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor and neutralises SARS-CoV-2 with at least 60% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor and neutralises SARS-CoV-2 with at least 60% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and
the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111
provided that the antibody has the CDRs of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111, YANG-2111a, YANG-2111b, respectively.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111,
provided that the antibody has the CDRs of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111, respectively.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1101 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1101, provided that the antibody has the CDRs of antibody YANG-1101.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1103 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1103, provided that the antibody has the CDRs of antibody YANG-1103.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1105 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1105, provided that the antibody has the CDRs of antibody YANG-1105.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1106 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1106, provided that the antibody has the CDRs of antibody YANG-1106.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1107 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1107, provided that the antibody has the CDRs of antibody YANG-1107.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1108 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1108, provided that the antibody has the CDRs of antibody YANG-1108.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1109 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1109, provided that the antibody has the CDRs of antibody YANG-1109.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1110 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1110, provided that the antibody has the CDRs of antibody YANG-1110.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1112 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1112, provided that the antibody has the CDRs of antibody YANG-1112.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1113 and the variable light (VL) domain sequence

comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1113, provided that the antibody has the CDRs of antibody YANG-1113.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1114 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1114, provided that the antibody has the CDRs of antibody YANG-1114.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1115 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1115, provided that the antibody has the CDRs of antibody YANG-1115.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1116 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1116, provided that the antibody has the CDRs of antibody YANG-1116.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1117 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1117, provided that the antibody has the CDRs of antibody YANG-1117.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1118 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1118, provided that the antibody has the CDRs of antibody YANG-1118.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1119 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1119, provided that the antibody has the CDRs of antibody YANG-1119.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2101 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2101, provided that the antibody has the CDRs of antibody YANG-2101.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2102 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2102, provided that the antibody has the CDRs of antibody YANG-2102.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2103 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2103, provided that the antibody has the CDRs of antibody YANG-2103.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2104 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2104, provided that the antibody has the CDRs of antibody YANG-2104.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2105 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2105, provided that the antibody has the CDRs of antibody YANG-2105.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2106 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2106, provided that the antibody has the CDRs of antibody YANG-2106.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2107 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2107, provided that the antibody has the CDRs of antibody YANG-2107.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2108 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2108, provided that the antibody has the CDRs of antibody YANG-2108.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2109 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2109, provided that the antibody has the CDRs of antibody YANG-2109.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2110 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2110, provided that the antibody has the CDRs of antibody YANG-2110.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2111 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2111, provided that the antibody has the CDRs of antibody YANG-2111.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, and

the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL)

domain sequences of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111

provided that the antibody has the CDRs of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111, YANG-2111a, YANG-2111b, respectively.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, and

the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111

provided that the antibody has the CDRs of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111, YANG-2111a, YANG-2111b, respectively.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, and

the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111,
provided that the antibody has the CDRs of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111, respectively.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, and
the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111,
provided that the antibody has the CDRs of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111, respectively.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor and neutralises SARS-CoV-2 with at least 60% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111,
provided that the antibody has the CDRs of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111, respectively.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor and neutralises SARS-CoV-2 with at least 60% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and
the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111,
provided that the antibody has the CDRs of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111, respectively.

In one embodiment, the present invention provides an antibody specifically binds to the RBD of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111.

In one embodiment, the present invention provides an antibody specifically binds to the RBD of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1101.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1103.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1105.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1106.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1107.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1108.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1109.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1110.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1112.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1113.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1114.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1115.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1116.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1117.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1118.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1119.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2101.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2102.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2103.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2104.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2105.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2106.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2107.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2108.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2109.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2110.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2111.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111.

In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1101.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1103.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1105.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1106.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1107.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1108.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1109.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1110.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1112.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1113.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1114.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1115.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1116.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1117.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1118.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1119.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2101.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2102.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2103.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2104.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2105.

In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2106.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2107.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2108.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2109.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2110.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2111.

Antibodies are provided which bind to the same epitope on the RBD of the SARS-CoV-2 spike protein as an antibody described anywhere herein.

An antibody is provided which bind to the same epitope as antibody YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111, YANG-2111a, YANG-2111b, e.g. as defined by its VH and VL sequences.

An antibody is provided which bind to the same epitope as antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111, e.g. as defined by its VH and VL sequences.

In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1101.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1103.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1105.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1106.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1107.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1108.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1109.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1110.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1112.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1113.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1114.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1115.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1116.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1117.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1118.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1119.

In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2101.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2102.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2103.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2104.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2105.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2106.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2107.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2108.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2109.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2110.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2111.

An antibody may contact the SARS-CoV-2 spike protein with a footprint that fully or partly overlaps with that of an antibody disclosed anywhere herein. As described elsewhere herein, competition between antibodies may be determined, for example using SPR, and antibodies are provided which compete for binding to the spike protein (compete for binding to their epitope) with an IgG antibody as described anywhere herein.

An antibody of the present invention may be one which competes for binding to SARS-CoV-2 spike protein with any anti-RBD antibody described herein, such as YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111, YANG-2111a, YANG-2111b, e.g. as defined by its VH and VL sequences.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1101.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1103.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1105.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1106.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1107.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1108.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1109.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1110.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1112.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1113.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1114.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1115.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1116.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1117.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1118.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1119.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2101.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2102.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2103.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2104.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2105.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2106.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2107.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2108.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2109.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2110.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2111.

In one embodiment, the antibody comprises VH and/or VL domain framework regions of human germline gene segment sequences.

In one embodiment, the antibody comprises an antibody VH domain which

i) is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein

the V gene segment is IGHV4-39*01, IGHV3-53*01, IGHV3-30*18, IGHV2-5*10, IGHV3-21*03, IGHV3-13*01, IGHV3-33*01, IGHV4-4*02, IGHV1-69*05 or IGHV3-9*01; and/or

the J gene segment is IGHJ3*02, IGHJ4*02 or IGHJ6*02; or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGHV4-39*01, IGHV3-53*01, IGHV3-30*18, IGHV2-5*10, IGHV3-21*03, IGHV3-13*01, IGHV3-33*01, IGHV4-4*02, IGHV1-69*05 or IGHV3-9*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGHV4-39*01, IGHV3-53*01, IGHV3-30*18, IGHV2-5*10, IGHV3-21*03, IGHV3-13*01, IGHV3-33*01, IGHV4-4*02, IGHV1-69*05 or IGHV3-9*01with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR3 aligns with human germline V gene segment IGHV4-39*01, IGHV3-53*01, IGHV3-30*18, IGHV2-5*10, IGHV3-21*03, IGHV3-13*01, IGHV3-33*01, IGHV4-4*02, IGHV1-69*05 or IGHV3-9*01 with up to 1, 2, 3, 4, or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGHJ3*02, IGHJ4*02 or IGHJ6*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VH domain which

i) is derived from recombination of a human heavy chain V gene segment IGHV4-39*01, IGHV3-53*01, IGHV3-30*18, IGHV2-5*10, IGHV3-21*03, IGHV3-13*01, IGHV3-33*01, IGHV4-4*02, IGHV1-69*05 or IGHV3-9*01, a human heavy chain D gene segment and a human heavy chain J gene segment, or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1, FR2 and FR3 each align with human germline V segment IGHV4-39*01, IGHV3-53*01, IGHV3-30*18, IGHV2-5*10, IGHV3-21*03, IGHV3-13*01, IGHV3-33*01, IGHV4-4*02, IGHV1-69*05 or IGHV3-9*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the J gene segment is IGHJ3*02, IGHJ4*02 or IGHJ6*02, or the VH domain framework region FR4 aligns with human germline J gene segment IGHJ3*02, IGHJ4*02 or IGHJ6*02 with 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain which
i) is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein

the V gene segment is IGLV2-23*d02, IGKV1-9*d01, IGKV3-15*01, IGKV1D-13*d01, IGLV4-60*d03, IGLV3-10*01, IGLV2-14*01, IGKV1-16*02, IGLV3-21*d01, IGKV1D-17*01, IGKV1-17*01, IGKV3D-7*01 or IGKV2-28*01; and/or

the J gene segment is IGLJ2*01, IGKJ5*01, IGKJ2*04, IGKJ1*01, IGKJ4*01 or IGLJ3*02; or
ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGLV2-23*d02, IGKV1-9*d01, IGKV3-15*01, IGKV1D-13*d01, IGLV4-60*d03, IGLV3-10*01, IGLV2-14*01, IGKV1-16*02, IGLV3-21*d01, IGKV1D-17*01, IGKV1-17*01, IGKV3D-7*01 or IGKV2-28*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGLV2-23*d02, IGKV1-9*d01, IGKV3-15*01, IGKV1D-13*d01, IGLV4-60*d03, IGLV3-10*01, IGLV2-14*01, IGKV1-16*02, IGLV3-21*d01, IGKV1D-17*01, IGKV1-17*01, IGKV3D-7*01 or IGKV2-28*01 with up to 1, 2, 3, 4, or 5 amino acid alterations

FR3 aligns with human germline V gene segment IGLV2-23*d02, IGKV1-9*d01, IGKV3-15*01, IGKV1D-13*d01, IGLV4-60*d03, IGLV3-10*01, IGLV2-14*01, IGKV1-16*02, IGLV3-21*d01, IGKV1D-17*01, IGKV1-17*01, IGKV3D-7*01 or IGKV2-28*01with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGLJ2*01, IGKJ5*01, IGKJ2*04, IGKJ1*01, IGKJ4*01 or IGLJ3*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein:

the V gene segment is IGLV2-23*d02, IGKV1-9*d01, IGKV3-15*01, IGKV1D-13*d01, IGLV4-60*d03, IGLV3-10*01, IGLV2-14*01, IGKV1-16*02, IGLV3-21*d01, IGKV1D-17*01, IGKV1-17*01, IGKV3D-7*01 or IGKV2-28*01, and optionally

the J gene segment is IGLJ2*01, IGKJ5*01, IGKJ2*04, IGKJ1*01, IGKJ4*01 or IGLJ3*02.

Example combinations of v and j gene segments for heavy and light chain variable domains are shown in Table 3, and these represent preferred combinations. The heavy and light chain variable domains may

optionally be derived from the v and j gene segments identified in Table 3 for any one individual YANG antibody.

GROUP B – TRIMER BINDERS:

In a second aspect, the present invention provides an antibody that preferentially binds to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, isolated S1 subunit or isolated S2 subunit of the SARS-CoV-2 spike protein.

In one embodiment, the antibody specifically binds to the trimer form of the SARS-CoV-2 spike protein and does not bind to the isolated RBD domain.

In one embodiment, the antibody specifically binds to the trimer form of the SARS-CoV-2 spike protein and does not bind to the isolated RBD domain, isolated S1 subunit or isolated S2 subunit of the SARS-CoV-2 spike protein.

In one embodiment, the antibody is a neutralising antibody.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 75nM or lower, preferably 15nM or lower (e.g. as measured in a pseudovirus neutralisation assay).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the HCDR3 is the HCDR3 of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072.

In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-030.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-053.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-025.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-040.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-007.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-020.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-032.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-023.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-039.

In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-001.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-019.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-010.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-008.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-031.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-057.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-022.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-035.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-067.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-072.

In one embodiment, the present invention provides anti-SARS-CoV2 antibody,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072.

In one embodiment, the antibody has the CDRs of antibody IMPI-030.
In one embodiment, the antibody has the CDRs of antibody IMPI-053.
In one embodiment, the antibody has the CDRs of antibody IMPI-025.
In one embodiment, the antibody has the CDRs of antibody IMPI-040.
In one embodiment, the antibody has the CDRs of antibody IMPI-007.
In one embodiment, the antibody has the CDRs of antibody IMPI-020.
In one embodiment, the antibody has the CDRs of antibody IMPI-032.
In one embodiment, the antibody has the CDRs of antibody IMPI-023.
In one embodiment, the antibody has the CDRs of antibody IMPI-039.
In one embodiment, the antibody has the CDRs of antibody IMPI-001.
In one embodiment, the antibody has the CDRs of antibody IMPI-019.
In one embodiment, the antibody has the CDRs of antibody IMPI-010.

In one embodiment, the antibody has the CDRs of antibody IMPI-008.
In one embodiment, the antibody has the CDRs of antibody IMPI-031.
In one embodiment, the antibody has the CDRs of antibody IMPI-057.
In one embodiment, the antibody has the CDRs of antibody IMPI-022.
In one embodiment, the antibody has the CDRs of antibody IMPI-035.
In one embodiment, the antibody has the CDRs of antibody IMPI-067.
In one embodiment, the antibody has the CDRs of antibody IMPI-072.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-030, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-030, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-053, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-053, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-025, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-025, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-040, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-040, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-007, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-007, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-020, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-020, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-032, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-032, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-023, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-023, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-039, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-039, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-001, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-001, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-019, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-019, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-010, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining

regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-010, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-008, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-008, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-031, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-031, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-057, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-057, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-022, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-022, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-035, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-035, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-067, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-067, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-072, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-072, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072,
provided that the antibody has the CDRs of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-030 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-030, provided that the antibody has the CDRs of antibody IMPI-030.

In one embodiment, variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-053 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-053, provided that the antibody has the CDRs of antibody IMPI-053.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-025 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-025, provided that the antibody has the CDRs of antibody IMPI-025.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-040 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-040, provided that the antibody has the CDRs of antibody IMPI-040.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-007 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-007, provided that the antibody has the CDRs of antibody IMPI-007.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-020 and the variable light (VL) domain sequence

comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-020, provided that the antibody has the CDRs of antibody IMPI-020.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-032 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-032, provided that the antibody has the CDRs of antibody IMPI-032.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-023 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-023, provided that the antibody has the CDRs of antibody IMPI-023.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-039 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-039, provided that the antibody has the CDRs of antibody IMPI-039.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-001 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-001, provided that the antibody has the CDRs of antibody IMPI-001.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-019 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-019, provided that the antibody has the CDRs of antibody IMPI-019.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-010 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-010, provided that the antibody has the CDRs of antibody IMPI-010.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-008 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-008, provided that the antibody has the CDRs of antibody IMPI-008.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-031 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-031, provided that the antibody has the CDRs of antibody IMPI-031.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-057 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-057, provided that the antibody has the CDRs of antibody IMPI-057.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-022 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-022, provided that the antibody has the CDRs of antibody IMPI-022.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-035 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-035, provided that the antibody has the CDRs of antibody IMPI-035.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-067 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-067, provided that the antibody has the CDRs of antibody IMPI-067.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-072 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-072, provided that the antibody has the CDRs of antibody IMPI-072.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-030 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-030.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-053 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-053.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-025 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-025.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-040 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-040.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-007 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-007.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-020 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-020.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-032 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-032.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-023 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-023.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-039 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-039.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-001 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-001.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-019 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-019.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-010 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-010.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-008 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-008.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-031 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-031.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-057 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-057.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-022 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-022.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-035 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-035.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-067 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-067.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-072 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-072.

In one embodiment, the antibody comprises VH and/or VL domain framework regions of human germline gene segment sequences.

In one embodiment, the antibody comprises an antibody VH domain which
i) is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein
the V gene segment is IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18;
and/or
the J gene segment is IGHJ4*02 or IGHJ6*02, or
ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein
FR1 aligns with human germline V gene segment IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18 with up to 1, 2, 3, 4, or 5 amino acid alterations,
FR2 aligns with human germline V gene segment IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18 with up to 1, 2, 3, 4, or 5 amino acid alterations,
FR3 aligns with human germline V gene segment IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18 with up to 1, 2, 3, 4, or 5 amino acid alterations, and/or
FR4 aligns with human germline J gene segment IGHJ4*02 or IGHJ6*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VH domain which
i) is derived from recombination of a human heavy chain V gene segment IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18, a human heavy chain D gene segment and a human heavy chain J gene segment, or
ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1, FR2 and FR3 each align with human germline V segment IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the J gene segment is IGHJ4*02 or IGHJ6*02, or the VH domain framework region FR4 aligns with human germline J gene segment IGHJ4*02 or IGHJ6*02 with 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain which

i) is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein

the V gene segment is IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01, and/or

the J gene segment is IGKJ4*01 or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations

FR3 aligns with human germline V gene segment IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGKJ4*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein:

the V gene segment is IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01, and optionally

the J gene segment is IGKJ4*01.

Example combinations of v and j gene segments for heavy and light chain variable domains are shown in Table 3, and these represent preferred combinations. The heavy and light chain variable domains may optionally be derived from the v and j gene segments identified in Table 3 for any one individual IMPI antibody identified in this Group B section.

GROUP C – S2 BINDERS:

In a third aspect, the present invention provides a neutralising antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 10nM or lower (e.g. as measured in a pseudovirus neutralisation assay).

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 5nM or lower (e.g. as measured in a pseudovirus neutralisation assay).

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 3nM or lower (e.g. as measured in a pseudovirus neutralisation assay).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the HCDR3 is the HCDR3 of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071.

In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-003.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-013.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-063.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-061.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-062.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-064.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-065.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-066.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-069.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-070.
In one embodiment, the HCDR3 is the HCDR3 of antibody IMPI-071.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the CDRs are those of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071.

In one embodiment, the antibody has the CDRs of antibody IMPI-003.
In one embodiment, the antibody has the CDRs of antibody IMPI-013.
In one embodiment, the antibody has the CDRs of antibody IMPI-063.
In one embodiment, the antibody has the CDRs of antibody IMPI-061.
In one embodiment, the antibody has the CDRs of antibody IMPI-062.
In one embodiment, the antibody has the CDRs of antibody IMPI-064.

In one embodiment, the antibody has the CDRs of antibody IMPI-065.
In one embodiment, the antibody has the CDRs of antibody IMPI-066.
In one embodiment, the antibody has the CDRs of antibody IMPI-069.
In one embodiment, the antibody has the CDRs of antibody IMPI-070.
In one embodiment, the antibody has the CDRs of antibody IMPI-071.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071,
optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-003, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-003, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-013, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-013, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-063, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-063, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-061, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-061, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-062, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining

regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-062, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-064, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-064, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-065, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-065, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-066, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-066, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-069, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-069, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-070, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-070, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-071, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-071, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071,

provided that the antibody has the CDRs of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-003 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-003, provided that the antibody has the CDRs of antibody IMPI-003.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-013 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-013, provided that the antibody has the CDRs of antibody IMPI-013.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-063 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-063, provided that the antibody has the CDRs of antibody IMPI-063.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-061 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-061, provided that the antibody has the CDRs of antibody IMPI-061.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-062 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-062, provided that the antibody has the CDRs of antibody IMPI-062.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-064 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-064, provided that the antibody has the CDRs of antibody IMPI-064.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-065 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-065, provided that the antibody has the CDRs of antibody IMPI-065.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-066 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-066, provided that the antibody has the CDRs of antibody IMPI-066.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-069 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-069, provided that the antibody has the CDRs of antibody IMPI-069.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-070 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-070, provided that the antibody has the CDRs of antibody IMPI-070.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-071 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-071, provided that the antibody has the CDRs of antibody IMPI-071.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,
wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-003 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-003.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-013 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-013.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-063 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-063.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-061 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-061.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-062 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-062.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-064 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-064.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-065 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-065.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-066 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-066.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-069 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-069.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-070 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-070.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-071 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-071.

In one embodiment, the antibody comprises VH and/or VL domain framework regions of human germline gene segment sequences.

In one embodiment, the antibody comprises an antibody VH domain which
i) is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein
the V gene segment is IGHV3-9*01 or IGHV3-20*d01;
and/or
the J gene segment is IGHJ6*02 or IGHJ4*02, or
ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein
FR1 aligns with human germline V gene segment IGHV3-9*01 or IGHV3-20*d01 with up to 1, 2, 3, 4, or 5 amino acid alterations,
FR2 aligns with human germline V gene segment IGHV3-9*01 or IGHV3-20*d01 with up to 1, 2, 3, 4, or 5 amino acid alterations,
FR3 aligns with human germline V gene segment IGHV3-9*01 or IGHV3-20*d01 with up to 1, 2, 3, 4, or 5 amino acid alterations, and/or
FR4 aligns with human germline J gene segment IGHJ6*02 or IGHJ4*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VH domain which
i) is derived from recombination of a human heavy chain V gene segment IGHV3-9*01 or IGHV3-20*d01, a human heavy chain D gene segment and a human heavy chain J gene segment, or
ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1, FR2 and FR3 each align with human germline V segment IGHV3-9*01 or IGHV3-20*d01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the J gene segment is IGHJ6*02 or IGHJ4*02, or the VH domain framework region FR4 aligns with human germline J gene segment IGHJ6*02 or IGHJ4*02 with 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain which
i) is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein
the V gene segment is IGKV1-6*01 or IGKV3-20*01, and/or

the J gene segment is IGKJ1*01 or IGKJ2*04; or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGKV1-6*01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGKV1-6*01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations

FR3 aligns with human germline V gene segment IGKV1-6*01 or IGKV3-20*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGKJ1*01 or IGKJ2*04 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein:

the V gene segment is IGKV1-6*01 or IGKV3-20*01, and optionally

the J gene segment is IGKJ1*01 or IGKJ2*04.

Example combinations of v and j gene segments for heavy and light chain variable domains are shown in Table 3, and these represent preferred combinations. The heavy and light chain variable domains may optionally be derived from the v and j gene segments identified in Table 3 for any one individual IMPI antibody identified in this Group C section.

Further S2 binders

According to the third aspect of the invention, further antibodies are provided herein which specifically bind to the S2 subunit of the SARS-CoV-2 spike protein. For example, antibodies YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, and YANG-2208 as exemplified herein have been found to specifically bind to the S2 subunit of the SARS-CoV-2 spike protein.

In a first aspect, the present invention provides an antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein.

In one embodiment, the antibody specifically binds the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the HCDR3 is the HCDR3 of antibody YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein HCDR3 is the HCDR3 of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1201.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1202.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1203.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1204.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1205.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1206.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1207.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2201.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2202.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2203.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2204.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2205.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2206.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2207.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2208.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and HCDR3 is the HCDR3 of antibody YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and HCDR3 is the HCDR3 of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, YANG-2208.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein and neutralises SARS-CoV-2 with at least 35% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and HCDR3 is the HCDR3 of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, YANG-2208.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and neutralises SARS-CoV-2 with at least 35% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and HCDR3 is the HCDR3 of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, YANG-2208.

In one embodiment, the present invention provides an anti-SARS-CoV-2,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

In one embodiment, the antibody has the CDRs of antibody YANG-1201.
In one embodiment, the antibody has the CDRs of antibody YANG-1202.
In one embodiment, the antibody has the CDRs of antibody YANG-1203.
In one embodiment, the antibody has the CDRs of antibody YANG-1204.
In one embodiment, the antibody has the CDRs of antibody YANG-1205.
In one embodiment, the antibody has the CDRs of antibody YANG-1206.

In one embodiment, the antibody has the CDRs of antibody YANG-1207.
In one embodiment, the antibody has the CDRs of antibody YANG-2201.
In one embodiment, the antibody has the CDRs of antibody YANG-2202.
In one embodiment, the antibody has the CDRs of antibody YANG-2203.
In one embodiment, the antibody has the CDRs of antibody YANG-2204.
In one embodiment, the antibody has the CDRs of antibody YANG-2205.
In one embodiment, the antibody has the CDRs of antibody YANG-2206.
In one embodiment, the antibody has the CDRs of antibody YANG-2207.
In one embodiment, the antibody has the CDRs of antibody YANG-2208.

In one embodiment, the present invention provides an anti-SARS-CoV-2,
wherein the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) , and
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,
wherein the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)), and
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein and neutralises SARS-CoV-2 with at least 35% neutralisation (e.g. as measured in a pseudovirus neutralisation assay) , and
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and neutralises SARS-CoV-2 with at least 35% neutralisation (e.g. as measured in a pseudovirus neutralisation assay) , and

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, YANG-2209, YANG-2210, YANG-2211, YANG-2212, YANG-2213, YANG-2214, YANG-2215, YANG-2216, YANG-2217, YANG-2218, YANG-2219, YANG-2220, YANG-2221, YANG-2222, YANG-2223, YANG-2224, YANG-2225, YANG-2226, YANG-2227, YANG-2228, YANG-2229, YANG-2230, YANG-2231, YANG-2232, YANG-2233, YANG-2234, YANG-2235, YANG-2236, YANG-2237, YANG-2238, YANG-2239, YANG-2240, YANG-2241, YANG-2242, YANG-2243, YANG-2244, YANG-2245, YANG-2246, YANG-2247, YANG-2248, YANG-2249, YANG-2250, YANG-2251, YANG-2252, YANG-2253, YANG-2254, YANG-2255, YANG-2256, YANG-2257, YANG-2258, YANG-2259, YANG-2260, YANG-2261, YANG-2262, YANG-2263, YANG-2264, YANG-2265, YANG-2266, YANG-2267, YANG-2268, YANG-2269, YANG-2270, YANG-2271, YANG-2272, YANG-2273, YANG-2274, YANG-2275, YANG-2276, YANG-2277, YANG-2278, YANG-2279, YANG-2280, YANG-2281, YANG-2282, YANG-2283, YANG-2284, YANG-2285, YANG-2286, YANG-2287, YANG-2288, YANG-2289, YANG-2290, YANG-2291, YANG-2292, YANG-2293, YANG-2294, YANG-2295, YANG-2296, YANG-2297, YANG-2298, YANG-2299, YANG-2299a, YANG-2299b, YANG-2299c, YANG-2299d, YANG-2299e, YANG-2299f, YANG-2299g, YANG-2299h, YANG-2299i, YANG-2299j, YANG-2299k, YANG-2299l, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1201, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1201, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1202, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1202, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1203, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1203, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1204, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1204, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1205, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1205, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1206, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1206, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1207, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1207, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2201, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2201, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2202, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2202, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2203, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2203, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2204, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2204, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2205, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2205, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2206, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2206, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2207, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2207, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2208, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2208, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody specifically binds the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)), and
the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202,

YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, YANG-2209, YANG-2210, YANG-2211, YANG-2212, YANG-2213, YANG-2214, YANG-2215, YANG-2216, YANG-2217, YANG-2218, YANG-2219, YANG-2220, YANG-2221, YANG-2222, YANG-2223, YANG-2224, YANG-2225, YANG-2226, YANG-2227, YANG-2228, YANG-2229, YANG-2230, YANG-2231, YANG-2232, YANG-2233, YANG-2234, YANG-2235, YANG-2236, YANG-2237, YANG-2238, YANG-2239, YANG-2240, YANG-2241, YANG-2242, YANG-2243, YANG-2244, YANG-2245, YANG-2246, YANG-2247, YANG-2248, YANG-2249, YANG-2250, YANG-2251, YANG-2252, YANG-2253, YANG-2254, YANG-2255, YANG-2256, YANG-2257, YANG-2258, YANG-2259, YANG-2260, YANG-2261, YANG-2262, YANG-2263, YANG-2264, YANG-2265, YANG-2266, YANG-2267, YANG-2268, YANG-2269, YANG-2270, YANG-2271, YANG-2272, YANG-2273, YANG-2274, YANG-2275, YANG-2276, YANG-2277, YANG-2278, YANG-2279, YANG-2280, YANG-2281, YANG-2282, YANG-2283, YANG-2284, YANG-2285, YANG-2286, YANG-2287, YANG-2288, YANG-2289, YANG-2290, YANG-2291, YANG-2292, YANG-2293, YANG-2294, YANG-2295, YANG-2296, YANG-2297, YANG-2298, YANG-2299, YANG-2299a, YANG-2299b, YANG-2299c, YANG-2299d, YANG-2299e, YANG-2299f, YANG-2299g, YANG-2299h, YANG-2299i, YANG-2299j, YANG-2299k, YANG-2299l, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody specifically binds the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)), and
the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein and neutralises SARS-CoV-2 with at least 35% neutralisation (e.g. as measured in a pseudovirus neutralisation assay) , and
the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and neutralises SARS-CoV-2 with at least 35% neutralisation (e.g. as measured in a pseudovirus neutralisation assay) , and

the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, YANG-2209, YANG-2210, YANG-2211, YANG-2212, YANG-2213, YANG-2214, YANG-2215, YANG-2216, YANG-2217, YANG-2218, YANG-2219, YANG-2220, YANG-2221, YANG-2222, YANG-2223, YANG-2224, YANG-2225, YANG-2226, YANG-2227, YANG-2228, YANG-2229, YANG-2230, YANG-2231, YANG-2232, YANG-2233, YANG-2234, YANG-2235, YANG-2236, YANG-2237, YANG-2238, YANG-2239, YANG-2240, YANG-2241, YANG-2242, YANG-2243, YANG-2244, YANG-2245, YANG-2246, YANG-2247, YANG-2248, YANG-2249, YANG-2250, YANG-2251, YANG-2252, YANG-2253, YANG-2254, YANG-2255, YANG-2256, YANG-2257, YANG-2258, YANG-2259, YANG-2260, YANG-2261, YANG-2262, YANG-2263, YANG-2264, YANG-2265, YANG-2266, YANG-2267, YANG-2268, YANG-2269, YANG-2270, YANG-2271, YANG-2272, YANG-2273, YANG-2274, YANG-2275, YANG-2276, YANG-2277, YANG-2278, YANG-2279, YANG-2280, YANG-2281, YANG-2282, YANG-2283, YANG-2284, YANG-2285, YANG-2286, YANG-2287, YANG-2288, YANG-2289, YANG-2290, YANG-2291, YANG-2292, YANG-2293, YANG-2294, YANG-2295, YANG-2296, YANG-2297, YANG-2298, YANG-2299, YANG-2299a, YANG-2299b, YANG-2299c, YANG-2299d, YANG-2299e, YANG-2299f, YANG-2299g, YANG-2299h, YANG-2299i, YANG-2299j, YANG-2299k, YANG-2299l,

provided that the antibody has the CDRs of antibody YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-

2207, or YANG-2208, YANG-2209, YANG-2210, YANG-2211, YANG-2212, YANG-2213, YANG-2214, YANG-2215, YANG-2216, YANG-2217, YANG-2218, YANG-2219, YANG-2220, YANG-2221, YANG-2222, YANG-2223, YANG-2224, YANG-2225, YANG-2226, YANG-2227, YANG-2228, YANG-2229, YANG-2230, YANG-2231, YANG-2232, YANG-2233, YANG-2234, YANG-2235, YANG-2236, YANG-2237, YANG-2238, YANG-2239, YANG-2240, YANG-2241, YANG-2242, YANG-2243, YANG-2244, YANG-2245, YANG-2246, YANG-2247, YANG-2248, YANG-2249, YANG-2250, YANG-2251, YANG-2252, YANG-2253, YANG-2254, YANG-2255, YANG-2256, YANG-2257, YANG-2258, YANG-2259, YANG-2260, YANG-2261, YANG-2262, YANG-2263, YANG-2264, YANG-2265, YANG-2266, YANG-2267, YANG-2268, YANG-2269, YANG-2270, YANG-2271, YANG-2272, YANG-2273, YANG-2274, YANG-2275, YANG-2276, YANG-2277, YANG-2278, YANG-2279, YANG-2280, YANG-2281, YANG-2282, YANG-2283, YANG-2284, YANG-2285, YANG-2286, YANG-2287, YANG-2288, YANG-2289, YANG-2290, YANG-2291, YANG-2292, YANG-2293, YANG-2294, YANG-2295, YANG-2296, YANG-2297, YANG-2298, YANG-2299, YANG-2299a, YANG-2299b, YANG-2299c, YANG-2299d, YANG-2299e, YANG-2299f, YANG-2299g, YANG-2299h, YANG-2299i, YANG-2299j, YANG-2299k, YANG-2299l, respectively.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208,
provided that the antibody has the CDRs of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, respectively.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1201 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1201, provided that the antibody has the CDRs of antibody YANG-1201.
In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1202 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1202, provided that the antibody has the CDRs of antibody YANG-1202.
In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1203 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1203, provided that the antibody has the CDRs of antibody YANG-1203.
In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1204 and the variable light (VL) domain sequence

comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1204, provided that the antibody has the CDRs of antibody YANG-1204.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1205 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1205, provided that the antibody has the CDRs of antibody YANG-1205.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1206 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1206, provided that the antibody has the CDRs of antibody YANG-1206.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1207 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1207, provided that the antibody has the CDRs of antibody YANG-1207.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2201 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2201, provided that the antibody has the CDRs of antibody YANG-2201.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2202 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2202, provided that the antibody has the CDRs of antibody YANG-2202.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2203 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2203, provided that the antibody has the CDRs of antibody YANG-2203.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2204 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2204, provided that the antibody has the CDRs of antibody YANG-2204.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2205 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2205, provided that the antibody has the CDRs of antibody YANG-2205.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2206 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2206, provided that the antibody has the CDRs of antibody YANG-2206.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2207 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2207, provided that the antibody has the CDRs of antibody YANG-2207.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2208 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2208, provided that the antibody has the CDRs of antibody YANG-2208.

In one embodiment, the antibody specifically binds the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)), and

the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, YANG-2209, YANG-2210, YANG-2211, YANG-2212, YANG-2213, YANG-2214, YANG-2215, YANG-2216, YANG-2217, YANG-2218, YANG-2219, YANG-2220, YANG-2221, YANG-2222, YANG-2223, YANG-2224, YANG-2225, YANG-2226, YANG-2227, YANG-2228, YANG-2229, YANG-2230, YANG-2231, YANG-2232, YANG-2233, YANG-2234, YANG-2235, YANG-2236, YANG-2237, YANG-2238, YANG-2239, YANG-2240, YANG-2241, YANG-2242, YANG-2243, YANG-2244, YANG-2245, YANG-2246, YANG-2247, YANG-2248, YANG-2249, YANG-2250, YANG-2251, YANG-2252, YANG-2253, YANG-2254, YANG-2255, YANG-2256, YANG-2257, YANG-2258, YANG-2259, YANG-2260, YANG-2261, YANG-2262, YANG-2263, YANG-2264, YANG-2265, YANG-2266, YANG-2267, YANG-2268, YANG-2269, YANG-2270, YANG-2271, YANG-2272, YANG-2273, YANG-2274, YANG-2275, YANG-2276, YANG-2277, YANG-2278, YANG-2279, YANG-2280, YANG-2281, YANG-2282, YANG-2283, YANG-2284, YANG-2285, YANG-2286, YANG-2287, YANG-2288, YANG-2289, YANG-2290, YANG-2291, YANG-2292, YANG-2293, YANG-2294, YANG-2295, YANG-2296, YANG-2297, YANG-2298, YANG-2299, YANG-2299a, YANG-2299b, YANG-2299c, YANG-2299d, YANG-2299e, YANG-2299f, YANG-2299g, YANG-2299h, YANG-2299i, YANG-2299j, YANG-2299k, YANG-2299l ,

provided that the antibody has the CDRs of antibody YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, YANG-2209, YANG-2210, YANG-2211, YANG-2212, YANG-2213, YANG-

2214, YANG-2215, YANG-2216, YANG-2217, YANG-2218, YANG-2219, YANG-2220, YANG-2221, YANG-2222, YANG-2223, YANG-2224, YANG-2225, YANG-2226, YANG-2227, YANG-2228, YANG-2229, YANG-2230, YANG-2231, YANG-2232, YANG-2233, YANG-2234, YANG-2235, YANG-2236, YANG-2237, YANG-2238, YANG-2239, YANG-2240, YANG-2241, YANG-2242, YANG-2243, YANG-2244, YANG-2245, YANG-2246, YANG-2247, YANG-2248, YANG-2249, YANG-2250, YANG-2251, YANG-2252, YANG-2253, YANG-2254, YANG-2255, YANG-2256, YANG-2257, YANG-2258, YANG-2259, YANG-2260, YANG-2261, YANG-2262, YANG-2263, YANG-2264, YANG-2265, YANG-2266, YANG-2267, YANG-2268, YANG-2269, YANG-2270, YANG-2271, YANG-2272, YANG-2273, YANG-2274, YANG-2275, YANG-2276, YANG-2277, YANG-2278, YANG-2279, YANG-2280, YANG-2281, YANG-2282, YANG-2283, YANG-2284, YANG-2285, YANG-2286, YANG-2287, YANG-2288, YANG-2289, YANG-2290, YANG-2291, YANG-2292, YANG-2293, YANG-2294, YANG-2295, YANG-2296, YANG-2297, YANG-2298, YANG-2299, YANG-2299a, YANG-2299b, YANG-2299c, YANG-2299d, YANG-2299e, YANG-2299f, YANG-2299g, YANG-2299h, YANG-2299i, YANG-2299j, YANG-2299k, YANG-2299l , respectively.

In one embodiment, the antibody specifically binds the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)), and
the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208,
provided that the antibody has the CDRs of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, respectively.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein and neutralises SARS-CoV-2 with at least 35% neutralisation (e.g. as measured in a pseudovirus neutralisation assay) , and
the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208,
provided that the antibody has the CDRs of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, respectively.

In one embodiment, the antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and neutralises

SARS-CoV-2 with at least 35% neutralisation (e.g. as measured in a pseudovirus neutralisation assay) , and
the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208,
provided that the antibody has the CDRs of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, respectively.

In one embodiment, the present invention provides an antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein,
wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

In one embodiment, the present invention provides an antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein,
wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1201.
An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1202.
An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1203.
An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1204.
An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1205.

An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1206.
An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1207.
An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2201.
An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2202.
An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2203.
An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2204.
An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2205.
An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2206.
An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2207.
An antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2208.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1201.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1202.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1203.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1204.

In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1205.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1206.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1207.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2201.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2202.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2203.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2204.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2205.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2206.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2207.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2208.

Antibodies are provided which bind to the same epitope on the S2 subunit of the SARS-CoV-2 spike protein as an antibody described anywhere herein.

An antibody is provided which bind to the same epitope as antibody YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, YANG-2209, YANG-2210, YANG-2211, YANG-2212, YANG-2213, YANG-2214, YANG-2215, YANG-2216, YANG-2217, YANG-2218, YANG-2219, YANG-2220, YANG-2221, YANG-2222, YANG-2223, YANG-2224, YANG-2225, YANG-2226, YANG-2227, YANG-2228, YANG-2229, YANG-2230, YANG-2231, YANG-2232, YANG-2233, YANG-2234, YANG-2235, YANG-2236, YANG-2237, YANG-2238, YANG-2239, YANG-2240, YANG-2241, YANG-2242, YANG-2243, YANG-2244, YANG-2245, YANG-2246, YANG-2247, YANG-2248, YANG-2249, YANG-2250, YANG-2251, YANG-2252, YANG-2253, YANG-2254, YANG-2255, YANG-2256, YANG-2257, YANG-2258, YANG-2259, YANG-2260, YANG-2261, YANG-2262, YANG-2263, YANG-2264, YANG-2265, YANG-2266, YANG-2267, YANG-2268, YANG-2269, YANG-2270, YANG-2271, YANG-2272, YANG-2273, YANG-2274, YANG-2275, YANG-2276, YANG-2277, YANG-2278, YANG-2279, YANG-2280, YANG-2281, YANG-2282, YANG-2283, YANG-2284, YANG-2285, YANG-2286, YANG-2287, YANG-2288, YANG-2289, YANG-2290, YANG-2291, YANG-2292, YANG-2293, YANG-2294, YANG-2295, YANG-2296, YANG-2297, YANG-2298, YANG-2299, YANG-2299a, YANG-2299b, YANG-2299c, YANG-2299d, YANG-2299e, YANG-2299f, YANG-2299g, YANG-2299h, YANG-2299i, YANG-2299j, YANG-2299k, YANG-2299l, e.g. as defined by its VH and VL sequences.

An antibody is provided which bind to the same epitope as antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, e.g. as defined by its VH and VL sequences.

In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1201.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1202.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1203.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1204.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1205.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1206.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1207.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2201.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2202.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2203.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2204.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2205.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2206.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2207.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2208.

An antibody may contact the SARS-CoV-2 spike protein with a footprint that fully or partly overlaps with that of an antibody disclosed anywhere herein. As described elsewhere herein, competition between antibodies may be determined, for example using SPR, and antibodies are provided which compete for binding to the spike protein (compete for binding to their epitope) with an IgG antibody as described anywhere herein.

An antibody of the present invention may be one which competes for binding to SARS-CoV-2 spike protein with any anti-S2 antibody described herein, such as YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208, YANG-2209, YANG-2210, YANG-2211, YANG-2212, YANG-2213, YANG-2214, YANG-2215, YANG-2216, YANG-2217, YANG-2218, YANG-2219, YANG-2220, YANG-2221, YANG-2222, YANG-2223, YANG-2224, YANG-2225, YANG-2226, YANG-2227, YANG-2228, YANG-2229, YANG-2230, YANG-2231, YANG-2232, YANG-2233, YANG-2234, YANG-2235, YANG-2236, YANG-2237, YANG-2238, YANG-2239, YANG-2240, YANG-2241, YANG-2242, YANG-2243, YANG-2244, YANG-2245, YANG-2246, YANG-2247, YANG-2248, YANG-2249, YANG-2250, YANG-2251, YANG-2252, YANG-2253, YANG-2254, YANG-2255, YANG-2256, YANG-2257, YANG-2258, YANG-2259, YANG-2260, YANG-2261, YANG-2262, YANG-2263, YANG-2264, YANG-2265, YANG-2266, YANG-2267, YANG-2268, YANG-2269, YANG-2270, YANG-2271, YANG-2272, YANG-2273, YANG-2274, YANG-2275, YANG-2276, YANG-2277,

YANG-2278, YANG-2279, YANG-2280, YANG-2281, YANG-2282, YANG-2283, YANG-2284, YANG-2285, YANG-2286, YANG-2287, YANG-2288, YANG-2289, YANG-2290, YANG-2291, YANG-2292, YANG-2293, YANG-2294, YANG-2295, YANG-2296, YANG-2297, YANG-2298, YANG-2299, YANG-2299a, YANG-2299b, YANG-2299c, YANG-2299d, YANG-2299e, YANG-2299f, YANG-2299g, YANG-2299h, YANG-2299i, YANG-2299j, YANG-2299k, YANG-2299l, e.g. as defined by its VH and VL sequences.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1201.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1202.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1203.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1204.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1205.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1206.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1207.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2201.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2202.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2203.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2204.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2205.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2206.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2207.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2208.

In one embodiment, the antibody comprises VH and/or VL domain framework regions of human germline gene segment sequences.

In one embodiment, the antibody comprises an antibody VH domain which
i) is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein
the V gene segment is IGHV4-4*02, IGHV3-7*01, IGHV3-9*01, IGHV3-30*18, IGHV1-46*03, IGHV3-33*01 or IGHV3-23*04; and/or
the J gene segment is IGHJ6*02, IGHJ3*02 or IGHJ4*02; or
ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein
FR1 aligns with human germline V gene segment IGHV4-4*02, IGHV3-7*01, IGHV3-9*01, IGHV3-30*18, IGHV1-46*03, IGHV3-33*01 or IGHV3-23*04 with up to 1, 2, 3, 4, or 5 amino acid alterations,
FR2 aligns with human germline V gene segment IGHV4-4*02, IGHV3-7*01, IGHV3-9*01, IGHV3-30*18, IGHV1-46*03, IGHV3-33*01 or IGHV3-23*04 with up to 1, 2, 3, 4, or 5 amino acid alterations,
FR3 aligns with human germline V gene segment IGHV4-4*02, IGHV3-7*01, IGHV3-9*01, IGHV3-30*18, IGHV1-46*03, IGHV3-33*01 or IGHV3-23*04 with up to 1, 2, 3, 4, or 5 amino acid alterations, and/or
FR4 aligns with human germline J gene segment IGHJ6*02, IGHJ3*02 or IGHJ4*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VH domain which
i) is derived from recombination of a human heavy chain V gene segment IGHV4-4*02, IGHV3-7*01, IGHV3-9*01, IGHV3-30*18, IGHV1-46*03, IGHV3-33*01 or IGHV3-23*04, a human heavy chain D gene segment and a human heavy chain J gene segment, or
ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1, FR2 and FR3 each align with human germline V segment IGHV4-4*02, IGHV3-7*01, IGHV3-9*01, IGHV3-30*18, IGHV1-46*03, IGHV3-33*01 or IGHV3-23*04 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the J gene segment is IGHJ6*02, IGHJ3*02 or IGHJ4*02, or the VH domain framework region FR4 aligns with human germline J gene segment IGHJ6*02, IGHJ3*02 or IGHJ4*02 with 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain which
i) is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein

the V gene segment is IGKV3-20*01, IGKV1-16*02, IGKV1-33*01, IGKV2-30*01, IGKV2D-29*01, IGLV1-40*01, IGLV3-1*01, IGKV2D-28*d01, IGKV1-12*01 or IGLV1-51*01; and/or

the J gene segment is IGKJ1*01, IGKJ3*01, IGKJ4*01, IGLJ3*02, IGLJ2*01 or IGKJ5*01; or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGKV3-20*01, IGKV1-16*02, IGKV1-33*01, IGKV2-30*01, IGKV2D-29*01, IGLV1-40*01, IGLV3-1*01, IGKV2D-28*d01, IGKV1-12*01 or IGLV1-51*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGKV3-20*01, IGKV1-16*02, IGKV1-33*01, IGKV2-30*01, IGKV2D-29*01, IGLV1-40*01, IGLV3-1*01, IGKV2D-28*d01, IGKV1-12*01 or IGLV1-51*01 with up to 1, 2, 3, 4, or 5 amino acid alterations

FR3 aligns with human germline V gene segment IGKV3-20*01, IGKV1-16*02, IGKV1-33*01, IGKV2-30*01, IGKV2D-29*01, IGLV1-40*01, IGLV3-1*01, IGKV2D-28*d01, IGKV1-12*01 or IGLV1-51*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGKJ1*01, IGKJ3*01, IGKJ4*01, IGLJ3*02, IGLJ2*01 or IGKJ5*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein:

the V gene segment is IGKV3-20*01, IGKV1-16*02, IGKV1-33*01, IGKV2-30*01, IGKV2D-29*01, IGLV1-40*01, IGLV3-1*01, IGKV2D-28*d01, IGKV1-12*01 or IGLV1-51*01, and optionally

the J gene segment is IGKJ1*01, IGKJ3*01, IGKJ4*01, IGLJ3*02, IGLJ2*01 or IGKJ5*01.

Example combinations of v and j gene segments for heavy and light chain variable domains are shown in Table 3, and these represent preferred combinations. The heavy and light chain variable domains may optionally be derived from the v and j gene segments identified in Table 3 for any one individual YANG antibody.

GROUP D - NON-COMPETING RBD BINDERS

In a fourth aspect, the present invention provides an antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody does not compete for binding to the SARS-CoV2 spike protein with the human ACE2 receptor.

In one embodiment, the antibody is a neutralising antibody.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 55nM or lower (e.g. as measured in a pseudovirus neutralisation assay).

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 35nM or lower (e.g. as measured in a pseudovirus neutralisation assay).

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 15nM or lower (e.g. as measured in a pseudovirus neutralisation assay).

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 10nM or lower (e.g. as measured in a pseudovirus neutralisation assay).

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 3nM or lower (e.g. as measured in a pseudovirus neutralisation assay).

In one embodiment, the antibody increases binding between SARS-CoV-2 and the human ACE2 receptor.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the HCDR3 is the HCDR3 of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068.

In one embodiment, the antibody is a neutralising antibody and comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the HCDR3 is the HCDR3 of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody is a neutralising antibody and comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the HCDR3 is the HCDR3 of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068.

In one embodiment, the antibody increases binding between SARS-CoV2 and the human ACE2 receptor and comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the HCDR3 is the HCDR3

of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody increases binding between SARS-CoV2 and the human ACE2 receptor and comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2and LCDR3, wherein the HCDR3 is the HCDR3 of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068.

In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-026.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-034.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-016.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-050.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-049.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-015.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-009.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-011.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-044.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-046.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-051.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-024.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-058.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-043.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-045.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-027.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-018.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-048.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-033.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-014.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-038.
In one embodiment, HCDR3 is the HCDR3 of antibody IMPI-068.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the CDRs are those of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068.

In one embodiment, the antibody is a neutralising antibody, wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody is a neutralising antibody, wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068.

In one embodiment, the antibody increases binding between SARS-CoV-2 and the human ACE2 receptor, wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the CDRs are those of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068, or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody increases binding between SARS-CoV-2 and the human ACE2 receptor, wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the CDRs are those of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068.

In one embodiment, the antibody has the CDRs of antibody IMPI-026.

In one embodiment, the antibody has the CDRs of antibody IMPI-034.
In one embodiment, the antibody has the CDRs of antibody IMPI-016.
In one embodiment, the antibody has the CDRs of antibody IMPI-050.
In one embodiment, the antibody has the CDRs of antibody IMPI-049.
In one embodiment, the antibody has the CDRs of antibody IMPI-015.
In one embodiment, the antibody has the CDRs of antibody IMPI-009.
In one embodiment, the antibody has the CDRs of antibody IMPI-011.
In one embodiment, the antibody has the CDRs of antibody IMPI-044.
In one embodiment, the antibody has the CDRs of antibody IMPI-046.
In one embodiment, the antibody has the CDRs of antibody IMPI-051.
In one embodiment, the antibody has the CDRs of antibody IMPI-024.
In one embodiment, the antibody has the CDRs of antibody IMPI-058.
In one embodiment, the antibody has the CDRs of antibody IMPI-043.
In one embodiment, the antibody has the CDRs of antibody IMPI-045.
In one embodiment, the antibody has the CDRs of antibody IMPI-027.
In one embodiment, the antibody has the CDRs of antibody IMPI-018.
In one embodiment, the antibody has the CDRs of antibody IMPI-048.
In one embodiment, the antibody has the CDRs of antibody IMPI-033.
In one embodiment, the antibody has the CDRs of antibody IMPI-014.
In one embodiment, the antibody has the CDRs of antibody IMPI-038.
In one embodiment, the antibody has the CDRs of antibody IMPI-068.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody is a neutralising antibody, wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068,

optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody is a neutralising antibody, wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068,
optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody increases binding between SARS-CoV-2 and the human ACE2 receptor, wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068,
optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody increases binding between SARS-CoV-2 and the human ACE2 receptor, wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068,
optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-026, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining

regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-026, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-034, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-034, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-016, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-016, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-050, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-050, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-049, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-049, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-015, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-015, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-009, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-009, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-011, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-011, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-044, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-044, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-046, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-046, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-051, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-051, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-024, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-024, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-058, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-058, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-043, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-043, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-045, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-045, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-027, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining

regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-027, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-018, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-018, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-048, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-048, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-033, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-033, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-014, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-014, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-038, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-038, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-068, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-068, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049,

IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068,
provided that the antibody has the CDRs of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068.

In one embodiment, the antibody is a neutralising antibody, wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068, or an antibody in the same cluster as one of these antibodies, provided that the antibody has the CDRs of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068, or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody is a neutralising antibody, wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068, provided that the antibody has the CDRs of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068.

In one embodiment, the antibody increases binding between SARS-CoV2 and the human ACE2 receptor, wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068, or an antibody in the same cluster as one of these antibodies, provided that the antibody has the CDRs of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068, or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody increases binding between SARS-CoV2 and the human ACE2 receptor, wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068,
provided that the antibody has the CDRs of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-026 and the variable light (VL) domain sequence

comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-026, provided that the antibody has the CDRs of antibody IMPI-026.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-034and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-034, provided that the antibody has the CDRs of antibody IMPI-034.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-016 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-016, provided that the antibody has the CDRs of antibody IMPI-016.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-050 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-050, provided that the antibody has the CDRs of antibody IMPI-050.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-049 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-049, provided that the antibody has the CDRs of antibody IMPI-049.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-015 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-015, provided that the antibody has the CDRs of antibody IMPI-015.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-009 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-009, provided that the antibody has the CDRs of antibody IMPI-009.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-011 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-011, provided that the antibody has the CDRs of antibody IMPI-011.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-044 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-044, provided that the antibody has the CDRs of antibody IMPI-044.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-046 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-046, provided that the antibody has the CDRs of antibody IMPI-046.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-051 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-051, provided that the antibody has the CDRs of antibody IMPI-051.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-024 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-024, provided that the antibody has the CDRs of antibody IMPI-024.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-058 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-058, provided that the antibody has the CDRs of antibody IMPI-058.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-043 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-043, provided that the antibody has the CDRs of antibody IMPI-043.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-045and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-045, provided that the antibody has the CDRs of antibody IMPI-045.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-027 and the variable light (VL) domain sequence

comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-027, provided that the antibody has the CDRs of antibody IMPI-027.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-018 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-018, provided that the antibody has the CDRs of antibody IMPI-018.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-048 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-048, provided that the antibody has the CDRs of antibody IMPI-048.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-033 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-033, provided that the antibody has the CDRs of antibody IMPI-033.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-014 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-014, provided that the antibody has the CDRs of antibody IMPI-014.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-038 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-038, provided that the antibody has the CDRs of antibody IMPI-038.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-068 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-068, provided that the antibody has the CDRs of antibody IMPI-068.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-

044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068.

In one embodiment, the antibody is a neutralising antibody, wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody is a neutralising antibody, wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068.

In one embodiment, the antibody increases binding between SARS-CoV2 and the human ACE2 receptor, wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068 or an antibody in the same cluster as one of these antibodies.

In one embodiment, the antibody increases binding between SARS-CoV2 and the human ACE2 receptor, wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068.

In one embodiment, the present invention provides an anti-SARS-CoV2 antibody,
wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-026 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-026.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-034 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-034.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-016 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-016.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-050 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-050.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-049 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-049.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-015 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-015.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-009 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-009.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-011 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-011.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-044 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-044.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-046 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-046.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-051 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-051.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-024 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-024.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-058 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-058.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-043 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-043.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-045 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-045.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-027 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-027.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-018 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-018.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-048 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-048.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-033 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-033.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-014 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-014.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-038 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-038.

In one embodiment, the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-068 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-068.

In one embodiment, the antibody neutralises SARS-CoV2 with an IC50 of 2nM or greater (e.g. as measured in a pseudovirus neutralisation assay) (see, for example, IMPI-024; IMPI-068; IMPI-027; and IMPI-038).

In one embodiment, the antibody neutralises SARS-CoV2 with an IC50 of 5nM or greater (e.g. as measured in a pseudovirus neutralisation assay) (see, for example, IMPI-024; IMPI-068; IMPI-027; IMPI-038).

In one embodiment, the antibody neutralises SARS-CoV2 with an IC50 of 10nM or greater (e.g. as measured in a pseudovirus neutralisation assay) (see, for example, IMPI-068; IMPI-027; and IMPI-038).

In one embodiment, the antibody neutralises SARS-CoV2 with an IC50 of 30nM or greater (e.g. as measured in a pseudovirus neutralisation assay) (see, for example, IMPI-027 and IMPI-038).

In one embodiment, the antibody neutralises SARS-CoV2 with an IC50 of 50nM or greater (e.g. as measured in a pseudovirus neutralisation assay) (see, for example, IMPI-038).

In one embodiment, the antibody comprises VH and/or VL domain framework regions of human germline gene segment sequences.

In one embodiment, the antibody comprises an antibody VH domain which
i) is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein
the V gene segment is IGHV5-51*01, IGHV4-31*03 or IGHV3-30*18;
and/or
the J gene segment is IGHJ4*02 or IGHJ6*02, or
ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGHV5-51*01, IGHV4-31*03 or IGHV3-30*18 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGHV5-51*01, IGHV4-31*03 or IGHV3-30*18 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR3 aligns with human germline V gene segment IGHV5-51*01, IGHV4-31*03 or IGHV3-30*18 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGHJ4*02 or IGHJ6*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VH domain which
i) is derived from recombination of a human heavy chain V gene segment IGHV5-51*01, IGHV4-31*03 or IGHV3-30*18, a human heavy chain D gene segment and a human heavy chain J gene segment, or
ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1, FR2 and FR3 each align with human germline V segment IGHV5-51*01, IGHV4-31*03 or IGHV3-30*18 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the J gene segment is IGHJ4*02 or IGHJ6*02, or the VH domain framework region FR4 aligns with human germline J gene segment IGHJ4*02 or IGHJ6*02 with 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain which
i) is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein

the V gene segment is IGKV1D-13*d01 or IGKV1-12*01, and/or

the J gene segment is IGKJ1*01, IGKJ4*01 or IGKJ3*01; or
ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGKV1D-13*d01 or IGKV1-12*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGKV1D-13*d01 or IGKV1-12*01 with up to 1, 2, 3, 4, or 5 amino acid alterations

FR3 aligns with human germline V gene segment IGKV1D-13*d01 or IGKV1-12*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGKJ1*01, IGKJ4*01 or IGKJ3*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein:

the V gene segment is IGKV1D-13*d01 or IGKV1-12*01, and optionally

the J gene segment is IGKJ1*01, IGKJ4*01 or IGKJ3*01.

Example combinations of v and j gene segments for heavy and light chain variable domains are shown in Table 3, and these represent preferred combinations. The heavy and light chain variable domains may optionally be derived from the v and j gene segments identified in Table 3 for any one individual IMPI antibody identified in this Group D section.

Further non-competing RBD binders

According to the fourth aspect of the invention, further antibodies are provided herein which specifically bind to the RBD of the SARS-CoV-2 spike protein and do not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor. For example, antibodies YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403, and YANG-2112 as exemplified herein have been found to specifically bind to the RBD of the SARS-CoV-2 spike protein and do not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the HCDR3 is the HCDR3 of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112.

In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1102.

In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1111.

In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1401.

In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1402.

In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1403.

In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2112.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein, and HCDR3 is the HCDR3 of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)), and HCDR3 is the HCDR3

of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein and neutralises SARS-CoV-2 with at least 70%, 85%, or 90% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and HCDR3 is the HCDR3 of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112.
In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and neutralises SARS-CoV-2 with at least 70%, 85%, or 90% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and HCDR3 is the HCDR3 of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112.

In one embodiment, the antibody has the CDRs of antibody YANG-1102.
In one embodiment, the antibody has the CDRs of antibody YANG-1111.
In one embodiment, the antibody has the CDRs of antibody YANG-1401.
In one embodiment, the antibody has the CDRs of antibody YANG-1402.
In one embodiment, the antibody has the CDRs of antibody YANG-1403.
In one embodiment, the antibody has the CDRs of antibody YANG-2112.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein, and the CDRs are those of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)), and the CDRs are those of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein and neutralises SARS-CoV-2 with at least 70%, 85%, or 90% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and the CDRs are those of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and neutralises SARS-CoV-2 with at least 70%, 85%, or 90% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and the CDRs are those of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112.
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1111, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1111, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1102, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1102, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1401, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1401, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1402, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1402, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1403, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions

(CDRs), and a variable light (VL) domain sequence of antibody YANG-1403, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).
In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2112, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2112, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein, and the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)), and
the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein and neutralises SARS-CoV-2 with at least 70%, 85%, or 90% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and
the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and neutralises SARS-CoV-2 with at least 70%, 85%, or 90% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and

the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody

provided that the antibody has the CDRs of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112, respectively.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1102 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1102, provided that the antibody has the CDRs of antibody YANG-1102.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1111 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1111, provided that the antibody has the CDRs of antibody YANG-1111.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1401 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1401, provided that the antibody has the CDRs of antibody YANG-1401.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1402 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1402, provided that the antibody has the CDRs of antibody YANG-1402.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1403 and the variable light (VL) domain sequence

comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1403, provided that the antibody has the CDRs of antibody YANG-1403.
In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2112 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2112, provided that the antibody has the CDRs of antibody YANG-2112.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein, and the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112
provided that the antibody has the CDRs of YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112, respectively.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)), and
the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112
provided that the antibody has the CDRs of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112, respectively.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein and neutralises SARS-CoV-2 with at least 70%, 85%, or 90% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and
the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112

provided that the antibody has the CDRs of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112, respectively.

In one embodiment, the antibody specifically binds to the RBD of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and neutralises SARS-CoV-2 with at least 70%, 85%, or 90% neutralisation (e.g. as measured in a pseudovirus neutralisation assay), and
the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112
provided that the antibody has the CDRs of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112, respectively.

In one embodiment, the present invention provides an antibody specifically binds to the RBD of the SARS-CoV-2 spike protein,
wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112.

An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1102.
An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1111.
An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1401.
An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1402.
An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1403.
An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2112.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112.

In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1102.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1111.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1401.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1402.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1403.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2112.

Antibodies are provided which bind to the same epitope on the RBD of the SARS-CoV-2 spike protein as an antibody described anywhere herein.

An antibody is provided which bind to the same epitope as antibody YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112, e.g. as defined by its VH and VL sequences.

An antibody is provided which bind to the same epitope as antibody YANG-1102.
An antibody is provided which bind to the same epitope as antibody YANG-1111.
An antibody is provided which bind to the same epitope as antibody YANG-1401.
An antibody is provided which bind to the same epitope as antibody YANG-1402.
An antibody is provided which bind to the same epitope as antibody YANG-1403.
An antibody is provided which bind to the same epitope as antibody YANG-2112.

An antibody may contact the SARS-CoV-2 spike protein with a footprint that fully or partly overlaps with that of an antibody disclosed anywhere herein. As described elsewhere herein, competition between antibodies may be determined, for example using SPR, and antibodies are provided which compete for binding to the spike protein (compete for binding to their epitope) with an IgG antibody as described anywhere herein.

An antibody of the present invention may be one which competes for binding to SARS-CoV-2 spike protein with any anti-RBD antibody described herein, such as YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112, e.g. as defined by its VH and VL sequences.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1111.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1102.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1401.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1402.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1403.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2112.

In one embodiment, the antibody comprises an antibody VH domain which

i) is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein

the V gene segment is IGHV4-4*02, IGHV3-48*02, IGHV3-53*01, IGHV3-33*01 or IGHV1-24*d01; and/or

the J gene segment is IGHJ4*02, IGHJ5*02 or IGHJ6*02; or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGHV4-4*02, IGHV3-48*02, IGHV3-53*01, IGHV3-33*01 or IGHV1-24*d01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGHV4-4*02, IGHV3-48*02, IGHV3-53*01, IGHV3-33*01 or IGHV1-24*d01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR3 aligns with human germline V gene segment IGHV4-4*02, IGHV3-48*02, IGHV3-53*01, IGHV3-33*01 or IGHV1-24*d01 with up to 1, 2, 3, 4, or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGHJ4*02, IGHJ5*02 or IGHJ6*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VH domain which

i) is derived from recombination of a human heavy chain V gene segment IGHV4-4*02, IGHV3-48*02, IGHV3-53*01, IGHV3-33*01 or IGHV1-24*d01, a human heavy chain D gene segment and a human heavy chain J gene segment, or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1, FR2 and FR3 each align with human germline V segment IGHV4-4*02, IGHV3-48*02, IGHV3-53*01, IGHV3-33*01 or IGHV1-24*d01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the J gene segment is IGHJ4*02, IGHJ5*02 or IGHJ6*02, or the VH domain framework region FR4 aligns with human germline J gene segment IGHJ4*02, IGHJ5*02 or IGHJ6*02 with 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain which

i) is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein

the V gene segment is IGLV1-40*01, IGLV3-21*d01, IGKV1D-16*01, IGKV1-9*d01, IGKV1D-17*01 or IGLV1-47*01; and/or

the J gene segment is IGLJ3*02, IGLJ2*01, IGKJ4*01 or IGKJ1*01; or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGLV1-40*01, IGLV3-21*d01, IGKV1D-16*01, IGKV1-9*d01, IGKV1D-17*01 or IGLV1-47*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGLV1-40*01, IGLV3-21*d01, IGKV1D-16*01, IGKV1-9*d01, IGKV1D-17*01 or IGLV1-47*01 with up to 1, 2, 3, 4, or 5 amino acid alterations

FR3 aligns with human germline V gene segment IGLV1-40*01, IGLV3-21*d01, IGKV1D-16*01, IGKV1-9*d01, IGKV1D-17*01 or IGLV1-47*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGLJ3*02, IGLJ2*01, IGKJ4*01 or IGKJ1*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein:

the V gene segment is IGLV1-40*01, IGLV3-21*d01, IGKV1D-16*01, IGKV1-9*d01, IGKV1D-17*01 or IGLV1-47*01, and optionally

the J gene segment is IGLJ3*02, IGLJ2*01, IGKJ4*01 or IGKJ1*01.

Example combinations of v and j gene segments for heavy and light chain variable domains are shown in Table 3, and these represent preferred combinations. The heavy and light chain variable domains may optionally be derived from the v and j gene segments identified in Table 3 for any one individual YANG antibody.

GROUP E – NTD BINDERS

According to a fifth aspect of the invention, antibodies are provided herein which specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein. For example, antibodies YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302,

YANG-2303, YANG-2304, YANG-2305, and YANG-2306 as exemplified herein have been found to specifically bind to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein.

In a first aspect, the present invention provides an antibody that specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein.

In one embodiment, the antibody specifically binds the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)).

In one embodiment, the antibody is a neutralising antibody.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 5.5 nM or lower (e.g. as measured in a pseudovirus neutralisation assay).

In one embodiment, the antibody specifically binds the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and the antibody neutralises SARS-CoV2 with an IC50 of 5.5 nM or lower (e.g. as measured in a pseudovirus neutralisation assay).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the HCDR3 is the HCDR3 of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306.

In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1301.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1302.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1303.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1304.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-1305.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2301.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2302.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2303.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2304.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2305.
In one embodiment, HCDR3 is the HCDR3 of antibody YANG-2306.

In one embodiment, the antibody specifically binds the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and HCDR3 is the HCDR3 of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 5.5 nM or lower (e.g. as measured in a pseudovirus neutralisation assay) and HCDR3 is the HCDR3 of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306.

In one embodiment, the antibody specifically binds the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and neutralises SARS-CoV-2 with an IC50 of 5.5 nM or lower (e.g. as measured in a pseudovirus neutralisation assay), and HCDR3 is the HCDR3 of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306.

In one embodiment, the antibody has the CDRs of antibody YANG-1301.
In one embodiment, the antibody has the CDRs of antibody YANG-1302.
In one embodiment, the antibody has the CDRs of antibody YANG-1303.
In one embodiment, the antibody has the CDRs of antibody YANG-1304.
In one embodiment, the antibody has the CDRs of antibody YANG-1305.
In one embodiment, the antibody has the CDRs of antibody YANG-2301.
In one embodiment, the antibody has the CDRs of antibody YANG-2302.
In one embodiment, the antibody has the CDRs of antibody YANG-2303.
In one embodiment, the antibody has the CDRs of antibody YANG-2304.
In one embodiment, the antibody has the CDRs of antibody YANG-2305.
In one embodiment, the antibody has the CDRs of antibody YANG-2306.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,

wherein the antibody specifically binds the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)), and wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,
wherein the antibody neutralises SARS-CoV-2 with an IC50 of 5.5 nM or lower (e.g. as measured in a pseudovirus neutralisation assay), and
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306.

In one embodiment, the present invention provides an anti-SARS-CoV-2 antibody,
wherein the antibody specifically binds the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and neutralises SARS-CoV-2 with an IC50 of 5.5 nM or lower (e.g. as measured in a pseudovirus neutralisation assay), and
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1301, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1301, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1302, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1302, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1303, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1303, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1304, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1304, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-1305, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-1305, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2301, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2301, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2302, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2302, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2303, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2303, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2304, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2304, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2305, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2305, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence of antibody YANG-2306, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody YANG-2306, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

In one embodiment, the antibody specifically binds the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)), and

the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 5.5 nM or lower (e.g. as measured in a pseudovirus neutralisation assay), and

and the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody specifically binds the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and neutralises SARS-CoV-2 with an IC50 of 5.5 nM or lower (e.g. as measured in a pseudovirus neutralisation assay), and

and the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306 provided that the antibody has the CDRs of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306, respectively.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1301 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1301, provided that the antibody has the CDRs of antibody YANG-1301.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG- 1302 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1302, provided that the antibody has the CDRs of antibody YANG-1302.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1303 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1303, provided that the antibody has the CDRs of antibody YANG-1303.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1304 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1304, provided that the antibody has the CDRs of antibody YANG-1304.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-1305 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-1305, provided that the antibody has the CDRs of antibody YANG-1305.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2301 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2301, provided that the antibody has the CDRs of antibody YANG-2301.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2302 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2302, provided that the antibody has the CDRs of antibody YANG-2302.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2303 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2303, provided that the antibody has the CDRs of antibody YANG-2303.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2304and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2304, provided that the antibody has the CDRs of antibody YANG-2304.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2305 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2305, provided that the antibody has the CDRs of antibody YANG-2305.

In one embodiment, the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody YANG-2306 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody YANG-2306, provided that the antibody has the CDRs of antibody YANG-2306.

In one embodiment, the antibody specifically binds the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)), and

and the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306,

provided that the antibody has the CDRs of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306, respectively.

In one embodiment, the antibody neutralises SARS-CoV-2 with an IC50 of 5.5 nM or lower (e.g. as measured in a pseudovirus neutralisation assay), and
and the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306,
provided that the antibody has the CDRs of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306, respectively.

In one embodiment, the antibody specifically binds the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein with a KD of 0.1 nM or lower (e.g. as measured by surface plasmon resonance (SPR)) and neutralises SARS-CoV-2 with an IC50 of 5.5 nM or lower (e.g. as measured in a pseudovirus neutralisation assay), and
and the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306,
provided that the antibody has the CDRs of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306, respectively.

In one embodiment, the present invention provides an antibody that specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein,
wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306.

In one embodiment, the antibody specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1301.

In one embodiment, the antibody specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1302.

In one embodiment, the antibody specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1303.

In one embodiment, the antibody specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1304.

In one embodiment, the antibody specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-1305.

In one embodiment, the antibody specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2301.

In one embodiment, the antibody specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2302.

In one embodiment, the antibody specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2303.

In one embodiment, the antibody specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2304.

In one embodiment, the antibody specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2305.

In one embodiment, the antibody specifically binds to the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein, wherein the antibody comprises the VH and VL domain sequences of antibody YANG-2306.

In one embodiment, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of

antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306.

In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1301.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1302.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1303.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1304.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-1305.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2301.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2302.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2303.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2304.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2305.
In one embodiment, the antibody comprises the VH and VL domain sequences of antibody YANG-2306.

Antibodies are provided which bind to the same epitope on the N-terminal domain (NTD) of the S1 subunit of the SARS-CoV-2 spike protein as an antibody described anywhere herein.

An antibody is provided which bind to the same epitope as antibody YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306, e.g. as defined by its VH and VL sequences.

In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1301.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1302.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1303.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1304.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-1305.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2301.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2302.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2303.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2304.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2305.
In one embodiment, an antibody is provided which binds to the same epitope as antibody YANG-2306.

An antibody may contact the SARS-CoV-2 spike protein with a footprint that fully or partly overlaps with that of an antibody disclosed anywhere herein. As described elsewhere herein, competition between antibodies may be determined, for example using SPR, and antibodies are provided which compete for

binding to the spike protein (compete for binding to their epitope) with an IgG antibody as described anywhere herein.

An antibody of the present invention may be one which competes for binding to SARS-CoV-2 spike protein with any anti-NTD antibody described herein, such as YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306, e.g. as defined by its VH and VL sequences.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1301.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1302.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with any antibody YANG-1303.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1304.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-1305.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2301.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2302.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2303.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2304.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2305.
An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein with antibody YANG-2306.

In one embodiment, the antibody comprises VH and/or VL domain framework regions of human germline gene segment sequences.

In one embodiment, the antibody comprises an antibody VH domain which
i) is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein

the V gene segment is IGHV3-33*01, IGHV1-18*01, IGHV4-34*01, IGHV3-30*18 or IGHV1-24*d01; and/or

the J gene segment is IGHJ5*02, IGHJ4*02 or IGHJ6*02; or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGHV3-33*01, IGHV1-18*01, IGHV4-34*01, IGHV3-30*18 or IGHV1-24*d01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGHV3-33*01, IGHV1-18*01, IGHV4-34*01, IGHV3-30*18 or IGHV1-24*d01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR3 aligns with human germline V gene segment IGHV3-33*01, IGHV1-18*01, IGHV4-34*01, IGHV3-30*18 or IGHV1-24*d01 with up to 1, 2, 3, 4, or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGHJ5*02, IGHJ4*02 or IGHJ6*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VH domain which

i) is derived from recombination of a human heavy chain V gene segment IGHV3-33*01, IGHV1-18*01, IGHV4-34*01, IGHV3-30*18 or IGHV1-24*d01, a human heavy chain D gene segment and a human heavy chain J gene segment, or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1, FR2 and FR3 each align with human germline V segment IGHV3-33*01, IGHV1-18*01, IGHV4-34*01, IGHV3-30*18 or IGHV1-24*d01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the J gene segment is IGHJ5*02, IGHJ4*02 or IGHJ6*02, or the VH domain framework region FR4 aligns with human germline J gene segment IGHJ5*02, IGHJ4*02 or IGHJ6*02 with 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain which

i) is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein

the V gene segment is IGLV3-1*01, IGLV3-10*01, IGKV1-27*01, IGKV3-15*01, IGKV3-20*01 or IGLV2-8*01; and/or

the J gene segment is IGLJ2*01, IGLJ3*02, IGKJ3*01, IGKJ4*01 or IGKJ2*04; or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGLV3-1*01, IGLV3-10*01, IGKV1-27*01, IGKV3-15*01, IGKV3-20*01 or IGLV2-8*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGLV3-1*01, IGLV3-10*01, IGKV1-27*01, IGKV3-15*01, IGKV3-20*01 or IGLV2-8*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR3 aligns with human germline V gene segment IGLV3-1*01, IGLV3-10*01, IGKV1-27*01, IGKV3-15*01, IGKV3-20*01 or IGLV2-8*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGLJ2*01, IGLJ3*02, IGKJ3*01, IGKJ4*01 or IGKJ2*04 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one embodiment, the antibody comprises an antibody VL domain derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein:

the V gene segment is IGLV3-1*01, IGLV3-10*01, IGKV1-27*01, IGKV3-15*01, IGKV3-20*01 or IGLV2-8*01, and optionally

the J gene segment is IGLJ2*01, IGLJ3*02, IGKJ3*01, IGKJ4*01 or IGKJ2*04.

Example combinations of v and j gene segments for heavy and light chain variable domains are shown in Table 3, and these represent preferred combinations. The heavy and light chain variable domains may optionally be derived from the v and j gene segments identified in Table 3 for any one individual YANG antibody identified.

ANTIBODIES- GENERAL

In an embodiment, the antibody as defined anywhere herein shows ADCC activity.

In an embodiment, the antibody as defined anywhere herein does not cross-react with the existing endemic seasonal coronaviruses (NL63, 229E, OC43 and HKU1).

In an embodiment, the antibody as defined anywhere herein cross-reacts with SARS-CoV spike protein and/or MERS-CoV spike protein.

An antibody as defined anywhere herein may be a human IgG1 or human IgG4. In one embodiment, the antibody is a human IgG1. In one embodiment, the antibody is a human IgG1 comprising a constant region sequence of SEQ ID NO: 418. In one embodiment, the antibody is a human IgG4. In one embodiment, the antibody is a human IgG4 comprising a constant region sequence of SEQ ID NO: 436.

An antibody as defined anywhere herein may be a human IgA1 (e.g., comprising a constant region sequence SEQ ID NO: 484) or human IgA2 (e.g., comprising a constant region sequence SEQ ID NO: 485).

An antibody as defined anywhere herein may comprise kappa (κ) light chain constant regions, preferably constant domain sequence SEQ ID NO: 448.

Nucleic acid may comprise a sequence that encodes a VH domain and/or an VL domain of an antibody as defined anywhere herein. The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067, IMPI-072, IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070, IMPI-071; IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-028, IMPI-038 or IMPI-068.

Nucleic acid may comprise a sequence that encodes the VH domain of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067, IMPI-072, IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070, IMPI-071; IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-028, IMPI-038 or IMPI-068.

Nucleic acid may comprise a sequence that encodes the VL domain of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067, IMPI-072, IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070, IMPI-071; IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-028, IMPI-038 or IMPI-068.

A nucleic acid sequence provided by the invention may comprise a sequence that encodes a VH domain and/or an VL domain of an antibody as defined anywhere herein.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody IMPI-037.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1101.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1103.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1105.
nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1106.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1107.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1108.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1109.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1110.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1112.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1113.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1114.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1115.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1116.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1117.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1118.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1119.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2101.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2102.
The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2103.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2104.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2105.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2106.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2107.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2108.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2109.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2110.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2111.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1201.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1202.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1203.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1204.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1205.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1206.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1207.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2201.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2202.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2203.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2204.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2205.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2206.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2207.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2208.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1102.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1111.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1401.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1402.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1403.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2112.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1301.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1302.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1303.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1304.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-1305.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2301.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2302.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2303.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2304.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2305.

The nucleic acid may comprise a sequence that encodes a VH domain and/or a VL domain of antibody YANG-2306.

A vector may comprise the nucleic acid as defined anywhere herein; optionally wherein the vector is a CHO vector.

A host cell may comprise the nucleic acid as defined anywhere herein or the vector as defined anywhere herein.

A pharmaceutical composition may comprise an antibody as defined anywhere herein and a pharmaceutically acceptable excipient.

A pharmaceutical composition may comprise an isolated nucleic acid encoding an antibody as defined anywhere herein, or the isolated nucleic acid as defined anywhere herein, and a pharmaceutically acceptable excipient.

In one embodiment, the pharmaceutical composition is formulated for intravenous, intramuscular or subcutaneous administration.

In one embodiment, the pharmaceutical composition further comprises at least one further therapeutic agent.

In one embodiment, the further therapeutic agent is at least one, preferably one or two, further antibodies.

In one embodiment, the at least one further antibody is selected from:

an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;

an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and does not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;

an antibody that specifically binds to the N-terminal domain (NTD) of the S1 subunit of the of SARS-CoV-2 spike protein;

an antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein; and

an antibody preferentially binds to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, S1 subunit and S2 subunit of the SARS-CoV-2 spike protein.

In one embodiment, the pharmaceutical composition comprises a first antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor and a second antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein. Such combinations have been found to advantageously inhibit syncytia formation. In this embodiment, the pharmaceutical composition may be capable of syncytia formation inhibition of 45% or greater or even 50% or greater (e.g. as measured in a syncytia formation inhibition assay as described herein). The first antibody may be an antibody according to the first aspect of the invention. The second antibody may be an antibody according to the third aspect of the invention. In this embodiment, the first antibody may be IMPI-059 or an antibody having HCDR3, the 6 CDRs, or the VH and/or VL domain sequences of IMPI-059. In this embodiment, the second antibody may be YANG-2204, YANG-2206, and YANG-2207 or an antibody having HCDR3, the 6 CDRs, or the VH and/or VL domain sequences of YANG-2204, YANG-2206, and YANG-2207. In this embodiment, the first antibody may be an antibody having the 6 CDRs of IMPI-059 and the second antibody may an antibody having the 6 CDRs of YANG-2204. In this embodiment, the first antibody may be an antibody having the 6 CDRs of IMPI-059 and the second antibody may an antibody having the 6 CDRs of YANG-2206. In this embodiment, the first antibody may be an antibody having the 6 CDRs of IMPI-059 and the second antibody may an antibody having the 6 CDRs of YANG-2207. In this embodiment, the first antibody may be an antibody having the VH and VL domain sequences of IMPI-059 and the second antibody may an antibody having the VH and VL domain sequences of YANG-2204. In this embodiment, the first antibody may be an antibody having the VH and VL domain sequences of IMPI-059 and the second antibody may an antibody having the VH and VL domain sequences of YANG-2206. In this embodiment, the first antibody may be an antibody having the VH and VL domain sequences of IMPI-059 and the second antibody may an antibody having the VH and VL domain sequences of YANG-2207.

A kit may comprise the pharmaceutical composition as defined anywhere herein. In one embodiment, the kit further comprises at least one further therapeutic agent. In one embodiment, the further therapeutic agent is a further pharmaceutical composition comprising at least one, preferably one or two, further antibodies. In one embodiment, the at least one further antibody is selected from:

an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;

an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and does not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;

an antibody that specifically binds to the N-terminal domain (NTD) of the S1 subunit of the of SARS-CoV-2 spike protein;

an antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein; and

an antibody preferentially binds to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, S1 subunit and S2 subunit of the SARS-CoV-2 spike protein.

In one embodiment, the kit comprises a first antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor and a second antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein. Such combinations have been found to advantageously inhibit syncytia formation. In this embodiment, the kit may be capable of syncytia formation inhibition of 45% or greater or even 50% or greater (e.g. as measured in a syncytia formation inhibition assay as described herein). The first antibody may be an antibody according to the first aspect of the invention. The second antibody may be an antibody according to the third aspect of the invention. In this embodiment, the first antibody may be IMPI-059 or an antibody having HCDR3, the 6 CDRs, or the VH and/or VL domain sequences of IMPI-059. In this embodiment, the second antibody may be YANG-2204, YANG-2206, and YANG-2207 or an antibody having HCDR3, the 6 CDRs, or the VH and/or VL domain sequences of YANG-2204, YANG-2206, and YANG-2207. In this embodiment, the first antibody may be an antibody having the 6 CDRs of IMPI-059 and the second antibody may an antibody having the 6 CDRs of YANG-2204. In this embodiment, the first antibody may be an antibody having the 6 CDRs of IMPI-059 and the second antibody may an antibody having the 6 CDRs of YANG-2206. In this embodiment, the first antibody may be an antibody having the 6 CDRs of IMPI-059 and the second antibody may an antibody having the 6 CDRs of YANG-2207. In this embodiment, the first antibody may be an antibody having the VH and VL domain sequences of IMPI-059 and the second antibody may an antibody having the VH and VL domain sequences of YANG-2204. In this embodiment, the first antibody may be an antibody having the VH and VL domain sequences of IMPI-059 and the second antibody may an antibody having the VH and VL domain sequences of YANG-2206. In this embodiment, the first antibody may be an antibody having the VH and VL domain sequences of IMPI-059 and the second antibody may an antibody having the VH and VL domain sequences of YANG-2207.

In one embodiment, the kit further comprises a label or instructions for use to treat and/or prevent a SARS-CoV-2-related disease or condition, such as COVID-19, in a human; optionally wherein the label

or instructions comprise a marketing authorisation number (e.g., an FDA or EMA authorisation number); optionally wherein the kit comprises an IV or injection device that comprises the antibody or fragment.

An antibody as defined anywhere herein or a composition as defined anywhere herein may be provided for use as a medicament.

The antibody as defined anywhere herein, or the composition as defined anywhere herein, may be provided for use in a method of treating a SARS-CoV-2-related disease or condition, said method comprising administering the antibody or composition to a patient.

The antibody as defined anywhere herein, or the composition as defined anywhere herein, may be provided for use in a method of preventing a SARS-CoV-2-related disease or condition, said method comprising administering the antibody or composition to a patient.

Also described is the use of an antibody as defined anywhere herein, or the composition as defined anywhere herein, in the manufacture of a medicament for use in a method of treating a SARS-CoV-2-related disease or condition.

Also described is the use of an antibody as defined anywhere herein, or the composition as defined anywhere herein, in the manufacture of a medicament for use in a method of preventing a SARS-CoV-2-related disease or condition.

A method of treating a SARS-CoV-2-related disease or condition in a human may comprise administering to said human a therapeutically effective amount of an antibody as defined anywhere herein, or the composition as defined anywhere herein.

A method of preventing a SARS-CoV-2-related disease or condition in a human may comprise administering to said human a therapeutically effective amount of an antibody as defined anywhere herein, or the composition as defined anywhere herein.

In one embodiment, the SARS-CoV-2-related disease or condition is a SARS-CoV-2-mediated disease or condition.

In one embodiment, the SARS-CoV-2-related disease or condition is a COVID-19-related disease or condition. In some examples, the COVID-19-related disease or condition is COVID-19. In some examples, the COVID-19-related disease or condition is a long manifestation of infection by SARS-CoV-2 such as ‘Long COVID’.

In one embodiment, the SARS-CoV-2-related disease or condition is COVID-19.

In one embodiment, the method further comprises administering at least one further therapeutic agent.

In one embodiment, the administration of the further therapeutic agent is simultaneous, separate or sequential.

In one embodiment, the further therapeutic agent is at least one, preferably one or two, further antibodies.

In one embodiment, the at least one further antibody is selected from:

an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV2 spike protein with the human ACE2 receptor;

an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and does not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;

an antibody that specifically binds to the N-terminal domain (NTD) of the S1 subunit of the of SARS-CoV-2 spike protein;

an antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein; and

an antibody preferentially binds to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, S1 subunit and S2 subunit of the SARS-CoV-2 spike protein.

In one embodiment, the method comprises administering a first antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor and a second antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein. Such combinations have been found to advantageously inhibit syncytia formation. In this embodiment, the method may be capable of syncytia formation inhibition of 45% or greater or even 50% or greater (e.g. as measured in a syncytia formation inhibition assay as described herein). The first antibody may be an antibody according to the first aspect of the invention. The second antibody may be an antibody according to the third aspect of the invention. In this embodiment, the first antibody may be IMPI-059 or an antibody having HCDR3, the 6 CDRs, or the VH and/or VL domain sequences of IMPI-059. In this embodiment, the second antibody may be YANG-2204, YANG-2206, and YANG-2207 or an antibody having HCDR3, the 6 CDRs, or the VH and/or VL domain sequences of YANG-2204, YANG-2206, and YANG-2207. In this embodiment, the first antibody may be an antibody having the 6 CDRs of IMPI-059 and the second antibody may an antibody having the 6 CDRs of YANG-2204. In this embodiment, the first antibody may be an antibody having the 6 CDRs of IMPI-059 and the second antibody may an antibody having the 6 CDRs of YANG-2206. In this embodiment, the first antibody may be an antibody having the 6 CDRs of IMPI-059 and the second antibody

may an antibody having the 6 CDRs of YANG-2207. In this embodiment, the first antibody may be an antibody having the VH and VL domain sequences of IMPI-059 and the second antibody may an antibody having the VH and VL domain sequences of YANG-2204. In this embodiment, the first antibody may be an antibody having the VH and VL domain sequences of IMPI-059 and the second antibody may an antibody having the VH and VL domain sequences of YANG-2206. In this embodiment, the first antibody may be an antibody having the VH and VL domain sequences of IMPI-059 and the second antibody may an antibody having the VH and VL domain sequences of YANG-2207.

In one example, the first antibody and the second antibody may be administered simultaneously, separately, or sequentially.

Also described is the use of an antibody as defined anywhere herein, for determining the presence or absence of SARS-CoV-2 in a sample.

A method of determining the presence or absence of SARS-CoV-2 in a sample may comprise contacting the sample with an antibody as defined anywhere herein; and testing for binding between the antibody and SARS-CoV2 in the sample; wherein detection of binding indicates the presence of SARS-CoV-2 in the sample and wherein absence of binding indicates the absence of SARS-CoV-2 in the sample.

In one embodiment, the antibody comprises or is conjugated to a detectable label.

In one embodiment, the sample has been obtained from a human who has been or is suspected of having been infected with SARS-CoV-2 and/or who exhibits one or more symptoms of COVID-19. In one embodiment, the sample is a serum, plasma, or whole blood sample, an oral or nasal swab, urine, faeces, or cerebrospinal fluid (CFS), or wherein the sample is from any suspected SARS-CoV-2 infected organ or tissue.

A diagnostic kit for the use as defined anywhere herein, or the method as defined anywhere herein, may comprise an antibody as defined anywhere herein, and optionally one or more buffering solutions. In one embodiment, the diagnostic kit comprises a first reagent comprising the antibody as defined anywhere herein, and a second reagent comprising a detector molecule that binds to the first reagent. In one embodiment, the detector molecule is an antibody that comprises or is conjugated to a detectable label.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1:

Figure 1 depicts a single monomer of the SARS-CoV-2 virus trimeric spike protein (S).

Figures 2A-2B:

Amino acid sequence of the SARS-CoV-2 spike protein, with residue numbering for the nascent polypeptide. The signal peptide (residues 1-13, bold italics) is cleaved off before secretion. During maturation the polypeptide is cleaved at the S1/S2 cleavage site (residues 681-686, boxed) into subunits S1 (residues 14-685) and S2 (residues 686-1273, bold). These subunits remain non-covalently attached. The S1 subunit is further sub-divided into two functional domains: the N-terminal domain (NTD) (residues 14-306, wavy underlined) and the Receptor Binding Domain (RBD) (residues 331-528, underlined). The S2 subunit contains a transmembrane-domain (residues 1212-1234, bold underlined); the ectodomain (ECD) of spike contains all membrane-distal residues of subunits S1 and S2 (residues 1-1211). Following secretion, the protein is further cleaved at the S2' cleavage site (residues 815-816) upon cell adhesion, initiating a conformational change in the spike protein that leads to virus entry into the cell. To prevent the protein from spontaneously changing conformation in *in vitro* assays, a double-proline mutation (residues 986-987, dashed box) was introduced to stabilise the protein in its pre-fusion configuration. Figure 2A depicts the wild-type spike protein amino acid sequence. Figure 2B depicts the engineered spike protein sequence containing substitutions K986P and V987P.

Figures 3A-3Z:

Alignments of exemplary anti-SARS-CoV-2 antibody light and heavy chain amino acid sequences showing exemplary anti-SARS-CoV-2 antibodies and their siblings based on sequence homology. In summary, clusters were generated as follows: B cells were isolated from the immunised mice and their antibody-encoding sequences were recovered. By comparing sequences of the heavy and light chain variable domains, we identified clusters of sequences which correspond to families of B cells within a lineage. These clusters share the same v and j gene segments in their heavy and light chain variable domains and the same HCDR3 length. Given their inferred in vivo evolutionary relationship, all siblings within a cluster may be expected to share similar qualitative properties such as epitope binding and mode of action, especially where siblings were obtained from B cells which were recovered by antigen specific sorting, even if assay data for those siblings are not provided herein.

Figure 4:

Diagram showing binding properties of exemplary antibodies described herein as determined by HTRF.

Figure 5:

Neutralisation of SARS CoV-2 pseudovirus by RBD binding ACE2 competing antibodies mAb A, mAb B, mAb C and SAD S35.

Figure 6:

Neutralisation of SARS CoV2 pseudovirus by RBD ACE2 competing antibodies. Graph shows only antibodies that are equivalent to or more potent than the comparator antibodies mAb A, mAb B, mAb C and SAD S35 (dashed lines).

Figure 7:

Neutralisation of SARS CoV2 pseudovirus by NTD binding antibody 4A8 compared to a RBD ACE2 competing antibody SAD-S35 (dashed line).

Figure 8:

Neutralisation of SARS CoV2 pseudovirus by RBD binding but non-ACE2 competing antibodies. An RBD ACE2 competing antibody, SAD-S35, is included for comparison.

Figure 9:

Neutralisation of SARS CoV2 pseudovirus by S2 binding antibodies. An RBD ACE2 competing antibody, SAD-S35, is included for comparison (dashed line).

Figure 10:

Example of a neutralising antibody in the HTRF ACE2:trimer neutralisation assay (IMPI-027) and an antibody (IMPI-059) that increases binding activity.

Figure 11:

HTRF ACE2:trimer neutralisation curves for antibodies IMPI-024 and IMPI-068 which increase binding activity (open symbols), and comparator antibodies (filled symbols) which decrease binding activity.

Figure 12:

Epitope cross-competition binning of clones by SPR. Grey boxes indicate the two antibodies compete with each other for binding to RBD, white boxes indicate no competition between the pair of antibodies. Black boxes indicate assays not undertaken as they are the same antibody.

Figure 13:

IC50 values obtained for antibodies in live virus plaque neutralisation assay. Note log scale for IC50. The two control mAbs COV2-2196 and COV2-2130 are presently (October 2020) clinical candidate therapeutic antibodies. The 4 IMPI mAbs, tested singly (i.e., in monoclonal compositions), are also shown. IMPI-059 was the most potent antibody in this assay. IMPI-013 is an S2 binding neutralising mAb. IMPI-017 had an IC50 of 326 pM and IMPI-004 had an IC50 of 86 pM, IMPI-059 had an IC50 of 26pM and IMPI-013 had an IC50 of 3.4nM.

Figure 14:

Results of the syncytia inhibition assay of Example 18.

Figure 15:

Showing cluster information for antibody YANG-1401 VH

Figure 16:

Showing cluster information for antibody YANG-1401 VL

Figure 17:

Showing cluster information for antibodies YANG-2107 and YANG-2108 VH

Figure 18:

Showing cluster information for antibodies YANG-2107 and YANG-2108 VL

Figure 19:

Showing cluster information for antibody YANG-2111 VH

Figure 20:

Showing cluster information for antibody YANG-2111 VL

Figure 21:

Showing cluster information for antibody YANG-2203 VH

Figure 22:

Showing cluster information for antibody YANG-2203 VL

Figure 23A-C:

Showing cluster information for antibodies YANG-2204, YANG-2205, YANG-2206, YANG-2207, and YANG-2208 VH

Figure 24A-C:

Showing cluster information for antibodies YANG-2204, YANG-2205, YANG-2206, YANG-2207, and YANG-2208 VL

Figure 25:

Showing cluster information for antibody YANG-1112 VH

Figure 26:

Showing cluster information for antibody YANG-1112 VL

DETAILED DESCRIPTION

DEFINITIONS

Unless otherwise defined herein, scientific and technical terms shall have the meanings that are commonly understood by those of ordinary skill in the art. Further, unless otherwise required by context, singular terms shall include pluralities and plural terms shall include the singular.

The singular terms "a," "an," and "the" include plural referents unless context clearly indicates otherwise. Similarly, the word "or" is intended to include "and" unless the context clearly indicates otherwise.

Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of this disclosure, suitable methods and materials are described below. The abbreviation, "e.g." is derived from the Latin exempli gratia and is used herein to indicate a non-limiting example. Thus, the abbreviation "e.g." is synonymous with the term "for example."

In the specification and claims, the term "about" is used to modify, for example, the quantity of an ingredient in a composition, concentration, volume, process temperature, process time, yield, flow rate, pressure, and like values, and ranges thereof, employed in describing the examples of the disclosure. The term "about" refers to variation in the numerical quantity that can occur, for example, through typical measuring and handling procedures used for making compounds, compositions, concentrates or use formulations; through inadvertent error in these procedures; through differences in the manufacture, source, or purity of starting materials or ingredients used to carry out the methods, and like proximate considerations. The term "about" also encompasses amounts that differ due to aging of a formulation with a particular initial concentration or mixture and amounts that differ due to mixing or processing a formulation with a particular initial concentration or mixture. Where modified by the term "about" the claims appended hereto include equivalents to these quantities.

As used herein, “administer” or “administration” refers to the act of injecting or otherwise physically delivering a substance as it exists outside the body (e.g., an anti-SARS-CoV-2 spike protein antibody provided herein, or its encoding nucleic acid e.g. in an expression vector) into a patient, such as by mucosal, intradermal, intravenous, intramuscular delivery, inhalation e.g. nebulisation and/or any other method of physical delivery described herein or known in the art. When a disease, or a symptom thereof, is being treated, administration of the substance typically occurs after the onset of the disease or symptoms thereof.

When a disease, or symptoms thereof, are being prevented, administration of the substance typically occurs before the onset of the disease or symptoms thereof.

The term "antibody", "immunoglobulin" or "Ig" may be used interchangeably herein and means an immunoglobulin molecule that recognizes and specifically binds to a target, such as a protein, polypeptide, peptide, carbohydrate, polynucleotide, lipid, or combinations of the foregoing through at least one antigen recognition site within the variable region of the immunoglobulin molecule. As used herein, the term "antibody" encompasses intact polyclonal antibodies, intact monoclonal antibodies, antibody fragments (such as Fab, Fab', F(ab')2, and Fv fragments), single chain Fv (scFv) mutants, multispecific antibodies such as bispecific antibodies (including dual binding antibodies), chimeric antibodies, humanized antibodies, human antibodies, fusion proteins comprising an antigen determination portion of an antibody, and any other modified immunoglobulin molecule comprising an antigen recognition site so long as the antibodies exhibit the desired biological activity. The term "antibody" can also refer to a Y-shaped glycoprotein with a molecular weight of approximately 150 kDa that is made up of four polypeptide chains: two light (L) chains and two heavy (H) chains. There are five types of mammalian Ig heavy chain isotypes denoted by the Greek letters alpha (α), delta (δ), epsilon (ε), gamma (γ), and mu (μ). The type of heavy chain defines the class of antibody, i.e., IgA, IgD, IgE, IgG, and IgM, respectively. The γ and α classes are further divided into subclasses on the basis of differences in the constant domain sequence and function, e.g., IgG1, hIgG2, mIgG2A, mIgG2B, IgG3, IgG4, IgA1 and IgA2. In mammals, there are two types of immunoglobulin light chains, λ and κ. The "variable region" or "variable domain" of an antibody refers to the amino-terminal domains of the heavy or light chain of the antibody. The variable domains of the heavy chain and light chain may be referred to as "VH" and "VL", respectively. These domains are generally the most variable parts of the antibody (relative to other antibodies of the same class) and contain the antigen binding sites. An example of antibodies are heavy chain-only (i.e., H2) antibodies that comprise a dimer of a heavy chain (5'- VH-(optional Hinge)-CH2-CH3-3') and are devoid of a light chain.

The antibodies described herein may be oligoclonal, polyclonal, monoclonal (including full-length monoclonal antibodies), camelised, chimeric, CDR-grafted, multi-specific, bi-specific (including dual-binding antibodies), catalytic, chimeric, humanized, fully human, anti-idiotypic, including antibodies that can be labelled in soluble or bound form as well as fragments, variants or derivatives thereof, either alone or in combination with other amino acid sequences provided by known techniques. An antibody may be from any species. Antibodies described herein can be naked or conjugated to other molecules such as toxins, radioisotopes, etc.

The term "antigen binding domain," "antigen binding region," "antigen binding fragment," and similar terms refer to that portion of an antibody which comprises the amino acid residues that interact with an antigen and confer on the binding agent its specificity and affinity for the antigen (e.g. the complementarity determining regions (CDRs)). The antigen binding region can be derived from any animal species, such as

rodents (e.g. rabbit, rat or hamster) and humans. Preferably, the antigen binding region will be of human origin.

Antigen binding fragments described herein can include single-chain Fvs (scFv), single- chain antibodies, single domain antibodies, domain antibodies, Fv fragments, Fab fragments, F(ab') fragments, F(ab')2 fragments, antibody fragments that exhibit the desired biological activity, disulfide-stabilised variable region (dsFv), dimeric variable region (diabody), anti-idiotypic (anti-Id) antibodies (including, e.g. anti-Id antibodies to antibodies), intrabodies, linear antibodies, single-chain antibody molecules and multispecific antibodies formed from antibody fragments and epitope-binding fragments of any of the above. In particular, antibodies and antibody fragments described herein can include immunoglobulin molecules and immunologically active fragments of immunoglobulin molecules, i.e., molecules that contain an antigen-binding site. Digestion of antibodies with the enzyme, papain, results in two identical antigen-binding fragments, known also as "Fab" fragments, and a "Fc" fragment, having no antigen-binding activity but having the ability to crystallize. "Fab" when used herein refers to a fragment of an antibody that includes one constant and one variable domain of each of the heavy and light chains. The term "Fc region" herein is used to define a C-terminal region of an immunoglobulin heavy chain, including native- sequence Fc regions and variant Fc regions. The "Fc fragment" refers to the carboxy-terminal portions of both H chains held together by disulfides. The effector functions of antibodies are determined by sequences in the Fc region, the region which is also recognized by Fc receptors (FcR) found on certain types of cells. Digestion of antibodies with the enzyme, pepsin, results in a F(ab')2 fragment in which the two arms of the antibody molecule remain linked and comprise two-antigen binding sites. The F(ab')2 fragment has the ability to crosslink antigen.

"Fv" when used herein refers to the minimum fragment of an antibody that retains both antigen-recognition and antigen-binding sites. This region consists of a dimer of one heavy and one light chain variable domain in tight, non-covalent or covalent association. It is in this configuration that the three CDRs of each variable domain interact to define an antigen-binding site on the surface of the VH-VL dimer. Collectively, the six CDRs confer antigen-binding specificity to the antibody. However, even a single variable domain (or half of an Fv comprising only three CDRs specific for an antigen) has the ability to recognize and bind antigen, although at a lower affinity than the entire binding site.

The term "monoclonal antibody" as used herein refers to an antibody obtained from a population of substantially homogeneous antibodies, i.e. the individual antibodies comprising the population are identical except for possible naturally occurring mutations and/or post-translation modifications (e.g. isomerizations, amidations) that may be present in minor amounts. Monoclonal antibodies are highly specific, and are directed against a single antigenic determinant or epitope. In contrast, polyclonal antibody preparations typically include different antibodies directed against different antigenic determinants (or epitopes). The term "monoclonal antibody" as used herein encompasses both intact and full-length monoclonal antibodies

as well as antibody fragments (such as Fab, Fab', F(ab')2, Fv), single chain (scFv) mutants, fusion proteins comprising an antibody portion, and any other modified immunoglobulin molecule comprising an antigen recognition site. Furthermore, "monoclonal antibody" refers to such antibodies made in any number of ways including, but not limited to, hybridoma, phage selection, recombinant expression, and transgenic animals. The monoclonal antibodies herein can include "chimeric" antibodies (immunoglobulins) in which a portion of the heavy and/or light chain is identical with or homologous to corresponding sequences in antibodies derived from a particular species or belonging to a particular antibody class or subclass, while the remainder of the chain(s) is(are) identical with or homologous to corresponding sequences in antibodies derived from another species or belonging to another antibody class or subclass, as well as fragments of such antibodies that exhibit the desired biological activity.

The term "humanized antibody" refers to a subset of chimeric antibodies in which a "hypervariable region" from a non-human immunoglobulin (the donor antibody) replaces residues from a hypervariable region in a human immunoglobulin (recipient antibody). In general, a humanized antibody will include substantially all of at least one, and typically two, variable domains, in which all or substantially all of the hypervariable loops correspond to those of a non-human immunoglobulin sequence, and all or substantially all of the framework regions are those of a human immunoglobulin sequence, although the framework regions may include one or more substitutions that improve antibody performance, such as binding affinity, isomerization, immunogenicity, etc.

The term “bispecific antibody” means an antibody which comprises specificity for two target molecules, and includes, but is not limited to, formats such as DVD-Ig (see DiGiammarino et al., “Design and generation of DVD-Ig™ molecules for dual-specific targeting”, Meth. Mo. Biol., 2012, 889, 145-156), mAb2 (see WO2008/003103, the description of the mAb2 format is incorporated herein by reference), FIT-Ig (see WO2015/103072, the description of the FIT-Ig scaffold is incorporated herein by reference), mAb-dAb, dock and lock, Fab-arm exchange, SEEDbody, Triomab, LUZ-Y, Fcab, κλ-body, orthogonal Fab, scDiabody-Fc, diabody-Fc, tandem scFv-Fc, Fab-scFv-Fc, Fab-scFv, intrabody, BiTE, diabody, DART, TandAb, scDiabody, scDiabody-CH3, Diabody-CH3, Triple body, Miniantibody, minibody, TriBi minibody, scFv-CH3 KIH, scFv-CH-CL-scFv, F(ab’)2-scFv, scFv-KIH, Fab-scFv-Fc, tetravalent HCab, ImmTAC, knobs-in-holes, knobs-in-holes with common light chain, knobs-in-holes with common light chain and charge pairs, charge pairs, charge pairs with common light chain, DT-IgG, DutaMab, IgG(H)-scFv, scFv-(H)IgG, IgG(L)-scFv, scFv-(L)IgG, IgG(L,H)-Fv, IgG(H)-V, V(H)-IgG, IgG(L)-V, V(L)-IgG, KIH IgG-scFab, 2scFv-IgG, IgG-2scFv, scFv4-Ig and zybody. For a review of bispecific formats, see Spiess, C., et al., Mol. Immunol. (2015). In another example, the bispecific molecule comprises an antibody which is fused to another non-Ig format, for example a T-cell receptor binding domain; an immunoglobulin superfamily domain; an agnathan variable lymphocyte receptor; a fibronectin domain (e.g. an Adnectin™); an antibody constant domain (e.g. a CH3 domain, e.g., a CH2 and/or CH3 of an Fcab™) wherein the constant domain is not a functional CH1 domain; an scFv; an (scFv)2; an sc-diabody; an scFab; a centyrin

and an epitope binding domain derived from a scaffold selected from CTLA-4 (Evibody™); a lipocalin domain; Protein A such as Z-domain of Protein A (e.g. an Affibody™ or SpA); an A-domain (e.g. an Avimer™ or Maxibody™); a heat shock protein (such as and epitope binding domain derived from GroEI and GroES); a transferrin domain (e.g. a trans-body); ankyrin repeat protein (e.g. a DARPin™); peptide aptamer; C-type lectin domain (e.g. Tetranectin™); human γ- crystallin or human ubiquitin (an affilin); a PDZ domain; scorpion toxin; and a kunitz type domain of a human protease inhibitor.

In one example, the bispecific antibody is a mAb2. A mAb2 comprises a VH and VL domain from an intact antibody, fused to a modified constant region, which has been engineered to form an antigen-binding site, known as an "Fcab". The technology behind the Fcab/mAb2 format is described in more detail in WO2008/003103, and the description of the mAb2 format is incorporated herein by reference.

In one example, a "bispecific antibody" does not include a FIT-Ig format. In one example, a "bispecific antibody" does not include a mAb2 format. In one example, a "bispecific antibody" does not include either a FIT-Ig format or a mAb2 format.

In another example, the bispecific antibody is a "dual binding antibody". As used herein, the term "dual binding antibody" is a bispecific antibody wherein both antigen-binding domains are formed by a VH/VL pair, and includes FIT-Ig (see WO2015/103072, incorporated herein by reference), mAb-dAb, dock and lock, Fab-arm exchange, SEEDbody, Triomab, LUZ-Y, Fcab, κλ-body, orthogonal Fab, scDiabody-Fc, diabody-Fc, tandem scFv-Fc, Fab-scFv-Fc, Fab-scFv, intrabody, BiTE, diabody, DART, TandAb, scDiabody, scDiabody-CH3, Diabody-CH3, Triple body, Miniantibody, minibody, scFv-CH3 KIH, scFv-CH-CL-scFv, F(ab')2-scFv, scFv-KIH, Fab-scFv-Fc, tetravalent HCab, ImmTAC, knobs-in-holes, knobs-in-holes with common light chain, knobs-in-holes with common light chain and charge pairs, charge pairs, charge pairs with common light chain, DT-IgG, DutaMab, IgG(H)-scFv, scFv-(H)IgG, IgG(L)-scFv, scFv-(L)IgG, IgG(L,H)-Fv, IgG(H)-V, V(H)-IgG, IgG(L)-V, V(L)-IgG, KIH IgG-scFab, 2scFv-IgG, IgG-2scFv and scFv4-Ig.

The term "hypervariable region", "CDR region" or "CDR" refers to the regions of an antibody variable domain which are hypervariable in sequence and/or form structurally defined loops. Generally, antigen binding sites of an antibody include six hypervariable regions: three in the VH (CDRH1, CDRH2, CDRH3), and three in the VL (CDRL1, CDRL2, CDRL3). These regions of the heavy and light chains of an antibody confer antigen-binding specificity to the antibody. CDRs may be defined according to the Kabat system (see Kabat, E. A.et al., 1991, "Sequences of Proteins of Immunological Interest", 5th edit., NIH Publication no. 91-3242, U.S. Department of Health and Human Services). Other systems may be used to define CDRs, which as the system devised by Chothia et al (see Chothia, C. & Lesk, A. M., 1987, "Canonical structures for the hypervariable regions of immunoglobulins", J. Mol. Biol., 196, 901-917) and the IMGT system (see Lefranc, M. P., 1997, "Unique database numbering system for immunogenetic analysis", Immunol. Today,

18, 50). An antibody typically contains 3 heavy chain CDRs and 3 light chain CDRs. The term CDR or CDRs is used here to indicate one or several of these regions. A person skilled in the art is able to readily compare the different systems of nomenclature and determine whether a particular sequence may be defined as a CDR.

A "human antibody" is an antibody that possesses an amino-acid sequence corresponding to that of an antibody produced by a human and/or has been made using any of the techniques for making human antibodies and specifically excludes a humanized antibody comprising non- human antigen-binding residues. The term "specifically binds to" refers to measurable and reproducible interactions such as binding between a target and an antibody, which is determinative of the presence of the target in the presence of a heterogeneous population of molecules including biological molecules. For example, an antibody that specifically binds to a target (which can be an epitope) is an antibody that binds this target with greater affinity, avidity, more readily, and/or with greater duration than it binds to other targets. In one example, the extent of binding of an antibody to an unrelated target is less than about 10% of the binding of the antibody to the target as measured, e.g. by a radioimmunoassay (RIA).

An antibody that specifically binds to a SARS-CoV-2 spike protein antigen may be cross-reactive with related antigens such as those of other epidemic human coronaviruses like SARS and MERS. An antibody that specifically binds to a SARS-CoV-2 spike protein antigen can be identified, for example, by immunoassays, BIAcore™, or other techniques known to those of skill in the art. An antibody binds specifically to a SARS-CoV-2 spike protein antigen when it binds to a SARS-CoV-2 spike protein antigen with higher affinity than to any cross-reactive antigen as determined using experimental techniques, such as radioimmunoassays (RIA) and enzyme-linked immunosorbent assays (ELISAs). Typically, a specific or selective reaction will be at least twice background signal or noise and more typically more than 10 times (such as more than 15 times, more than 20 times, more than 50 times or more than 100 times) background. See, e.g. Paul, ed., 1989, Fundamental Immunology Second Edition, Raven Press, New York at pages 332-336 for a discussion regarding antibody specificity.

As used herein, “authorization number” or “marketing authorization number” refers to a number issued by a regulatory agency upon that agency determining that a particular medical product and/or composition may be marketed and/or offered for sale in the area under the agency’s jurisdiction. As used herein “regulatory agency” refers to one of the agencies responsible for evaluating, e.g. the safety and efficacy of a medical product and/or composition and controlling the sales/marketing of such products and/or compositions in a given area. The Food and Drug Administration (FDA) in the US and the European Medicines Agency (EPA) in Europe are but two examples of such regulatory agencies. Other non-limiting examples can include SDA, MPA, MHPRA, IMA, ANMAT, Hong Kong Department of Health-Drug Office, CDSCO, Medsafe, and KFDA.

As used herein, the term “carrier” refers to a diluent, adjuvant (e.g., Freund's adjuvant (complete and incomplete)), excipient, or vehicle with which the therapeutic is administered. Such pharmaceutical carriers can be sterile liquids, such as water and oils, including those of petroleum, animal, vegetable or synthetic origin, such as peanut oil, soybean oil, mineral oil, sesame oil and the like. Water is a preferred carrier when the pharmaceutical composition is administered intravenously. Saline solutions and aqueous dextrose and glycerol solutions can also be employed as liquid carriers, particularly for injectable solutions.

As used herein, the term “composition” is intended to encompass a product containing the specified ingredients (e.g. an antibody) in, optionally, the specified amounts, as well as any product which results, directly or indirectly, from combination of the specified ingredients in, optionally, the specified amounts.

As used herein the term "comprising" or "comprises" is used with reference to antibodies, uses, compositions, methods, and respective component(s) thereof, that are essential to the method or composition, yet open to the inclusion of unspecified elements, whether essential or not.

The term "consisting of" refers to antibodies, uses, compositions, methods, and respective components thereof as described herein, which are exclusive of any element not recited in that description of the example.

As used herein the term "consisting essentially of" refers to those elements required for a given example. The term permits the presence of elements that do not materially affect the basic and novel or functional characteristic(s) of that example.

The term "effector function" as used herein is meant to refer to one or more of antibody dependant cell mediated cytotoxic activity (ADCC), complement-dependant cytotoxic activity (CDC) mediated responses, Fc-mediated phagocytosis or antibody dependant cellular phagocytosis (ADCP), antibody recycling via the FcRn receptor, opsonisation of the virus particle and complement-mediated disruption of virus particle lipid envelope.

An "effective amount" refers to an amount effective, at dosages and for periods of time necessary, to achieve the desired effect, including a therapeutic or prophylactic result. A "therapeutically effective amount" refers to the minimum concentration required to effect a measurable improvement or prevention of a particular disorder. A therapeutically effective amount herein may vary according to factors such as the disease state, age, sex, and weight of the patient, and the ability of the antibody to elicit a desired response in the individual. A therapeutically effective amount is also one in which toxic or detrimental effects of the antibody are outweighed by the therapeutically beneficial effects. A "prophylactically effective amount" refers to an amount effective, at the dosages and for periods of time necessary, to achieve the desired prophylactic result. In some examples, the effective amount of an antibody is from about 0.1 mg/kg (mg of

antibody per kg weight of the subject) to about 100 mg/kg. In certain examples, an effective amount of an antibody provided therein is about 0.1 mg/kg, about 0.5 mg/kg, about 1 mg/kg, 3 mg/kg, 5 mg/kg, about 10 mg/kg, about 15 mg/kg, about 20 mg/kg, about 25 mg/kg, about 30 mg/kg, about 35 mg/kg, about 40 mg/kg, about 45 mg/kg, about 50 mg/kg, about 60 mg/kg, about 70 mg/kg, about 80 mg/kg about 90 mg/kg or about 100 mg/kg (or a range therein). In some examples, "effective amount" as used herein also refers to the amount of an antibody to achieve a specified result (e.g. neutralising the SARS-CoV-2 spike protein).

The term "epitope" as used herein refers to a localized region on the surface of an antigen, such as SARS-CoV-2 spike protein, that is capable of being bound to one or more antigen binding regions of an antibody, and that has antigenic or immunogenic activity in an animal, preferably a mammal, and most preferably in a human, that is capable of eliciting an immune response. An epitope having immunogenic activity is a portion of a polypeptide that elicits an antibody response in an animal. An epitope having antigenic activity is a portion of a polypeptide to which an antibody specifically binds as determined by any method well known in the art, for example, by the immunoassays described herein. Antigenic epitopes need not necessarily be immunogenic. Epitopes usually consist of chemically active surface groupings of molecules such as amino acids or sugar side chains and have specific three-dimensional structural characteristics as well as specific charge characteristics. A region of a polypeptide contributing to an epitope may be contiguous amino acids of the polypeptide or the epitope may come together from two or more non-contiguous regions of the polypeptide. The epitope may or may not be a three-dimensional surface feature of the antigen. In certain embodiments, a SARS-CoV-2 spike protein epitope is a three-dimensional surface feature of a SARS-CoV-2 spike protein polypeptide (e.g. in a trimeric form of a SARS-CoV-2 spike protein polypeptide). In other embodiments, a SARS-CoV-2 spike protein epitope is linear feature of a SARS-CoV-2 spike protein polypeptide (e.g. in a trimeric form or monomeric form of the SARS-CoV-2 spike protein polypeptide). Antibodies provided herein may specifically bind to an epitope of the monomeric (denatured) form of SARS-CoV-2 spike protein, an epitope of the trimeric (native) form of SARS-CoV-2 spike protein, or both the monomeric (denatured) form and the trimeric (native) form of SARS-CoV-2 spike protein. In specific examples, the antibodies provided herein specifically bind to an epitope of the trimeric form of SARS-CoV-2 spike protein but do not specifically bind the monomeric form of SARS-CoV-2 spike protein. In certain embodiments, antibodies provided herein may specifically bind to an epitope of the SARS-CoV-2 spike protein in part by using an interaction with an N-linked glycan or another post-translational modification of the spike protein. Binding to the respective epitope thus might involve moving the N-linked glycan or post-translational modification away thereby removing or reducing steric hindrance that would otherwise prevent or hinder antibody binding. In certain embodiments, antibodies provided herein may specifically bind to an epitope of the SARS-CoV-2 spike protein that only arises following priming cleavage between S1 and S2 or following activating cleavage at the S2' cleavage site. Antibodies may be provided which bind to the same epitope as any antibody disclosed herein. Antibodies may be provided which bind to the same epitope as an IMPI antibody disclosed herein. Antibodies may be provided which bind to the same epitope as a YANG antibody disclosed herein. This is optionally determined using

X-ray crystallography or other fine mapping techniques such as electron microscopy to identify the contact points between antibody and antigen. An antibody may contact the SARS-CoV-2 spike protein with a footprint that fully or partly overlaps with that of an antibody disclosed herein. An antibody may contact the SARS-CoV-2 spike protein with a footprint that fully or partly overlaps with that of an IMPI antibody. An antibody may contact the SARS-CoV-2 spike protein with a footprint that fully or partly overlaps with that of a YANG antibody. As described elsewhere herein, competition between antibodies may also be determined, for example using SPR, and antibodies of the present invention may compete for binding to the spike protein (compete for binding to their epitope) with an IgG antibody that is any IMPI antibody or YANG antibody described herein.

The term "excipients" as used herein refers to inert substances which are commonly used as a diluent, vehicle, preservatives, binders, or stabilizing agent for drugs and includes, but not limited to, proteins (e.g. serum albumin, etc.), amino acids (e.g. aspartic acid, glutamic acid, lysine, arginine, glycine, histidine, etc.), fatty acids and phospholipids (e.g. alkyl sulfonates, caprylate, etc.), surfactants (e.g. SDS, polysorbate, non-ionic surfactant, etc.), saccharides (e.g. sucrose, maltose, trehalose, etc.) and polyols (e.g. mannitol, sorbitol, etc.). See, also, Remington's Pharmaceutical Sciences (1990) Mack Publishing Co., Easton, Pa., which is hereby incorporated by reference in its entirety.

The term "fusion protein" as used herein refers to a polypeptide that comprises an amino acid sequence of an antibody and an amino acid sequence of a heterologous polypeptide or protein (i.e. a polypeptide or protein not normally a part of the antibody (e.g. a non-anti-SARS-CoV-2 spike protein antigen antibody)). The term "fusion" when used in relation to an antibody refers to the joining of a peptide or polypeptide, or fragment, variant and/or derivative thereof, with a heterologous peptide or polypeptide. Preferably, the fusion protein retains the biological activity of the anti- SARS-CoV-2 spike protein antibody.

The term "heavy chain" when used with reference to an antibody refers to five distinct types, called alpha (α), delta (δ), epsilon (ε), gamma (γ) and mu (μ), based on the amino acid sequence of the heavy chain constant domain. These distinct types of heavy chains are well known and give rise to five classes of antibodies, IgA, IgD, IgE, IgG and IgM, respectively, including two subclasses of IgA, namely IgA1 and IgA2 and four subclasses of IgG, namely IgG1, IgG2, IgG3 and IgG4. Preferably the heavy chain is a human heavy chain. In the human population, multiple heavy chain constant region alleles, of each immunoglobulin or immunoglobulin subclass, exist. The nucleotide and amino acid sequences of these allelic variants are accessible on publicly available databases such as IMGT, ENSEMBL Swiss-Prot and Uniprot. Allelic variants may also be identified in various genome sequencing projects. In one example, the antibodies disclosed herein comprise a heavy chain encoded by a IgG1 constant region allele, which includes, but is not limited to, human IGHG1*01, IGHG1*02, IGHG1*03, IGHG1*04 and IGHG1*05 (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). In one example, the antibodies disclosed herein comprise a protein encoded by a IgG4 constant region allele, which includes

but is not limited to human IGHG4*01, IGHG4*02, IGHG4*03 and IGHG4*04 (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). In another example, the heavy chain is an IgA isotype, human IgA1 or human IgA2, example amino acid sequences for which are shown in Table 2. In another example, the heavy chain is a disabled IgG isotype, e.g. a disabled IgG4. In certain examples, the antibodies comprise a human gamma 4 constant region. In another example, the heavy chain constant region does not bind Fc-γ receptors, and e.g. comprises a Leu235Glu mutation. In another example, the heavy chain constant region comprises a Ser228Pro mutation to increase stability. In another example, the heavy chain constant region is IgG4-PE. In another example, the antibodies disclosed herein comprise a heavy chain constant region encoded by a murine IgG1 constant region allele, which includes but is not limited to mouse IGHG1*01 or IGHG1*02.

The term “host” as used herein refers to an animal, preferably a mammal, and most preferably a human.

The term “host cell” as used herein refers to the particular subject cell transfected with a nucleic acid molecule and the progeny or potential progeny of such a cell. Progeny of such a cell may not be identical to the parent cell transfected with the nucleic acid molecule due to mutations or environmental influences that may occur in succeeding generations or integration of the nucleic acid molecule into the host cell genome.

The term “in combination” in the context of the administration of other therapies refers to the use of more than one therapy. The use of the term “in combination” does not restrict the order in which therapies are administered to a subject with a disease. A first therapy can be administered before (e.g. 1 minute, 45 minutes, 30 minutes, 45 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 12 hours, 24 hours, 48 hours, 72 hours, 96 hours, 1 week, 2 weeks, 3 weeks, 4 weeks, 5 weeks, 6 weeks, 8 weeks, or 12 weeks), concurrently, or after (e.g. 1 minute, 45 minutes, 30 minutes, 45 minutes, 1 hour, 2 hours, 4 hours, 6 hours, 12 hours, 24 hours, 48 hours, 72 hours, 96 hours, 1 week, 2 weeks, 3 weeks, 4 weeks, 5 weeks, 6 weeks, 8 weeks, or 12 weeks) the administration of a second therapy to a subject. Any additional therapy can be administered in any order with the other additional therapies. In certain examples, the antibodies can be administered in combination with one or more therapies.

As used herein, "injection device" refers to a device that is designed for carrying out injections, an injection including the steps of temporarily fluidically coupling the injection device to a person's tissue, typically the subcutaneous tissue. An injection further includes administering an amount of liquid drug into the tissue and decoupling or removing the injection device from the tissue. In some examples, an injection device can be an intravenous device or IV device, which is a type of injection device used when the target tissue is the blood within the circulatory system, e.g. the blood in a vein. A common, but non-limiting example of an injection device is a needle and syringe.

As used herein, “instructions” refers to a display of written, printed or graphic matter on the immediate container of an article, for example the written material displayed on a vial containing a pharmaceutically active agent, or details on the composition and use of a product of interest included in a kit containing a composition of interest. Instructions set forth the method of the treatment as contemplated to be administered or performed.

An "isolated" or “purified” antibody or protein is one that has been identified, separated and/or recovered from a component of its production environment (e.g. natural or recombinant). For example, the antibody or protein is substantially free of cellular material or other contaminating proteins from the cell or tissue source from which the antibody is derived, or substantially free of chemical precursors or other chemicals when chemically synthesized. The language “substantially free of cellular material” includes preparations of an antibody in which the antibody is separated from cellular components of the cells from which it is isolated or recombinantly produced. Thus, an antibody that is substantially free of cellular material includes preparations of antibody having less than about 30%, 20%, 10%, or 5% (by dry weight) of heterologous protein (also referred to herein as a “contaminating protein”). When the antibody is recombinantly produced, it is also preferably substantially free of culture medium, i.e. culture medium represents less than about 20%, 10%, or 5% of the volume of the protein preparation. When the antibody is produced by chemical synthesis, it is preferably substantially free of chemical precursors or other chemicals, i.e., it is separated from chemical precursors or other chemicals which are involved in the synthesis of the protein. Accordingly, such preparations of the antibody have less than about 30%, 20%, 10%, 5% (by dry weight) of chemical precursors or compounds other than the antibody of interest. In a preferred example, antibodies are isolated or purified.

The terms “Kabat numbering,” and like terms are recognized in the art and refer to a system of numbering amino acid residues which are more variable (i.e. hypervariable) than other amino acid residues in the heavy chain variable regions of an antibody, or an antigen binding portion thereof (Kabat et al., (1971) Ann. NY Acad. Sci., 190:382-391 and, Kabat et al. (1991) Sequences of Proteins of Immunological Interest, Fifth Edition, U.S. Department of Health and Human Services, NIH Publication No. 91-3242). For the heavy chain variable region, the hypervariable region typically ranges from amino acid positions 31 to 35 for CDR1, amino acid positions 50 to 65 for CDR2, and amino acid positions 95 to 102 for CDR3.

"Label" or "labelled" as used herein refers to the addition of a detectable moiety to a polypeptide, for example, a radiolabel, fluorescent label, enzymatic label, chemiluminescent label or a biotinyl group or gold. Radioisotopes or radionuclides may include 3H, 14C, 15N, 35S, 90Y, 99Tc, 115In, 125I, 131I, fluorescent labels may include rhodamine, lanthanide phosphors or FITC and enzymatic labels may include horseradish peroxidase, β-galactosidase, luciferase, alkaline phosphatase. Additional labels include, by way of illustration and not limitation: enzymes, such as glucose-6-phosphate dehydrogenase ("G6PDH"), alpha-D-galactosidase, glucose oxydase, glucose amylase, carbonic anhydrase, acetylcholinesterase, lysozyme,

malate dehydrogenase and peroxidase; dyes (e.g. cyanine dyes, e.g. Cy5TM, Cy5.5TM. or Cy7TM); additional fluorescent labels or fluorescers include, such as fluorescein and its derivatives, fluorochrome, GFP (GFP for "Green Fluorescent Protein"), other fluorescent proteins (e.g. mCherry, mTomato), dansyl, umbelliferone, phycoerythrin, phycocyanin, allophycocyanin, o-phthaldehyde, and fiuorescamine; fluorophores such as lanthanide cryptates and chelates e.g. Europium etc (Perkin Elmer and Cisbio Assays); chemoluminescent labels or chemiluminescers, such as isoluminol, luminol and the dioxetanes; sensitisers; coenzymes; enzyme substrates; particles, such as latex or carbon particles; metal sol; crystallite; liposomes; cells, etc., which may be further labelled with a dye, catalyst or other detectable group; molecules such as biotin, digoxygenin or 5-bromodeoxyuridine; toxin moieties, such as for example a toxin moiety selected from a group of Pseudomonas exotoxin (PE or a cytotoxic fragment or mutant thereof), Diptheria toxin or a cytotoxic fragment or mutant thereof, a botulinum toxin A, B, C, D, E or F, ricin or a cytotoxic fragment thereof e.g. ricin A, abrin or a cytotoxic fragment thereof, saporin or a cytotoxic fragment thereof, pokeweed antiviral toxin or a cytotoxic fragment thereof and bryodin 1 or a cytotoxic fragment thereof.

The term “light chain” when used in reference to an antibody refers to the immunoglobulin light chains, of which there are two types in mammals, lambda (λ) and kappa (κ). Preferably, the light chain is a human light chain. Preferably the light chain constant region is a human constant region. In the human population, multiple light chain constant region alleles exist. The nucleotide and amino acid sequences of these allelic variants are accessible on publicly available databases such as IMGT, ENSEMBL, Swiss-Prot and Uniprot. In one example, the antibodies disclosed herein comprise a protein encoded by a human κ constant region allele, which includes, but is not limited to, IGKC*01, IGKC*02, IGKC*03, IGKC*04 and IGKC*05 (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). In one example, the antibodies disclosed herein comprise a protein encoded by a human λ constant region allele, which includes but is not limited to IGLC1*01, IGLC1*02, IGLC2*01, IGLC2*02, IGLC2*03, IGLC3*01, IGLC3*02, IGLC3*03, IGLC3*04, IGLC6*01, IGLC7*01, IGLC7*02, and IGLC7*03 (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). In another example, the antibodies disclosed herein comprise a light chain constant region encoded by a mouse κ constant region allele, which includes, but is not limited to, IGKC*01, IGKC*03 or IGKC*03 (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). In another example, the antibodies disclosed herein comprise a light chain constant region encoded by a mouse λ constant region allele, which includes, but is not limited to, IGLC1*01, IGLC2*01 or IGLC3*01 (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

"Percent (%) amino acid sequence identity" with respect to a peptide, polypeptide or antibody sequence are defined as the percentage of amino acid residues in a candidate sequence that are identical with the amino acid residues in the specific peptide or polypeptide sequence, after aligning the sequences and introducing gaps, if necessary, to achieve the maximum percent sequence identity, and not considering any conservative substitutions as part of the sequence identity. Alignment for purposes of determining percent amino acid

sequence identity can be achieved in various ways that are within the skill in the art, for instance, using publicly available computer software such as BLAST, BLAST-2, ALIGN or MEG ALIGN™ (DNASTAR) software. In one example, the % identity is about 70%. In one example, the % identity is about 75%. In one example, the % identity is about 80%. In one example, the % identity is about 85%. In one example, the % identity is about 90%. In one example, the % identity is about 92%. In one example, the % identity is about 95%. In one example, the % identity is about 97%. In one example, the % identity is about 98%. In one example, the % identity is about 99%. In one example, the % identity is 100%.

The term "naturally occurring" or "native" when used in connection with biological materials such as nucleic acid molecules, polypeptides, host cells, and the like, refers to those which are found in nature and not manipulated by a human being.

As used herein, "packaging" refers to how the components are organized and/or restrained into a unit fit for distribution and/or use. Packaging can include, e.g. boxes, bags, syringes, ampoules, vials, tubes, clamshell packaging, barriers and/or containers to maintain sterility, labelling, etc.

The term "pharmaceutically acceptable" as used herein means being approved by a regulatory agency of the Federal or a state government, or listed in the U.S. Pharmacopeia, European Pharmacopeia or other generally recognized Pharmacopeia for use in animals, and more particularly in humans.

As used herein, the term "polynucleotide," "nucleotide," nucleic acid" "nucleic acid molecule" and other similar terms are used interchangeable and include DNA, RNA, mRNA and the like.

As used herein, the terms "prevent", "preventing", and "prevention" refer to the total or partial inhibition of the development, recurrence, onset or spread of a SARS-CoV-2 related disease, such as COVID-19,and/or symptom related thereto, resulting from the administration of a therapy or combination of therapies provided herein (e.g. a combination of prophylactic or therapeutic agents, such as an antibody).

The term "soluble" refers to a polypeptide that is lacking one or more transmembrane or cytoplasmic domains found in the native or membrane-associated form. In one example, the "soluble" form of a polypeptide lacks both the transmembrane domain and the cytoplasmic domain.

The term "subject" or "patient" refers to any animal, including, but not limited to, mammals. As used herein, the term "mammal" refers to any vertebrate animal that suckle their young and either give birth to living young (eutharian or placental mammals) or are egg-laying (metatharian or nonplacental mammals). Examples of mammalian species include, but are not limited to, humans and other primates, including non-human primates such as chimpanzees and other apes and monkey species; farm animals such as cattle, sheep, pigs, goats and horses; domestic mammals such as dogs and cats; laboratory animals including

rodents such as mice, rats (including cotton rats) and guinea pigs; birds, including domestic, wild and game birds such as chickens, turkeys and other gallinaceous birds, ducks, geese, and the like.

As used herein "substantially all" refers to refers to at least about 60%, at least about 70%, at least about 75%, at least about 80%, at least about 85%, at least about 90%, at least about 95%, at least about 98%, at least about 99%, or about 100%.

The term "surfactant" as used herein refers to organic substances having amphipathic structures; namely, they are composed of groups of opposing solubility tendencies, typically an oil-soluble hydrocarbon chain and a water-soluble ionic group. Surfactants can be classified, depending on the charge of the surface-active moiety, into anionic, cationic, and non-ionic surfactants. Surfactants are often used as wetting, emulsifying, solubilizing, and dispersing agents for various pharmaceutical compositions and preparations of biological materials.

As used herein, the term "tag" refers to any type of moiety that is attached to, e.g. a polypeptide and/or a polynucleotide that encodes a SARS-CoV-2 antibody. For example, a polynucleotide that encodes a SARS-CoV-2 antibody can contain one or more additional tag-encoding nucleotide sequences that encode e.g. a detectable moiety or a moiety that aids in affinity purification. When translated, the tag and the antibody can be in the form of a fusion protein. The term "detectable" or "detection" with reference to a tag refers to any tag that is capable of being visualized or wherein the presence of the tag is otherwise able to be determined and/or measured (e.g. by quantitation). A non-limiting example of a detectable tag is a fluorescent tag.

As used herein, the term "therapeutic agent" refers to any agent that can be used in the treatment, management or amelioration of a SARS-CoV-2-related disease or condition, such as COVID-19 and/or a symptom related thereto. In certain examples, the term "therapeutic agent" refers to an antibody. In certain other examples, the term "therapeutic agent" refers to an agent other than an antibody. Preferably, a therapeutic agent is an agent which is known to be useful for, or has been or is currently being used for the treatment, management or amelioration of a SARS-CoV-2-related disease or condition, such as COVID-19 and/or one or more symptoms related thereto. In specific examples, the therapeutic agent is an anti-SARS-CoV-2 antibody. In specific examples, the therapeutic agent is a fully human anti-SARS-CoV-2 antibody, such as a fully human SARS-CoV-2 monoclonal antibody.

As used herein, the term "therapy" refers to any protocol, method and/or agent that can be used in the prevention, management, treatment and/or amelioration of a SARS-CoV-2-related disease or condition, such as COVID-19. In certain examples, the terms "therapies" and "therapy" refer to a biological therapy, supportive therapy, and/or other therapies useful in the prevention, management, treatment and/or

amelioration of a SARS-CoV-2-related disease or condition, such as COVID-19 known to one of skill in the art such as medical personnel.

The terms "treat", "treatment" and "treating" refer to the reduction or amelioration of the progression, severity, and/or duration of a SARS-CoV-2-related disease or condition, such as COVID-19 resulting from the administration of one or more therapies (including, but not limited to, the administration of one or more prophylactic or therapeutic agents, such as an antibody). In specific examples, such terms refer to the reduction or inhibition of the binding of SARS-CoV-2 to ACE 2, and/or the inhibition or reduction of one or more symptoms associated with a SARS-CoV-2-related disease or condition, such as COVID-19.

The term "variable region" or "variable domain" refers to a portion of the light and heavy chains, typically about the amino-terminal 120 to 130 amino acids in the heavy chain and about 100 to 110 amino acids in the light chain, which differ extensively in sequence among antibodies and are used in the binding and specificity of each particular antibody for its particular antigen. The variability in sequence is concentrated in those regions called complimentarily determining regions (CDRs) while the more highly conserved regions in the variable domain are called framework regions (FR). The CDRs are primarily responsible for the interaction of the antibody with antigen. Numbering of amino acid positions used herein is according to IMGT (Lefranc MP "IMGT unique numbering for immunoglobulin and T cell receptor variable domains and Ig superfamily V-like domains", Dev. Comp. Immunol. 27(1):55-77 (2003)). In preferred examples, the variable region is a human variable region.

Definitions of common terms in cell biology and molecular biology can be found in "The Merck Manual of Diagnosis and Therapy", 19th Edition, published by Merck Research Laboratories, 2006 (ISBN 0-911910-19-0); Robert S. Porter et al. (eds.), The Encyclopedia of Molecular Biology, published by Blackwell Science Ltd., 1994 (ISBN 0-632-02182-9); Benjamin Lewin, Genes X, published by Jones & Bartlett Publishing, 2009 (ISBN-10: 0763766321); Kendrew et al. (Eds.), Molecular Biology and Biotechnology: a Comprehensive Desk Reference, published by VCH Publishers, Inc., 1995 (ISBN 1-56081-569-8) and Current Protocols in Protein Sciences 2009, Wiley Intersciences, Coligan et al., eds.

Unless otherwise stated, the present disclosure was performed using standard procedures, as described, for example in Sambrook et al., Molecular Cloning: A Laboratory Manual (4 ed.), Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y., USA (2012); Davis et al., Basic Methods in Molecular Biology, Elsevier Science Publishing, Inc., New York, USA (1995); or Methods in Enzymology: Guide to Molecular Cloning Techniques Vol.152, S. L. Berger and A. R. Kimmel Eds., Academic Press Inc., San Diego, USA (1987); Current Protocols in Protein Science (CPPS) (John E. Coligan, et al., ed., John Wiley and Sons, Inc.), Current Protocols in Cell Biology (CPCB) (Juan S. Bonifacino et al. ed., John Wiley and Sons, Inc.), and Culture of Animal Cells: A Manual of Basic Technique by R. Ian Freshney, Publisher: Wiley-Liss; 5th edition (2005), Animal Cell Culture Methods (Methods in Cell Biology, Vol. 57, Jennie P.

Mather and David Barnes editors, Academic Press, 1st edition, 1998) which are all incorporated by reference herein in their entireties.

Other terms are defined herein within the description of the various examples of the disclosure.

ANTI-SARS-COV-2 ANTIBODIES

The antibodies described herein are described with respect to the following concepts, aspects, sentences, arrangements and embodiments. Unless otherwise stated, all concepts, embodiments, sentences, arrangements and aspects are to be read as being able to be combined with any other concept, aspect, sentence, arrangement or embodiment, unless such combination would not make technical sense or is explicitly stated otherwise.

BINDING – LOCATION:

Antibodies that specifically bind the spike protein of SARS-CoV-2 are provided. In particular, neutralising antibodies, which inhibit or prevent SARS-CoV-2 from entering cells are provided. In some aspects the antibodies specifically bind the S1 subunit of the SARS-CoV-2 spike protein. For example, antibodies may bind the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein. Such antibodies binding the RBD may or may not compete with ACE2 for binding to SARS-Cov-2 and thus may or may not directly inhibit binding of SARS-CoV-2 to its receptor ACE2. Alternatively, the antibodies may preferentially bind to the trimer form of the SARS-CoV-2 spike protein. Alternatively, the antibodies may specifically bind the S2 subunit of the SARS-CoV-2 spike protein.

The spike protein and its domain and subunit structure are illustrated in Figure 1, Figure 2A and Figure 2B, and reference herein to the S1 subunit, S2 subunit, RBD, NTD, extracellular domain and trimer refer to the wild-type spike protein in Figure 2A unless stated otherwise or unless indicated by context. It will be appreciated that, as the epidemic has spread, vast numbers of different strains of SARS-CoV-2, comprising a variety of mutations, are now at large in the population and that these include spike proteins with a number of mutations relative to the defined wild-type of Figure 2A. One such mutation is D614G (i.e., substitution of glycine for aspartic acid at residue 614 of the spike protein) which is now present in the majority of clinical isolates of SARS-CoV-2. Preferably, antibodies of the present invention bind SARS-CoV-2 D614G with at least the affinity with which they bind SARS-CoV-2 614D. This residue lies between the RBD and S2 domains and is thus not present in soluble preparations of these domains, but anti-RBD and anti-S2 antibodies may be tested for binding to the spike protein trimer to confirm maintenance of binding to the D614G form. Similarly, neutralisation assays may be performed with SARS-CoV-2 spike D614G to confirm neutralising potency.

An antibody of the present invention may be one which competes for binding to the isolated soluble RBD subunit with any anti-RBD IMPI antibody described herein, such as IMPI-059, IMPI-017 or IMPI-004.

An antibody of the present invention may be one which competes for binding to the isolated soluble RBD subunit with any anti-RBD YANG antibody described herein, such as YANG-1112, YANG-2107, YANG-2108, YANG-2111, and YANG-1401.

An antibody of the present invention may be one which competes for binding to the isolated soluble S2 subunit with any anti-S2 IMPI antibody described herein, such as IMPI-013.

An antibody of the present invention may be one which competes for binding to the isolated soluble S2 subunit with any anti-S2 YANG antibody described herein, such as YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208.

An antibody of the present invention may be one which competes for binding to the isolated soluble S2 subunit with any anti-NTD YANG antibody described herein, YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306.

An antibody of the present invention may be one which competes for binding to the SARS-CoV-2 spike protein trimer with any IMPI antibody described herein, optionally with a "trimer-only" binding antibody.

Methods of determining competition between molecules are described elsewhere herein (e.g., SPR) and may be performed with the test antibody and IMPI antibody in IgG format or optionally in scFv format.

Methods of determining competition between molecules are described elsewhere herein (e.g., SPR) and may be performed with the test antibody and YANG antibody in IgG format or optionally in scFv format.

BINDING – MEASUREMENT:

Any suitable method may be used to determine whether an antibody binds to the SARS-CoV-2 spike protein. Such a method may comprise surface plasmon resonance (SPR), bio-layer interferometry, or an ELISA to determine specificity of antibodies. An antibody may be said to bind its antigen if the level of binding to antigen is at least 2.5 fold greater, e.g., at least 10 fold greater, than binding to a control antigen. Binding between an antibody and its cognate antigen is often referred to as specific binding. Precise identification of the residues bound by an antibody can usually be obtained using x-ray crystallography. This technique may be used to determine that an antibody described herein binds one or more residues of SARS-CoV-2 spike protein.

Ability of an antibody to bind its target antigen, and the specificity and affinity of that binding (KD, Kd and/or Ka) can be determined by any routine method in the art, e.g. using surface plasmon resonance (SPR), such as by BiacoreTM (Cytiva Life Sciences) or using the ProteOn XPR36TM (Bio-Rad®), using KinExA® (Sapidyne Instruments, Inc), or using ForteBio Octet (Pall ForteBio Corp.).

The term "KD", as used herein, is intended to refer to the equilibrium dissociation constant of a particular antibody-antigen interaction. Affinity of antibody-antigen binding may be determined, e.g., by SPR. Affinity may also be determined by bio-layer interferometry. Examples of affinity determination by SPR are provided in Example 6 herein. In some examples, an antibody may bind to a SARS-CoV-2 spike protein with an affinity (KD) of 1 mM or less, preferably less than 50 nM, less than 40 nM, less than 30 nM, less than 20 nM, as determined by SPR. In other examples, the antibody may bind to SARS-CoV-2 spike protein with a KD of less than 10 nM (e.g. less than 9 nM, less than 8 nM, less than 7 nM, less than 6 nM, less than 5 nM, less than 4 nM, less than 3 nM, less than 2 nM or less than 1 nM as determined by SPR. Preferably the KD may be less than 1 nM as determined by SPR. The KD may be 0.9 nM or less, 0.8 nM or less, 0.7 nM or less, 0.6 nM or less, 0.5 nM or less, 0.4 nM or less, 0.3 nM or less, 0.2 nM or less, or 0.1 nM or less, as determined by SPR. In some examples, an antibody may bind to a SARS-CoV-2 spike protein with KD of 0.1nM or less, as determined by SPR. In some examples, an antibody may bind to a SARS-CoV-2 spike protein with a KD of 50pM or less, as determined by SPR. Binding and binding affinity can be determined to various purified spike proteins and sub-domains, for example, the wild type trimer spike protein (Figure 2A), the trimer stabilised by proline mutations (Figure 2B), mutations to the trimeric spike protein observed in clinical isolates, for example D614G, expressed and purified sub-domains of the trimers, such as the S1 subunit or the S2 subunit, or the Receptor binding domain (RBD) or the N-terminal domain (NTD) or any of the above sub-domains with mutations observed from clinical isolates. If the antibody epitope is a linear continuous epitope, then binding and binding affinity can be determined using synthetic purified peptide sequences.

In one example, the antibody binds to the SARS-CoV-2 spike protein with an affinity of less than 1 nM (e.g. from 1 nM to 0.01 pM or from 1 nM to 0.1 pM, or from 1 nM to 1pM), as determined by SPR. In one example, the antibody binds to the SARS-CoV-2 spike protein with an affinity of less than 10 nM (e.g. from 10 nM to 0.01 pM or from 10 nM to 0.1 pM, or from 10 nM to 1pM), as determined by SPR. In one example, the antibody binds to the SARS-CoV-2 spike protein with an affinity of less than 0.1 nM (e.g. from 0.1 nM to 0.01 pM or from 0.1 nM to 0.1 pM, or from 0.1 nM to 1pM), as determined by SPR. In one example, the antibody binds to SARS-CoV-2 spike protein with an affinity of less than 0.01 nM (e.g. from 0.011 nM to 0.01 pM or from 0.01 nM to 0.1 pM), as determined by SPR. In another example, the KD is within a range of 0.01 to 1 nM, or a range of 0.05 to 2 nM, or a range of 0.05 to 1nM, as determined by SPR.

In one example, the SPR is carried out at 25°C. A suitable SPR protocol is set out in detail in Example 6. In brief, the affinity of the antibody can be determined using SPR by:

1. Coupling mouse anti-human (or other relevant human, rat or non-human vertebrate antibody constant region species-matched) IgG to a biosensor chip (e.g. dextran-coated gold chip) such as by primary amine coupling. Thus, an anti-Fc antibody may be covalently immobilised on the chip surface using amine coupling.
2. Exposing the mouse anti-human IgG (or other matched species antibody) to the test antibody (e.g., in human IgG format) to capture the test antibody on the chip;
3. Passing the test antigen over the chip's capture surface at a series of concentrations up to a maximum of 100 nM, e.g., at 0.39, 1.56, 6.25, 25 and 100 nM, and a 0 nM (i.e. buffer alone) control run. The buffer may optionally be 0.01 M HEPES (4-(2-hydroxyethyl)-1-piperazineethanesulfonic acid), 0.15 M NaCl and 0.05% v/v surfactant P20 in aqueous solution, buffered to pH 7.4; and
4. Determining the affinity of binding of test antibody to test antigen using surface plasmon resonance. KD, Ka and Kd may then be calculated.

SPR can be carried out using any standard SPR apparatus, such as by BiacoreTM or using the ProteOn XPR36TM (Bio-Rad®).

Regeneration of the capture surface can be carried out with 3 M magnesium chloride solution. This removes the captured test antibody and allows the surface to be used for another interaction. The binding data can be fitted to 1:1 model inherent using standard techniques, e.g. using analysis software such as Biacore Insight Evaluation Software.

CROSS-REACTIVITY:

In some examples, an antibody that specifically binds to a SARS-CoV-2 spike protein antigen does not cross-react with other antigens (but may optionally cross-react with SARS-CoV spike protein and/or MERS-CoV spike protein). In some examples, an antibody that specifically binds to a SARS-CoV-2 spike protein antigen does not cross react with the existing endemic seasonal coronaviruses (NL63, 229E, OC43 and HKU1).

In some examples, an antibody that specifically binds to a SARS-CoV-2 spike protein antigen cross-reacts with SARS-CoV spike protein. In some examples, an antibody that specifically binds to a SARS-CoV-2 spike protein antigen cross-reacts with MERS spike protein. In some examples, an antibody that specifically binds to a SARS-CoV-2 spike protein antigen cross-reacts with SARS-CoV spike protein and MERS spike protein.

For antibodies that specifically bind to a SARS-CoV-2 spike protein antigen and cross-react with SARS-CoV spike protein and/or MERS spike protein, in some examples, the antibody may bind SARS-CoV-2 spike protein with at least a 10 fold greater binding affinity than to SARS-CoV spike protein and/or MERS spike protein (e.g. as measured by SPR). In some examples, the antibody may bind SARS-CoV-2 spike

protein with at least a 20 fold greater binding affinity than to SARS-CoV spike protein and/or MERS spike protein (e.g. as measured by SPR). In some examples, the antibody may bind SARS-CoV-2 spike protein with at least a 50 fold greater binding affinity than to SARS-CoV spike protein and/or MERS spike protein (e.g. as measured by SPR).

FUNCTION – INHIBITION, NEUTRALISATION, etc:

Antibodies described herein are inhibitory antibodies that inhibit a function of the SARS-CoV-2 spike protein, thus being useful in therapy and prophylaxis to prevent infection. In an example, the antibodies inhibit or prevent SARS-CoV-2 entering cells. In an example, the antibodies are neutralising antibodies. In some examples, the antibodies inhibit the SARS-CoV-2 spike protein binding to the human ACE2 receptor. Inhibition of SARS-CoV-2 spike protein binding to the human ACE2 receptor may be achieved by an antibody directly blocking the epitope on the SARS-CoV-2 spike protein which binds to the human ACE2 receptor. Such antibodies may compete for binding to SARS-CoV-2 spike protein with the human ACE2 receptor, as described further below. Alternatively, inhibition of SARS-CoV-2 spike protein binding to the human ACE2 receptor may be achieved by an indirect mechanism, e.g. where an antibody binds to an epitope of the SARS-CoV-2 spike protein outside of the epitope on the SARS-CoV-2 spike protein which binds to the human ACE2 receptor, but which modifies the structure or function of the spike protein such that binding to human ACE2 receptor is reduced or prevented or the process of infecting the cell after ACE2 receptor binding is inhibited.

Human ACE2 (angiotensin-converting enzyme 2) is encodable by the mRNA sequence deposited in GenBank under accession number AB193259.1. ACE2 having the amino acid sequence from this accession number may be used in assays herein. The expression vector pCAGGS-ACE2 which was used in Examples herein comprised this coding sequence.

Human TMPRSS2 (transmembrane serine protease 2), which cleaves the spike protein, is encodable by the mRNA sequence deposited under NCBI reference sequence NM_001135099.1. TMPRSS2 having the amino acid sequence from this accession number may be used in assays herein. The expression vector pCAGGS-TMPRSS2 which was used in Examples herein comprised this coding sequence.

An inhibitory or neutralising antibody may bind either of the subunits (S1 or S2) of the SARS-CoV-2 spike protein. An inhibitory or neutralising antibody may bind any of the domains of the S1 subunit (e.g. RTB or NTD or a non-RBD/NTD domain) of the SARS-CoV-2 spike protein. Thus, in some examples, an inhibitory antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein is provided. In some examples, a neutralising antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein is provided. In some examples, an antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody inhibits or prevents SARS-CoV-2 entering cells is provided. In other examples, an inhibitory

antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein is provided. In some examples, a neutralising antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein is provided. In some examples, an antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody inhibits or prevents SARS-CoV-2 entering cells is provided.

NEUTRALISATION – MEASUREMENT:

The ability of an antibody to neutralise SARS-CoV-2 entry to cells may be determined by in vitro assays. A widely used assay is the pseudovirus neutralisation assay, which uses a non-replication-competent virus-like particle with the SARS-CoV-2 spike protein within the virus envelope. Pseudotyped virus neutralisation assays using replication-deficient viruses are commonly used as a replacement for the use of wild-type viruses when studying pathogenic human viruses, which would otherwise need to be handled at higher levels of containment. The neutralizing ability of an antibody can be measured in a pseudotype neutralization assay using spike SARS-CoV-2 enveloped lentiviral pseudotypes carrying a firefly luciferase reporter. The use of such a reporter results in a wide dynamic range of neutralization titers and a high level of sensitivity. When the lentiviral genome integrates after entry into cells, firefly luciferase expression and activity is proportional to the number of cells that were infected (transduced) by the pseudotyped virus.

The pseudotype neutralization assay described herein, and detailed in Example 4, is a cell-based viral neutralization assay that is performed in a 384-well format. For the SARS-CoV-2 pseudotype neutralization, LentiX 293T cells (ATCC, CRL-3216) are used which are cultured and maintained in DMEM with 10% FBS added. The cells are prepared on day one, 24h later the cells are transiently transfected to express ACE2 (the SARS-CoV-2 viral receptor) and TMPRSS2 (the protease required for viral entry). After 24h the ACE2/TMPRSS2 transiently transfected target cells are ready for use.

Serial dilutions of antibodies are prepared in a 384-well format and incubated with an appropriate titre (50 – 100 TCID50) of lentiviral particles for one hour at 37°C. The starting concentration of antibodies ranges from 50 nm to 100 nM, upon which 3- to 5-fold 8-point dilutions are performed. Each assay includes the following controls: cells only, cells and pseudovirus, positive and negative control antibodies.

After one hour, ACE2/TMPRSS2 transiently transfected target cells are added to the wells and the plates are incubated for 48h at 37°C to permit cell infection (transduction) of non-neutralized particles and expression of firefly luciferase. Following the 48h incubation cells are lysed for 5 min in the presence of a luciferase substrate (e.g., Bright-Glo Luciferase Assay System (Promega)) to assess luciferase activity. After this 5 min incubation at room temperature the luminescence in each well is measured.

The comparison between the luciferase signal detected in uninfected (untransduced) cells, in cells infected (transduced) with pseudotypes only, and in cells infected (transduced) with pseudotypes in the presence of

antibodies, enables us to determine if the antibody has neutralizing activity against the SARS-CoV-2 pseudotype tested.

Alternatively, the ability of an antibody to neutralise wild type, replication competent, authentic SARS-CoV-2 entry to cells may be determined by in vitro assays which are known as live virus assays. The live virus assay involves producing a laboratory stock of SARS-CoV-2 virus from an isolate of the virus derived from an infected person. Each isolate from different people results in a different live virus stock, which will normally have the full virus genome sequence determined to ensure the virus is not defective in any gene and to determine where, if anywhere the virus isolate differs genetically from the wild type virus genome sequence and if the genetic changes alter the amino acid sequence of a virus protein. Live virus isolates can be produced by culturing the SARS-CoV-2 virus on human cells or on animal cells in vitro, providing the cells are permissive to virus replication. Two known factors that confer permissivity are the ACE-2 receptor and the cell surface protein TMPRSS2. Some primary human cells naturally express these proteins, such as primary human airway epithelial cells (PAE cells), some cancer cell lines naturally express these proteins, such as Caco-2 and Calu-3, some human cells can be made to express these proteins artificially such as 293T cells transiently transfected to express ACE2 (the SARS-CoV-2 viral receptor) and TMPRSS2 and some animal cells are naturally permissive to SARS-CoV-2 such as Vero E6 cells from the African Green Monkey. Therefore, all live virus assays are related but often with specific differences. The neutralizing ability of an antibody can be measured in a live virus neutralization assay by incubating a known fixed amount of the live virus with different dilutions of the antibody, and then following incubation, adding the mixture to cells that are permissive for SARS-CoV-2 infection. The cells are then incubated to allow virus infection and replication to occur. Detection of virus infection and replication can be determined by a number of methods, including, colourimetry detection and quantitation of infected cells using labelled antibodies to a SAR-CoV-2 protein such as the Nucleoprotein (N), or visualisation of infected cell foci by staining and enumeration of cells stained with a labelled antibody to a SAR-CoV-2 protein such as the Nucleoprotein (N). The amount of reduction in cell infection caused by an antibody is calculated relative to a control infection where no antibody is added. These assays can be performed in 24, 48 or 96 well tissue culture plates.

The neutralising ability of an antibody of the invention can be determined in vitro according to the methods for pseudovirus neutralisation and/or live virus neutralisation. In both cases the concentration of the antibody, expressed as either or both of the antibody weight (milligrams, or micrograms, or nanograms or picograms) in a given volume (litre or millilitre or microlitre), or as a molarity of the antibody (millimolar, or micromolar or nanomolar or picomolar), that is required to inhibit 50% of the detectable infection in the assay (the inhibitory concentration for 50%, or IC50) or inhibit 90% of the detectable infection in the assay (the inhibitory concentration for 90%, or IC90) or inhibit 95% of the detectable infection in the assay (the inhibitory concentration for 95%, or IC95) is reported. This can be calculated using any of a variety of methods known to the art, including the fitting of inhibition curves mathematically to the experimentally

derived data and reporting these as an IC50 or IC90 or IC95. Finally, the antibody concentration that completely inhibits SARS-CoV-2 infection of cells can be determined. This value will be similar to the IC95 value and this was determined for the data in Table E5-1.

An example protocol for the pseudovirus neutralisation assay is provided in Example 4 herein.

In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 10nM or lower (e.g. as determined in a pseudovirus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 1nM or lower (e.g. as determined in a pseudovirus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 500pM or lower (e.g. as determined in a pseudovirus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 100pM or lower (e.g. as determined in a pseudovirus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as determined in a pseudovirus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 40pM or lower (e.g. as determined in a pseudovirus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 30pM or lower (e.g. as determined in a pseudovirus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 20pM or lower (e.g. as determined in a pseudovirus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 10pM or lower (e.g. as determined in a pseudovirus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 5pM or lower (e.g. as determined in a pseudovirus assay).

In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 10nM or lower (e.g. as determined in a live virus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 1nM or lower (e.g. as determined in a live virus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 500pM or lower (e.g. as determined in a live virus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 100pM or lower (e.g. as determined in a live virus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as determined in a live virus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 40pM or lower (e.g. as determined in a live virus assay). In some examples, the antibodies neutralise SARS-CoV-2 with an IC50 of 30pM or lower (e.g. as determined in a live virus assay).

In some examples, the antibodies may neutralise SARS-CoV-2 with an activity level which is greater than a reference antibody. In some examples, the reference antibody may be SAD S35 (Acro Biosystems; https://www.acrobiosystems.com/P3209-Anti-SARS-CoV-2-RBD-Neutralizing-Antibody-Human-IgG1.html). In some examples, the reference antibody may be 4A8 (Chi et al., Science vol. 369 (6504), 650-655). For example, the antibodies may neutralise SARS-CoV-2 with an activity level which is greater than the reference antibody expressed as fold change relative to the reference antibody. In one example, the antibody may neutralise SARS-CoV-2 with an activity level greater than a 2-fold change relative to the reference antibody. In one example, the antibody may neutralise SARS-CoV-2 with an activity level greater

than a 25-fold change relative to the reference antibody. In one example, the antibody may neutralise SARS-CoV-2 with an activity level greater than a 50-fold change relative to the reference antibody. In one example, the antibody may neutralise SARS-CoV-2 with an activity level greater than a 100-fold change relative to the reference antibody. In one example, the antibody may neutralise SARS-CoV-2 with an activity level greater than a 500-fold change relative to the reference antibody. In one example, the antibody may neutralise SARS-CoV-2 with an activity level greater than a 1000-fold change relative to the reference antibody.

The antibodies provided may inhibit the SARS-CoV-2 spike protein binding to the human ACE2 receptor. In some examples, an antibody specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody inhibits the SARS-CoV-2 spike protein binding to the human ACE2 receptor. Various modes of inhibition may be envisaged. For instance, inhibition may be by competition for binding to ACE2 (whether for the same epitope or by steric hindrance), or inhibition may be through the prevention of RBD becoming in its UP states leading to inhibiting ACE2 interaction with RBD.

In some examples, an antibody specifically binds to the S2 subunit of the SARS-CoV-2 spike protein, wherein the antibody inhibits a function of the SARS-CoV-2 spike protein binding to the human ACE2 receptor triggering entry into the cell. Again, various modes of inhibition may be envisaged. For example, an anti-S2 antibody may inhibit fusion with the host cell membrane or it may inhibit the cleavage of S1 and S2 by TMPRSS2 or cathepsins or other cellular protease that can modify the spike protein.

COMPETITION WITH ACE2:

The antibodies provided may compete with the SARS-CoV-2 spike protein for binding to the human ACE2 receptor. The antibodies provided may specifically bind to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody is a neutralising antibody which competes with the SARS-CoV-2 spike protein for binding to the human ACE2 receptor, thereby preventing cell infection. Other antibodies, that do not compete with the SARS-CoV-2 spike protein for binding to the human ACE2 receptor, may alter the ability of the spike protein to function correctly and thereby also be a neutralising antibody even though the antibody does not block RBD and ACE2 interaction.

Whether an antibody competes with the SARS-CoV-2 spike protein for binding to the human ACE2 receptor may be measured using a competition assay. Competition may be determined by surface plasmon resonance (SPR), such techniques being readily apparent to the skilled person. SPR may be carried out using Biacore™, Proteon™ or another standard SPR technique. Such competition may be due, for example, to the antibodies or fragments binding to identical or overlapping epitopes of the SARS-CoV-2 spike protein to that which the ACE2 receptor binds. In one example, competition is determined by ELISA, such techniques being readily apparent to the skilled person. In one example, competition is determined by homogenous time resolved fluorescence (HTRF), such techniques being readily apparent to the skilled

person. In one example, competition is determined by fluorescence activated cell sorting (FACS), such techniques being readily apparent to the skilled person. In one example, competition is determined by ForteBio Octet® Bio-Layer Interferometry (BLI) such techniques being readily apparent to the skilled person.

In one example, the antibody competes (e.g. in a dose-dependent manner) with SARS-CoV-2 spike protein (or a fusion protein thereof) for binding to cell surface-expressed human ACE2 receptor. In one embodiment, the antibody competes (e.g. in a dose-dependent manner) with SARS-CoV-2 spike protein (or a fusion protein thereof) for binding to soluble human ACE2 receptor.

In one example, the antibody partially or completely inhibits binding of SARS-CoV-2 spike protein to cell surface-expressed human ACE2 receptor. In another example, the antibody partially or completely inhibits binding of SARS-CoV-2 to soluble human ACE2 receptor.

If the epitope to which the antagonist antibody binds completely blocks the binding site of the ACE2 receptor, then receptor binding is completely prevented (which may be a physical blocking – in the case of overlapping epitopes - or steric blocking – where the antagonist is large such that it prevents the receptor binding to its distinct epitope). If the epitope to which the antibody binds partially blocks the binding site of the ACE2 receptor, the receptor may be able to bind, but only weakly (in the case of partial inhibition), or in a different orientation to the natural binding interaction.

OTHER MODES – DESTABILISING:
In some examples, the antibody may destabilise the SARS-CoV-2 spike protein. Such antibodies may therefore disrupt binding of the SARS-CoV-2 spike protein to the human ACE2 receptor as a result of destabilising the spike protein thereby resulting in a beneficial therapeutic effect, either when the antibody is used alone or in combination with a further anti-SARS-CoV-2 antibody.

OTHER MODES – INCREASED BINDING:
In some examples, the antibody may increase the number of RBDs in the UP position with an apparent increase in the binding between the SARS-CoV-2 spike protein and the human ACE2 receptor in biochemistry assays, but with an overall inhibition of appropriate spike protein function in the virus particle, leading to neutralisation of the virus. Such antibodies may be particularly useful therapeutically when used in combination with another RBD binding and ACE-2 blocking anti-SARS-CoV-2 antibody. For example, they may destabilise the interactions within the SARS-CoV-2 spike protein trimer or may force the RBD of the SARS-CoV-2 spike protein into upward configuration more often which may make it more susceptible to a neutralising antibody that specifically binds the RBD of the SARS-CoV-2 spike protein. Data supporting this mode of action are presented in Example 3.

Such antibodies may also be particularly useful as diagnostic antibodies, especially if used in a double antigen binding assays where the antibody is used to capture the spike protein.

Exemplary antibodies described herein are set out in Tables 1a and 1b and described further below.

GROUP A 'ACE2-COMPETING' RBD BINDERS:

In some aspects, the antibody specifically binds the RBD of the SARS-CoV-2 spike protein, wherein the antibody competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor.

Provided herein are antibodies that neutralise SARS-CoV-2 and specifically bind to the receptor binding domain (RBD) of the S1 subunit of SARS-CoV-2 and compete with ACE2 for binding to SARS-CoV-2. In one example, the antibodies have a high affinity (such as a KD of 10-9 M or lower or even a KD of 5x10-10 M or lower) for the isolated RBD of the SARS-CoV-2 spike protein, particularly when measured using a surface plasmon resonance (SPR) assay (e.g. a Biacore SPR assay). In one example, the antibodies neutralise SARS-CoV-2 with high potency (such as with an IC50 of 1nM or lower, an IC50 of 100pM or lower, an IC50 of 50pM or lower, an IC50 of 10pM or lower, or even an IC50 of 5pM or lower) particularly in vitro in pseudovirus assays. In one example, the antibodies neutralise SARS-CoV-2 with high potency (such as with an IC50 of 1nM or lower, an IC50 of 100pM or lower, an IC50 of 50pM or lower, an IC50 of 30pM) particularly in vitro in live virus assays. In one example, the antibodies (i) have a high affinity (such as a KD of 10-9 M or lower or even a KD of 5x10-10 M or lower) for the RBD of SARS-CoV-2 and (ii) neutralise SARS-CoV-2 with high potency (such as with an IC50 of 1nM or lower, an IC50 of 100pM or lower, an IC50 of 50pM or lower, an IC50 of 10pM or lower, or even an IC50 of 5pM or lower).

In one example, the antibody is selected from the group consisting of IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-060, IMPI-006, IMPI-004, IMPI-047, IMPI-037, IMPI-017 and IMPI-059.

In one example, the antibody is selected from the group consisting of IMPI-029, IMPI-056 and IMPI-005 (cluster 5 in Figure 3). In one example, the antibody is selected from the group consisting of IMPI-012, IMPI-052 and IMPI-002 (cluster 6 in Figure 3). In one example, the antibody is selected from the group consisting of IMPI-041, IMPI-036 and IMPI-055 (cluster 7 in Figure 3). In one example, the antibody is selected from the group consisting of IMPI-054 and IMPI-042 (cluster 9 in Figure 3). In one example, the antibody is selected from the group consisting of IMPI-021 and IMPI-060 (cluster 10 in Figure 3).

In one example, the antibody is IMPI-029, IMPI-056 or IMPI-005. In one example, the antibody is IMPI-012, IMPI-052 or IMPI-002. In one example, the antibody is IMPI-041, IMPI-036 or IMPI-055. In one example, the antibody is IMPI-054 or IMPI-042. In one example, the antibody is IMPI-021 or IMPI-060.

In one example, the antibody is selected from the group consisting of YANG-1101, YANG-1103, YANG-1105, YANG-1106, YANG-1107, YANG-1108, YANG-1109, YANG-1110, YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c, YANG-1113, YANG-1114, YANG-1115, YANG-1116, YANG-1117, YANG-1118, YANG-1119, YANG-2101, YANG-2102, YANG-2103, YANG-2104, YANG-2105, YANG-2106, YANG-2107, YANG-2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l, YANG-2109, YANG-2110, or YANG-2111.

In one example, the antibody is selected from the group consisting of YANG-1112, YANG-2107, YANG-2108, or YANG-2111.

In one example, the antibody is an antibody in the YANG-1112 antibody cluster, e.g. as shown in Figures 25 and 26: YANG-1112a, YANG-1112b, YANG-1112c.

In one example, the antibody is an antibody in the YANG 2107 and 2108 antibody cluster, e.g. as shown in Figures 17 and 18: YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l.

In one example, the antibody is an antibody in the YANG-2111 antibody cluster, e.g. as shown in Figures 19 and 20: YANG-2111a, YANG-2111b.

GROUP B 'TRIMER' BINDERS:

In some aspects, the antibody specifically binds the trimer form of the SARS-CoV-2 spike protein.

Such antibodies preferentially bind to the trimer form of the SARS-CoV-2 spike protein over each of the isolated RBD, isolated S1 subunit and isolated S2 subunit of the SARS-CoV-2 spike protein. Such antibodies may show at least 50 fold, at least 100 fold, at least 150 fold, or at least 200 fold higher affinity for the trimer form of the SARS-CoV-2 spike protein over each of the isolated RBD, isolated S1 subunit and isolated S2 subunit of the SARS-CoV-2 spike protein, particularly in HTRF binding assays (e.g. as set out in Example 2). Such antibodies may show at least 50 fold, at least 100 fold, at least 150 fold, or at least 200 fold higher affinity for the trimer form of the SARS-CoV-2 spike protein over each of the isolated RBD, isolated S1 subunit and isolated S2 subunit of the SARS-CoV-2 spike protein, particularly in SPR binding assays (e.g. as defined herein). Such antibodies may prevent a function of ACE2 binding to SARS-CoV-2. Such antibodies generally do not compete with ACE2 for binding to SARS-CoV-2. Such antibodies may not bind to the isolated RBD of SARS-CoV-2. Such antibodies may not bind to the isolated RBD, the isolated S1 subunit or the isolated S2 subunit of SARS-CoV-2.

Preferably, the antibody is selected from the group consisting of IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 and IMPI-072. In one example, the antibody is selected from the group consisting of IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001 and IMPI-019 (cluster 2 in Figure 3). In one example, the antibody is selected from the group consisting of IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022 and IMPI-035 (cluster 4 in Figure 3). In one example, the antibody is selected from the group consisting of IMPI-067 and IMPI-072 (cluster 12 in Figure 3). In one example, the antibody is IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001 or IMPI-019. In one example, the antibody is IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022 or IMPI-035. In one example, the antibody is IMPI-067 or IMPI-072.

GROUP C 'S2' BINDERS:

In some aspects, the antibody specifically binds to the S2 subunit of the SARS-CoV spike protein.

Provided herein are antibodies neutralise SARS-CoV-2 and specifically bind to the S2 subunit of SARS-CoV-2. Such antibodies generally do not compete with ACE2 for binding to SARS-CoV-2. Such antibodies may show high affinity for the S2 subunit e.g. KD of 10-9 M or lower. Such antibodies may be valuable as medicaments as described herein, such as in combination therapies, especially for example where they also show ADCC activity.

In one example, the antibody is selected from the group consisting of IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 and IMPI-071. In one example, the antibody is selected from the group consisting of IMPI-003 and IMPI-013 (cluster 8 in Figure 3). More preferably, the antibody is selected from the group consisting of IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 and IMPI-071 (cluster 11 in example 3). In one example, the antibody is IMPI-003 or IMPI-013. More preferably, the antibody is IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071.

In one example, the antibody is selected from the group consisting of YANG-1201, YANG-1202, YANG-1203, YANG-1204, YANG-1205, YANG-1206, YANG-1207, YANG-2201, YANG-2202, YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k, YANG-2204, YANG-2205, YANG-2206, YANG-2207, and YANG-2208.

In one example, the antibody is selected from the group consisting of YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, and YANG-2208.

In one example, the antibody is an antibody in the YANG-2203 antibody cluster, e.g. as shown in Figures 21 and 22: YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k.

In one example, the antibody is an antibody in the YANG-2204, YANG-2205, YANG-2206, YANG-2207, and YANG-2208 antibody cluster, e.g. as shown in Figures 23 and 24: YANG-2209, YANG-2210, YANG-2211, YANG-2212, YANG-2213, YANG-2214, YANG-2215, YANG-2216, YANG-2217, YANG-2218, YANG-2219, YANG-2220, YANG-2221, YANG-2222, YANG-2223, YANG-2224, YANG-2225, YANG-2226, YANG-2227, YANG-2228, YANG-2229, YANG-2230, YANG-2231, YANG-2232, YANG-2233, YANG-2234, YANG-2235, YANG-2236, YANG-2237, YANG-2238, YANG-2239, YANG-2240, YANG-2241, YANG-2242, YANG-2243, YANG-2244, YANG-2245, YANG-2246, YANG-2247, YANG-2248, YANG-2249, YANG-2250, YANG-2251, YANG-2252, YANG-2253, YANG-2254, YANG-2255, YANG-2256, YANG-2257, YANG-2258, YANG-2259, YANG-2260, YANG-2261, YANG-2262, YANG-2263, YANG-2264, YANG-2265, YANG-2266, YANG-2267, YANG-2268, YANG-2269, YANG-2270, YANG-2271, YANG-2272, YANG-2273, YANG-2274, YANG-2275, YANG-2276, YANG-2277, YANG-2278, YANG-2279, YANG-2280, YANG-2281, YANG-2282, YANG-2283, YANG-2284, YANG-2285, YANG-2286, YANG-2287, YANG-2288, YANG-2289, YANG-2290, YANG-2291, YANG-2292, YANG-2293, YANG-2294, YANG-2295, YANG-2296, YANG-2297, YANG-2298, YANG-2299, YANG-2299a, YANG-2299b, YANG-2299c, YANG-2299d, YANG-2299e, YANG-2299f, YANG-2299g, YANG-2299h, YANG-2299i, YANG-2299j, YANG-2299k, YANG-2299l

GROUP D 'NON-COMPETE' RBD BINDERS:

In some aspects, the antibody specifically binds the RBD of the SARS-CoV-2 spike protein, wherein the antibody does not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor.

Provided herein are antibodies that specifically bind to the receptor binding domain (RBD) of the S1 subunit of SARS-CoV-2 and do not compete with ACE2 for binding to SARS-CoV-2. Such antibodies may show 0-2 fold change in neutralising activity relative to SAD S35 antibody. Such antibodies may optionally show neutralising activity. For example, the antibody may neutralise SARS-CoV-2 with an IC50 of 55nM or lower, an IC50 of 35nM or lower, an IC50 of 15nM or lower, an IC50 of 10nM or lower, or an IC50 of 3nM or lower (e.g. as measured in a pseudovirus neutralisation assay). In other examples, the antibody may neutralise SARS-CoV-2 with an IC50 of 2nM or greater, an IC50 of 5nM or greater, an IC50 of 10nM or greater, an IC50 of 30nM or greater, or even an IC50 of 50nM or greater (e.g. as measured in a pseudovirus neutralisation assay) and yet are still of interest as therapeutic antibodies. Such antibodies may show high affinity for the RBD e.g. KD of 10-9 M or lower. Such antibodies may result in increased binding between the RBD and the ACE2 receptor. Such antibodies may also result in destabilising of the trimer form of the SARS-CoV-2 spike protein and/ or may cross-react with SARS-CoV.

In one example, the antibody is selected from the group consisting of IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 and IMPI-068. In one example, the antibody is selected from the group consisting of IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058 and IMPI-043 (cluster 1 in Figure 3). In one example, the antibody is selected from the group consisting of IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033 and IMPI-014 (cluster 3 in Figure 3). In one example, the antibody is IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058 or IMPI-043. In another example, the antibody is IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033 or IMPI-014.

In one example, the antibody is selected from the group consisting of YANG-1111, YANG-1102, YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e, YANG-1402, YANG-1403 or YANG-2112.

In one example, the antibody is an antibody in the YANG-1401 antibody cluster, e.g. as shown in Figures 15 and 16: YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e.

GROUP E 'NTD' BINDERS:
In some aspects, the antibody specifically binds the NTD of the S1 sub-unit of the SARS-CoV-2 spike protein.

In one example, the antibody is selected from the group consisting of YANG-1301, YANG-1302, YANG-1303, YANG-1304, YANG-1305; YANG-2301, YANG-2302, YANG-2303, YANG-2304, YANG-2305, or YANG-2306.

GROUPS A-D:
In one example the antibody is IMPI-001. In one example the antibody is IMPI-002. In one example the antibody is IMPI-003. In one example the antibody is IMPI-004. In one example the antibody is IMPI-005. In one example the antibody is IMPI-006. In one example the antibody is IMPI-007. In one example the antibody is IMPI-008. In one example the antibody is IMPI-009. In one example the antibody is IMPI-010. In one example the antibody is IMPI-011. In one example the antibody is IMPI-012. In one example the antibody is IMPI-013. In one example the antibody is IMPI-014. In one example the antibody is IMPI-015. In one example the antibody is IMPI-016. In one example the antibody is IMPI-017. In one example the antibody is IMPI-018. In one example the antibody is IMPI-019. In one example the antibody is IMPI-020. In one example the antibody is IMPI-021. In one example the antibody is IMPI-022. In one example the antibody is IMPI-023. In one example the antibody is IMPI-024. In one example the antibody is IMPI-025.

In one example the antibody is IMPI-026. In one example the antibody is IMPI-027. In one example the antibody is IMPI-028. In one example the antibody is IMPI-029. In one example the antibody is IMPI-030. In one example the antibody is IMPI-031. In one example the antibody is IMPI-032. In one example the antibody is IMPI-033. In one example the antibody is IMPI-034. In one example the antibody is IMPI-035. In one example the antibody is IMPI-036. In one example the antibody is IMPI-037. In one example the antibody is IMPI-038. In one example the antibody is IMPI-039. In one example the antibody is IMPI-040. In one example the antibody is IMPI-041. In one example the antibody is IMPI-042. In one example the antibody is IMPI-043. In one example the antibody is IMPI-044. In one example the antibody is IMPI-045. In one example the antibody is IMPI-046. In one example the antibody is IMPI-047. In one example the antibody is IMPI-048. In one example the antibody is IMPI-049. In one example the antibody is IMPI-050. In one example the antibody is IMPI-051. In one example the antibody is IMPI-052. In one example the antibody is IMPI-053. In one example the antibody is IMPI-054. In one example the antibody is IMPI-055. In one example the antibody is IMPI-056. In one example the antibody is IMPI-057. In one example the antibody is IMPI-058. In one example the antibody is IMPI-059. In one example the antibody is IMPI-060. In one example the antibody is IMPI-061. In one example the antibody is IMPI-062. In one example the antibody is IMPI-063. In one example the antibody is IMPI-064. In one example the antibody is IMPI-065. In one example the antibody is IMPI-066. In one example the antibody is IMPI-067. In one example the antibody is IMPI-068. In one example the antibody is IMPI-069. In one example the antibody is IMPI-070. In one example the antibody is IMPI-071. In one example the antibody is IMPI-072.

In one example the antibody is YANG-1101.
In one example the antibody is YANG-1103.
In one example the antibody is YANG-1105.
In one example the antibody is YANG-1106.
In one example the antibody is YANG-1107.
In one example the antibody is YANG-1108.
In one example the antibody is YANG-1109.
In one example the antibody is YANG-1110.
In one example the antibody is YANG-1112.
In one example the antibody is YANG-1113.
In one example the antibody is YANG-1114.
In one example the antibody is YANG-1115.
In one example the antibody is YANG-1116.
In one example the antibody is YANG-1117.
In one example the antibody is YANG-1118.
In one example the antibody is YANG-1119.
In one example the antibody is YANG-2101.
In one example the antibody is YANG-2102.

In one example the antibody is YANG-2103.

In one example the antibody is YANG-2104.

In one example the antibody is YANG-2105.

In one example the antibody is YANG-2106.

In one example the antibody is YANG-2107.

In one example the antibody is YANG-2108.

In one example the antibody is YANG-2109.

In one example the antibody is YANG-2110.

In one example the antibody is YANG-2111.

In one example the antibody is YANG-1201.

In one example the antibody is YANG-1202.

In one example the antibody is YANG-1203.

In one example the antibody is YANG-1204.

In one example the antibody is YANG-1205.

In one example the antibody is YANG-1206.

In one example the antibody is YANG-1207.

In one example the antibody is YANG-2201.

In one example the antibody is YANG-2202.

In one example the antibody is YANG-2203.

In one example the antibody is YANG-2204.

In one example the antibody is YANG-2205.

In one example the antibody is YANG-2206.

In one example the antibody is YANG-2207.

In one example the antibody is YANG-2208.

In one example the antibody is YANG-1102.

In one example the antibody is YANG-1111.

In one example the antibody is YANG-1401.

In one example the antibody is YANG-1402.

In one example the antibody is YANG-1403.

In one example the antibody is YANG-2112.

In one embodiment, the antibody is YANG-1301.

In one embodiment, the antibody is YANG-1302.

In one embodiment, the antibody is YANG-1303.

In one embodiment, the antibody is YANG-1304.

In one embodiment, the antibody is YANG-1305.

In one embodiment, the antibody is YANG-2301.

In one embodiment, the antibody is YANG-2302.

In one embodiment, the antibody is YANG-2303.

In one embodiment, the antibody is YANG-2304.

In one embodiment, the antibody is YANG-2305.

In one embodiment, the antibody is YANG-2306.

Antibody IMPI-052 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No:2, comprising the CDRH1 amino acid sequence of SEQ ID No: 3 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 4 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 5 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 1. Antibody IMPI-052 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 7, comprising the CDRL1 amino acid sequence of SEQ ID No: 8 (IMGT), the CDRL2 amino acid sequence of SEQ ID No:9 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 10 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 6. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-047 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 12, comprising the CDRH1 amino acid sequence of SEQ ID No: 13 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 14 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 15 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 11. Antibody IMPI-047 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 17, comprising the CDRL1 amino acid sequence of SEQ ID No: 8 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 18 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 19 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 16. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-003 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 21, comprising the CDRH1 amino acid sequence of SEQ ID No: 22 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 23 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 24 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 20. Antibody IMPI-003 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 26, comprising the CDRL1 amino acid sequence of SEQ ID No: 27 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3

amino acid sequence of SEQ ID No: 29 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 25. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-043 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 31, comprising the CDRH1 amino acid sequence of SEQ ID No: 32 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 33 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 34 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 30. Antibody IMPI-043 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 36, comprising the CDRL1 amino acid sequence of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 38 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 35. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-048 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 40, comprising the CDRH1 amino acid sequence of SEQ ID No: 41 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 42 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 43 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 39. Antibody IMPI-048 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 45, comprising the CDRL1 amino acid sequence of SEQ ID No: 46 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 47 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 44. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-014 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 49, comprising the CDRH1 amino acid sequence of SEQ ID No: 41 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 42 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 43 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 48. Antibody IMPI-014 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 51, comprising the CDRL1 amino acid sequence of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 47 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 50. The VH domain may be combined with any of the heavy chain constant region sequences

described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-059 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 53, comprising the CDRH1 amino acid sequence of SEQ ID No: 54 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 55 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 56 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 52. Antibody IMPI-059 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 58, comprising the CDRL1 amino acid sequence of SEQ ID No: 59 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 60 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 57. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-057 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 62, comprising the CDRH1 amino acid sequence of SEQ ID No: 22 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 63 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 64 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 61. Antibody IMPI-057 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 66, comprising the CDRL1 amino acid sequence of SEQ ID No: 67 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 68 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 69 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 65. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-015 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 71, comprising the CDRH1 amino acid sequence of SEQ ID No: 72 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 33 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 34 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 70. Antibody IMPI-015 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 74, comprising the CDRL1 amino acid sequence of SEQ ID No: 75 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 76 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 73. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-025 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 78, comprising the CDRH1 amino acid sequence of SEQ ID No: 79 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 80 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 81 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 77. Antibody IMPI-025 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 83, comprising the CDRL1 amino acid sequence of SEQ ID No: 84 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 85 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 86 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 82. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-051 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 88, comprising the CDRH1 amino acid sequence of SEQ ID No: 89 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 33 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 34 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 87. Antibody IMPI-051 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 91, comprising the CDRL1 amino acid sequence of SEQ ID No: 92 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 93 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 90. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-031 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 95, comprising the CDRH1 amino acid sequence of SEQ ID No: 22 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 23 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 96 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 94. Antibody IMPI-031 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 98, comprising the CDRL1 amino acid sequence of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 69 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No:97. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-045 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 100, comprising the CDRH1 amino acid sequence of SEQ ID No: 101 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 42 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 43 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 99. Antibody IMPI-045 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 103, comprising the CDRL1 amino acid sequence of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 47 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 102. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-005 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 105, comprising the CDRH1 amino acid sequence of SEQ ID No: 13 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 14 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 106 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 104. Antibody IMPI-005 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 108, comprising the CDRL1 amino acid sequence of SEQ ID No: 8 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 18 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 109 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 107. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-038 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 111, comprising the CDRH1 amino acid sequence of SEQ ID No: 112 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 113 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 114 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 110. Antibody IMPI-038 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 116, comprising the CDRL1 amino acid sequence of SEQ ID No: 117 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 118 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 115. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-036 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 120, comprising the CDRH1 amino acid sequence of SEQ ID No: 121 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 122 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 123 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 119. Antibody IMPI-036 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 125, comprising the CDRL1 amino acid sequence of SEQ ID No: 126 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 127 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 128 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 124. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-023 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 130, comprising the CDRH1 amino acid sequence of SEQ ID No: 131 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 132 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 133 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 129. Antibody IMPI-023 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 135, comprising the CDRL1 amino acid sequence of SEQ ID No 136 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 85 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 86 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 134. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-019 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 138, comprising the CDRH1 amino acid sequence of SEQ ID No: 139 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 140 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 141 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 137. Antibody IMPI-019 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 143, comprising the CDRL1 amino acid sequence of SEQ ID No: 144 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 85 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 86 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 142. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-008 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 146, comprising the CDRH1 amino acid sequence of SEQ ID No: 22 (IMGT), the CDRH2 amino acid sequence

of SEQ ID No: 23 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 147 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 145. Antibody IMPI-008 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 149, comprising the CDRL1 amino acid sequence of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 69 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 148. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-004 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 151, comprising the CDRH1 amino acid sequence of SEQ ID No: 112 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 152 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 153 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 150. Antibody IMPI-004 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 155, comprising the CDRL1 amino acid sequence of SEQ ID No: 156 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 157 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 158 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 154. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-012 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 160, comprising the CDRH1 amino acid sequence of SEQ ID No: 161 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 4 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 5 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 159. Antibody IMPI-012 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 163, comprising the CDRL1 amino acid sequence of SEQ ID No: 8 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 18 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 164 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 162. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-010 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 166, comprising the CDRH1 amino acid sequence of SEQ ID No: 22 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 23 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 167 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 165. Antibody IMPI-010 has a light chain

variable region (VL) amino acid sequence of SEQ ID No: 169, comprising the CDRL1 amino acid sequence of SEQ ID No: 67 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 69 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 168. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-017 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 171, comprising the CDRH1 amino acid sequence of SEQ ID No: 172 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 14 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 173 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 170. Antibody IMPI-017 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 175, comprising the CDRL1 amino acid sequence of SEQ ID No: 176 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 18 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 177 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 174. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-037 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 179, comprising the CDRH1 amino acid sequence of SEQ ID No: 180 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 181 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 182 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 178. Antibody IMPI-037 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 184, comprising the CDRL1 amino acid sequence of SEQ ID No: 185 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 18 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 186 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 183. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The sequences of antibody IMPI-037 are of particular interest in the present invention.

Antibody IMPI-022 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 188, comprising the CDRH1 amino acid sequence of SEQ ID No: 22 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 63 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 147 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 187. Antibody IMPI-022 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 190, comprising the CDRL1 amino acid sequence

of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 69 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 189. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-058 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 192, comprising the CDRH1 amino acid sequence of SEQ ID No: 193 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 194 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 34 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 191. Antibody IMPI-058 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 196, comprising the CDRL1 amino acid sequence of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 197 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 195. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-024 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 199, comprising the CDRH1 amino acid sequence of SEQ ID No: 32 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 33 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 200 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 198. Antibody IMPI-024 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 202, comprising the CDRL1 amino acid sequence of SEQ ID No: 92 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 203 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 204 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 201. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-039 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 206, comprising the CDRH1 amino acid sequence of SEQ ID No: 79 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 80 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 207 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 205. Antibody IMPI-039 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 209, comprising the CDRL1 amino acid sequence of SEQ ID No: 84 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 85 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 86 (IMGT). The light chain nucleic acid sequence of the VL domain

is SEQ ID No: 208. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-020 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 211, comprising the CDRH1 amino acid sequence of SEQ ID No: 212 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 140 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 133 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 210. Antibody IMPI-020 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 214, comprising the CDRL1 amino acid sequence of SEQ ID No: 84 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 85 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 86 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 213. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-053 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 216, comprising the CDRH1 amino acid sequence of SEQ ID No: 79 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 140 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 207 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 215. Antibody IMPI-053 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 218, comprising the CDRL1 amino acid sequence of SEQ ID No: 219 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 85 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 86 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 217. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-021 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 221, comprising the CDRH1 amino acid sequence of SEQ ID No: 3 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 14 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 222 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 220. Antibody IMPI-021 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 224, comprising the CDRL1 amino acid sequence of SEQ ID No: 8 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 18 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 225 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 223. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out

in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-032 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 227, comprising the CDRH1 amino acid sequence of SEQ ID No: 228 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 132 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 133 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 226. Antibody IMPI-032 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 230, comprising the CDRL1 amino acid sequence of SEQ ID No: 136 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 85 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 86 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 229. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-001 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 227, comprising the CDRH1 amino acid sequence of SEQ ID No: 228 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 132 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 133 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 226. Antibody IMPI-001 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 232, comprising the CDRL1 amino acid sequence of SEQ ID No: 144 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 85 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 86 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 231. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-041 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 234, comprising the CDRH1 amino acid sequence of SEQ ID No 121 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 235 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 236 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 233. Antibody IMPI-041 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 238, comprising the CDRL1 amino acid sequence of SEQ ID No: 126 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 239 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 128 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 237. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-029 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 241, comprising the CDRH1 amino acid sequence of SEQ ID No: 3 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 14 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 106 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 240. Antibody IMPI-029 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 108, comprising the CDRL1 amino acid sequence of SEQ ID No: 8 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 18 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 109 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 107. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-009 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 243, comprising the CDRH1 amino acid sequence of SEQ ID No: 32 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 33 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 34 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 242. Antibody X has a light chain variable region (VL) amino acid sequence of SEQ ID No: 245, comprising the CDRL1 amino acid sequence of SEQ ID No: 92 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 246 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 244. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-006 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 248, comprising the CDRH1 amino acid sequence of SEQ ID No: 249 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 250 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 251 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 247. Antibody IMPI-006 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 253, comprising the CDRL1 amino acid sequence of SEQ ID No: 254 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 255 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 252. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-054 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 257, comprising the CDRH1 amino acid sequence of SEQ ID No: 172 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 14 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 258 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 256. Antibody IMPI-054 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 260, comprising the CDRL1 amino acid sequence of SEQ ID No: 261 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 262 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 263 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 259. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-044 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 265, comprising the CDRH1 amino acid sequence of SEQ ID No: 32 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 33 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 34 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 264. Antibody IMPI-044 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 267, comprising the CDRL1 amino acid sequence of SEQ ID No: 92 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 203 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 204 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 266. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-002 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 26, comprising the CDRH1 amino acid sequence of SEQ ID No: 3 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 14 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 5 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 268. Antibody IMPI-002 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 271, comprising the CDRL1 amino acid sequence of SEQ ID No: 8 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 18 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 10 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 270. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-027 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 273, comprising the CDRH1 amino acid sequence of SEQ ID No: 41 (IMGT), the CDRH2 amino acid sequence

of SEQ ID No: 42 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 43 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 272. Antibody IMPI-027 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 275, comprising the CDRL1 amino acid sequence of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 47 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 274. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-011 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 265, comprising the CDRH1 amino acid sequence of SEQ ID No: 32 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 33 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 34 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 264. Antibody IMPI-011 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 277, comprising the CDRL1 amino acid sequence of SEQ ID No: 92 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 76 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 276. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-033 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 279, comprising the CDRH1 amino acid sequence of SEQ ID No: 41 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 42 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 43 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 278. Antibody IMPI-033 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 281, comprising the CDRL1 amino acid sequence of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 282 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 280. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-055 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 284, comprising the CDRH1 amino acid sequence of SEQ ID No: 121 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 235 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 285 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 283. Antibody IMPI-055 has a light chain

variable region (VL) amino acid sequence of SEQ ID No: 287, comprising the CDRL1 amino acid sequence of SEQ ID No: 126 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 288 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 128 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 286. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-049 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 199, comprising the CDRH1 amino acid sequence of SEQ ID No: 32 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 33 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 200 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 198. Antibody IMPI-049 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 267, comprising the CDRL1 amino acid sequence of SEQ ID No: 92 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 203 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 204 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 289. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-042 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 257, comprising the CDRH1 amino acid sequence of SEQ ID No: 172 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 14 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 258 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 290. Antibody IMPI-042 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 292, comprising the CDRL1 amino acid sequence of SEQ ID No: 261 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 262 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 263 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 291. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-035 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 294, comprising the CDRH1 amino acid sequence of SEQ ID No: 22 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 23 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 147 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 293. Antibody IMPI-035 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 296, comprising the CDRL1 amino acid sequence of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3

amino acid sequence of SEQ ID No: 69 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 295. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-028 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 298, comprising the CDRH1 amino acid sequence of SEQ ID No: 13 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 14 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 299 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 297. Antibody IMPI-028 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 301, comprising the CDRL1 amino acid sequence of SEQ ID No: 302 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 157 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 303 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 300. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-018 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 305, comprising the CDRH1 amino acid sequence of SEQ ID No: 306 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 42 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 307 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 304. Antibody IMPI-018 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 309, comprising the CDRL1 amino acid sequence of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 47 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 308. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-050 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 265, comprising the CDRH1 amino acid sequence of SEQ ID No 32 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 33 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 34 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 264. Antibody IMPI-050 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 31, comprising the CDRL1 amino acid sequence of SEQ ID No: 312 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 203 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 93 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 310. The VH domain may be combined with any of the heavy chain constant region

sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-016 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 265, comprising the CDRH1 amino acid sequence of SEQ ID No 32 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 33 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 34 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 264. Antibody IMPI-016 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 314, comprising the CDRL1 amino acid sequence of SEQ ID No: 92 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 76 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 313. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-040 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 316, comprising the CDRH1 amino acid sequence of SEQ ID No: 131 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 140 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 317 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 315. Antibody IMPI-040 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 319, comprising the CDRL1 amino acid sequence of SEQ ID No: 144 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 85 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 86 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 318. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-030 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 78, comprising the CDRH1 amino acid sequence of SEQ ID No: 79 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 80 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 81 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 77. Antibody IMPI-030 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 321, comprising the CDRL1 amino acid sequence of SEQ ID No: 84 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 85 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 86 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 320. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out

in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-034 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 265, comprising the CDRH1 amino acid sequence of SEQ ID No: 32 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 33 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 34 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 264. Antibody IMPI-034 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 323, comprising the CDRL1 amino acid sequence of SEQ ID No: 324 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 203 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 93 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 322. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-013 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 326, comprising the CDRH1 amino acid sequence of SEQ ID No: 22 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 23 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 327 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 325. Antibody IMPI-013 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 329, comprising the CDRL1 amino acid sequence of SEQ ID No: 27 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 29 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 328. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-026 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 331, comprising the CDRH1 amino acid sequence of SEQ ID No: 32 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 33 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 34 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 330. Antibody IMPI-026 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 333, comprising the CDRL1 amino acid sequence of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 76 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 332. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-007 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 335, comprising the CDRH1 amino acid sequence of SEQ ID No: 336 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 140 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 337 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 334. Antibody IMPI-007 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 339, comprising the CDRL1 amino acid sequence of SEQ ID No: 84 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 85 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 86 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 338. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-046 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 341, comprising the CDRH1 amino acid sequence of SEQ ID No: 342 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 33 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 34 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 340. Antibody IMPI-046 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 344, comprising the CDRL1 amino acid sequence of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 38 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 343. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-060 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 221, comprising the CDRH1 amino acid sequence of SEQ ID No: 3 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 14 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 222 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 220. Antibody IMPI-060 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 346, comprising the CDRL1 amino acid sequence of SEQ ID No: 8 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 18 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 347 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 345. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-056 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 349, comprising the CDRH1 amino acid sequence of SEQ ID No: 172 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 14 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 106 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 348. Antibody IMPI-056 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 351, comprising the CDRL1 amino acid sequence of SEQ ID No: 8 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 18 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 10 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 350. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-061 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 353, comprising the CDRH1 amino acid sequence of SEQ ID No: 354 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 355 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 356 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 352. Antibody IMPI-061 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 358, comprising the CDRL1 amino acid sequence of SEQ ID No: 359 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 157 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 360 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 357. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-062 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 353, comprising the CDRH1 amino acid sequence of SEQ ID No: 354 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 355 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 356 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 361. Antibody IMPI-062 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 363, comprising the CDRL1 amino acid sequence of SEQ ID No: 364 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 157 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 360 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 362. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-063 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 366, comprising the CDRH1 amino acid sequence of SEQ ID No: 354 (IMGT), the CDRH2 amino acid sequence

of SEQ ID No: 355 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 356 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 365. Antibody IMPI-063 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 368, comprising the CDRL1 amino acid sequence of SEQ ID No: 369 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 157 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 360 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 367. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-064 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 353, comprising the CDRH1 amino acid sequence of SEQ ID No: 354 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 355 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 356 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 370. Antibody IMPI-064 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 372, comprising the CDRL1 amino acid sequence of SEQ ID No: 364 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 157 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 373 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 371. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-065 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 353, comprising the CDRH1 amino acid sequence of SEQ ID No: 354 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 355 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 356 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 352. Antibody IMPI-065 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 375, comprising the CDRL1 amino acid sequence of SEQ ID No: 364 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 157 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 376 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 374. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-066 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 378, comprising the CDRH1 amino acid sequence of SEQ ID No: 354 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 379 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 356 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 377. Antibody IMPI-066 has a light chain

variable region (VL) amino acid sequence of SEQ ID No: 381, comprising the CDRL1 amino acid sequence of SEQ ID No: 382 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 157 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 383 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 380. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-067 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 385, comprising the CDRH1 amino acid sequence of SEQ ID No: 386 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 387 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 388 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 384. Antibody IMPI-067 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 390, comprising the CDRL1 amino acid sequence of SEQ ID No: 391 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 157 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 392 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 389. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-068 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 394, comprising the CDRH1 amino acid sequence of SEQ ID No: 395 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 113 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 396 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 393. Antibody IMPI-068 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 398, comprising the CDRL1 amino acid sequence of SEQ ID No: 37 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 28 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 399 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 397. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-069 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 401, comprising the CDRH1 amino acid sequence of SEQ ID No: 354 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 355 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 356 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 400. Antibody IMPI-069 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 403, comprising the CDRL1 amino acid sequence of SEQ ID No: 404 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 157 (IMGT), and the CDRL3

amino acid sequence of SEQ ID No: 360 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 402. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-070 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 353, comprising the CDRH1 amino acid sequence of SEQ ID No: 354 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 355 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 356 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 370. Antibody IMPI-070 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 406, comprising the CDRL1 amino acid sequence of SEQ ID No: 407 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 157 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 408 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 405. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-071 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 353, comprising the CDRH1 amino acid sequence of SEQ ID No: 354 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 355 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 356 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 370. Antibody IMPI-071 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 410, comprising the CDRL1 amino acid sequence of SEQ ID No: 364 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 157 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 360 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 409. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody IMPI-072 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 412, comprising the CDRH1 amino acid sequence of SEQ ID No: 413 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 387 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 388 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 411. Antibody IMPI-072 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 415, comprising the CDRL1 amino acid sequence of SEQ ID No: 391 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 157 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 416 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 414. The VH domain may be combined with any of the heavy chain constant region

sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

The sequences of YANG antibodies provided herein (particularly RBD-binders YANG-1401, YANG-1112, YANG-2107, YANG-2108, and YANG-2111; and S2-binders YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, and YANG-2208) are of particular interest in the present invention.

Antibody YANG-1401 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 777, comprising the CDRH1 amino acid sequence of SEQ ID No: 778 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 779 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 780 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 776. Antibody YANG-1401 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 782, comprising the CDRL1 amino acid sequence of SEQ ID No: 783 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 18 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 784 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 781. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody YANG-1112 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 571, comprising the CDRH1 amino acid sequence of SEQ ID No: 572 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 573 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 574 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 570. Antibody YANG-1112 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 576, comprising the CDRL1 amino acid sequence of SEQ ID No: 577 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 578 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 579 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 575. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody YANG-2107 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 898, comprising the CDRH1 amino acid sequence of SEQ ID No: 899 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 900 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 901 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 897. Antibody YANG-2107 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 903, comprising the CDRL1 amino acid sequence

of SEQ ID No: 904 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 203 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 905 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 902. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody YANG-2108 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 907, comprising the CDRH1 amino acid sequence of SEQ ID No: 908 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 909 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 910 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 906. Antibody YANG-2108 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 912, comprising the CDRL1 amino acid sequence of SEQ ID No: 913 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 203 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 914 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 911. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody YANG-2111 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 1045, comprising the CDRH1 amino acid sequence of SEQ ID No: 1046 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 1047 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 1048 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 1044. Antibody YANG-2111 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 1050, comprising the CDRL1 amino acid sequence of SEQ ID No: 1051 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 1052 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 1053 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 1049. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody YANG-2203 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 1105, comprising the CDRH1 amino acid sequence of SEQ ID No: 1106 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 1107 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 1108 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 1104. Antibody YANG-2203 has

a light chain variable region (VL) amino acid sequence of SEQ ID No: 1110, comprising the CDRL1 amino acid sequence of SEQ ID No: 1111 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 1112 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 1113 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 1109. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody YANG-2204 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 1225, comprising the CDRH1 amino acid sequence of SEQ ID No: 1226 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 1227 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 1228 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 1224. Antibody YANG-2204 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 1230, comprising the CDRL1 amino acid sequence of SEQ ID No: 1231 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 1232 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 1233 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 1229. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody YANG-2205 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 1235, comprising the CDRH1 amino acid sequence of SEQ ID No: 1236 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 1237 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 1238 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 1234. Antibody YANG-2205 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 1240, comprising the CDRL1 amino acid sequence of SEQ ID No: 1241 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 1242 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 1243 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 1239. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody YANG-2206 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 1245, comprising the CDRH1 amino acid sequence of SEQ ID No: 1246 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 1247 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 1248 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 1244. Antibody YANG-2206 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 1250, comprising the CDRL1 amino acid sequence of SEQ ID No: 1251 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 1252 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 1253 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 1249. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody YANG-2207 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 1255, comprising the CDRH1 amino acid sequence of SEQ ID No: 1256 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 1257 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 1258 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 1254. Antibody YANG-2207 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 1260, comprising the CDRL1 amino acid sequence of SEQ ID No: 1261 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 1262 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 1263 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 1259. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

Antibody YANG-2208 has a heavy chain variable region (VH) amino acid sequence of SEQ ID No: 1265, comprising the CDRH1 amino acid sequence of SEQ ID No: 1266 (IMGT), the CDRH2 amino acid sequence of SEQ ID No: 1267 (IMGT), and the CDRH3 amino acid sequence of SEQ ID No: 1268 (IMGT). The heavy chain nucleic acid sequence of the VH domain is SEQ ID No: 1264. Antibody YANG-2208 has a light chain variable region (VL) amino acid sequence of SEQ ID No: 1270, comprising the CDRL1 amino acid sequence of SEQ ID No: 1271 (IMGT), the CDRL2 amino acid sequence of SEQ ID No: 1272 (IMGT), and the CDRL3 amino acid sequence of SEQ ID No: 1273 (IMGT). The light chain nucleic acid sequence of the VL domain is SEQ ID No: 1269. The VH domain may be combined with any of the heavy chain constant region sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2). The VL domain may be combined with any of the light chain constant region

sequences described herein (the nucleotide and corresponding amino acid sequences of which are set out in Table 2).

CDRS, VL/VH:

In some examples the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the HCDR3 is the HCDR3 of any one of the antibodies described herein and set out in Table 1 (Table 1a and/or Table 1b).

In some examples, the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein the CDRs are those of any one of the antibodies described herein and set out in Table 1 (Table 1a and/or Table 1b).

In some examples, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of any one of the antibodies described herein and set out in Table 1 (Table 1a and/or Table 1b), optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

In some examples, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% (preferably 95%, more preferably 98%) identity to the variable heavy (VH) and variable light (VL) domain sequences of any one of the antibodies described herein and set out in Table 1 (Table 1a and/or Table 1b), provided that the antibody has the CDRs of said antibody described herein and set out in Table 1 (Table 1a and/or Table 1b).

In work underlying the present invention, antibody sequences were recovered from antigen-binding B cells or from plasma cells from immunised mice as described elsewhere herein, and grouped into the clusters shown in Figures 3 and Figures 15 to 26 using bioinformatics analysis. It will be understood that antibodies in the same cluster (Figure 3 and Figures 15 to 26) share a degree of sequence identity and/ or conserved sequences. As such, antibodies in the same cluster might be considered as 'sibling antibodies'. Sibling antibodies are within the scope of the present invention. In one embodiment, the present invention provides an expanded group of antibodies consisting of any antibody disclosed herein together with its sibling

antibodies. In one embodiment, the present invention provides an expanded group of antibodies consisting of any group of antibodies disclosed herein together with their sibling antibodies. The present invention also provides antibodies having at least 90% (preferably 95%, more preferably 98%) identity to the variable heavy (VH) and variable light (VL) domain sequences of any one of the antibodies described herein and set out in Table 1 (Table 1a and/or Table 1b), provided that any substitutions in the VH and VL domain sequences are to amino acid residues present in a sibling antibody in the same cluster disclosed herein. The present invention also provides antibodies comprising a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of any one of the antibodies described herein and set out in Table 1 (Table 1a and/or Table 1b), optionally with 1, 2, 3, 4 or 5 amino acid substitutions in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid substitutions in the variable light (VL) domain sequence, provided that any substitutions in the VH and VL domain sequences are to amino acid residues present in a sibling antibody in the same cluster disclosed herein.

One or more substitutions may be introduced in an antibody VH or VL domain at a position at which a different residue is present in a sibling antibody as shown in the clusters of Figures 3 and 15 to 26 herein. Thus, for example, an antibody may comprise the VH and VL domain of an IMPI antibody or YANG antibody disclosed herein, with one or more substitutions in framework regions, where those one or more substitutions are at positions shown to be variable in the cluster (optionally, at positions that vary between siblings obtained from antigen-binding B cells in the cluster and/or siblings for which assay data are presented herein). For cluster 1, for example, IMGT position 67 is variable since either Tyr or Asn may be present. Optionally, the substituted residue is the amino acid residue present in the sibling sequence (preferably, the sequence of a sibling obtained from an antigen-binding B cell or a sibling for which assay data are presented herein). Thus, a Y67N mutation may be introduced in a cluster 1 antibody, reflecting the residue present in IMPI-043. Conversely, N67Y mutation may be introduced in the VH domain of IMPI-043, reflecting the residue present in the other siblings of this cluster. As noted, siblings which were recovered from plasma cells (i.e., not recovered via antigen-binding of their expressing B cell) and for which assay data are not shown herein may optionally be discounted for this analysis. After subtracting such siblings from the clusters, the remaining siblings in each cluster are:

Cluster 1: IMPI-016, IMPI-024, IMPI-026, IMPI-034, IMPI-043, IMPI-050, IMPI-051, IMPI-058

Cluster 2: IMPI-001, IMPI-007, IMPI-019, IMPI-020, IMPI-023, IMPI-025, IMPI-030, IMPI-032, IMPI-039, IMPI-040, IMPI-053

Cluster 3: IMPI-014, IMPI-018, IMPI-027, IMPI-033, IMPI-045, IMPI-048

Cluster 4: IMPI-008, IMPI-010, IMPI-022, IMPI-035

Cluster 5: IMPI-005, IMPI-029, IMPI-056

Cluster 6: IMPI-002, IMPI-052

Cluster 7: IMPI-041, IMPI-055

Cluster 8: IMPI-003, IMPI-013

Cluster 9: IMPI-042, IMPI-054

Cluster 10: IMPI-021, IMPI-060

Cluster 11: IMPI-061, IMPI-062, IMPI-063, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070, IMPI-071

Cluster 12: IMPI-067

Cluster 13: YANG-1401, YANG-1401a, YANG-1401b, YANG-1401c, YANG-1401d, YANG-1401e

Cluster 14: YANG 2107, YANG- 2108, YANG-2108a, YANG-2108b, YANG-2108c, YANG-2108d, YANG-2108e, YANG-2108f, YANG-2108g, YANG-2108h, YANG-2108i, YANG-2108j, YANG-2108k, YANG-2108l

Cluster 15: YANG-2111, YANG-2111a, YANG-2111b

Cluster 16: YANG-2203, YANG-2203a, YANG-2203b, YANG-2203c, YANG-2203d, YANG-2203e, YANG-2203f, YANG-2203g, YANG-2203h, YANG-2203i, YANG-2203j, YANG-2203k.

Cluster 17: YANG-2204, YANG-2205, YANG-2206, YANG-2207, YANG-2208, YANG-2209, YANG-2210, YANG-2211, YANG-2212, YANG-2213, YANG-2214, YANG-2215, YANG-2216, YANG-2217, YANG-2218, YANG-2219, YANG-2220, YANG-2221, YANG-2222, YANG-2223, YANG-2224, YANG-2225, YANG-2226, YANG-2227, YANG-2228, YANG-2229, YANG-2230, YANG-2231, YANG-2232, YANG-2233, YANG-2234, YANG-2235, YANG-2236, YANG-2237, YANG-2238, YANG-2239, YANG-2240, YANG-2241, YANG-2242, YANG-2243, YANG-2244, YANG-2245, YANG-2246, YANG-2247, YANG-2248, YANG-2249, YANG-2250, YANG-2251, YANG-2252, YANG-2253, YANG-2254, YANG-2255, YANG-2256, YANG-2257, YANG-2258, YANG-2259, YANG-2260, YANG-2261, YANG-2262, YANG-2263, YANG-2264, YANG-2265, YANG-2266, YANG-2267, YANG-2268, YANG-2269, YANG-2270, YANG-2271, YANG-2272, YANG-2273, YANG-2274, YANG-2275, YANG-2276, YANG-2277, YANG-2278, YANG-2279, YANG-2280, YANG-2281, YANG-2282, YANG-2283, YANG-2284, YANG-2285, YANG-2286, YANG-2287, YANG-2288, YANG-2289, YANG-2290, YANG-2291, YANG-2292, YANG-2293, YANG-2294, YANG-2295, YANG-2296, YANG-2297, YANG-2298, YANG-2299, YANG-2299a, YANG-2299b, YANG-2299c, YANG-2299d, YANG-2299e, YANG-2299f, YANG-2299g, YANG-2299h, YANG-2299i, YANG-2299j, YANG-2299k, YANG-2299l

Cluster 18: YANG-1112, YANG-1112a, YANG-1112b, YANG-1112c

When one or more mutations (whether additions, insertions, substitutions or deletions of one or more amino acids) are made in the variable domain sequence of an antibody described herein, whether in a CDR or framework region, the resulting antibody may be tested (e.g., in one or more assays described herein) to confirm that affinity and/or potency are retained.

In some examples, the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of any one of the antibodies described herein and set out in Table 1 (Table 1a and/or Table 1b).

GENE SEGMENTS:
In some aspects, the antibody comprises VH and/or VL domain and framework regions of human germline gene segment sequences. Gene segment sequences from which the exemplary antibodies described herein are derived are set out in Table 3.

In one example, the antibody comprises an antibody VH domain which is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment.

In one example, the antibody comprises an antibody VH domain which is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein the V gene segment is IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01; and/or the J gene segment is IGHJ6*02, IGHJ4*02 or IGHJ3*02. In one example, the antibody comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1 aligns with human germline V gene segment IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR2 aligns with human germline V gene segment IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR3 aligns with human germline V gene segment IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or FR4 aligns with human germline J gene segment IGHJ6*02, IGHJ4*02 or IGHJ3*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one example, the antibody comprises an antibody VH domain which is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein the V gene segment is IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18; and/or the J gene segment is IGHJ4*02 or IGHJ6*02. In one example, the antibody comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1 aligns with human germline V gene segment IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR2 aligns with human germline V gene segment IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR3 aligns with human germline V gene segment IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or FR4 aligns with human germline J gene segment IGHJ4*02 or IGHJ6*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one example, the antibody comprises an antibody VH domain which is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein the V gene segment is IGHV3-9*01 or IGHV3-20*d01; and/or the J gene segment is IGHJ6*02 or IGHJ4*02. In one example, the antibody comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1 aligns with human germline V gene segment IGHV3-9*01 or IGHV3-20*d01 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR2 aligns with human germline V gene segment IGHV3-9*01 or IGHV3-20*d01 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR3 aligns with human germline V gene segment IGHV3-9*01 or IGHV3-20*d01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or FR4 aligns with human germline J gene segment IGHJ6*02 or IGHJ4*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one example, the antibody comprises an antibody VH domain which is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein the V gene segment is IGHV5-51*01, IGHV4-31*03, IGHV3-53*01 or IGHV3-30*18; and/or the J gene segment is IGHJ4*02 or IGHJ6*02. In one example, the antibody comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1 aligns with human germline V gene segment IGHV5-51*01, IGHV4-31*03, IGHV3-53*01 or IGHV3-30*18 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR2 aligns with human germline V gene segment IGHV5-51*01, IGHV4-31*03, IGHV3-53*01 or IGHV3-30*18 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR3 aligns with human germline V gene segment IGHV5-51*01, IGHV4-31*03, IGHV3-53*01 or IGHV3-30*18 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or FR4 aligns with human germline J gene segment IGHJ4*02 or IGHJ6*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one example, the antibody comprises an antibody VL domain which is derived from recombination of a human light chain V gene segment and a human light chain J gene segment.

In one example, the antibody comprises an antibody VL domain which is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein the V gene segment is IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01, and/or the J gene segment is IGKJ5*01, IGKJ4*01, IGKJ3*01, IGKJ2*04 or IGKJ1*01. In one example, the antibody comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1 aligns with human germline V gene segment IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01with up to 1, 2, 3, 4, or 5 amino acid alterations, FR2 aligns with human germline V gene segment IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01with up to 1, 2, 3, 4, or 5 amino acid alterations, FR3 aligns with human germline V gene segment IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or FR4 aligns with human germline J gene segment IGKJ5*01, IGKJ4*01, IGKJ3*01, IGKJ2*04 or IGKJ1*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one example, the antibody comprises an antibody VL domain which is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein the V gene segment is IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01, and/or the J gene segment is IGKJ4*01. In one example, the antibody comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1 aligns with human germline V gene segment IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR2 aligns with human germline V gene segment IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR3 aligns with human germline V gene segment IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or FR4 aligns with human germline J gene segment IGKJ4*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one example, the antibody comprises an antibody VL domain which is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein the V gene segment is IGKV1-6*01 or IGKV3-20*01, and/or the J gene segment is IGKJ1*01 or IGKJ2*04. In one example, the antibody comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1 aligns with human germline V gene segment IGKV1-6*01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR2 aligns with human germline V gene segment IGKV1-6*01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR3 aligns with human germline V gene segment IGKV1-6*01 or IGKV3-20*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or FR4 aligns with human germline J gene segment IGKJ1*01 or IGKJ2*04 with up to 1, 2, 3, 4 or 5 amino acid alterations.

In one example, the antibody comprises an antibody VL domain which is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein the V gene segment is IGKV1D-13*d01, IGKV3-20*01 or IGKV1-12*01, and/or the J gene segment is IGKJ1*01, IGKJ4*01 or IGKJ3*01. In one example, the antibody comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1 aligns with human germline V gene segment IGKV1D-13*d01, IGKV3-20*01 or IGKV1-12*01 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR2 aligns with human germline V gene segment IGKV1D-13*d01, IGKV3-20*01 or IGKV1-12*01 with up to 1, 2, 3, 4, or 5 amino acid alterations, FR3 aligns with human germline V gene segment IGKV1D-13*d01, IGKV3-20*01 or IGKV1-12*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or FR4 aligns with human germline J gene segment IGKJ1*01, IGKJ4*01 or IGKJ3*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

ANTIBODY PROPERTIES:

In some examples, the antibody is a monoclonal antibody. Methods of making monoclonal antibodies are known and include, for example, fusing myeloma cells with the cells from an animal that was immunized with the desired antigen. In other examples, the monoclonal antibodies may be generated using recombinant DNA technology. In one example, the antibody is a monoclonal antibody that specifically binds the SARS-CoV-2 spike protein. In one example, the antibody is a fully human monoclonal antibody.

In some examples, the antibody is a human antibody. In one example, the antibody is a fully human antibody. In one example, the antibody is a fully human monoclonal antibody.

SEQUENCE IDENTITY:
In some examples, the antibody comprises an amino acid sequence which has a high level of sequence identity to the amino acid sequence of one of the exemplary antibodies described herein and set out in Table 1 (Table 1a and/or Table 1b).

In one example, the amino acid sequence is at least 70% identical to the specified SEQ ID No. In one example, the amino acid sequence is at least 75% identical to the specified SEQ ID No. In one example, the amino acid sequence is at least 95% identical to the specified SEQ ID No. In one example, the amino acid sequence is at least 96% identical to the specified SEQ ID No. In one example, the amino acid sequence is at least 97% identical to the specified SEQ ID No. In one example, the amino acid sequence is at least 98% identical to the specified SEQ ID No. In one example, the amino acid sequence is at least 99% identical to the specified SEQ ID No. In one example, the amino acid sequence is at least 99.5% identical to the specified SEQ ID No.

SUBSTITUTIONS:
In some examples, the antibody comprises amino acid substitutions.

Amino acid substitutions include alterations in which an amino acid is replaced with a different naturally-occurring amino acid residue. Such substitutions may be classified as "conservative", in which case an amino acid residue contained in a polypeptide is replaced with another naturally occurring amino acid of similar character either in relation to polarity, side chain functionality or size. Such conservative substitutions are well known in the art. Substitutions encompassed by the present invention may also be "non-conservative", in which an amino acid residue which is present in a peptide is substituted with an amino acid having different properties, such as naturally-occurring amino acid from a different group (e.g. substituting a charged or hydrophobic amino; acid with alanine), or alternatively, in which a naturally-occurring amino acid is substituted with a non-conventional amino acid.

In one embodiment, the conservative amino acid substitutions are as described herein. For example, the substitution may be of Y with F, T with S or K, P with A, E with D or Q, N with D or G, R with K, G with N or A, T with S or K, D with N or E, I with L or V, F with Y, S with T or A, R with K, G with N or A, K with R, A with S, K or P. In another embodiment, the conservative amino acid substitutions may be wherein Y is substituted with F, T with A or S, I with L or V, W with Y, M with L, N with D, G with A, T with A or S, D with N, I with L or V, F with Y or L, S with A or T and A with S, G, T or V.
In one example, the amino acid substitutions are located outside the CDR sequences.

LIGHT CHAINS:

In some examples, the antibody comprises a kappa light chain. Kappa light chain constant region amino acid and nucleotide sequences are set out in SEQ ID Nos: 447-456.

In one example, the light chain may be a lambda light chain. Lambda light chain constant region amino acid and nucleotide sequences can be found in SEQ ID Nos: 457-481.

ISOTYPES, CONSTANT REGIONS + MODIFICATIONS:

In some examples, the antibodies may block the progress of an infection at the point of viral entry into a cell, by binding to the virus and preventing it infecting the cell (neutralisation). The antibody may then further mediate uptake and destruction of the virus by immune cells (opsonisation). The antibody may further mediate the disruption of the virus lipid envelope by the fixation of complement. In other examples, the antibodies facilitate the killing of an infected cell via antibody dependent cellular cytotoxicity (ADCC), where antibodies bind to infected cells and allow immune cells to kill them. Selection of an appropriate format for the antibody (e.g., IgG4 or IgG1), can be used to achieve one or more of these outcomes.

Infection can in principle be prevented by high potency neutralising antibodies that bind with high affinity to the virus spike protein and prevent cell entry. The format for that antibody could be an antibody with limited Fc effector functions, e.g., an IgG4, e.g., a stabilised IgG4 isotype. Administration of an anti- IgG4 antibody in a prophylactic setting should give protective viral neutralising activity, however, repeated doses of the antibody may be required every 3-4 weeks to maintain protective efficacy and until the risk of infection has reduced. In a therapeutic setting such an antibody would also neutralise virus and reduce virus load thereby possibly impacting on disease severity.

The same potent spike binding antibody can alternatively be formatted to neutralise virus entry and target infected cells for killing by inclusion of a portion with Fc effector function, e.g., an IgG1 constant region. An effector enabled antibody may recruit natural killer cells to infected cells to achieve ADCC, facilitate opsonisation of virus particles to allow engulfment and destruction by macrophages and/or target virus particles for complement deposition.

The antibodies described herein may comprise a constant region, such as a human constant region, for example an effector-null human constant region, e.g. an IgG4 constant region or an IgG1 constant region, optionally wherein the constant region is IgG4-PE (SEQ ID Nos: 441-446 and 482-483), or a disabled IgG1 as defined in SEQ ID Nos: 425-426.

In other embodiments, the antibody is any of the isotypes or constant regions as defined hereinabove. In one embodiment, the constant region is wild-type human IgG1 (SEQ ID Nos: 417-424). For example, the

constant region is an effector-enabled IgG1 constant region, optionally having ADCC and/or CDC activity. In one embodiment, the constant region is engineered for enhanced ADCC and/or CDC and/or ADCP. In another embodiment, the constant region is engineered for enhanced effector function.

In some embodiments, the antibody may comprise modifications that enhance the ability of the antibody to cluster and therefore be a better substrate for complement fixation. The Fc domain of IgG1 may be mutated for example at E345 or E430 to reinforce inter-antibody Fc:Fc interactions, stimulating formation of hexamers, which enhances the induction of CDC and ADCC of target cells (de Jong et al., PloS Biol 14(1) e1002344 2016). Hexamer formation is optionally combined with a bispecific antibody format.

The IgG4 constant region may be any of the IgG4 constant region amino acid sequences, or encoded by any of the nucleic acid sequences (SEQ ID Nos: 435-440). A heavy chain constant region may be an IgG4 comprising both the Leu235Glu mutation and the Ser228Pro mutation. This "IgG4-PE" heavy chain constant region (SEQ ID Nos: 441-446 and 482-483) is effector null.

An alternative effector null human constant region is a disabled IgG1 being an IgG1*01 allele comprising the L235A and/or G237A mutations (e.g. LAGA, SEQ ID Nos: 425-426). In one example, the antibodies or antibody fragments disclosed herein comprise an IgG1 heavy chain constant region, wherein the sequence contains alanine at position 235 and/or 237 (EU index numbering). The antibody-dependent cell phagocytosis (ADCP) mechanism is discussed in Gül et al., "Antibody-Dependent Phagocytosis of Tumor Cells by Macrophages: A Potent Effector Mechanism of Monoclonal Antibody Therapy of Cancer", Cancer Res., 75(23), December 1, 2015.

The potency of Fc-mediated effects may be enhanced by engineering the Fc domain by various established techniques. Such methods increase the affinity for certain Fc-receptors or decrease the affinity for inhibitory Fc-receptors, thus creating potential diverse profiles of activation enhancement. This can be achieved by modification of one or several amino acid residues (e.g. as described in Lazar et al., 2006, Proc. Natl. Acad. Sci. U.S.A., Mar 14; 103(11):4005-10; the modifications disclosed therein are incorporated herein by reference). Human IgG1 constant regions containing specific mutations or altered glycosylation on residue Asn297 (e.g. N297Q, EU index numbering) have been shown to enhance binding to certain Fc receptors. In one example, such mutations are one or more of the residues selected from 239, 332 and 330 for human IgG1 constant regions (or the equivalent positions in other IgG isotypes). In one example, the antibody or fragment comprises a human IgG1 constant region having one or more mutations independently selected from N297Q, S239D, I332E and A330L (EU index numbering).

In another example, the increase in affinity for Fc-receptors is achieved by altering the natural glycosylation profile of the Fc domain by, for example, generating under fucosylated or de-fucosylated variants (as described in Natsume et al., 2009, Drug Des. Devel. Ther., 3:7–16 or by Zhou Q., Biotechnol. Bioeng.,

2008, Feb 15, 99(3):652-65, the modifications described therein are incorporated herein by reference). Non-fucosylated antibodies harbour a tri-mannosyl core structure of complex-type N-glycans of Fc without fucose residue. These glycoengineered antibodies that lack core fucose residue from the Fc N-glycans may exhibit stronger ADCC than fucosylated equivalents due to enhancement of FcγRIIIa binding capacity. For example, to increase ADCC, residues in the hinge region can be altered to increase binding to Fc-γRIII (see, for example, Shields et al., 2001, J. Biol. Chem., Mar 2; 276(9):6591-604; the modifications described therein are incorporated herein by reference). Thus, in one example, the antibody or fragment comprises a human IgG heavy chain constant region that is a variant of a wild-type human IgG heavy chain constant region, wherein the variant human IgG heavy chain constant region binds to human Fcγ receptors selected from the group consisting of FcγRIIB and FcγRIIA with higher affinity than the wild type human IgG heavy chain constant region binds to the human Fcγ receptors. In one example, the antibody or fragment comprises a human IgG heavy chain constant region that is a variant of a wild type human IgG heavy chain constant region, wherein the variant human IgG heavy chain constant region binds to human FcγRIIB with higher affinity than the wild type human IgG heavy chain constant region binds to human FcγRIIB. In one example, the variant human IgG heavy chain constant region is a variant human IgG1, a variant human IgG2, or a variant human IgG4 heavy chain constant region. In one example, the variant human IgG heavy chain constant region comprises one or more amino acid mutations selected from G236D, P238D, S239D, S267E, L328F, and L328E (EU index numbering system). In another example the variant human IgG heavy chain constant region comprises a set of amino acid mutations selected from the group consisting of: S267E and L328F; P238D and L328E; P238D and one or more substitutions selected from the group consisting of E233D, G237D, H268D, P271G, and A330R; P238D, E233D, G237D, H268D, P271G, and A330R; G236D and S267E; S239D and S267E; V262E, S267E, and L328F; and V264E, S267E, and L328F (EU index numbering system). In another example, the variant human IgG heavy chain constant region further comprises one or more amino acid mutations that reduce the affinity of the IgG for human FcγRIIIA, human FcγRIIA, or human FcγRI. In one example, the FcγRIIB is expressed on a cell selected from the group consisting of macrophages, monocytes, B-cells, dendritic cells, endothelial cells, and activated T-cells. In one embodiment, the variant human IgG heavy chain constant region comprises one or more of the following amino acid mutations G236A, S239D, F243L, T256A, K290A, R292P, S298A, Y300L, V305I, A330L, I332E, E333A, K334A, A339T, and P396L (EU index numbering system). In one example, the variant human IgG heavy chain constant region comprises a set of amino acid mutations selected from the group consisting of: S239D; T256A; K290A; S298A; I332E; E333A; K334A; A339T; S239D and I332E; S239D, A330L, and I332E; S298A, E333A, and K334A; G236A, S239D, and I332E; and F243L, R292P, Y300L, V305I, and P396L (EU index numbering system). In one example, the variant human IgG heavy chain constant region comprises a S239D, A330L, or I332E amino acid mutations (EU index numbering system). In one example, the variant human IgG heavy chain constant region comprises an S239D and I332E amino acid mutations (EU index numbering system). In one example, the variant human IgG heavy chain constant region is a variant human IgG1 heavy chain constant region comprising the S239D and I332E amino acid mutations (EU index numbering system). In one example, the antibody or fragment

comprises an afucosylated Fc region. In another example, the antibody or fragment thereof is defucosylated. In another example, the antibody or fragment is under fucosylated.

In another example, the antibodies and fragments disclosed herein may comprise a triple mutation (M252Y/S254T/T256E) which enhances binding to FcRn. See Dall'Aqua et al., Immunol 2002; 169:5171-5180 for a discussion of mutations affection FcRn binding in table 2, the mutations described therein are incorporated herein by reference.

Equally, the enhancement of CDC may be achieved by amino acid changes that increase affinity for C1q, the first component of the classic complement activation cascade (see Idusogie et al., J. Immunol., 2001, 166:2571–2575; the modifications described are incorporated herein by reference). Another approach is to create a chimeric Fc domain created from human IgG1 and human IgG3 segments that exploit the higher affinity if IgG3 for C1q (Natsume et al., 2008, Cancer Res., 68: 3863–3872; the modifications are incorporated herein by reference). In another example, the antibody or antibody fragments disclosed herein may comprise mutated amino acids at residues 329, 331 and/or 322 to alter the C1q binding and/or reduced or abolished CDC activity. In another example, the antibodies or antibody fragments disclosed herein may contain Fc regions with modifications at residues 231 and 239, whereby the amino acids are replaced to alter the ability of the antibody to fix complement. In one example, the antibody or fragment has a constant region comprising one or more mutations selected from E345K, E430G, R344D and D356R, in particular a double mutation comprising R344D and D356R (EU index numbering system).

An antibody may have a heavy chain constant region that binds one or more types of Fc receptor but does not induce cellular effector functions, i.e. which does not mediate ADCC, CDC or ADCP activity. Such a constant region may be unable to bind the particular Fc receptor(s) responsible for triggering ADCC, CDC or ADCP activity. An antibody may have a heavy chain constant region that does not bind Fcγ receptors. Thus, in one example, the constant region may comprise a Leu235Glu mutation (EU index numbering system).

In another example, the antibodies disclosed herein are modified to increase or decrease serum half-life. In one embodiment, one or more of the following mutations: T252L, T254S or T256F are introduced to increase biological half-life of the antibody. Biological half-life can also be increased by altering the heavy chain constant region CH1 domain or CL region to contain a salvage receptor binding epitope taken from two loops of a CH2 domain of an Fc region of an IgG, as described in U.S. Patent Numbers. 5,869,046 and 6,121,022, the modifications described therein are incorporated herein by reference. In another example, the Fc hinge region of an antibody or antigen-binding fragment of the invention is mutated to decrease the biological half-life of the antibody or fragment. One or more amino acid mutations are introduced into the CH2-CH3 domain interface region of the Fc-hinge fragment such that the antibody or fragment has impaired Staphylococcyl protein A (SpA) binding relative to native Fc-hinge domain SpA binding. Other

methods of increasing serum half-life are known to those skilled in the art. Thus, in one example, the antibody or fragment is PEGylated. In another example, the antibody or fragment is fused to an albumin-binding domain, e.g. an albumin binding single domain antibody (dAb). In another example, the antibody or fragment is PASylated (i.e. genetic fusion of polypeptide sequences composed of PAS (XL-Protein GmbH) which forms uncharged random coil structures with large hydrodynamic volume). In another example, the antibody or fragment is XTENylated®/rPEGylated (i.e. genetic fusion of non-exact repeat peptide sequence (Amunix, Versartis) to the therapeutic peptide). In another example, the antibody or fragment is ELPylated (i.e. genetic fusion to ELP repeat sequence (PhaseBio)). These various half-life extending fusions are described in more detail in Strohl, BioDrugs (2015) 29:215–239, which fusions are incorporated herein by reference.

The antibody may have a modified constant region which increases stability. Thus, in one example, the heavy chain constant region comprises a Ser228Pro mutation. In another example, the antibodies and fragments disclosed herein comprise a heavy chain hinge region that has been modified to alter the number of cysteine residues. This modification can be used to facilitate assembly of the light and heavy chains or to increase or decrease the stability of the antibody.

NUCLEIC ACIDS, VECTORS, HOST CELLS

Nucleic acids that encode a VH domain and/or a VL domain of any one of the antibodies described herein are also provided. The nucleic acid sequences encoding each of the VH and VL domains of each the exemplary antibodies described herein are set out in Tables 1a and 1b.

In one example, the nucleic acid sequence is at least 70% identical to the specified SEQ ID NO. In one example, the nucleic acid sequence is at least 80% identical to the specified SEQ ID NO. In one example, the nucleic acid sequence is at least 90% identical to the specified SEQ ID NO. In one example, the nucleic acid sequence is at least 95% identical to the specified SEQ ID NO. In one example, the nucleic acid sequence is at least 96% identical to the specified SEQ ID NO. In one example, the nucleic acid sequence is at least 97% identical to the specified SEQ ID NO. In one example, the nucleic acid sequence is at least 98% identical to the specified SEQ ID NO. In one example, the nucleic acid sequence is at least 99% identical to the specified SEQ ID NO. In one example, the nucleic acid sequence is at least 99.5% identical to the specified SEQ ID NO.

In one example, the nucleic acid encodes a heavy chain of any one of the antibodies described herein. In another example, the nucleic acid encodes a light chain of any one of the antibodies described herein.
In one example, the nucleic acid is an isolated and purified nucleic acid.

Vectors comprising the nucleic acids described above are also provided. In one example, the vector may be a CHO vector. In one example, the vector may be a HEK293 vector.

Host cells comprising the nucleic acids described above are also provided. In some examples, the host cells are eukaryotic cells, e.g., mammalian cells, preferably CHO cells (e.g., CHO cells grown in suspension culture).

PHARMACEUTICAL COMPOSITION

In one example, there is provided a pharmaceutical composition comprising an effective amount of an antibody as described herein and a pharmaceutically acceptable excipient. An effective amount of antibody to be employed therapeutically will depend, for example, upon the therapeutic objectives, the route of administration, and the condition of the patient. In one example, the composition includes other excipients or stabilizers.

Pharmaceutically acceptable excipients are known and include carriers, excipients, or stabilizers that are nontoxic to the cell or mammal being exposed thereto at the dosages and concentrations employed. Often the physiologically acceptable excipient is an aqueous pH buffered solution. Examples of physiologically acceptable excipient include buffers such as phosphate, citrate, and other organic acids; antioxidants including ascorbic acid; low molecular weight (less than about 10 residues) polypeptide; proteins, such as serum albumin, gelatin, or immunoglobulins; hydrophilic polymers such as polyvinylpyrrolidone; amino acids such as glycine, glutamine, asparagine, arginine or lysine; monosaccharides, disaccharides, and other carbohydrates including glucose, mannose, or dextrins; chelating agents such as Ethylenediaminetetraacetic acid (EDTA); sugar alcohols such as mannitol or sorbitol; salt-forming counterions such as sodium; and/or nonionic surfactants such as TWEEN™, polyethylene glycol (PEG), and PLURONICS™.

The antibodies can be administered intravenously or through the nose, lung, for example, as a liquid or powder aerosol (lyophilized) or by nebulisation of a liquid. The composition can also be administered parenterally or subcutaneously. When administered systemically, the composition should be sterile, pyrogen-free and in a physiologically acceptable solution having due regard for pH, isotonicity and stability. These conditions are known to those skilled in the art.

Methods of administering a prophylactic or therapeutic agent (e.g., an antibody as disclosed herein), or pharmaceutical composition include, but are not limited to, parenteral administration (e.g., intradermal, intramuscular, intraperitoneal, intravenous and subcutaneous), epidural, and mucosal (e.g., intranasal and oral routes). In a specific example, a prophylactic or therapeutic agent (e.g., an antibody as disclosed herein), or a pharmaceutical composition is administered intranasally, intramuscularly, intravenously, or subcutaneously. The prophylactic or therapeutic agents, or compositions may be administered by any convenient route, for example by infusion or bolus injection, by absorption through epithelial or mucocutaneous linings (e.g., oral mucosa, intranasal mucosa, rectal and intestinal mucosa, etc.) and may

be administered together with other biologically active agents. Administration can be systemic or local. Each dose may or may not be administered by an identical route of administration. In one example, an anti-SARS-CoV-2 antibody as disclosed herein may be administered *via* multiple routes of administration simultaneously or subsequently to other doses of the same or a different anti-SARS-CoV-2 antibody as disclosed herein.

Various delivery systems are known and can be used to administer a prophylactic or therapeutic agent (e.g., an antibody as disclosed herein), including, but not limited to, encapsulation in liposomes, microparticles, microcapsules, recombinant cells capable of expressing the antibody, receptor-mediated endocytosis (see, e.g., Wu and Wu, J. Biol. Chem. 262:4429-4432 (1987)), construction of a nucleic acid as part of a retroviral or other vector, etc. In addition, pulmonary administration can also be employed, e.g., by use of an inhaler or nebulizer, and formulation with an aerosolizing agent. See, e.g., U.S. Pat. Nos. 6,019,968, 5,985,320, 5,985,309, 5,934,272, 5,874,064, 5,855,913, 5,290,540, and 4,880,078; and PCT Publication Nos. WO92/19244, WO97/32572, WO97/44013, WO98/31346, and WO99/66903, each of which is incorporated herein by reference their entirety.

In a specific example, it may be desirable to administer a prophylactic or therapeutic agent, or a pharmaceutical composition as described herein locally to the area in need of treatment. This may be achieved by, for example, local infusion, by topical administration (e.g., by intranasal spray), by injection, or by means of an implant, said implant being of a porous, non-porous, or gelatinous material, including membranes, such as sialastic membranes, or fibres. When administering an anti-SARS-CoV-2 antibody, care must be taken to use materials to which the antibody does not absorb.

In the case of medicaments that are intended for local and/or topical administration, such as by absorption to epithelial or mucocutaneous linings, an antibody may be provided as an IgA isotype antibody. For human patients, human IgA1 or human IgA2 antibodies are preferred. Medicaments formulated for inhalation and/or for delivery of antibody (or its encoding nucleic acid, e.g., in a DNA vector) to the upper and/or lower respiratory tract, including formulations for delivery of a nebulised medicament, may comprise an IgA (e.g., human IgA1 or human IgA2) antibody. Inhalers, nebulisers and similar devices may thus be provided containing a medicament comprising an IgA antibody or its encoding nucleic acid, together with any buffers or other excipients suitable for stabilisation of the medicament and/or for promoting its delivery to the target tissue.

THERAPEUTIC USE

Antibodies described herein may be used to treat or prevent a SARS-CoV-2-related disease or condition, such as COVID-19. One aspect includes use of an antibody or composition described herein as a medicament.

Thus, in one example antibodies described herein or compositions described herein for use in a method of treating a SARS-CoV-2-related disease or condition are provided, said method comprising administering the antibody or composition to a patient. In another example, antibodies described herein or compositions described herein for use in a method of preventing a SARS-CoV-2-related disease or condition are provided, said method comprising administering the antibody or composition to a patient.

In one example, the SARS-CoV-2-related disease or condition is a SARS-CoV-2-mediated disease or condition.

Preferably, the SARS-CoV-2-related disease or condition is a COVID-19-related disease or condition. In some examples, the COVID-19-related disease or condition is COVID-19. In some examples, the COVID-19-related disease or condition is long manifestation of infection by SARS-CoV-2 such as 'Long COVID'.

In one example, the antibody for use or the composition for use described above, one or more symptoms of COVID-19 are reduced. In one example, the progression of SARS-CoV-2 infection is reduced. In one example, the risk of developing COVID-19 is reduced. In one example, the risk of transmission of SARS-CoV-2 to and/or from a human is reduced.

In one example, said method further comprises administering at least one further therapeutic agent. In one example, the first antibody and further therapeutic agent are administered simultaneously, separately, or sequentially.

In one example, the further therapeutic agent is a further antibody. Accordingly, monoclonal antibodies of the invention might be administered as part of an antibody cocktail comprising multiple (e.g., 2, 3 or 4) different monoclonal antibodies.

The further antibody may be selected from:

i. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;
ii. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and does not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;
iii. an antibody that specifically binds to the N-terminal domain (NTD) of the S1 subunit of the of SARS-CoV-2 spike protein;
iv. an antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein; and
v. an antibody preferentially binds to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, S1 subunit and S2 subunit of the SARS-CoV-2 spike protein.

The further antibody might bind to the same or a different subunit of SARS-CoV-2 as the first antibody.

The further antibody might bind to the same or a different domain of SARS-CoV-2 as the first antibody.

An antibody cocktail might comprise a first antibody and a second antibody and optionally one or more further antibodies.

In one example, where the first antibody binds to the RBD of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, the second antibody also specifically binds to the receptor binding domain (RBD) of the S1 subunit of the of SARS-CoV-2 spike protein.

An antibody cocktail might comprise, for example:

i. a first antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of SARS-CoV-2 and which competes with ACE2 for binding to SARS-CoV-2; and
ii. a second antibody that also specifically binds to the receptor binding domain (RBD) of the S1 subunit of SARS-CoV-2 and which competes with ACE2 for binding to SARS-CoV-2.

An antibody cocktail might comprise, for example:

iii. a first antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of SARS-CoV-2 and which competes with ACE2 for binding to SARS-CoV-2; and
iv. a second antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of SARS-CoV-2 outside the ACE2 epitope region, such that the second antibody does not compete with ACE2 for binding to SARS-CoV-2.

Alternatively, in one example, where the first antibody binds to the RBD of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, the second antibody specifically binds to the N-terminal domain (NTD) of the S1 subunit of the of SARS-CoV-2 spike protein. In another example, where the first antibody binds to the RBD of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, the second antibody the further antibody specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein. In still another example, where the first antibody binds to the RBD of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor, the second antibody preferentially binds to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, S1 subunit and S2 subunit of the SARS-CoV-2 spike protein

Provided herein is the use of an antibody described herein or a composition described herein in the manufacture of a medicament for treating a SARS-CoV-2-related disease or condition. Use of an antibody described herein or a composition described herein in the manufacture of a medicament for preventing a SARS-CoV-2- related disease or condition is also provided. Preferably, the SARS-CoV-2- related disease or condition is COVID-19. Thus, in one example, one or more symptoms of COVID-19 are reduced. In another example, the progression of SARS-CoV-2 infection is reduced. In another example, the risk of developing COVID-19 is reduced. In another example, the risk of transmission of SARS-CoV-2 to and/or from a human is reduced.

In one example, the use of an antibody or composition described herein further comprises administering at least one further therapeutic agent. In one example, the first antibody and further therapeutic agent are administered simultaneously, separately or sequentially. In one example, the further therapeutic agent is a further antibody as defined herein.

A method of treating a SARS-CoV-2-related disease or condition in a human, comprising administering to said human a therapeutically effective amount of an antibody described herein or a composition described herein is provided. A method of preventing a SARS-CoV-2-related disease or condition in a human, comprising administering to said human a therapeutically effective amount of an antibody described herein or a composition described herein is also provided. Preferably, the SARS-CoV-2-related disease or condition is COVID-19. In one example, one or more symptoms of COVID-19 are reduced. In one example, the progression of SARS-CoV-2 infection is reduced. In one example, the risk of developing COVID-19 is reduced. In one example, the risk of transmission of SARS-CoV-2 to and/or from a human is reduced.

In one example, said method further comprising administering at least one further therapeutic agent. In one example, the first antibody and further therapeutic agent are administered simultaneously, separately or sequentially. In one example, the further therapeutic agent is a further antibody as defined anywhere herein.

In one example, the antibody is administered as an antibody-drug conjugate in which the antibody is linked to a drug moiety. For example, the antibody may be linked to a drug moiety which may be a cytokine, chemokine, or small molecule antiviral.

Antibodies described herein may be used to prevent death and shorten the time to recovery and discharge for COVID19 patients. Patients will generally be human patients and may be patients admitted to hospital and diagnosed as testing positive for SARS-CoV-2 and/or suspected or believed to be suffering from COVID19. Patient groups for treatment include all people hospitalised with COVID-19.

In some examples, antibodies described herein or pharmaceutical compositions comprising the antibody as described herein may be used singly or in combination with other anti-SARS-CoV-2 antibodies or

pharmaceutical compositions comprising other anti-SARS-CoV-2 antibodies. Combinations of two or more anti-SARS-CoV-2 antibodies may have additive or synergistic potency compared to the potency of a single antibody, e.g. as measured in a pseudovirus assay or by the live virus assay. In some examples, combinations of RBD and S2 antibodies have additive potency over a single mAb. In some examples, combinations of RBD antibodies have additive potency over a single mAb. In some examples, combinations of S2 antibodies have additive potency over a single mAb. In some examples, combinations of RBD and NTD antibodies have additive potency over a single mAb. In some examples, combinations of S2 and NTD antibodies have additive potency over a single mAb. In some examples, combinations of RBD and S2 antibodies have synergistic potency over a single mAb. In some examples, combinations of RBD antibodies have synergistic potency over a single mAb. In some examples, combinations of S2 antibodies have synergistic potency over a single mAb. In some examples, combinations of RBD and NTD antibodies have synergistic potency over a single mAb. In some examples, combinations of S2 and NTD antibodies have synergistic potency over a single mAb. In some examples, triple combinations of RBD, S2 and NTD antibodies have additive potency over a single mAb. In some examples, triple combinations of RBD, S2 and NTD antibodies have synergistic potency over a single mAb.

In some examples, the antibody as described herein or pharmaceutical composition comprising the antibody as described herein is administered in combination with a directly acting antiviral (DAA) drug. In some examples, the antibody as described herein or pharmaceutical composition comprising the antibody as described herein is administered in combination with anti-inflammatory medication. In some examples, the antibody as described herein or pharmaceutical composition comprising the antibody as described herein is administered in combination with a Type I interferon. In some examples, the antibody as described herein or pharmaceutical composition comprising the antibody as described herein is administered in combination with a Type II interferon. In some examples, the antibody as described herein or pharmaceutical composition comprising the antibody as described herein is administered in combination with a Type III interferon. In some examples, the antibody as described herein or pharmaceutical composition comprising the antibody as described herein is administered in combination with another drug that reduces COVID-19-related death. In some examples, the antibody as described herein or pharmaceutical composition comprising the antibody as described herein is administered in combination with another drug that reduces COVID-19-related induced inflammation. In some examples, the antibody as described herein or pharmaceutical composition comprising the antibody as described herein is administered in combination with another drug that reduces severity or disease progression from mild to severe for COVID-19.

In another example, a kit for treating SARS-CoV-2 related diseases, such as COVID-19, is provided, wherein the kit includes an antibody as described herein and instructions to administer the antibody to a subject in need of treatment. There is also provided a pharmaceutical or diagnostic pack or kit comprising one or more containers filled with one or more of the ingredients of the pharmaceutical compositions as disclosed herein, such as one or more anti-SARS-CoV-2 antibodies provided herein. Optionally associated

with such container(s) can be a notice in the form prescribed by a governmental agency regulating the manufacture, use or sale of pharmaceuticals or biological products, which notice reflects approval by the agency of manufacture, use or sale for human administration, e.g., an authorisation number.

In another example, an article of manufacture that includes a container in which a composition containing an antibody as described herein and a packaging insert or label indicating that the composition can be used to treat a SARS-CoV-2 related disease, such as COVID-19, is provided. In one example, there is provided a kit for treating and/or preventing a SARS-CoV-2 related disease, such as COVID-19, the kit comprising an antibody as disclosed herein in any example or combination of examples (and optionally a further therapeutic agent as described elsewhere herein) optionally in combination with a label or instructions for use to treat and/or prevent said disease or condition in a human; optionally wherein the label or instructions comprise a marketing authorisation number (e.g., an FDA or EMA authorisation number); optionally wherein the kit comprises an IV or injection device that comprises the antibody. In another example, the kit comprises an antibody contained within a container or an IV bag. In another example, the container or IV bag is a sterile container or a sterile IV bag. In another example, the antibody is formulated into a pharmaceutical composition contained within a (sterile) container or contained within a (sterile) IV bag. In a further example, the kit further comprises instructions for use.

In another example, a kit for treating SARS-CoV-2 related diseases, such as COVID-19, is provided, wherein the kit includes an antibody as described herein and instructions to administer the antibody to a subject in need of treatment. The subject in need is specifically defined in the kit as someone of a specific higher risk group defined by epidemiological data, risk stratification data from the person's health records, risk stratification by the genotype of certain genes of the individual or the presence of certain biomarkers in the person's blood or other tissue sample. Where the risk stratification involves another pharmaceutical or diagnostic pack or kit, the combined product will act as a linked diagnostic/prognostic and treatment kit.

PREVENTION OF INFECTION- PROPHYLATIC USE

Antibodies as described herein may be used prophylactically. Administration of antibodies may prevent infection or reduce the risk of infection by SARS-CoV-2. Antibodies may for example be used to prevent infection in those at risk in high transmission environments and to prevent infection in those unable to be vaccinated or where vaccine efficacy is low.

1. It is estimated in the UK about hundreds of thousands of people may not be able to be vaccinated due to underlying co-morbidities and immune deficiencies.
2. Vaccine efficacy is known to decrease gradually in people older the 50 years old. In the UK 18% of the population (~12 million people) are older than 65 years old.

Often, group 1 and group 2 overlap. These define risk groups for mAb prophylaxsis during peak SARS-CoV-2 transmission. A relevant end point is decreased rate of infection in the risk group(s).

DIAGNOSTICS

Antibodies as described herein can be used to detect the presence, absence and/or level of SARS-CoV-2 in a biological sample from a patient. In one example, the biological sample is a tissue sample (e.g., in pathology studies or biopsy samples of tissue used for diagnostics and prognostics). In other examples, the biological sample is blood, plasma, serum, urine, faeces, cerebrospinal fluid (CFS). In other examples, the biological sample is from a nasal or throat swab. Liquid samples are convenient for use in many types of diagnostic assays.

The antibodies described herein can be used to identify the presence, absence and/or level of SARS-CoV-2 at baseline, i.e., before treatment.

The antibodies described herein can be used to guide therapy, particularly to identify the presence, absence and/or level of SARS-CoV-2 during or after treatment.

The antibodies described herein can be used for patient monitoring, to help evaluate whether a course of treatment is effective and whether or not treatment should be continued.

In one example, the antibody described herein is labelled with a detectable moiety, for example, a radiolabel, fluorescent label, enzymatic label, chemiluminescent labelled or a biotinyl group. Radioisotopes or radionuclides may include 3H, 14C, 15N, 35S, 90Y, 99Tc, 115In, 125I, 131I, fluorescent labels may include rhodamine, lanthanide phosphors or FITC and enzymatic labels may include horseradish peroxidase, β-galactosidase, luciferase, alkaline phosphatase. Additional labels include, by way of illustration and not limitation: enzymes, such as glucose-6-phosphate dehydrogenase ("G6PDH"), alpha-D- galactosidase, glucose oxydase, glucose amylase, carbonic anhydrase, acetylcholinesterase, lysozyme, malate dehydrogenase and peroxidase; dyes; additional fluorescent labels or fluorescers include, such as fluorescein and its derivatives, fluorochrome, GFP (GFP for "Green Fluorescent Protein"), dansyl, umbelliferone, phycoerythrin, phycocyanin, allophycocyanin, o- phthaldehyde, and fiuorescamine; fluorophores such as lanthanide cryptates and chelates e.g. Europium etc (Perkin Elmer and Cisbio Assays); chemoluminescent labels or chemiluminescers, such as isoluminol, luminol and the dioxetanes; sensitisers; coenzymes; enzyme substrates; particles, such as latex or carbon particles; metal sol; crystallite; liposomes; cells, etc., which may be further labelled with a dye, catalyst or other detectable group; molecules such as biotin, digoxygenin or 5-bromodeoxyuridine; toxin moieties, such as for example a toxin moiety selected from a group of Pseudomonas exotoxin (PE or a cytotoxic fragment or mutant thereof), Diptheria toxin or a cytotoxic fragment or mutant thereof, a botulinum toxin A, B, C, D, E or F, ricin or a cytotoxic fragment thereof e.g. ricin A, abrin or a cytotoxic fragment thereof, saporin or a cytotoxic fragment thereof, pokeweed antiviral toxin or a cytotoxic fragment thereof and bryodin 1 or a cytotoxic fragment thereof.

In one example, the antibody can be administered to a patient, wherein the antibody is conjugated to a label. The presence of the label in the patient can be measured or observed, wherein a relatively high amount of the label may indicate a high risk of disease and a relatively low amount of the label may indicate a relatively low risk of the disease. In one example, the label is a contrast agent, isotopic tag, or fluorescent marker, such as green fluorescent protein.

For use in diagnostics, antibodies with high affinity, especially with fast on-rate and slow off-rate (e.g., as measured by SPR) are particularly valuable.

In some embodiments, it is desirable to include 2 antibodies in a diagnostic assay and these should preferably be directed to different regions of the spike protein. The diagnostic assay could be a double antigen binding assay (DABA). In a DABA, a first antibody is used as a capture antibody to bind the virus or spike protein in a sample (for this purpose, a high affinity antibody with fast on-rate and slow off-rate is desirable, as noted above), and a second antibody, specific for an epitope that is different from the capture antibody's epitope, is used for detection. The second antibody may thus be detectably labelled, by direct or indirect labelling. A DABA may comprise providing the first antibody (optionally immobilised on a surface), contacting the surface with a sample to allow capture of antigen, if present, followed by washing to remove unbound antigen and sample, and then exposing the surface to the detection antibody to allow binding to the antigen, if present, washing to remove unbound detection antibody, and detecting the presence of the detection antibody. The presence of the detection antibody indicates that the sample is positive for the spike protein. This type of assay may be used to determine whether a patient is infected with the virus.

In other embodiments, a diagnostic assay may employ neutralising antibodies (e.g., an antibody that neutralises binding of spike protein to ACE2) as competitive antibodies to determine the level of neutralising antibodies in the serum of convalescent patients, vaccinated individuals or those who were previously infected with SARS-CoV-2. The neutralising monoclonal antibody is supplied in the assay in excess, and competition with antibodies in the sample is assessed. Detection of competition is indicative of the presence of neutralising antibody in the sample.

In one example, a kit for detecting SARS-CoV-2 in a biological sample is provided. The kit can be used to screen for SARS-CoV-2 related diseases. In one example, the kit includes an antibody according to the invention as described anywhere herein and a means for determining whether the antibody is bound to SARS-CoV-2 in a sample. In one example, the antibody is specific for SARS-CoV-2. In one example, the antibody is labelled. In another example, the antibody is an unlabelled primary antibody and the kit includes means for detecting the primary antibody. In one example, the means for detecting includes a labelled secondary antibody that is an anti-immunoglobulin antibody. The antibody may be labelled with any

suitable marker, including, for example, a fluorochrome, an enzyme, a radionuclide and a radiopaque material.

In one example, the primary antibody is an antibody that specifically binds to the RBD of SARS-CoV-2 spike protein and does not compete for binding with the ACE2 receptor and the secondary antibody is an antibody that specifically binds to the RBD of SARS-CoV-2 spike protein and does compete for binding with the ACE2 receptor.

In one example, a kit for detecting SARS-CoV-2 is provided, wherein the kit includes an antibody as described herein. In one example, the kit may also include instructions and one or more reagents for detecting SARS-CoV-2.

CLAUSES

Aspects of the invention are disclosed in the following lettered and numbered clauses:

A1. An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor.

A2. An antibody according to clause A1,

wherein the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)).

A3. An antibody according to clause A1,

wherein the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay).

A4. An antibody according to clause A2 or clause A3,

wherein the antibody binds the isolated RBD of the SARS-CoV-2 spike protein with a KD of 10-9 M or lower (e.g. as measured by surface plasmon resonance (SPR)) and wherein the antibody neutralises SARS-CoV-2 with an IC50 of 50pM or lower (e.g. as measured in a pseudovirus neutralisation assay).

A5. An antibody according to any one of clauses A1 to A4,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the HCDR3 is the HCDR3 of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

A6. An antibody according to clause A2,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the HCDR3 is the HCDR3 of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, or IMPI-059.

A7. An antibody according to clause A3,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the HCDR3 is the HCDR3 of antibody IMPI-004, IMPI-029, IMPI-055, IMPI-059, or IMPI-017.

A8. An antibody according to clause A4,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the HCDR3 is the HCDR3 of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059.

A9. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-029.

A10. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-056.

A11. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-005.

A12. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-012.

A13. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-052.

A14. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-002.

A15. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-041.

A16. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-036.

A17. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-055.

A18. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-054.

A19. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-042.

A20. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-021.

A21. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-004.

A22. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-047.

A23. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-017.

A24. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-059.

A25. The antibody according to clause A5, wherein the HCDR3 is the HCDR3 of antibody IMPI-028.

A26. An anti-SARS-CoV-2 antibody,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

A27. An anti-SARS-CoV-2 antibody which competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

A28. An antibody according to any one of clauses A1 to A4,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

A29. An antibody according to clause A2,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055, or IMPI-059.

A30. An antibody according to clause A3,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody IMPI-004, IMPI-029, IMPI-055, IMPI-059 or IMPI-017.

A31. An antibody according to clauseA4,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody IMPI-004, IMPI-029, IMPI-055 or IMPI-059.

A32. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-029.

A33. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-056.

A34. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-005.

A35. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-012.

A36. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-052.

A37. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-002.

A38. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-041.

A39. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-036.

A40. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-055.

A41. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-054.

A42. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-042.

A43. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-021.

A44. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-004.

A45. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-047.

A46. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-017.

A47. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-059.

A48. The antibody according to any one of clauses A26 to A28, wherein the antibody has the CDRs of antibody IMPI-028.

A49. An antibody according to any one of clauses A1 to A4,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

A50. An antibody according to clause A2,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences

respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055 or IMPI-059, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

A51. An antibody according to clause A3,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059 or IMPI-017, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

A52. An antibody according to clause A4,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-055 or IMPI-059, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

A53. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-029, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-029, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A54. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-056, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-056, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A55. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-005, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-005, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A56. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-012, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the

complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-012, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A57. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-052, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-052, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A58. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-002, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-002, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A59. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-041, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-041, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A60. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-036, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-036, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A61. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-055, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-055, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A62. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-054, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-054, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A63. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-042, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-042, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A64. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-021, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-021, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A65. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-004, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-004, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A66. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-047, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-047, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A67. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-017, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-017, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A68. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-059, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-059, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A69. The antibody according to clause A49, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-028, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-028, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

A70. An antibody according to any one of clauses A1 to A4,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028,

provided that the antibody has the CDRs of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

A71. An antibody according to clause A2,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055 or IMPI-059,

provided that the antibody has the CDRs of antibody IMPI-004, IMPI-029, IMPI-056, IMPI-055 or IMPI-059.

A72. An antibody according to clause A3,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059 or IMPI-017,

provided that the antibody has the CDRs of antibody IMPI-004, IMPI-029, IMPI-055, or IMPI-059 or IMPI-017.

A73. An antibody according to clause A4,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-004, IMPI-029, IMPI-055 or IMPI-059,

provided that the antibody has the CDRs of antibody IMPI-004, IMPI-029, IMPI-055 or IMPI-059.

A74. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-029 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-029, provided that the antibody has the CDRs of antibody IMPI-029.

A75. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-056 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-056, provided that the antibody has the CDRs of antibody IMPI-056.

A76. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-005 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-005, provided that the antibody has the CDRs of antibody IMPI-005.

A77. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-012 and

the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-012, provided that the antibody has the CDRs of antibody IMPI-012.

A78. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-052 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-052, provided that the antibody has the CDRs of antibody IMPI-052.

A79. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-002 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-002, provided that the antibody has the CDRs of antibody IMPI-002.

A80. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-041 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-041, provided that the antibody has the CDRs of antibody IMPI-041.

A81. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-036 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-036, provided that the antibody has the CDRs of antibody IMPI-036.

A82. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-055 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-055, provided that the antibody has the CDRs of antibody IMPI-055.

A83. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-054 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-054, provided that the antibody has the CDRs of antibody IMPI-054.

A84. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-042 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-042, provided that the antibody has the CDRs of antibody IMPI-042.

A85. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-021 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-021, provided that the antibody has the CDRs of antibody IMPI-021.

A86. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-004 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-004, provided that the antibody has the CDRs of antibody IMPI-004.

A87. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-047 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-047, provided that the antibody has the CDRs of antibody IMPI-047.

A88. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-017 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-017, provided that the antibody has the CDRs of antibody IMPI-017.

A89. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-059 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-059, provided that the antibody has the CDRs of antibody IMPI-059.

A90. The antibody according to clause A70, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-028 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-028, provided that the antibody has the CDRs of antibody IMPI-028.

A91. An antibody to any one of clauses A1 to A4,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

A92. An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, or IMPI-028.

A93. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-029.

A94. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-056.

A95. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-005.

A96. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-012.

A97. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-052.

A98. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-002.

A99. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-041.

A100. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-036.

A101. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-055.

A102. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-054.

A103. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-042.

A104. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-021.

A105. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-004.

A106. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-047.

A107. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-017.

A108. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-059.

A109. The antibody according to clause A91 or clause A92, wherein the antibody comprises the VH domain and VL domain sequences of antibody IMPI-028.

A110. The antibody according to any one of clauses A1 to A4, comprising VH and/or VL domain framework regions of human germline gene segment sequences.

A111. The antibody according to any one of clauses A1 to A4 or A110, comprising an antibody VH domain which

i) is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein

the V gene segment is IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01;

and/or

the J gene segment is IGHJ6*02, IGHJ4*02 or IGHJ3*02, or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR3 aligns with human germline V gene segment IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGHJ6*02, IGHJ4*02 or IGHJ3*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

A112. The antibody according to any one of clauses A1 to A4, A110 or A111, comprising an antibody VH domain which

i) is derived from recombination of a human heavy chain V gene segment IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01, a human heavy chain D gene segment and a human heavy chain J gene segment, or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1, FR2 and FR3 each align with human germline V segment IGHV3-53*01, IGHV1-8*01 or IGHV3-33*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

A113. The antibody according to any one of clauses A1 to A4 or A110 to A112, wherein the J gene segment is IGHJ6*02, IGHJ4*02 or IGHJ3*02, or wherein the VH domain framework region FR4 aligns with human germline J gene segment IGHJ6*02, IGHJ4*02 or IGHJ3*02 with 1, 2, 3, 4 or 5 amino acid alterations.

A114. The antibody according to any one of clauses A1 to A4 or A110, comprising an antibody VL domain which

i) is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein

the V gene segment is IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01, and/or

the J gene segment is IGKJ5*01, IGKJ4*01, IGKJ3*01, IGKJ2*04 or IGKJ1*01; or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations

FR3 aligns with human germline V gene segment IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGKJ5*01, IGKJ4*01, IGKJ3*01, IGKJ2*04 or IGKJ1*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

A115. The antibody according to any one of clauses A1 to A4 or A110, comprising an antibody VL domain derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein:

the V gene segment is IGKV1-9*d01, IGKV6-21*01, IGKV1-33*01 or IGKV3-20*01, and optionally

the J gene segment is IGKJ5*01, IGKJ4*01, IGKJ3*01, IGKJ2*04 or IGKJ1*01.

B1. An antibody that preferentially binds to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, isolated S1 subunit or isolated S2 subunit of the SARS-CoV-2 spike protein.

B2. An antibody according to clause B1, wherein the antibody specifically binds to the trimer form of the SARS-CoV-2 spike protein and does not bind to the isolated RBD domain.

B3. An antibody according to clause B1 or clause B2, wherein the antibody specifically binds to the trimer form of the SARS-CoV-2 spike protein and does not bind to the isolated RBD domain, isolated S1 subunit or isolated S2 subunit of the SARS-CoV-2 spike protein.

B4. An antibody according to any one of clauses B1 to B3, wherein the antibody neutralises SARS-CoV-2 with an IC50 of 75nM or lower, preferably 15nM or lower (e.g. as measured in a pseudovirus neutralisation assay).

B5. An antibody according to any one of clauses B1 to B4,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the HCDR3 is the HCDR3 of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072.

B6. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-030.

B7. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-053.

B8. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-025.

B9. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-040.

B10. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-007.

B11. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-020.

B12. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-032.

B13. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-023.

B14. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-039.

B15. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-001.

B16. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-019.

B17. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-010.

B18. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-008.

B19. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-031.

B20. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-057.

B21. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-022.

B22. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-035.

B23. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-067.

B24. The antibody according to clause B5, wherein the HCDR3 is the HCDR3 of antibody IMPI-072.

B25. An anti-SARS-CoV-2 antibody,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072.

B26. An antibody according to any one of clauses B1 to B4,
wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,
wherein the CDRs are those of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072.

B27. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-030.

B28. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-053.

B29. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-025.

B30. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-040.

B31. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-007.

B32. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-020.

B33. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-032.

B34. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-023.

B35. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-039.

B36. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-001.

B37. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-019.

B38. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-010.

B39. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-008.

B40. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-031.

B41. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-057.

B42. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-022.

B43. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-035.

B44. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-067.

B45. The antibody according to clause B25 or clause B26, wherein the antibody has the CDRs of antibody IMPI-072.

B46. An antibody according to any one of clauses B1 to B4,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072,

optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

B47. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-030, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-030, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B48. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-053, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-053, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B49. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-025, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody

IMPI-025, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B50. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-040, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-040, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B51. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-007, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-007, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B52. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-020, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-020, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B53. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-032, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-032, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B54. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-023, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-023, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B55. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-039, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-039, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B56. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-001, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-001, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B57. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-019, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-019, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B58. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-010, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-010, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B59. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-008, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-008, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B60. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-031, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-031, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B61. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-057, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-057, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B62. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-022, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-022, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B63. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-035, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-035, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B64. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-067, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody

IMPI-067, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B65. The antibody according to clause B46, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-072, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-072, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

B66. An antibody according to any one of clauses B1 to B4,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072,

provided that the antibody has the CDRs of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072.

B67. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-030 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-030, provided that the antibody has the CDRs of antibody IMPI-030.

B68. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-053 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-053, provided that the antibody has the CDRs of antibody IMPI-053.

B69. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-025 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-025, provided that the antibody has the CDRs of antibody IMPI-025.

B70. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-040 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-040, provided that the antibody has the CDRs of antibody IMPI-040.

B71. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-007 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-007, provided that the antibody has the CDRs of antibody IMPI-007.

B72. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-020 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-020, provided that the antibody has the CDRs of antibody IMPI-020.

B73. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-032 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-032, provided that the antibody has the CDRs of antibody IMPI-032.

B74. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-023 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-023, provided that the antibody has the CDRs of antibody IMPI-023.

B75. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-039 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-039, provided that the antibody has the CDRs of antibody IMPI-039.

B76. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-001 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-001, provided that the antibody has the CDRs of antibody IMPI-001.

B77. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-019 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-019, provided that the antibody has the CDRs of antibody IMPI-019.

B78. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-010 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-010, provided that the antibody has the CDRs of antibody IMPI-010.

B79. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-008 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-008, provided that the antibody has the CDRs of antibody IMPI-008.

B80. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-031 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-031, provided that the antibody has the CDRs of antibody IMPI-031.

B81. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-057 and

the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-057, provided that the antibody has the CDRs of antibody IMPI-057.

B82. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-022 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-022, provided that the antibody has the CDRs of antibody IMPI-022.

B83. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-035 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-035, provided that the antibody has the CDRs of antibody IMPI-035.

B84. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-067 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-067, provided that the antibody has the CDRs of antibody IMPI-067.

B85. The antibody according to clause B66, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-072 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-072, provided that the antibody has the CDRs of antibody IMPI-072.

B86. An antibody according to any one of clauses B1 to B4,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072.

B87. An anti- SARS-CoV-2 antibody,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067 or IMPI-072.

B88. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-030 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-030.

B89. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-053 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-053.

B90. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-025 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-025.

B91. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-040 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-040.

B92. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-007 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-007.

B93. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-020 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-020.

B94. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-032 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-032.

B95. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-023 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-023.

B96. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-039 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-039.

B97. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-001 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-001.

B98. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-019 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-019.

B99. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-010 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-010.

B100. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-008 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-008.

B101. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-031 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-031.

B102. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-057 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-057.

B103. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-022 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-022.

B104. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-035 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-035.

B105. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-067 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-067.

B106. The antibody according to clause B86 or B87, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-072 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-072.

B107. The antibody according to any one of clauses B1 to B4, comprising VH and/or VL domain framework regions of human germline gene segment sequences.

B108. The antibody according to any one of clauses B1 to B4 or B107, comprising an antibody VH domain which

i) is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein

the V gene segment is IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18;

and/or

the J gene segment is IGHJ4*02 or IGHJ6*02, or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR3 aligns with human germline V gene segment IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGHJ4*02 or IGHJ6*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

B109. The antibody according to any one of clauses B1 to B4, B107 or B108, comprising an antibody VH domain which

i) is derived from recombination of a human heavy chain V gene segment IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18, a human heavy chain D gene segment and a human heavy chain J gene segment, or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1, FR2 and FR3 each align with human germline V segment IGHV4-4*02, IGHV3-9*01 or IGHV3-30*18 with up to 1, 2, 3, 4 or 5 amino acid alterations.

B110. The antibody according to any one of clauses B1 to B4 or B107 to B109, wherein the J gene segment is IGHJ4*02 or IGHJ6*02, or wherein the VH domain framework region FR4 aligns with human germline J gene segment IGHJ4*02 or IGHJ6*02 with 1, 2, 3, 4 or 5 amino acid alterations.

B111. The antibody according to any one of clauses B1 to B4 or B107, comprising an antibody VL domain which

i) is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein

the V gene segment is IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01, and/or

the J gene segment is IGKJ4*01 or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations

FR3 aligns with human germline V gene segment IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGKJ4*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

B112. The antibody according to any one of clauses B1 to B4 or B107, comprising an antibody VL domain derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein:

the V gene segment is IGKV2D-30*01, IGKV1D-13*d01 or IGKV3-20*01, and optionally

the J gene segment is IGKJ4*01.

C1. A neutralising antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein.

C2. An antibody according to clause C1,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the HCDR3 is the HCDR3 of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071.

C3. The antibody according to clause C2, wherein the HCDR3 is the HCDR3 of antibody IMPI-003.

C4. The antibody according to clause C2, wherein the HCDR3 is the HCDR3 of antibody IMPI-013.

C5. The antibody according to clause C2, wherein the HCDR3 is the HCDR3 of antibody IMPI-063.

C6. The antibody according to clause C2, wherein the HCDR3 is the HCDR3 of antibody IMPI-061.

C7. The antibody according to clause C2, wherein the HCDR3 is the HCDR3 of antibody IMPI-062.

C8. The antibody according to clause C2, wherein the HCDR3 is the HCDR3 of antibody IMPI-064.

C9. The antibody according to clause C2, wherein the HCDR3 is the HCDR3 of antibody IMPI-065.

C10. The antibody according to clause C2, wherein the HCDR3 is the HCDR3 of antibody IMPI-066.

C11. The antibody according to clause C2, wherein the HCDR3 is the HCDR3 of antibody IMPI-069.

C12. The antibody according to clause C2, wherein the HCDR3 is the HCDR3 of antibody IMPI-070.

C13. The antibody according to clause C2, wherein the HCDR3 is the HCDR3 of antibody IMPI-071.

C14. An anti-SARS-CoV-2 antibody,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071.

C15. An antibody according to clause C1,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071.

C16. The antibody according to clause C14 or clause C15, wherein the antibody has the CDRs of antibody IMPI-003.

C17. The antibody according to clause C14 or clause C15, wherein the antibody has the CDRs of antibody IMPI-013.

C18. The antibody according to clause C14 or clause C15, wherein the antibody has the CDRs of antibody IMPI-063.

C19. The antibody according to clause C14 or clause C15, wherein the antibody has the CDRs of antibody IMPI-061.

C20. The antibody according to clause C14 or clause C15, wherein the antibody has the CDRs of antibody IMPI-062.

C21. The antibody according to clause C14 or clause C15, wherein the antibody has the CDRs of antibody IMPI-064.

C22. The antibody according to clause C14 or clause C15, wherein the antibody has the CDRs of antibody IMPI-065.

C23. The antibody according to clause C14 or clause C15, wherein the antibody has the CDRs of antibody IMPI-066.

C24. The antibody according to clause C14 or clause C15, wherein the antibody has the CDRs of antibody IMPI-069.

C25. The antibody according to clause C14 or clause C15, wherein the antibody has the CDRs of antibody IMPI-070.

C26. The antibody according to clause C14 or clause C15, wherein the antibody has the CDRs of antibody IMPI-071.

C27. An antibody according to clause C1,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071,

optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

C28. The antibody according to clause C27, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-003, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-003, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

C29. The antibody according to clause C27, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-013, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-013, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

C30. The antibody according to clause C27, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-063, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-063, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

C31. The antibody according to clause C27, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-061, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-061, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

C32. The antibody according to clause C27, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-062, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody

IMPI-062, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

C33. The antibody according to clause C27, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-064, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-064, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

C34. The antibody according to clause C27, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-065, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-065, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

C35. The antibody according to clause C27, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-066, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-066, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

C36. The antibody according to clause C27, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-069, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-069, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

C37. The antibody according to clause C27, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-070, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-070, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

C38. The antibody according to clause C27, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-071, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-071, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

C39. An antibody according to clause C1,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071,

provided that the antibody has the CDRs of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071.

C40. The antibody according to clause C39, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-003 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-003, provided that the antibody has the CDRs of antibody IMPI-003.

C41. The antibody according to clause C39, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-013 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-013, provided that the antibody has the CDRs of antibody IMPI-013.

C42. The antibody according to clause C39, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-063 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-063, provided that the antibody has the CDRs of antibody IMPI-063.

C43. The antibody according to clause C39, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-061 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-061, provided that the antibody has the CDRs of antibody IMPI-061.

C44. The antibody according to clause C39, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-062 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-062, provided that the antibody has the CDRs of antibody IMPI-062.

C45. The antibody according to clause C39, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-064 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-064, provided that the antibody has the CDRs of antibody IMPI-064.

C46. The antibody according to clause C39, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-065 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-065, provided that the antibody has the CDRs of antibody IMPI-065.

C47. The antibody according to clause C39, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-066 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-066, provided that the antibody has the CDRs of antibody IMPI-066.

C48. The antibody according to clause C39, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-069 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-069, provided that the antibody has the CDRs of antibody IMPI-069.

C49. The antibody according to clause C39, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-070 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-070, provided that the antibody has the CDRs of antibody IMPI-070.

C50. The antibody according to clause C39, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-071 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-071, provided that the antibody has the CDRs of antibody IMPI-071.

C51. An antibody according to clause C1,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071.

C52. An anti- SARS-CoV-2 antibody,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070 or IMPI-071.

C53. The antibody according to clause C51 or C52, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-003 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-003.

C54. The antibody according to clause C51 or C52, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-013 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-013.

C55. The antibody according to clause C51 or C52, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-063 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-063.

C56. The antibody according to clause C51 or C52, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-061 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-061.

C57. The antibody according to clause C51 or C52, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-062 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-062.

C58. The antibody according to clause C51 or C52, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-064 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-064.

C59. The antibody according to clause C51 or C52, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-065 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-065.

C60. The antibody according to clause C51 or C52, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-066 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-066.

C61. The antibody according to clause C51 or C52, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-069 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-069.

C62. The antibody according to clause C51 or C52, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-070 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-070.

C63. The antibody according to clause C51 or C52, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-071 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-071.

C64. The antibody according to clause C1, comprising VH and/or VL domain framework regions of human germline gene segment sequences.

C65. The antibody according to clause C1 or C64, comprising an antibody VH domain which

i) is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein

the V gene segment is IGHV3-9*01 or IGHV3-20*d01;

and/or

the J gene segment is IGHJ6*02 or IGHJ4*02, or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGHV3-9*01 or IGHV3-20*d01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGHV3-9*01 or IGHV3-20*d01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR3 aligns with human germline V gene segment IGHV3-9*01 or IGHV3-20*d01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGHJ6*02 or IGHJ4*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

C66. The antibody according to any one of clauses C1, C64 or C65, comprising an antibody VH domain which

i) is derived from recombination of a human heavy chain V gene segment IGHV3-9*01 or IGHV3-20*d01, a human heavy chain D gene segment and a human heavy chain J gene segment, or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1, FR2 and FR3 each align with human germline V segment IGHV3-9*01 or IGHV3-20*d01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

C67. The antibody according to any one of clauses C1 or C61 to C66, wherein the J gene segment is IGHJ6*02 or IGHJ4*02, or wherein the VH domain framework region FR4 aligns with human germline J gene segment IGHJ6*02 or IGHJ4*02 with 1, 2, 3, 4 or 5 amino acid alterations.

C68. The antibody according to clause C1 or C64, comprising an antibody VL domain which

i) is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein

the V gene segment is IGKV1-6*01 or IGKV3-20*01, and/or

the J gene segment is IGKJ1*01 or IGKJ2*04; or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGKV1-6*01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGKV1-6*01 or IGKV3-20*01 with up to 1, 2, 3, 4, or 5 amino acid alterations

FR3 aligns with human germline V gene segment IGKV1-6*01 or IGKV3-20*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGKJ1*01 or IGKJ2*04 with up to 1, 2, 3, 4 or 5 amino acid alterations.

C69. The antibody according to any one of clause C1 or C64, comprising an antibody VL domain derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein:

the V gene segment is IGKV1-6*01 or IGKV3-20*01, and optionally

the J gene segment is IGKJ1*01 or IGKJ2*04.

D1. An antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody does not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor.

D2. An antibody according to clause D1, wherein the antibody is a neutralising antibody.

D3. An antibody according to clause D1 or clause D2, wherein the antibody increases binding between SARS-CoV-2 and the human ACE2 receptor.

D4. An antibody according to any one of clauses D1 to D3,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the HCDR3 is the HCDR3 of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068.

D5. An antibody according to clause D2,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the HCDR3 is the HCDR3 of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068.

D6. An antibody according to clause D3,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the HCDR3 is the HCDR3 of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068.

D7. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-026.

D8. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-034.

D9. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-016.

D10. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-050.

D11. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-049.

D12. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-015.

D13. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-009.

D14. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-011.

D15. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-044.

D16. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-046.

D17. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-051.

D18. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-024.

D19. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-058.

D20. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-043.

D21. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-045.

D22. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-027.

D23. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-018.

D24. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-048.

D25. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-033.

D26. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-014.

D27. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-038.

D28. The antibody according to clause D4, wherein the HCDR3 is the HCDR3 of antibody IMPI-068.

D29. An anti-SARS-CoV-2 antibody,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068.

D30. An antibody according to any one of clauses D1 to D3,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068.

D31. An antibody according to clause D2,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068.

D32. An antibody according to clause D3,

wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2, and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3,

wherein the CDRs are those of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068.

D33. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-026.

D34. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-034.

D35. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-016.

D36. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-050.

D37. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-049.

D38. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-015.

D39. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-009.

D40. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-011.

D41. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-044.

D42. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-046.

D43. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-051.

D44. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-024.

D45. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-058.

D46. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-043.

D47. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-045.

D48. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-027.

D49. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-018.

D50. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-048.

D51. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-033.

D52. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-014.

D53. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-038.

D54. The antibody according to clause D29 or clause D30, wherein the antibody has the CDRs of antibody IMPI-068.

D55. An antibody according to any one of clauses D1 to D3,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

D56. An antibody according to clause D2,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068,

optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

D57. An antibody according to clause D3,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068,

optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

D58. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-026, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-026, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D59. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-034, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-034, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D60. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-016, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-016, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D61. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-050, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-050, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D62. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-049, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-049, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D63. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-015, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-015, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D64. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-009, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-009, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D65. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-011, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-011, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D66. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-044, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-044, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D67. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-046, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-046, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D68. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-051, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-051, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D69. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-024, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody

IMPI-024, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D70. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-058, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-058, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D71. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-043, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-043, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D72. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-045, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-045, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D73. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-027, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-027, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D74. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-018, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-018, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D75. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-048, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-048, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D76. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-033, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-033, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D77. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-014, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-014, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D78. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-038, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-038, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D79. The antibody according to clause D55, wherein the antibody comprises a variable heavy (VH) domain sequence of antibody IMPI-068, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs), and a variable light (VL) domain sequence of antibody IMPI-068, optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs).

D80. An antibody according to any one of clauses D1 to D3,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068,

provided that the antibody has the CDRs of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068.

D81. An antibody according to clause D2,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068, provided that the antibody has the CDRs of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068.

D82. An antibody according to clause D3,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068,

provided that the antibody has the CDRs of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068.

D83. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-026 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-026, provided that the antibody has the CDRs of antibody IMPI-026.

D84. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-034and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-034, provided that the antibody has the CDRs of antibody IMPI-034.

D85. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-016 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-016, provided that the antibody has the CDRs of antibody IMPI-016.

D86. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-050 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-050, provided that the antibody has the CDRs of antibody IMPI-050.

D87. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-049 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-049, provided that the antibody has the CDRs of antibody IMPI-049.

D88. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-015 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-015, provided that the antibody has the CDRs of antibody IMPI-015.

D89. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-009 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-009, provided that the antibody has the CDRs of antibody IMPI-009.

D90. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-011 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-011, provided that the antibody has the CDRs of antibody IMPI-011.

D91. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-044 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-044, provided that the antibody has the CDRs of antibody IMPI-044.

D92. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-046and

the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-046, provided that the antibody has the CDRs of antibody IMPI-046.

D93. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-051 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-051, provided that the antibody has the CDRs of antibody IMPI-051.

D94. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody I IMPI-024 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-024, provided that the antibody has the CDRs of antibody IMPI-024.

D95. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-058 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-058, provided that the antibody has the CDRs of antibody IMPI-058.

D96. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-043 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-043, provided that the antibody has the CDRs of antibody IMPI-043.

D97. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-045and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-045, provided that the antibody has the CDRs of antibody IMPI-045.

D98. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-027 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-027, provided that the antibody has the CDRs of antibody IMPI-027.

D99. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-018 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-018, provided that the antibody has the CDRs of antibody IMPI-018.

D100. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-048 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-048, provided that the antibody has the CDRs of antibody IMPI-048.

D101. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-033 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-033, provided that the antibody has the CDRs of antibody IMPI-033.

D102. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-014 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-014, provided that the antibody has the CDRs of antibody IMPI-014.

D103. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-038 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-038, provided that the antibody has the CDRs of antibody IMPI-038.

D104. The antibody according to clause D80, wherein the variable heavy (VH) domain sequence comprises a sequence having at least 90% identity to the VH domain sequence of antibody IMPI-068 and the variable light (VL) domain sequence comprises a sequence having at least 90% identity to the VL domain sequence of antibody IMPI-068, provided that the antibody has the CDRs of antibody IMPI-068.

D105. An antibody according to any one of clauses D1 to D3,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068.

D106. An antibody according to clause D2,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-024, IMPI-027, IMPI-038 or IMPI-068.

D107. An antibody according to clause D3,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-027, IMPI-033, IMPI-038 or IMPI-068.

D108. An anti-SARS-CoV-2 antibody,

wherein the antibody comprises a variable heavy (VH) domain sequence and a variable light (VL) domain sequence and wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-038 or IMPI-068.

D109. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-026 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-026.

D110. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-034 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-034.

D111. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-016 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-016.

D112. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-050 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-050.

D113. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-049 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-049.

D114. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-015 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-015.

D115. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-009 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-009.

D116. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-011 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-011.

D117. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-044 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-044.

D118. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-046 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-046.

D119. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-051 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-051.

D120. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-024 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-024.

D121. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-058 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-058.

D122. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-043 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-043.

D123. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-045 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-045.

D124. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-027 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-027.

D125. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-018 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-018.

D126. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-048 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-048.

D127. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-033 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-033.

D128. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-014 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-014.

D129. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-038 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-038.

D130. The antibody according to clause D105 or D108, wherein the variable heavy (VH) domain sequence comprises the VH domain sequence of antibody IMPI-068 and the variable light (VL) domain sequence comprises the VL domain sequence of antibody IMPI-068.

D131. The antibody according to any one of clauses D1 to D3, comprising VH and/or VL domain framework regions of human germline gene segment sequences.

D132. The antibody according to any one of clauses D1 to D3 or D131, comprising an antibody VH domain which

i) is derived from recombination of a human heavy chain V gene segment, a human heavy chain D gene segment and a human heavy chain J gene segment, wherein

the V gene segment is IGHV5-51*01, IGHV4-31*03 or IGHV3-30*18;

and/or

the J gene segment is IGHJ4*02 or IGHJ6*02, or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGHV5-51*01, IGHV4-31*03 or IGHV3-30*18 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGHV5-51*01, IGHV4-31*03 or IGHV3-30*18 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR3 aligns with human germline V gene segment IGHV5-51*01, IGHV4-31*03 or IGHV3-30*18 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGHJ4*02 or IGHJ6*02 with up to 1, 2, 3, 4 or 5 amino acid alterations.

D133. The antibody according to any one of clauses D1 to D3, D131 or D132, comprising an antibody VH domain which

i) is derived from recombination of a human heavy chain V gene segment IGHV5-51*01, IGHV4-31*03 or IGHV3-30*18, a human heavy chain D gene segment and a human heavy chain J gene segment, or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein FR1, FR2 and FR3 each align with human germline V segment IGHV5-51*01, IGHV4-31*03 or IGHV3-30*18 with up to 1, 2, 3, 4 or 5 amino acid alterations.

D134. The antibody according to any one of clauses D1 to D3 or D131 to D133, wherein the J gene segment is IGHJ4*02 or IGHJ6*02, or wherein the VH domain framework region FR4 aligns with human germline J gene segment IGHJ4*02 or IGHJ6*02 with 1, 2, 3, 4 or 5 amino acid alterations.

D135. The antibody according to any one of clauses D1 to D3 or D131, comprising an antibody VL domain which

i) is derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein

the V gene segment is IGKV1D-13*d01 or IGKV1-12*01, and/or

the J gene segment is IGKJ1*01, IGKJ4*01 or IGKJ3*01; or

ii) comprises framework regions FR1, FR2, FR3 and FR4, wherein

FR1 aligns with human germline V gene segment IGKV1D-13*d01 or IGKV1-12*01 with up to 1, 2, 3, 4, or 5 amino acid alterations,

FR2 aligns with human germline V gene segment IGKV1D-13*d01 or IGKV1-12*01 with up to 1, 2, 3, 4, or 5 amino acid alterations

FR3 aligns with human germline V gene segment IGKV1D-13*d01 or IGKV1-12*01 with up to 1, 2, 3, 4 or 5 amino acid alterations, and/or

FR4 aligns with human germline J gene segment IGKJ1*01, IGKJ4*01 or IGKJ3*01 with up to 1, 2, 3, 4 or 5 amino acid alterations.

D136. The antibody according to any one of clauses D1 to D3 or D131, comprising an antibody VL domain derived from recombination of a human light chain V gene segment and a human light chain J gene segment, wherein:

the V gene segment is IGKV1D-13*d01 or IGKV1-12*01, and optionally

the J gene segment is IGKJ1*01, IGKJ4*01 or IGKJ3*01.

E1. The antibody according to any one of clauses A1 to A109, B1 to B106, C1 to C63, or D1 to D130, wherein the antibody is a human IgG1.

E2. The antibody according to clause E1, wherein the antibody is a human IgG1 comprising a constant region sequence of SEQ ID NO: 418.

E3. The antibody according to any one of clauses A1 to A109, B1 to B106, C1 to C63, or D1 to D130, wherein the antibody is a human IgG4.

E4. The antibody according to clause E3, wherein the antibody is a human IgG4 comprising a constant region sequence of SEQ ID NO: SEQ ID NO: 436.

E5. The antibody according to any one of clauses A1 to A109, B1 to B106, C1 to C63, D1 to D130, or E1 to E6 wherein the antibody comprises kappa (κ) light chain constant regions, preferably wherein the kappa (κ) light chain constant regions sequence is SEQ ID NO: 448.

E6. A nucleic acid comprising a sequence that encodes a VH domain and/or an VL domain of an antibody as defined in any preceding clause.

E7. A nucleic acid comprising a sequence that encodes a VH domain and/or an VL domain of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067, IMPI-072, IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070, IMPI-071; IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-028, IMPI-038 or IMPI-068.

E8. A nucleic acid comprising a sequence that encodes the VH domain of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031, IMPI-057, IMPI-022, IMPI-035, IMPI-067, IMPI-072, IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070, IMPI-071; IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-028, IMPI-038 or IMPI-068.

E9. A nucleic acid comprising a sequence that encodes the VL domain of antibody IMPI-029, IMPI-056, IMPI-005, IMPI-012, IMPI-052, IMPI-002, IMPI-041, IMPI-036, IMPI-055, IMPI-054, IMPI-042, IMPI-021, IMPI-004, IMPI-047, IMPI-017, IMPI-059, IMPI-030, IMPI-053, IMPI-025, IMPI-040, IMPI-007, IMPI-020, IMPI-032, IMPI-023, IMPI-039, IMPI-001, IMPI-019, IMPI-010, IMPI-008, IMPI-031,

IMPI-057, IMPI-022, IMPI-035, IMPI-067, IMPI-072, IMPI-003, IMPI-013, IMPI-063, IMPI-061, IMPI-062, IMPI-064, IMPI-065, IMPI-066, IMPI-069, IMPI-070, IMPI-071; IMPI-026, IMPI-034, IMPI-016, IMPI-050, IMPI-049, IMPI-015, IMPI-009, IMPI-011, IMPI-044, IMPI-046, IMPI-051, IMPI-024, IMPI-058, IMPI-043, IMPI-045, IMPI-027, IMPI-018, IMPI-048, IMPI-033, IMPI-014, IMPI-028, IMPI-038 or IMPI-068.

E10. A vector comprising the nucleic acid of any one of clauses E6 to E9; optionally wherein the vector is a CHO vector.

E11. A host cell comprising the nucleic acid of any one of clauses E6 to E9 or the vector of clause E10.

E12. A pharmaceutical composition comprising an antibody according to any one of clauses A1 to A115, B1 to B112, C1 to C69, D1 to D136 or E1 to E5 and a pharmaceutically acceptable excipient.

E13. A pharmaceutical composition comprising an isolated nucleic acid encoding an antibody according to any one of clauses A1 to A115, B1 to B112, C1 to C69, D1 to D136 or E1 to E5, or the isolated nucleic acid of any one of clauses E8 to E11 and a pharmaceutically acceptable excipient.

E14. The pharmaceutical composition according to clause E12 or E13, formulated for intravenous, intramuscular or subcutaneous administration.

E15. The pharmaceutical composition according to any of clauses E12 to E14, further comprising at least one further therapeutic agent.

E16. The pharmaceutical composition of clause E15, wherein the further therapeutic agent is at least one, preferably one or two, further antibodies.

E17. The pharmaceutical composition of clause E16, wherein the at least one further antibody is selected from:

a. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;

b. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and does not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;

c. an antibody that specifically binds to the N-terminal domain (NTD) of the S1 subunit of the of SARS-CoV-2 spike protein;

d. an antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein; and

e. an antibody preferentially binds to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, S1 subunit and S2 subunit of the SARS-CoV-2 spike protein.

E18. A kit comprising the pharmaceutical composition of any one of clauses E12 to E17.

E19. A kit comprising the pharmaceutical composition of any one of clauses E12 to E14.

E20. The kit according to clause E19 further comprising at least one further therapeutic agent.

E21. The kit according to clause E20, wherein the further therapeutic agent is a further pharmaceutical composition comprising at least one, preferably one or two, further antibodies.

E22. The kit according to clause E21, wherein the at least one further antibody is selected from:

a. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;

b. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and does not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;

c. an antibody that specifically binds to the N-terminal domain (NTD) of the S1 subunit of the of SARS-CoV-2 spike protein;

d. an antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein; and

e. an antibody preferentially binds to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, S1 subunit and S2 subunit of the SARS-CoV-2 spike protein.

E23. The kit according to any of clauses E18 and E22, further comprising a label or instructions for use to treat and/or prevent a SARS-CoV-2-related disease or condition, such as COVID-19, in a human; optionally wherein the label or instructions comprise a marketing authorisation number (e.g., an FDA or EMA authorisation number); optionally wherein the kit comprises an IV or injection device that comprises the antibody or fragment.

E24. The antibody according to any one of clauses A1 to A115, B1 to B112, C1 to C69, D1 to D136 or E1 to E5, or the composition according to any one of clauses E12 to E19, for use as a medicament.

E25. The antibody according to any one of clauses A1 to A115, B1 to B112, C1 to C69, D1 to D136 or E1 to E5, or the composition according to any one of clauses E12 to E19, for use in a method of treating a SARS-CoV-2-related disease or condition, said method comprising administering the antibody or composition to a patient.

E26. The antibody according to any one of clauses A1 to A115, B1 to B112, C1 to C69, D1 to D136 or E1 to E5, or the composition according to any one of clauses E12 to E19, for use in a method of preventing a SARS-CoV-2-related disease or condition, said method comprising administering the antibody or composition to a patient.

E27. Use of an antibody according to any one of clauses A1 to A115, B1 to B112, C1 to C69, D1 to D136 or E1 to E5, or the composition according to any one of clauses E12 to E19, in the manufacture of a medicament for use in a method of treating a SARS-CoV-2-related disease or condition.

E28. Use of an antibody according to any one of clauses A1 to A115, B1 to B112, C1 to C69, D1 to D136 or E1 to E5, or the composition according to any one of clauses E12 to E19, in the manufacture of a medicament for use in a method of preventing a SARS-CoV-2-related disease or condition.

E29. A method of treating a SARS-CoV-2-related disease or condition in a human, comprising administering to said human a therapeutically effective amount of an antibody according to any one of clauses A1 to A115, B1 to B112, C1 to C69, D1 to D136 or E1 to E5, or the composition according to any one of clauses E12 to E19.

E30. A method of preventing a SARS-CoV-2-related disease or condition in a human, comprising administering to said human a therapeutically effective amount of an antibody according to any one of

clauses A1 to A115, B1 to B112, C1 to C69, D1 to D136 or E1 to E5, or the composition according to any one of clauses E12 to E19.

E31. The antibody for use according to clause E25 or E26, or
the composition for use according to clause E25 or E26, or
the use of an antibody according to clause E27 or E28, or
the method according to clause E29 or E30,
wherein the SARS-CoV-2-related disease or condition is COVID-19.

E32. The antibody for use according to any one of clauses E25, E26 or E31, or
the composition for use according to any one of clauses E25, E26 or E31, or
the use of an antibody according to any one of clauses E27, E28 or E31, or
the method according to any one of clauses E29, E30 or E32,
said method further comprising administering at least one further therapeutic agent.

E33. The antibody for use according to any one of clauses E25, E26, E31 or E32, or
the composition for use according to any one of clauses E25, E26, E31 or E32, or
the use of an antibody according to any one of clauses E27, E28, E31 or E32, or
the method according to any one of clauses E29, E30, E31 or E32,
wherein administration of the further therapeutic agent is simultaneous, separate or sequential.

E34. The antibody for use according to any one of clauses E25, E26, or E31 to E33, or
the composition for use according to any one of clauses E25, E26, or E31 to E33, or
the use of an antibody according to any one of clauses E27, E28, or E31 to E33, or
the method according to any one of clauses E29, E30, or E31 to E33,
wherein the further therapeutic agent is at least one, preferably one or two, further antibodies.

E35. The antibody for use according to any one of clauses E25, E26, or E31 to E34, or
the composition for use according to any one of clauses E25, E26, or E31 to E34, or
the use of an antibody according to any one of clauses E27, E28, or E31 to E34, or
the method according to any one of clauses E29, E30, or E31 to E34,
wherein the at least one further antibody is selected from:

a. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;

b. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and does not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;

c. an antibody that specifically binds to the N-terminal domain (NTD) of the S1 subunit of the of SARS-CoV-2 spike protein;

d. an antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein; and

e. an antibody preferentially binds to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, S1 subunit and S2 subunit of the SARS-CoV-2 spike protein.

E36. Use of an antibody according to any of clauses A1 to A115, B1 to B112, C1 to C69, D1 to D136 or E1 to E5, for determining the presence or absence of SARS-CoV-2 in a sample.

E37. A method of determining the presence or absence of SARS-CoV-2, in a sample, the method comprising

contacting the sample with an antibody according to any of clauses A1 to A115, B1 to B112, C1 to C69, D1 to D136 or E1 to E5; and

testing for binding between the antibody and SARS-CoV-2 in the sample;

wherein detection of binding indicates the presence of SARS-CoV-2 in the sample and wherein absence of binding indicates the absence of SARS-CoV-2 in the sample.

E38. Use according to clause E36 or a method according to clause E37, wherein the antibody comprises or is conjugated to a detectable label.

E39. Use according to clause E36 or clause E38, or a method according to clause E37 or clause E38, wherein the sample has been obtained from a human who has been or is suspected of having been infected with SARS-CoV-2 and/or who exhibits one or more symptoms of a SARS-CoV-2-related disease or condition, such as COVID-19.

E40. Use or a method according to any of clauses E36, E38 or E39, or a method according to any one of clauses E37 to E40, wherein the sample is a serum, plasma, or whole blood sample, or an oral or nasal swab, urine, faeces, or cerebrospinal fluid (CFS), or wherein the sample is from any suspected SARS-CoV-2 infected organ or tissue.

E41. A diagnostic kit for the use as set out in any of clauses E36 or E38 to E40, or the method as set out in any of clauses E37 to E40, comprising an antibody according to any of clauses A1 to A115, B1 to B112, C1 to C69, D1 to D136 or E1 to E5, and optionally one or more buffering solutions.

E42. A diagnostic kit according to clause E41, wherein the antibody comprises or is conjugated to a detectable label.

E43. A diagnostic kit according to clause E42, comprising

a first reagent comprising the antibody according to any of clauses A1 to A115, B1 to B112, C1 to C69, D1 to D136 or E1 to E5, and

a second reagent comprising a detector molecule that binds to the first reagent.

E44. A diagnostic kit according to clause E43, wherein the detector molecule is an antibody that comprises or is conjugated to a detectable label.

EXAMPLES

Here we describe antibodies binding to the spike protein of SARS-CoV-2 which are suitable for use in treating COVID19 disease. Through immunising transgenic mice which generate fully human antibodies and testing a wide diversity of antibodies in a series of biologically relevant assays, we were able to obtain spike-binding monoclonal antibodies which neutralise the entry of SARS-CoV-2 into target cells. These antibodies target multiple domains on the spike protein, including S1 (e.g., RBD) and/or S2, and can be

used alone or in combination as a therapeutic or prophylactic against SARS-CoV-2 (e.g., for administration to human patients) or as a diagnostic for detecting SARS-CoV-2, (e.g., in *in vitro* diagnostic test assays and kits).

EXAMPLE 1. GENERATION OF SARS-COV-2 SPIKE ANTIGENS AND ANTI-SPIKE ANTIBODIES

Kymab Darwin transgenic mice, which produce human antibodies, were immunised with SARS-CoV-2 spike in a variety of immunisation regimens and immunogenic formats, and antigen-specific B cells were selected from the immunised mice. Single B cells from spleen, lymph node and bone marrow samples were sorted using a combination of plasma cell sorting and antigen specific probes. Immunogenic formats included (i) nucleic acid encoding full length spike protein (sequence as depicted in Figure 2B) and/or a (ii) soluble trimeric spike extracellular domain protein (ECD) comprising a C-terminal T4 fibritin (foldon) trimerisation motif (Meier et al., J Mol Biol. 2004 Dec 3;344(4):1051-69). This soluble version ends at glutamine Q1208 of the pre-fusion sequence followed by a GGGGSGGGGS linker, the T4 fibritin (foldon) trimerization motif, a further GGGGSGGGGS linker, the Myc tag, a GSGSGS linker and finally an 8xHIS tag to enable purification of the soluble recombinant protein. Sorting probes used were: soluble trimeric spike extracellular domain protein comprising C-terminal T4 fibritin (foldon) trimerisation motif, soluble spike receptor binding domain (RBD) protein (monomeric) and full length trimeric spike protein presented on green fluorescent protein (GFP) virus like particles (VLPs) generated from host cells transfected with DNA encoding full length spike protein. All constructs that encoded the spike protein contained the double proline stabilising mutations depicted in Figure 2B.

In a first study, 8,219 B-cells were recovered after B cell sorting from immunised mice. From 224 of these B-cells, complete antibody heavy and light chain encoding nucleic acids were recovered, and expressed as fully human IgG1 antibodies in mammalian host cells to be taken forward for screening.

In a second study, 2,183 B cells were recovered after B cell sorting from immunised mice, and from 268 of these B-cells, complete antibody heavy and light chain encoding nucleic acids were recovered, and expressed as fully human IgG1 antibodies in mammalian host cells to be taken forward for screening

All antibodies taken forward for screening were expressed as fully human IgG1 kappa.

Antigen/immunogen preparation

To generate purified proteins for use in mouse immunisations and sorting of B cells, DNA sequences were generated encoding ECD of trimeric spike protein containing stabilising double proline (PP) mutations (K968 and V969). Coding sequences were fused with a C-terminal His tag and N-terminal leader sequence, codon optimised for mammalian expression and expressed in CHO cells. ECD for immunisations also

included a trimerisation motif as noted above. Protein was sequentially purified by a HisTrap HP column and a HiPrep 16/60 Sephacryl S-300 HR size exclusion chromatography (SEC) column (both from GE Healthcare). Purified protein was first analyzed by Native-PAGE and Western blot, and then filtered through a 0.22 μm membrane, aliquoted and stored at −80 °C.

Stable cell lines expressing the SARS-CoV-2 full-length trimeric spike protein were created to generate virus like particles for sorting B cells. A full length DNA sequence encoding trimeric spike protein containing a double proline stabilising mutation (K968 and V969) was cloned into an expression vector under the control of the CMV promoter flanked by 3' and 5' piggyBac specific terminal repeat sequences, which facilitated stable integration into the cell genome. The expression vector contained a puromycin selection cassette to facilitate stable cell line generation. Constructs were transfected into HEK293 cell line, cultured under puromycin selection for 2 weeks and spike cell surface expression was validated by using flow cytometry to check for antigen surface expression using anti-spike monoclonal antibodies (cross-reactive anti-RBD SARS-CoV-1 antibody CR3022 obtained from Neil King, University of Washington, and anti-RBD SARS-CoV-2 antibody 40150-D001 from Sino Biologicals). VLPs were generated from HEK293 cells stably co-expressing PP stabilised trimeric spike with retroviral Group Antigens (gag) proteins and used for sorting specific B cells.

EXAMPLE 2. ANTIBODY BINDING BY HTRF

A homogeneous time resolved FRET (HTRF) assay was used for primary screening to establish binding of the recovered antibodies to purified spike proteins. All antibodies were screened in an initial single point assay at 1 - 2 μg/mL for binding to the RBD domain (Acro Biosystems SPD-C52H3), the S1 subunit (Sino Biologicals 40591-V08H), the S2 subunit (Sino Biologicals 40590-V08B) and the stabilised soluble spike trimer protein ECD (including engineered trimerisation motif) of SARS-CoV-2 virus (see domains in Figure 2B for reference). A summary of the primary screening results is shown in Table E2-1.

The 492 selected antibodies from Example 1 were screened in 4 batches, and 263 passed this initial HTRF screening. Criteria for passing the HTRF primary screen were that the antibody bound soluble spike trimer, S2, S1 or RBD with a ΔF value set out in Table E2-1.

	Screening batch 1: 151 clones			**Screening batch 4: 83 clones**				
Assay	**Selection criteria**	**No. hits**	**Selection criteria**	**No. hits**	**Selection criteria**	**No. hits**	**Selection criteria**	**No. hits**
Trimer	Delta F > 180	58	Delta F > 50	71	Delta F > 60	62	Delta F > 50	64
S2	Delta F > 45	30	Delta F > 30	33	Delta F > 70	25	Delta F > 40	39
S1	Delta F > 72	23	Delta F > 10	23	Delta F > 15	4	Delta F > 10	10

RBD	Delta F > 20	20	Delta F > 40	19	Delta F > 30	2	Delta F > 10	6

Table E2-1: Screening from batch 1, 2, 3 and 4 Summary of number of clones meeting primary screening selection criteria for binding to RBD, S1, S2 and spike trimer proteins. Table details number of antibodies screened, number of positive hits and associated cut-off values.

On the basis of these data, we selected clones which met the HTRF binding criteria for binding spike trimer and optionally also met the HTRF binding criteria for S1, S2 or RBD. 255 such clones were selected. No antibodies were detected that were positive (passed the criteria) for both S1 and S2 in the HTRF assay. Figure 4 summarises numbers of antibodies binding to trimer, S1, RBD and/or S2.

Binding data (presented as deltaF) for a selection of these antibody clones are shown in Table E2-2.

Clone	Binding trimer	Binding RBD	Binding S1	Binding S2
IMPI-004	952.1	1169.9	1749.3	19.2
IMPI-029	1704.1	1175.7	3053.1	4.1
IMPI-056	1627.1	1262.7	2996.8	2.1
IMPI-047	1414.2	899.2	2254.6	4.3
IMPI-005	1361.0	608.5	1507.4	-1.8
IMPI-006	1061.4	330.6	885.1	40.7
IMPI-055	550.8	983.3	1031.2	-10.3
IMPI-054	563.4	818.2	772.5	15.8
IMPI-017	549.6	894.4	752.5	13.0
IMPI-059	403.0	882.3	568.8	-2.7
IMPI-037	556.6	468.1	625.9	-2.0
IMPI-060	488.3	217.1	377.6	6.0
IMPI-013	1420.4	-10.9	-2.8	684.2
IMPI-028	480.1	108.0	253.7	1.3
IMPI-027	800.4	318.1	755.2	7.5
IMPI-033	884.5	454.2	929.3	-3.6
IMPI-021	961.8	596.6	1279.2	-0.3
IMPI-032	217.7	4.0	-8.9	-8.0
IMPI-038	1307.9	544.4	1443.8	-4.3
IMPI-022	483.0	-2.4	-5.8	-9.7
IMPI-024	1461.1	225.3	799.4	-15.4
IMPI-002	912.7	172.1	541.0	-5.8
IMPI-052	1134.4	228.8	732.2	-15.9
IMPI-042	925.8	121.4	616.7	1.6
IMPI-063	968.5	-7.3	-0.4	410.6
IMPI-067	962.8	-5.4	3.1	4.6
IMPI-068	1595.6	42.3	612.9	1.4

Table E2-2: HTRF binding to SARS-CoV-2 spike protein subunits. HTRF deltaF values for binding of antibody clones to the RBD domain, the S1 subunit, the S2 subunit and the full-length stabilised spike trimer protein of SARS-CoV-2 virus.

Materials and methods for HTRF binding assays

Supernatants collected from suspension CHO cells transfected with expression vectors encoding human IgG1 heavy and light chains were screened for binding to the RBD domain (Acro Biosystems SPD-C52H3), the S1 subunit (Sino Biological 40591-V08H), the S2 subunit (Sino Biological 40590-V08B) and the full-length stabilised spike trimer protein (in-house) of SARS-CoV-2 virus. All proteins included a His tag. 5µL/well of supernatants normalised between 1 and 2µg/mL were plated into 384 well white HTRF plates (Greiner 784904-012). 5µL/well of positive control (Sino Biological anti-SARS-COV-2 RBD antibody 40150-D001 for RBD, S1 and trimer binding assays; Sino Biological anti-SARS-COV-2 S2 antibody 40590-D001 for S2 binding assay) and negative control (non-binding human IgG1, in-house) antibodies were added to the required wells in expression medium (Gibco A1383502). Positive and negative control antibodies were added respectively at 1.2nM, 1.2nM, 2nM and 4nM for the RBD, the S1, the S2 and the trimer binding assays to give final concentrations of 0.3nM, 0.3nM, 0.5nM and 1nM. 5µL/well of RBD diluted at 4nM, S1 at 40nM, S2 at 20nM or spike trimer at 20nM in HTRF buffer (PBS (Gibco 14190250, 0.1% BSA (Sigma A7906), 0.53M KF (Sigma 60238-100G-F)) were added on top on the supernatants to give final concentrations of 1 nM, 10 nM, 5nM and 5nM. After a 30-min incubation at room temperature, 10 µL/well of an anti-Histidine d2 monoclonal antibody (Cisbio 61HISDLB) diluted at 13.3 nM in HTRF buffer together with an anti-human IgG Europium cryptate polyclonal antibody (Cisbio 61HFCKLB) diluted respectively at 0.42nM, 1.67nM, 0.83nM and 1.67nM for the RBD, the S1, the S2 and the spike trimer binding assays were added to the wells. Plates were left to incubate at room temperature for 2 hours for the RBD, the S1 and the S2 binding assays and for 4 hours for the spike trimer binding assay. Plates were then read on the Envision (Perkin Elmer) using 320 nm for excitation and detecting fluorescence at 665 and 620nm.

HTRF Binding Assays	Final concentration of Spike protein	Final concentration of anti-His d2 antibody	Final concentration of anti-human IgG antibody
Binding to RBD	[RBD] = 1nM	6.67nM	0.21nM
Binding to S1	[S1] = 10nM	6.67nM	0.83nM
Binding to S2	[S2] = 5nM	6.67nM	0.42nM
Binding to spike trimer	[trimer] = 5nM	6.67nM	0.83nM

Table E2-3: Reagent concentrations for HTRF assay

The selection of hits was based on a histogram generated using Genedata Biologics (Genedata) representing the overall distribution of the Delta F values obtained for all the wells in individual binding assays. The selection criteria for each binding assay ("cut-off") (Delta F, summarised in Table E2-1) is visually applied at the tail of the histogram when the frequency of hits decreases. Any clone positive in at least one of the HTRF assays was carried forward to a secondary screening stage.

Equation 1: Calculation of HTRF ratio for primary screening:

$$\text{HTRF Ratio} = \frac{Fluorescence\ at\ 665\ nm}{Fluorescence\ at\ 620\ nm} \times 10000$$

Equation 2: Calculation of Delta F for HTRF binding assays:

$$\text{Delta F} = \frac{(HTRF\ Ratio_{sample} - HTRF\ Ratio_{minimum})}{(HTRF\ Ratio_{minimum})} \times 100$$

Minimum signal ($\text{HTRF Ratio}_{\text{minimum}}$) is obtained from wells containing spike protein and the negative control antibody.

EXAMPLE 3. HTRF RBD:ACE2 NEUTRALISATION ASSAYS

The 492 selected antibodies from Example 1 were screened for their capacity to neutralise the binding between the RBD domain of the spike protein of SARS-CoV-2 virus and its ligand the human ACE2 protein. ACE2 is the cell surface protein targeted by the virus for binding and entry to the cells, thus serving as a receptor for the spike protein. All antibodies were initially screened as supernatants at a single concentration (summary shown in Table E3-1). Four batches of screening were performed, with hits (antibodies that passed the selection criteria) as follows:

	151 clones			83 clones				
Assay	**Selection criteria**	**No. hits**	**Selection criteria**	**No. hits**	**Selection criteria**	**No. hits**	**Selection criteria**	**No. hits**
Neutralisation RBD/ACE2	% Effect < 89	21	% Effect < 100	16	% Effect < 111	8	% Effect < 105	5

Table E3-1: Summary of number of primary hits fulfilling the selection cut-off resulting from HTRF RBD:ACE2 neutralisation screening

Supernatants from 263 antibody-expressing CHO cells passed initial primary screening in the HTRF binding assay of Example 2 and/or in the above neutralisation assay of Example 3. These 263 antibodies were purified and re-screened again as full titrations to generate IC50 values in the RBD:ACE2 neutralisation assay. Results and IC50 values (where it was possible to calculate) for a selection of these antibodies are shown in Table E3-2.

Clone	Neutralisation RBD:ACE2 (IC50, M)	Neutralisation Spike trimer:ACE2 (IC50, M)
IMPI-004	2.42E-09	4.09E-09
IMPI-029	1.26E-09	3.31E-09
IMPI-056	1.93E-09	3.73E-09
IMPI-047	3.36E-09	7.30E-09
IMPI-005	3.18E-09	1.31E-08

IMPI-006	Below threshold	inactive
IMPI-055	3.39E-09	4.50E-09
IMPI-054	2.28E-09	1.16E-08
IMPI-017	8.32E-10	3.15E-09
IMPI-059	2.02E-09	8.38E-09
IMPI-037	7.76E-09	1.37E-08
IMPI-060	Below threshold	5.26E-09
IMPI-013		Below threshold
IMPI-028		inactive
IMPI-027		Increased binding
IMPI-033		Increased binding
IMPI-021	4.87E-09	Yes
IMPI-032		Yes
IMPI-038		Increased binding
IMPI-022		inactive
IMPI-024	inactive	Increased binding
IMPI-002	8.15E-09	Yes
IMPI-052	4.85E-09	Yes
IMPI-042	5.54E-09	Yes
IMPI-063		inactive
IMPI-067		Below threshold
IMPI-068		Increased binding

Table E3-2: HTRF neutralisation IC50 values
"Below threshold" indicates that there was some neutralising activity but not enough to generate an IC50 value. "Yes" indicates the antibody was tested at single concentration and there was neutralising activity, but a full titration was not performed so that IC50 values could be calculated. "Increased binding" indicates that an increase in binding between ACE2:trimer (rather than blocking or no activity) was observed. "Inactive" indicates that no significant neutralisation activity was observed in this specific assay. Blank indicates that the antibody was not tested in the assay. IMPI-013 and IMPI-063 (S2 binders) and IMPI-032, IMPI-022 and IMPI-067 (trimer binders) were not tested in the RBD:ACE2 neutralisation assay as they do not bind to RBD.

The assay using the isolated RBD domain categorised the antibodies as either neutralising or non-neutralising for the interaction between RBD and ACE2. The IC50 values of antibodies which were determined to be neutralising antibodies are shown in Table E3-2, that is a numeric IC50 value in Table E3-2 is a neutralising antibody. Antibodies which were determined to be non-neutralising for RBD in this assay are also indicated ("inactive"). Note that antibodies that do not function by inhibition of RBD and ACE2 binding will be 'inactive' in this assay, however, it does not mean the antibodies will be inactive in other assays.

To check for neutralising activity in antibodies that do not bind ACE2, a subset of antibodies were also tested in an HTRF assay that measures neutralisation between the full soluble trimer protein and ACE2. The assay using the spike trimer protein categorised the antibodies as (i) neutralising the spike:ACE2

interaction, (ii) not neutralising the spike:ACE2 interaction or (iii) potentiating the spike:ACE2 interaction (Table E3-2).

Neutralising antibodies were IMPI-004, IMPI-029, IMPI-056, IMPI-47, IMPI-005, IMPI-006, IMPI-055, IMPI-054, IMPI-017, IMPI-059, IMPI-037, IMPI-060, IMPI-013, IMPI-021, IMPI-032, IMPI-002, IMPI-052, IMPI-042, IMPI-067.
Non-neutralising antibodies were IMPI-028, IMPI-022, IMPI-063.
Agonist-type antibodies were IMPI-027, IMPI-033, IMPI-038, IMPI-024, IMPI-068.

With reference to Figure 10, IMPI-059 is an ACE2 competing neutralising antibody in this assay and shows a typical sigmoid titration curve, neutralising binding of the spike protein to ACE2 in a dose-dependent manner. IMPI-027 exhibits an unusual agonist-like activity profile, with increased binding of spike to ACE2 being observed in the presence of the antibody, in a dose-dependent manner. The same agonist-like phenomenon was seen for IMPI-024 and IMPI-068. Figure 11. IMPI-033 and IMPI-038 behaved similarly.

As discussed elsewhere herein, a non-neutralising antibody or an agonist-type antibody may be useful therapeutically as combinations if the antibodies induce a destabilised trimeric spike protein, if they neutralise virus infection in pseudotype assays and/or live virus assays by an unusual mechanism or if they synergise with antibodies that neutralise RBD binding to ACE2.

Non-neutralising antibodies and neutralising antibodies are expected to bind to different regions of the RBD, and thus are useful in combination in DABA assays as described elsewhere herein.

Antibodies which potentiate binding between ACE2 and spike trimer protein may be especially valuable as capture antibodies for use in combination with anti-RBD antibodies which bind to different regions of the spike protein (e.g., in combination with anti-RBD antibodies which do not neutralise the ACE2:spike interaction). The potentiating antibodies may enhance binding of anti-RBD antibodies to the spike protein, thus enhance the sensitivity of detection of spike protein in a diagnostic assay.

Materials & Methods: Primary screening of antibody supernatants for neutralisation of RBD:ACE2
Supernatants collected from suspension CHO transfected with expression vectors encoding human IgG1 heavy and light chains as above were screened for neutralising the binding between the RBD domain (Acro Biosystems SPD-C52H3) of the spike protein of SARS-CoV-2 virus and its ligand the human ACE2 protein, used here directly labelled with Alexa Fluor 647. 5µL/well of supernatants normalised between 10 and 20 µg/mL were plated into 384 well white HTRF plates (Greiner 784904-012). 5µL/well of positive (Sino Biologicals 40150-D001) and negative control (human IgG1, in-house) antibodies were added to the required wells in expression medium (Gibco A1383502). Positive and negative control antibodies were

added at 40nM to give a final concentration of 10nM. 5µL/well of RBD protein diluted at 40nM in HTRF buffer (PBS (Gibco 14190250, 0.1% BSA (Sigma A7906), 0.53M KF (Sigma 60238-100G-F)) were added on top on the supernatants to give a final concentration of 10nM. After a 30-min incubation at room temperature, 5µL/well of AF647-labelled human ACE2 diluted at 20nM in HTRF buffer to give a final concentration of 5 nM was added to the wells followed 30-min later, by the addition of 5 µL/well of an anti-Histidine Europium cryptate monoclonal antibody (Cisbio 61HISKLB) diluted at 5.3nM in HTRF buffer to the wells. Plates were left to incubate at room temperature for 2 hours and then read on an Envision plate reader (Perkin Elmer) using 320 nm for excitation and detecting fluorescence at 665 and 620 nm.

The selection of hits was based on a histogram generated using Genedata Biologics (Genedata) representing the overall distribution of the % Effect values obtained for all the wells in the neutralisation assay. The selection criteria (% Effect, summarised in Table E3-1) is visually applied at the tail of the histogram when the frequency of hits decreases. Any clone positive in the RBD:ACE2 neutralisation primary HTRF screen was carried forward to a secondary screening stage.

Equation 3: Calculation of % of Effect for HTRF neutralisation assay:

$$\%\ \text{Effect} = \frac{(\text{HTRF}\ Ratio_{sample} - \text{HTRF}\ Ratio_{minimum})}{(\text{HTRF}\ Ratio_{maximum} - \text{HTRF}\ Ratio_{minimum})} \times 100$$

Wells containing 5nM of AF647 ACE2, 10nM of spike RBD and 10nM of human IgG1 isotype control are referred to as maximum signal (HTRF $Ratio_{maximum}$) and wells containing 5nM of AF647 ACE2, 10nM of spike RBD and 10nM of positive control antibody (Sino Biological 40590-D001) as minimum signal (HTRF $Ratio_{minimum}$).

Materials & Methods: Secondary screening of purified clones for neutralisation of RBD:ACE2

Purified antibodies identified during primary screening were screened again for neutralisation of the binding between the RBD domain (Acro Biosystems SPD-C52H3) of the spike protein of SARS-CoV-2 virus and its ligand the human ACE2 protein, used here directly labelled with Alexa Fluor 647 (in house). Purified antibodies as well as positive (Sino Biologicals 40150-D001) and negative control (human IgG1, in-house) antibodies were titrated in elution buffer (30 mM Formate, 75mM Tris pH 7) 3-fold, 8-point dilution in duplicates starting from 360 nM to reach a final range of concentrations from 90nM to 41pM. Positive and negative control antibodies were also diluted at 40 nM to give a final concentration of 10nM. 5 µL/well of titrated antibodies were plated into 384 well white HTRF plates (Greiner 784904-012). 5 µL/well of RBD protein diluted at 40nM in HTRF buffer (PBS (Gibco 14190250, 0.1% BSA (Sigma A7906), 0.53 M KF (Sigma 60238-100G-F)) were added to the wells to give a final concentration of 10nM. After a 30-min incubation at room temperature, 5µL/well of AF647-labelled human ACE2 diluted at 20nM in HTRF buffer to give a final concentration of 5 nM was added to the wells followed 30-min later, by the addition of 5 µL/well of an anti-Histidine Europium cryptate monoclonal antibody (Cisbio 61HISKLB) diluted at 5.3nM in HTRF buffer to the wells. Plates were left to incubate at room temperature for 2 hours

and then read on an Envision plate reader (Perkin Elmer) using 320 nm for excitation and detecting fluorescence at 665 and 620 nm.

Equation 4: Calculation of % of neutralisation for HTRF neutralisation assay:

$$\%\ \text{Neutralisation} = 100 - \frac{(\text{HTRF}\ Ratio_{sample} - \text{HTRF}\ Ratio_{minimum})}{(\text{HTRF}\ Ratio_{maximum} - \text{HTRF}\ Ratio_{minimum})}$$

Wells containing 5 nM of AF647 ACE2, 10nM of spike RBD and 10 nM of human IgG1 isotype control are referred to as maximum signal (HTRF $Ratio_{maximum}$) and wells containing 5 nM of AF647 ACE2, 10nM of spike RBD and 10 nM of positive control antibody (Sino Biological 40590-D001) as minimum signal (HTRF $Ratio_{minimum}$).

IC50 values for purified antibodies (summarised in Table E3-2) were determined using Prism 8 (GraphPad) whereby the calculated % neutralisation for each antibody dose response was analysed using the 'non-linear regression, dose response, log (inhibitor) vs. response – variable slope (four parameters) in-built analysis.

Materials & Methods: Secondary screening of purified clones for neutralisation of Spike Trimer:ACE2

Purified antibodies identified during primary screening were screened again for neutralisation of the binding between the full soluble spike trimer of SARS-CoV-2 virus and its ligand the human ACE2 protein, used here directly labelled with Alexa Fluor 647. Purified antibodies were titrated in elution buffer (30 mM Formate, 75mM Tris pH 7) 10-fold, 2-point dilution in duplicates starting from 800 nM to reach a final range of concentrations of 200 nM and 20 nM. Positive (Sino Biologicals 40150-D001) and negative control (human IgG1, in-house) antibodies were also titrated in elution buffer 5-fold, 8-point starting from 2400 nM to reach a final range of concentrations of 600 nM to 7.68 pM. 5 µL/well of titrated antibodies were plated into 384 well white HTRF plates (Greiner 784904-012). 5 µL/well of spike trimer diluted to 20 nM in HTRF buffer (PBS (Gibco 14190250, 0.1% BSA (Sigma A7906), 0.53 M KF (Sigma 60238-100G-F)) was added to the wells to give a final concentration of 5 nM. After a 30-min incubation at room temperature, 5µL/well of AF647-labelled human ACE2 diluted to 160 nM in HTRF buffer to give a final concentration of 40 nM was added to the wells followed 30-min later, by the addition of 5 µL/well of an anti-Histidine Europium cryptate monoclonal antibody (Cisbio 61HISKLB) diluted to 21.3 nM in HTRF buffer to the wells. Plates were left to incubate at room temperature for 4 hours and then read on an Envision plate reader (Perkin Elmer) using 320 nm for excitation and detecting fluorescence at 665 and 620 nm.

Equation 3: Calculation of % of Effect and % of neutralisation for neutralisation assay:

$$\%\ \text{Effect} = \frac{(\text{HTRF}\ Ratio_{sample} - \text{HTRF}\ Ratio_{minimum})}{(\text{HTRF}\ Ratio_{maximum} - \text{HTRF}\ Ratio_{minimum})} \times 100 = 100 - \%\ \text{Neutralisation}$$

Wells containing 40 nM of AF647 ACE2 and 5 nM of spike trimer are referred to as maximum signal (HTRF $Ratio_{maximum}$) and wells containing 40 nM of AF647 ACE2 alone as minimum signal (HTRF $Ratio_{minimum}$).

Antibodies identified to (i) neutralise the spike:ACE2 interaction and (iii) potentiate the spike:ACE2 interaction (Table E3-2) in the above assay were confirmed again in the spike trimer:ACE2 HTRF neutralisation assay, by performing titrations of purified antibodies in elution buffer (30 mM Formate, 75mM Tris pH 7) 3-fold, 8-point dilution in duplicates starting from 800 nM to reach a final range of concentrations from 200 nM to 91.4 pM. IC50 values for purified antibodies (summarised in Table E3-2) were calculated using Prism 8 (GraphPad) whereby the calculated % neutralisation for each antibody dose response was analysed using the 'non-linear regression, dose response, log (inhibitor) vs. response – variable slope (four parameters) in-built analysis.

EXAMPLE 4. PSEUDOVIRUS NEUTRALISATION ASSAY

The 255 trimer-binding antibodies which met the HTRF ΔF criteria described in Example 2, 4 further anti-S1 antibodies which met the HTRF ΔF criteria for S1 binding (but not for trimer binding) from Example 2, and 4 additional neutralising antibodies which were positive in the neutralising HTRF assay (see Example 3), provided a total of 263 candidate antibodies. We screened these further to evaluate their activity in a pseudovirus neutralisation assay using non-replication-competent pseudoviral particles with wild type SARS-CoV-2 spike trimer protein in the pseudoviral envelope.

Purified antibodies identified during primary HTRF screening as binding to SARS-Cov-2 spike trimer, were tested for neutralisation of the SARS-CoV-2 spike pseudovirus in a high throughput, 384-well format, cell-based viral neutralization assay developed at Kymab (adapted from Ferrera and Temperton, Methods Protoc. 2018 Mar; 1(1): 8). All trimer binders were initially tested as two-point titrations (100nM and 10nM) and all antibodies showing activity in this assay were run as full 8 point titrations, starting from 50nM. Antibody titrations were incubated with SARS-CoV-2 pseudovirus particles encoding firefly luciferase before adding to Lenti-X 293 cells transiently transfected with DNA plasmids encoding human recombinant ACE2 and TMPRSS2. TMPRSS2 is a protease which cleaves the spike protein into its S1 and S2 subunits to allow the virus to attach to ACE2 and enter the cell. When the genome of the pseudovirus particles integrates into the host cell genome after entry into cells, firefly luciferase expression is proportional to the number of cells that were transduced. After 48 hrs incubation, the cells are lysed and comparison between the luciferase signals detected in cells only, in cells transduced with pseudotype virus

only, and in cells transduced with pseudotype virus in the presence of antibodies, enables determination of neutralization activity against the pseudotype tested.

Clone	IC50 (pM)	IC50 Confidence interval (pM)	IC50 (ug/ml)	Fold change relative to SAD S35 antibody
IMPI-059	3.2	2.38 to 4.24	0.0005	1407.84
IMPI-017	9.0	6.64 to 12.1	0.0013	501.75
IMPI-004	34.0	25.7 to 44.8	0.0051	132.43
IMPI-055	36.2	21.5 to 57.8	0.0054	124.56
IMPI-029	43.3	28 to 66.31	0.0065	104.11
IMPI-056	82.2	48.4 to 137	0.0123	54.88
IMPI-047	87.2	38.5 to 186	0.0131	51.69
IMPI-054	94.5	42.5 to 194	0.0142	47.71
IMPI-021	164.2	95 to 274	0.0246	24.28
IMPI-002	343.9	113 to 895	0.0516	11.59
IMPI-052	507.7	254 to 942	0.0761	7.85
IMPI-005	530.5	308 to 889	0.0796	8.50
IMPI-042	1441.5	727 to 2690	0.2162	2.77
IMPI-013	2305.5	1070 to 4340	0.3458	1.73
IMPI-028	2921.4	1040 to 8370	0.4382	1.36
IMPI-060	6168.9	2440 to 15200	0.9253	0.73
IMPI-024	6846.2	2410 to 31700	1.0269	0.58
IMPI-063	9981.9	2330 to 270000	1.4973	0.35
IMPI-068	13091.4	2100 to 1540000	1.9637	0.26
IMPI-032	14862.7	6370 to 60500	2.2294	0.27
IMPI-037	30672.1	7300 to 1200000	4.6008	0.15
IMPI-027	31645.6	5320 to 3060000	4.7468	0.13
IMPI-038	54979.4	13400 to 3020000	8.2469	0.07
IMPI-067	72329.5	13600 to 1990000	10.849	0.05
IMPI-022	n/a	n/a	n/a	n/a
IMPI-006	n/a	n/a	n/a	n/a
IMPI-033	n/a	n/a	n/a	n/a
mAb A	34.404	24.1 to 48.3	0.0052	151.72
mAb B	291.3	125 to 649	0.0437	17.92
mAb C	227.4	159 to 322	0.0341	22.96
mAb D	n/a	n/a	n/a	n/a
4A8	960.4	444 to 2200	0.1441	5.44
SAD S35	5220	2770 to 9910	0.7830	1

Table E4-1: Potency of antibodies in pseudovirus neutralisation assay

Neutralisation potency of selected antibodies against SARS CoV2 pseudotype virus expressed as IC50 values in picomolar. Confidence intervals are indicated, and data expressed as fold change relative to SAD S35 antibody. n/a indicates antibody did not reach 50% neutralisation and IC50 cannot be calculated.

Materials and methods

Generation of SARS-CoV-2 recombinant pseudotype virus

Non-replicative pseudoparticles were generated using plasmids obtained from Dr Nigel Temperton, University of Kent (Hyseni et al Viruses 12(9):1011 2020). Plasmid pCAGGS-ACE2 contains the human ACE2 encoding sequence (GenBank: AB193259.1) in the expression vector pCAGGS. Plasmid pCAGGS-TMPRSS2 contains the human TMPRSS2 encoding sequence (NCBI Reference Sequence: NM_001135099.1) in the expression vector pCAGGS. Briefly, a total of $5x10^6$ Lenti-X 293T cells (Clontech, 632180) were seeded overnight in 10cm dishes in DMEM media containing 10% heat-inactivated fetal bovine serum (Gibco). The following day, the cells were transfected with 1μg of the spike expression plasmid, pcDNA 3.1-SARS2-spike, 1μg gag-pol (p8.9), and 1.5μg CSFLW (a DNA plasmid encoding lentivirus backbone with firefly luciferase as a reporter gene) using the lipofectamine Fugene (Promega cat#E2311) according to manufacturer's instructions. Supernatant containing pseudoparticles was collected at 48, 72 and 96h post transfection and sterile filtered using 0.45uM cellulose acetate filters. Supernatant were either aliquoted and stored at -80°C or concentrated further. If concentrating, supernatants were centrifuged at 6000g overnight and then the filtered supernatant was pooled in the desired volume and frozen at -80°C/liquid nitrogen. TCID50 (50% endpoint titre) of the viral pseudoparticles was then calculated using serial dilution according to Spearman-Karber method.

pCSFLW is the firefly luciferase reporter-expressing lentivirus-backbone plasmid, which produces the lentivirus modified RNA genome with a long terminal repeat, packaging signal, promoter firefly luciferase reporter gene. The pCSFLW is derived from pCSGW where the green fluorescent protein encoding gene is replaced by the firefly luciferase reporter gene.

Target cell line

Lenti-X HEK293T cells expressing ACE2 and TMPRRS2 were used as the target cell for the pseudotype neutralisation assay. Cells were prepared 24 hours in advance for the assay. A total of $2.5x10^6$ Lenti-X cells were seeded overnight in a T25 flask in DMEM media containing 10% heat-inactivated fetal bovine serum (Gibco). The following day the cells were transfected with 1μg pCAGGS-ACE2 plasmid and 75ng pCAGGS-TMPRSS2 plasmid using Fugene (Promega cat#E2311) transfection reagent according to manufacturer's instructions. After 24hrs, cells were removed by trypsinisation and used for the pseudovirus neutralisation assay.

8-point titration Pseudovirus neutralization assay

The purified antibodies were initially diluted 5-fold in DMEM media containing 10% heat-inactivated fetal bovine serum (Gibco) in a 96-well plate. Antibodies were then further titrated into a 384 well plate at 8-point dilution in triplicates starting from 50nM concentration to reach a final concentration of 0.64pM. Positive (Sino Biologicals 40150-D001 and Acro Biosystems SAD-S35 monoclonal antibodies) and negative (human IgG1 antibody, in house) control antibodies were also diluted at the same concentrations. 15µL/well of titrated antibodies were plated into 384 well plates. The following controls were used: cells only, cells and virus (no antibody), positive control antibody, negative control antibody. 15µL/well of diluted pseudotyped virus was then added (except to the cells only control) at a concentration of 50-100 $TCID_{50}$. The plate was centrifuged at 500rpm for 5 secs and the antibodies and pseudovirus left to incubate for 1 hour at 37°C (5% CO_2). Lenti-X 293T cells transiently expressing recombinant human ACE2 and TMPRSS2 were then added to each well to obtain a final cell number of $5x10^3$ cells per well. The plate was centrifuged at 500rpm for 5secs and left to incubate for 48 hours at 37°C (5% CO_2). 35ul of BrightGlo (Promega cat# E2610) was added to each well as the detection reagent. The plate was read on an Envision plate reader (Perkin Elmer) using X nm for excitation and detecting luminescence at x and x nm. The percent neutralization of each antibody was calculated based on the luciferase activity, normalised to cells only (100%) and virus/cells only (no antibody) as 0%.

EXAMPLE 5. SARS-COV-2 WILD-TYPE LIVE VIRUS NEUTRALIZATION ASSAY

The ability of antibodies to neutralize entry of wild type SARS-CoV-2 virus was assessed by neutralization assay on Vero-E6 cells. Antibody titrations were incubated with 100 TCID50 of SARS-CoV-2/England/IC19/2020 strain of virus (from Imperial College London) and incubated with Vero E6 cells for 5 days. Results for a selection of antibodies are presented in Table E5-1, expressed as the lowest dilution (as a pM concentration) that showed 100% virus neutralisation.

Clone	SARS CoV2 neutralisation (complete virus inhibition, pM)
IMPI-004	391
IMPI-029	781
IMPI-056	781
IMPI-047	781
IMPI-005	1563
IMPI-006	25000
IMPI-055	391
IMPI-054	391
IMPI-017	781
IMPI-059	1563
IMPI-037	25000
IMPI-060	12500
IMPI-013	50000
IMPI-028	12500

Table E5-1: Potency of antibodies in live virus neutralisation assay

Neutralisation potency of selected antibodies against wild type SARS CoV2 virus expressed as complete virus inhibition values in picomolar.

We found excellent correlation between performance of anti-RBD antibodies in the pseudovirus assay and live virus assay, indicating that the pseudovirus neutralisation assay is a good surrogate for measuring inhibition of viral entry to cells. Potent activity in this assay indicates these antibodies may neutralise the entry of the virus into cells in vivo.

Materials and methods

SARS-CoV-2/England/IC19/2020 was isolated on Caco2 cells from a clinical sample collected from a patient admitted to St. Mary's Hospital in London, United Kingdom. Antibodies were serially diluted (from a starting concentration of 0.5-1uM) in assay diluent consisting of DMEM (Gibco, Thermo Fisher Scientific) with 1% penicillin-streptomycin (Thermo Fisher Scientific), 0.3% BSA fraction V (Thermo Fisher Scientific) and 0.25 μg mL−1 TPCK trypsin (Worthington). Antibody dilutions were incubated with 100 TCID50 per well of SARS-CoV-2/England/IC19/2020 diluted in assay diluent for 1 h at RT and transferred to 96-well plates pre-seeded with Vero-E6 cells. A TCID50 (tissue culture infectious dose for 50% infection) is the amount of virus able to infect 50% of tissue culture cells in wells (i.e. 2/4, 4/8. 6/12) at a given dilution value of the virus). 100 TCID50s is therefore 100 times the TCID50. Antibody dilutions were performed in duplicate. Plates were incubated at 37 °C, 5% CO2 for 5 days before adding an equal volume of 2X crystal violet stain to wells for 1 h. Plates were washed, wells were scored for cytopathic effect and a 100% neutralization titre calculated as the highest antibody dilution at which full virus neutralization (no evidence of cell infection) occurred. As the starting antibody concentration is known, then the antibody dilution that resulted in complete virus inhibition is reported the concentration of antibody that results in 100% or complete virus neutralisation.

EXAMPLE 6. SURFACE PLASMON RESONANCE (SPR) DETERMINATION OF BINDING AFFINITY AND KINETICS

SPR runs (single cycle kinetics) were carried out using Biacore 8K (Cytiva) on a chip (CM4 from Cytiva) with anti hFc antibody immobilised on the chip (Human antibody capture kit; Cytiva). The chip is a dextran-coated layer of gold, and the anti-hFc is attached using amine coupling. Buffer HBS-P+ (Cytiva) was used as a running buffer. This buffer is at pH 7.4 and comprises 0.01 M HEPES (4-(2-hydroxyethyl)-1-piperazineethanesulfonic acid, 0.15 M NaCl and 0.05% v/v surfactant P20 in aqueous solution). Chip temperature was maintained at 25 degrees C.

IMPI antibodies were produced as human IgG1 by expression in CHO cells and were purified as previously described. Antibodies were captured at 1μg/ml. Receptor binding domain (Neil King, University of

Washington), S1 spike domain (Sino Biological),S1 spike domain D614G variant (Sino Biological), S2 spike domain (Sino Biological) or spike protein trimer (produced in house, either wild type as shown in Figure 2A or containing PP mutation as shown in Figure 2B, and in both cases containing C-terminal trimerisation domain) were injected at 0.39, 1.56, 6.25, 25 and 100 nM for 120 s at 30ul/min. Dissociation was monitored for 600 s. Chip surface was regenerated with 3M Magnesium Chloride. Reference and blank subtracted sensorgrams were fitted using 1:1 binding model (Biacore Insight Evaluation Software).

Clone	k_a (1/Ms)	k_d (1/s)	kD binding to RBD (M)
IMPI-004	2.01E+06	6.87E-04	3.41E-10
IMPI-029	8.08E+05	1.57E-04	1.95E-10
IMPI-056	5.84E+05	2.57E-04	4.40E-10
IMPI-047	3.68E+05	8.78E-04	2.38E-09
IMPI-005	2.30E+06	7.10E-03	3.09E-09
IMPI-006	9.30E+09	8.19E+00	8.80E-10
IMPI-055	2.75E+06	2.64E-03	9.59E-10
IMPI-054	5.64E+05	6.27E-04	1.11E-09
IMPI-017	5.22E+05	9.76E-04	1.87E-09
IMPI-059	6.59E+06	4.26E-03	6.46E-10
IMPI-037	2.50E+06	2.32E-02	9.28E-09
IMPI-060	4.69E+05	2.77E-02	5.92E-08
IMPI-013*			No binding
IMPI-028	5.34E+05	1.36E-02	2.56E-08
IMPI-027	6.48E+09	2.63E+01	4.06E-09
IMPI-033	2.20E+06	7.41E-03	3.37E-09
IMPI-021	5.48E+05	4.43E-03	8.08E-09
IMPI-032**			No binding
IMPI-038	4.20E+06	1.23E-02	2.92E-09
IMPI-022**			No binding
IMPI-024	2.12E+06	1.34E-03	6.33E-10
IMPI-002	1.82E+06	4.02E-02	2.21E-08
IMPI-052	1.93E+06	2.54E-02	1.32E-08
IMPI-042	5.36E+05	6.17E-04	1.15E-09
IMPI-063*			No binding
IMPI-067**			No binding
IMPI-068	1.85E+06	7.50E-02	4.05E-08
mAb A	4.89E+06	4.00E-03	8.19E-10
mAb B	3.65E+06	3.31E-02	9.06E-09
mAb C	2.93E+06	3.39E-02	1.16E-08

Table E6-1: Kinetic constants for isolated RBD measured by SPR

K_a Association rate constant

K_d Dissociation rate constant

K_D Equilibrium dissociation constant

*IMPI-013 and IMPI-063 are S2 binders so this lack of RBD binding is as expected.

**IMPI-022, IMPI-032 and IMPI-067 are trimer-only binders which did not exhibit detectable binding to the isolated RBD by SPR.

Comparing the SPR data for the ACE-2 competing anti-RBD antibodies with the corresponding data for these antibodies in the pseudovirus neutralisation assays, we see that the antibodies which showed the most potent (<100 pM) neutralisation in the pseudoviral neutralisation assay also showed high affinity (sub nM KD, i.e., <1E09 M) as determined by SPR. This includes IMPI-059, IMPI-004, IMPI-029, IMPI-056, IMPI-006 and IMPI-055.

A selection of the best antibodies from the ACE-2 competing anti-RBD group were further assessed by SPR for binding to the full S1 subunit, S2 subunit and to the spike protein trimer.

In summary we found higher affinity binding to RBD compared with reference antibodies, no significant binding to S2. The IMPI antibodies all bound a mutant of the S1 subunit of the spike protein, D614G. D614G is located in the S1 subunit downstream of the RBD. In the trimer protein this residue is positioned close to the interface with the S2 subunit. Despite its distance from the RBD, residue 614 does appear to be capable of influencing binding of at least some anti-RBD antibodies. Reference antibody mAb B, an ACE-2 competing anti-RBD antibody which binds to the side of the RBD domain, was observed to show a decrease in affinity to D614G. The D614G variant is a mutation that arose in the virus, observed near the beginning of the epidemic, which has gradually arisen to become the dominant variant of the virus. The significance of D614G is unclear but in some in vitro data suggests that this mutation makes the virus slightly more infectious, with more viral shedding, and since February 2020 this strain has become the most widespread form of the virus around the world. Therefore, binding to the spike protein comprising the D614G mutation is highly advantageous in antibodies intended for therapeutic use, as well as in diagnostics for detecting whether a sample is positive for SARS-CoV-2. Retention of binding to D614G strain by the IMPI antibodies is therefore encouraging for their use in the clinic.

Clone	Analyte	k_a (1/Ms)	k_d (1/s)	KD (M)
IMPI-013	Trimer (wt)	4.40E+04	2.95E-05	6.70E-10
IMPI-013	Stabilized trimer (PP mutation)	5.74E+04	1.72E-05	2.99E-10
IMPI-013	S2	9.33E+04	1.18E-05	1.26E-10
IMPI-013	S1	No binding		
IMPI-013	RBD	No binding		
IMPI-063	Trimer (wt)	4.11E+05	9.39E-04	2.29E-09
IMPI-063	S2	9.19E+09	7.77E+00	8.45E-10
IMPI-063	RBD	No binding		

Table E6-2. Kinetic constants measured by SPR for S2 binding neutralising antibodies

The S2 binder IMPI-013 was highly specific for binding to the S2 domain. High affinity binding to the trimer (both wild type sequence and stabilised PP mutant form) and to the isolated S2 domain was observed for IMPI-013. IMPI-013 did not show detectable binding to either the full isolated S1 subunit or to the isolated RBD. It is notable that IMPI-013 shows a very low dissociation rate. Impressively, observation of

the sensorgram showed that the majority of IMPI-013 remained associated with the S2 domain or trimer for a long time after binding, during a 10 minute dissociation period.

A second S2 binder, IMPI-063, also showed high specificity for binding to the S2 domain and bound to the wild type spike trimer protein, but showed no detectable binding to the isolated RBD domain. SPR was not performed for IMPI-063 with stabilised spike trimer or S1 domain.

EXAMPLE 7. EPITOPE BINNING

For competition studies, a sandwich method on the CM4 chip with anti hFc antibody immobilised on the chip was used (i.e., same chip as used in Example 6). First, purified CHO-expressed human IgG1 antibody at 1μg/mL was captured for 240 s at 10 μL/min. Chip surface was then blocked with 800nM irrelevant control human antibody for 180 s at 30 μL/min, to block remaining Fc binding sites on the chip surface. Receptor binding domain was injected at 200 nM for 120 s at 10 uL/min. A second antibody was then injected at 200 nM for 150 s at 10 μL/min. Reference cell without the first antibody captured was used for subtraction. Sensorgrams were analysed using Biacore Insight Evaluation Software.

A selection of anti-RBD ACE-2 competitor IMPI antibodies were tested for inter-competition. Antibody IMPI-037 did not compete with the other antibodies tested. This antibody also showed relatively low potency in functional assays as described above. This antibody thus represents one "bin". A second "bin" is represented by IMPI-006, as this competed with all tested antibodies except IMPI-004, IMPI-055 and IMPI-059. A third "bin" is represented by all other antibodies, which all competed with one another.

Antibody IMPI-037 is of particular interest in the present invention.

Figure 12 shows the results of epitope binning competition study.

EXAMPLE 8. SPR DETERMINATION OF COMPETITION WITH ACE2 FOR BINDING SPIKE PROTEIN RBD

The ability of antibodies to compete with human ACE-2 for binding to RBD was determined by SPR using the protocol described above in Example 7, using a human ACE2-Fc fusion protein in place of the test antibody.

	RBD:ACE-2 competition
IMPI-004	yes
IMPI-029	yes
IMPI-056	yes
IMPI-047	yes
IMPI-005	yes

IMPI-006	yes
IMPI-055	yes
IMPI-054	yes
IMPI-017	yes
IMPI-059	yes
IMPI-037	yes
IMPI-060	yes
IMPI-028	yes
IMPI-027	**no**
IMPI-033	**no**
IMPI-021	yes
IMPI-038	**no**
IMPI-024	**no**
IMPI-002	yes
IMPI-052	yes
IMPI-042	yes
IMPI-068	**no**
SAD S35	yes

Table E8-1. SPR results for competition of antibodies with ACE2 for binding to RBD.

In general, the preliminary results from the HTRF study (Example 3) were confirmed. IMPI-004, IMPI-029, IMPI-056, IMPI-047, IMPI-005, IMPI-055, IMPI-054, IMPI-017, IMPI-059, IMPI-037, IMPI-021, IMPI-002, IMPI-052 and IMPI-042 were all confirmed to compete with ACE2 in both types of assay. Additionally, antibody IMPI-028 exhibited competition with human ACE-2 for binding to the RBD as determined by SPR.

EXAMPLE 9. SARS-COV-2 WILD-TYPE VIRUS NEUTRALISATION ASSAY BY FOCI-REDUCTION ASSESSMENT

Antibodies IMPI-004, IMPI-013, IMPI-017 and IMPI-059 were compared against reference mAbs COV2-2196 and COV2-2130 (Zost, S. J. et al. Potently neutralizing and protective human antibodies against SARS-CoV-2. Nature 2020 doi.org/10.1038/s41586-020-2548-6) in a neutralisation assay with live SARS-CoV-2. These two control mAbs COV2-2196 and COV2-2130 are presently (October 2020) clinical candidate therapeutic antibodies.

IMPI-059 was the most potent antibody in this assay, with an IC50 of 26 pM.

IMPI-004 had an IC50 of 13 ng/ml (86 pM).

IMPI-017 had an IC50 of 49 ng/ml (326 pM).

The S2 subunit binder, IMPI-013, had an IC50 of 3400 pM (3.4nM).

Figure 13 presents these results with a log scale of IC50.

In general, the data obtained in this live virus assay (complete neutralisation or IC50 values) compared well with those from the pseudovirus neutralisation assay. Similar potent neutralisation profiles were observed, although absolute IC50 values differed as would be expected.

Based on the data presented herein overall, IMPI-059 represents the strongest candidate antibody based on its performance as a monoclonal composition. This is an anti-RBD, ACE2 neutralising antibody. IMPI-004 may represent the next strongest choice in this category, again based on its performance as a monoclonal composition. IMPI-017 is an anti-RBD, ACE2 neutralising antibody with high potency in the pseudovirus assay and good performance in the 100% neutralisation live virus assay, suggesting it is an interesting antibody. The S2 binder, IMPI-013, is also of particular interest in view of its different mode of binding and activity, coupled with high specificity and its neutralising ability. Combinations of these antibodies could be potent beyond additivity.

Materials & Methods:

For this foci (plaque) reduction neutralization assay, tests were performed using passage 4 of SARS-CoV-2 Victoria/01/2020 (Caly et al *Med. J. Aust.* **212**, 459–462 2020). A virus suspension was added at an appropriate concentration to yield approximately 100 foci in a final assay well in DMEM containing 1% FBS (D1). Virus suspension at appropriate concentrations in D1 (60 µl) was mixed with antibody (60 µl) to give a final concentration of 10 µg ml−1, 2.5 µg ml−1, 0.625 µg ml−1, 0.156 µg ml−1, 0.039 µg ml−1, 0.0097 µg ml−1, 0.0024 µg ml−1, 0.00061 µg ml−1, 0.00015 µg ml−1, 0.000038 µg ml−1, and 0.0000095 µg ml−1, and without antibody as the 100% control well in triplicate, in wells of a 24-well tissue culture plate, and incubated at room temperature for 30 min. Thereafter, 50 µl of antibody/virus complexes were added into Vero cells monolayer, in duplicate, in wells of a 96-well tissue culture plate incubated for 2 h at 37 °C before being overlain with 0.5 ml of D1 supplemented with carboxymethyl cellulose (1.5%). Cultures were incubated for a further 24 hours at 37 °C before foci were revealed by staining with anti-NP followed by anti-human IgG-HRP. NP (nucleoprotein) is a SARS-CoV2 specific protein that is present in infected cells and therefore a good antibody marker for detecting infected cells. TrueBlue peroxidase substrate was added and stained foci of infected cells were identified (stained foci of infected cells should be clearly visible in 5 min). The IC50 was calculated by assessing the number of foci plaques in the 100% control well and the reduction in foci numbers corresponding to each antibody concentration. The results can be analysed manually or by standard curve fitting methods allowing the interpolation or calculation of the antibody concentration required to cause a 50% decrease in the number of foci present in the wells (IC50).

EXAMPLE 10. CLASSIFICATION OF RBD BINDING ANTIBODIES INTO EPITOPE COMMUNITIES

In contrast to previous studies that classified mAbs using germline or structural information the RBD-reactive mAbs analysed here were instead distinguished by a competition profile created by high-throughput surface plasmon resonance (HT-SPR, Carterra). RBD-directed antibodies can be sorted into seven core "communities" (as described in Hastie et al., 2021), that are broadly defined by the competition profiles of each mAb to one another. Communities can be further divided into finer clusters and bins based on their discrete competition with other clusters and/or their ability to compete with ACE2. Twenty two IMPI antibodies were assigned to epitope communities (Table E10-1). Fifteen antibodies were assigned to epitope community RBD-2, six antibodies to RBD-5 and one to RBD-6 (IMPI-006) based on their epitope competition profiles.

To understand the position of each epitope community relative to the others negative stain electron microscopy was performed for representative antibodies across the different classes to determine the binding footprint on the Spike protein. The antibodies described here fall into three different classes. RBD-2 (community 2) mAbs compete with ACE2 and generally require the RBD to be in the "up" conformation for binding. The binding site for Group 2 mAbs is shifted from the centre of the ACE2 binding site towards the peak of the receptor binding motif. Most RBD-2 mAbs bind bivalently to a single spike trimer (in contrast to other mAbs that cross link multiple Spike trimers).

The epitope community is also characterised by the propensity of particular Spike mutations to escape antibody-mediated neutralization. Several new SARS-CoV-2 strains have continued to emerge from late 2020 and into 2021, some of which have been designed as variants of concern (VOC) by the World Health Organisation (WHO). The currently VOC strains listed by the WHO are: Alpha (B.1.1.7), Beta (B.1.351), Gamma (P.1), and Delta (B.1.617.2) strains. The Beta strain (also known as B.1.351 lineage) originated in South Africa and contains several mutations which may impact the binding of antibodies and vaccines. All antibodies were tested for neutralization using WA-1 strain and the VOC Beta/B.1.351. Most of the antibodies in RBD-2 were impacted by the mutations present in the Beta strain and showed a decrease in neutralizing potency to this strain (Table E10-1).

Antibodies in class 5 (RBD-5) bind to the outer face of the RBD and can do so in either the "up" or "down" configuration without steric hindrance. RBD-5 mAbs bind away from the receptor binding motif and toward the binding site for the S309 antibody and do not block ACE-2. RBD-5 mAbs that were neutralising often mediated cross-linking of Spike proteins (Hastie et el., 2021) which may provide a possible mechanism of neutralisation for these antibodies that do not block ACE-2. RBD-5 mAbs also showed broad resistance to nearly all virus mutations analysed in Hastie et al, 2021, indicating that these mAbs may be more useful clinically as they have wider breadth of response across different variant strains. Antibody IMPI-037 is particularly interesting as this retains potent neutralisation of the Beta variant strain.

Antibodies in the RBD-6 class (IMPI-006) block ACE2 and bind to the inner face of the RBD. They require two RBDs (the binding RBD and adjacent RBD) to be in the "up" configuration. Due to the binding location away from the receptor binding motif, RBD-6 antibodies are also resistant to mutations in VOCs (Hastie et al., 2021), which makes them attactive as broad therapeutics.

Classification of antibodies into different epitope communities is based on their epitope binding site and could be important for identifying mAbs that could be combined together as cocktails and identifies those mAbs that are most likely to be resistant to virus strain variation.

Clone ID	ACE2 blocking (%)	SPR binding to RBD (kD, M)	SPR binding to NTD (kD, M)	Live virus WA-1 strain IC50 (ng/mL)	Live virus B.1.351 strain IC50 (ng/mL)	RBD binding epitope community
IMPI-002	100	3.38E-08		17	15670	2
IMPI-004	99.88	8.42E-10	6.53E-07	0.32	nt	2
IMPI-005	100	2.49E-08		11	25000	2
IMPI-006	96.76	1.91E-07		nt	25000	6
IMPI-013	2.43			190	nt	nd (not RBD)
IMPI-017	97	2.25E-09	1.05E-06	10	nt	2
IMPI-021	99.62	1.47E-08		3	25000	2
IMPI-022			6.03E-07	18	1609	(not RBD)
IMPI-024	17.44	1.16E-09	6.60E-07	1001	1241	5
IMPI-027	46.24	6.31E-09	2.91E-06	1817	5398	5
IMPI-028	100	1.62E-07		66	7435	2
IMPI-029	97.91	4.46E-10	2.19E-07	2	25000	2
IMPI-032				7520	nt	nd (not RBD)
IMPI-033	31.24	3.02E-09	1.82E-06	3671	8896	5
IMPI-037	100	2.23E-08		12	0.38	5
IMPI-038	32.21	8.26E-10	4.75E-07	223	5894	5
IMPI-042	99.26	1.87E-09	6.62E-07	12	25000	2
IMPI-047	98.22	6.65E-09	2.32E-06	12	25000	2
IMPI-052	100	2.41E-08		10	3695	2
IMPI-054	99.42	2.06E-09	6.02E-07	15	25000	2
IMPI-055	100	1.85E-09	1.36E-06	0.32	25000	2
IMPI-056	99.55	1.59E-09	6.82E-07	3	25000	2
IMPI-059	100	2.30E-09	1.65E-06	0.32	3935	2
IMPI-060	100	1.41E-07		171	nt	2
IMPI-063	4.46			10399	nt	nd (not RBD)
IMPI-067			8.45E-08	2	25000	nd (not RBD)
IMPI-068	33.87	9.47E-09	2.57E-06	2541	4507	5

Table E10-1: Assay data used to categorise antibodies into different communities

K_D: Equilibrium dissociation constant.

nt: not tested. For the epitope community determination these antibodies (IMPI-067, IMPI-063, IMPI-022, IMPI-032, IMPI-013) were not RBD binding and could not be assigned to the RBD binding bins.

Materials and methods

High-throughput SPR binding kinetics

The binding kinetics measurements were performed on the Carterra LSA platform using HC30M sensor chips (Carterra) at 25 C. Two microfluidic modules, a 96-channel print-head (96PH) and a single flow cell (SFC), were used to deliver liquids onto the sensor chip. In each assay, a single analyte was titrated against multiple CoVIC antibody constructs. Full details are described in Hastie et al., 2021.

Goat anti-Human IgG Fc secondary antibody was first immobilized onto the chip through amine-coupling. Briefly, the chip was first activated by 100 mM N-Hydroxysuccinimide (NHS) and 400mM 1-Ethyl-3-(3-dimethylaminopropyl) carbodiimide hydrochloride (EDC) (GE healthcare, mixed 1:1:1 with 0.1 M MES buffer at pH 5.5) for 600 seconds, followed by immobilization of anti-Hu IgG Fc (in 10mM Sodium Acetate at pH .5) at 50µg/ml for 900 seconds. Unreactive esters were quenched with a 600-second injection of 1 M ethanolamine-HCl at pH 8.5. The chip was then exposed to double pulses (30 seconds per pulse) of 10 mM Glycine at pH 2.0. The IgG antibodies were then captured by the anti-Hu IgG Fc at 5µg/ml for 600 seconds using the 96PH, with 1X HBSTE buffer (10 mM HEPES pH 7.4, 150mM NaCl, 3mM EDTA and 0.01% Tween-20) as running buffer and antibody diluent. Each antibody construct at a given diluted concentration was immobilized onto 8 separate spots of the same chip, enabling replicating binding kinetics measurements.

A two-fold dilution series of the antigen was prepared in 1x HBSTE buffer. The top concentration for RBD, NTD and D614-HexaPro was respectively 40µg/ml (1.11µM), 320 µg/ml (5.71µM) and 100µg/ml (0.181µM). A single antigen was used in each assay. The antigen at different concentrations was then injected using SFC onto the chip surface from the lowest to the highest concentration without regeneration, including several injections of buffer before the lowest non-zero concentration for signal stabilization. For each concentration, the data collection time-length for 42 baseline, association and dissociation were 120 seconds, 300 seconds and 900 seconds, respectively. For all assays the running buffer for titration was 1X HBSTE. The titration data collected were first pre-processed in the NextGenKIT (Carterra) software, including reference subtraction, buffer subtraction and data smoothing. The data were then exported and analyzed using the TitrationAnalysis tool. The RBD, NTD and D614-HexaPro binding time courses for each antibody construct immobilized on different spots were fitted to a 1:1 Langmuir model to derive ka, kd and KD values.

High-throughput SPR epitope binning

Epitope binning was performed with a classical sandwich assay format on a Carterra LSA®HT-SPR instrument equipped with a CMDP sensor chip at 25°C and in a HBSTE-BSA running buffer (10 mM HEPES pH 7.4, 150 mM NaCl, 3 mM EDTA, 0.05% Tween-20, supplemented with 0.5 mg/ml BSA). Two microfluidic modules, a 96-channel print-head (96PH) and a single flow cell (SFC), were used to deliver

samples onto the sensor chip. Surface preparation was performed with 25 mM MES pH 5.5 with 0.05% Tween-20 as a running buffer. The chip was activated with a freshly prepared solution of 130 mM 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide (EDC) + 33 mM N-hydroxysulfosuccinimide (Sulfo-NHS) in 0.1 M MES pH 5.5 using the SFC. Antibodies were immobilized using the 96PH for 10 minutes at 10 µg/mL diluted into 10 mM sodium acetate (pH 4.25). Unreactive esters were quenched with a 7-minute injection of 1 M ethanolamine-HCl (pH 8.5) using the SFC. The binning analysis was performed over this array with the HBSTE-BSA buffer as the running buffer and sample diluent. The RBD antigen was injected in each cycle for 4 minutes at 50 nM (1.8 µg/mL) and followed immediately by a 4-minute injection of the analyte antibody at 30 µg/mL (200 nM for IgG constructs). The surface was regenerated each cycle with double pulses (17 seconds per pulse) of 10 mM Glycine pH 2.0. Data was processed and analyzed with Epitope®768 software (Carterra).

Negative-stain EM to define antibody binding area

Full details are described in Hastie et al., 2021. Fabs were obtained for EM study using either IdeS (Promega) or papain (Sigma), and purified by ion exchange chromatography using a MonoQ column (GE). Fab (70 µg) or IgG (140 µg); were incubated with 140 µg purified HexaPro. D614G Spike ectodomain in TBS buffer overnight at room temperature. The final concentration for Spike or IgG in incubation solution was ~0.25 µg/µL. Spike-antibody complexes were purified by SEC with a Superdex 6 Increase 10/300 column (GE) and verified by SDS-PAGE. For each complex, 4 µL of sample (~0.02 mg/mL) was applied to a CF400-Cu negative-stain grid (Electron Microscopy Sciences), and stained with 0.75% uranyl formate (Electron Microscopy Sciences). Between 50 and 400 micrographs were collected for each sample using a Titan Halo electron microscope (Thermo Fisher) and a Falcon 3EC direct electron detector at the magnification of 58,000X. EM-map reconstruction was performed using CryoSPARC and the maps were aligned and displayed using Chimera X. Specifically, models having different RBD status (One RBD up: PDB:7A94; Two RBDs up: PDB:7DCX; and Three RBDs up: PDB:7K4N), were fitted into NS-EM maps for antibody binding area identification.

ACE2- blocking assay

ACE2 blocking was measured using Biolayer Interferometry (BLI) on an Octet HTX instrument (Sartorius) by covalently immobilizing SARS-CoV-2 RBD and Human Serum Albumin (HSA) (reference to subtract response due to non-specific interactions) onto Amine Reactive 2nd Generation (AR2G) biosensors (Sartorius). The data was analyzed using Data Analysis HT 12.0 (CFR11) software (Sartorius). The biosensors were activated with a freshly prepared solution of EDC (1-Ethyl-3-[3-dimethylaminopropyl] carbodiimide hydrochloride) and s-NHS (N-hydroxysulfosuccinimide) in molecular biology grade water. RBD and HAS were diluted in 10 mM sodium acetate pH 5 buffer and immobilized onto 96 separate sensors to a loading density threshold not to exceed $\Delta\lambda = 0.7$ nm.

Unreactive NHS esters on the surface of the sensors were quenched with 1M ethanolamine pH 8.5. Antibody and ACE2 binding were performed sequentially by dipping the RBD and HSA loaded biosensors into a well plate containing antibodies at 20 µg/ml followed by a solution of recombinant ACE2 (human

IgGFc fused at 27.5 µg/ml for 5 minutes each. The diluent used for preparing antibodies and ACE2 solution was 1x kinetics buffer (Sartorius).

ACE2 binding to immobilized RBD was monitored in real time in the absence and presence of antibodies pre-bound to RBD. The CoVIC reference mAbs CC12.3 and CC12.14, and control SARS-CoV-2 Spike Neutralizing mAb (Sino Biological) were included in each experiment as a positive control. The percent ACE2 blocking was calculated as the percentage of decrease in ACE2 binding due to antibodies pre-bound to RBD compared with the ACE2 binding to RBD untreated with any antibody (1x kinetics buffer in place of antibody). The average of ACE2 binding to antibody untreated RBD was set as 0% blocking. The ACE2 blocking percentages shown for the CoVIC antibodies are the mean of triplicate measurements. For full details see Hastie et al., 2021.

Live virus neutralisation of variant strains

Neutralization of authentic SARS-CoV-2 carrying D614G (WA-1 strain) and B.1.351 by mAbs was assessed using a method similar to that described in Hou *et al.* 2020. Under BSL-3 containment, serially-diluted mAbs at 8 concentrations are incubated with 800 PFU/well nLuc virus for one hour at 5% CO2 and 37 °C. After incubation, the virus/antibody mixtures are added in duplicate to black-walled 96-well plates containing Vero E6/C1008 cells (2 x 104 cells/well). Each plate also contains virus-only control wells. The plates are incubated for 24 hr at 37 °C, 5% CO2 and the cells are lysed before measurement of luciferase activity with the Nano-Glo Luciferase Assay System (Promega) according to the manufacturer's instructions. Neutralization activity is expressed as the concentration at which the observed relative light units (RLU) are reduced by 50% relative to virus-only control wells.

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EXAMPLE 11: *IN VIVO* PROTECTION IN K18 HACE2 TRANSGENIC MOUSE MODEL

A subset of IMPI antibodies were tested for in vivo activity against SARS-CoV-2 live virus using the K18 transgenic mouse model. These mice are engineered to express the entry receptor for SARS-CoV-2, human angiotensin converting enzyme 2 (hACE2), to make them susceptible to SARS-CoV-2 infection. The virus strain used for infection is SARS-CoV-2 USA-WA1/2020, which was isolated in the USA in January 2020 and serves as the SARS-CoV-2 reference strain for the United States.

Antibodies were administered 1 day prior to infection in groups of 10 mice per antibody. Results were expressed as the percentage of mice that survived at 10 days post infection. Control mice (injected with PBS) showed 0% survival.

Twelve antibodies showed activity in this assay (Table E11-1) with survival ranging from 10% to 100%. Three antibodies showed particularly potent in vivo activity: IMPI-055 and IMPI-004 provided 80% protection and IMPI-037 showed 100% protection at 1.5mg/ml. IMPI-037 is of special interest as this antibody shows strong neutralising activity in vivo and as described in Example 10 it is resistant to mutations present in the Beta virus strain. IMPI-037 is in epitope community RBD-5 (see Example 10) and other antibodies in this group may also have similar properties.

Clone	In vivo K18 (0.5 mg/mL) % survival	In vivo K18 (1.5 mg/mL) % survival
IMPI-004	10	80
IMPI-017	nt	30
IMPI-021	nt	20
IMPI-022	60	nt
IMPI-029	50	nt
IMPI-037	nt	100
IMPI-054	10	nt
IMPI-055	80	nt
IMPI-056	20	nt
IMPI-059	10	nt
IMPI-063	20	nt
IMPI-067	20	40

nt: not tested

Table E11-1: *In vivo* activity of antibodies against SARS-CoV-2 in K18 hACE2 transgenic mouse model

Materials and methods

Experiments were performed at Texas Biomedical Research Institute, as described in Oladunni et al., 2020. Briefly, SARS-CoV-2, USA-WA1/2020 strain (Gen Bank: MN985325.1), was obtained from BEI Resources (NR-52281) and virus stocks prepared in Vero E6 cells (ATCC, CRL-1586). Virus stocks were titrated by standard plaque assays (PFU/ml) in Vero E6 cells and validated by using next generation sequencing. K18 human angiotensin converting enzyme 2 (hACE2) transgenic mice, B6.Cg-Tg(K18-ACE2)2Prlmn/J (Stock No: 034860, K18 hACE2) were purchased from The Jackson Laboratory (Bar Harbor, ME).

K18 hACE2 transgenic and WT C57BL/6 mice were either mock (PBS)-infected (controls) or infected intranasally (i.n.) with 1×10^5 PFU of SARS-CoV-2 in a final volume of 50 µl following isoflurane sedation. After viral infection, mice were monitored daily for morbidity (body weight) and mortality (survival). Mice showing >25% loss of their initial body weight were defined as reaching experimental end-point and humanely killed.

Antibodies were administered 1 day prior to infection using doses of 0.5mg/mL or 1.5mg/mL using groups of 10 mice per antibody and results presented as the percentage of 10 animals that survived at 10 days post-infection.

Reference:

Oladunni FS, Park JG, Pino PA, Gonzalez O, Akhter A, Allué-Guardia A, Olmo-Fontánez A, Gautam S, Garcia-Vilanova A, Ye C, Chiem K, Headley C, Dwivedi V, Parodi LM, Alfson KJ, Staples HM, Schami A, Garcia JI, Whigham A, Platt RN 2nd, Gazi M, Martinez J, Chuba C, Earley S, Rodriguez OH, Mdaki SD, Kavelish KN, Escalona R, Hallam CRA, Christie C, Patterson JL, Anderson TJC, Carrion R Jr, Dick EJ Jr, Hall-Ursone S, Schlesinger LS, Alvarez X, Kaushal D, Giavedoni LD, Turner J, Martinez-Sobrido L, Torrelles JB. Lethality of SARS-CoV-2 infection in K18 human angiotensin-converting enzyme 2 transgenic mice. Nat Commun. 2020 Nov 30;11(1):6122. doi: 10.1038/s41467-020-19891-7. PMID: 33257679; PMCID: PMC7705712.

EXAMPLE 12: MOUSE IMMUNISATIONS, SAMPLE COLLECTION AND SERUM TITER

In an additional study, Kymab mice, which have transgenic immunoglobulin loci containing human heavy and light chain gene segments, were immunized with SARS-CoV-2 spike in a variety of immunisation regimens and immunogenic formats, and antigen-specific B cells were selected from the immunised mice. Single B cells from spleen and lymph node samples were sorted using antigen specific probes.

Immunogenic formats included (i) nucleic acid encoding full length spike or (ii) nucleic acid encoding full length spike protein with furin cleavage site mutation (GSAS substitution at residue 682-685). Sorting probes used were soluble trimeric spike extracellular domain protein comprising furin cleavage site mutation, double proline mutation and C-terminal T4 fibritin (foldon) trimerisation motif and full length trimeric spike protein presented with furin cleavage site mutation and double proline mutation on green fluorescent protein (GFP) virus like particles (VLPs) generated from host cells.

In a first study, 9,430 antigen specific B-cells were recovered after B cell sorting from immunised mice. From 303 of these B-cells, complete antibody heavy and light chain encoding nucleic acids were recovered and expressed as fully human IgG1 antibodies in mammalian host cells to be taken forward for screening.

In a second study, 10,332 antigen specific B cells were recovered after B cell sorting from immunised mice, and from 299 of these B-cells, complete antibody heavy and light chain encoding nucleic acids were recovered and expressed as fully human IgG1 antibodies in mammalian host cells to be taken forward for screening.

All antibodies taken forward for screening were expressed as fully human IgG1.

Antigen/immunogen preparation

To generate purified proteins for use in sorting of B cells, DNA sequences were generated encoding ECD of trimeric spike protein containing furin cleavage site mutation (GSAS substitution at residue 682-685) and stabilising double proline (PP) mutations (K986 and V987). Coding sequence was fused with N-terminal leader sequence and C-terminal T4 fibritin (foldon) trimerization motif and His tag, codon optimised for mammalian expression and expressed in Expi293F cells. Protein was sequentially purified by a HisTrap HP column. Purified protein was analyzed by binding assays, and then aliquoted and stored at 4 °C.

Various antigen expressing stable cell lines were generated for different purposes. Antigen DNA sequence was cloned into an expression vector under the control of the CMV promoter flanked by 3' and 5' piggyBac specific terminal repeat sequences, which facilitated stable integration into the cell genome. The expression vector contained a puromycin selection cassette to facilitate stable cell line generation. Constructs were transfected into Expi293F cell line or HEK293T cell line, cultured under puromycin selection for 2 weeks and spike expression was validated by using flow cytometry to check for antigen surface expression using monoclonal antibodies. VLPs were generated from Expi293F cells stably co-expressing PP stabilized furin mutated trimeric spike with retroviral Group Antigens (gag) proteins and used for sorting specific B cells.

Cell line	Expressing antigen
293T – WT spike	Full length spike protein
293T – WT spike, RFP	Full length spike protein, red fluorescence protein

293T – spike FM, 18d	Full length spike protein with furin cleavage site mutation and C-terminal retention sequence 18 amino acid deletion
293T – hACE2, TMPRSS2	Full length human ACE2, full length human TMPRSS2
293T – hACE2, TMPRSS2, EGFP	Full length human ACE2, full length human TMPRSS2, enhanced green fluorescence protein
Expi293F – spike FM, 2P, 18d	Full length spike protein with furin cleavage site mutation, double proline mutation and C-terminal retention sequence 18 amino acid deletion
Expi293F – spike ECD	Extracellular domain of spike protein end at Q1208 with furin cleavage site mutation and double proline mutation, followed by T4 fibritin (foldon) trimerization motif and 6xHis tag
Expi293F – hACE2 ECD	Extracellular domain of human ACE2 end at S740 and followed by 6xHis tag

Table _E12-1: Stable cell lines and expressing antigen

EXAMPLE 13: CELL BINDING ASSAY (PRIMARY SCREEN)

The binding of the recovered antibodies (see Example 12) to the spike protein expressing cells was detected by flow cytometric analysis. All antibodies were tested in a single point assay at 5 ug/mL for their binding to the spike protein. Reference mAb A was included as the positive control for the staining in each assay. The binding of antibodies to two version of spike-expressing cell-lines, furin mutated spike (Expi293F–spike FM, 2P, 18d) and WT spike, were tested separately.

The 602 selected antibodies from Example 12 were screened. Among them, 508 were positive binders to furin mutated spike (Expi293F–spike FM, 2P, 18d) and 499 showed positive binding to WT spike. Criteria for passing this cell-based assay was that the geometric mean of the tested antibodies over the threshold set by the average geometric mean of isotype control plus three times of standard deviation.

Materials and Methods

Supernatants collected from suspension Expi293F cells transfected with expression vectors encoding human IgG1 heavy and light chains were screened for binding to spike protein expressed on the cell surface. Two versions of spike expressing cell-lines, mutated spike and WT spike, were used in this screening. Twenty thousand cells from either cell-line resuspended in FACS buffer (PBS (Corning 21-040-CMR), 1% BSA (Sigma SI-A7906-100G), 2mM EDTA (J.T. Baker 4040-01)) were plated into each well in 96-well V bottom plates (Greiner 651901) and incubated with 50 uL of collected supernatants normalized to 5 ug/mL or reference mAb A with 10 points of 3-fold dilutions starting from 15 ug/ml on ice for one hour. Before detection by secondary antibody, samples were washed once with FACS buffer to remove extra or non-binding antibodies. The anti-hIgG-AF647 (Jackson ImmunoResearch 109-606-170) was used as the detection antibody at the final concentration of 2 ug/mL. Samples were incubated with detection antibody on ice for additional 30 minutes in the dark followed by washing once with FACS buffer. Cells were then fixed with 2% paraformaldehyde (PBS (Corning 21-040-CMR), 4% paraformaldehyde (Alfa Aesar J61899)

for 15 mins at room temperature. Samples were resuspended in 2mM EDTA PBS buffer (PBS (Corning 21-040-CMR), EDTA (J.T.Baker 4040-01) prior to analysis on Cytoflex (Beckman Coulter). The intensity of AF647 fluorochrome was acquired and calculated into the geometric mean of the fluorescence for downstream analysis.

EXAMPLE 14: ANTIBODY BINDING BY HTRF

HTRF assay was used for primary screening to establish binding of the recovered antibodies (see Example 12) to purified spike proteins. All antibodies were screened in an initial single point assay at 0.5 μg/mL for binding to the RBD domain (Acro Biosystems SPD-C52H3), the NTD subunit (Acro Biosystems S1D-C52H6), and the S2 subunit (Acro Biosystems S2N-C52H5) of SARS-CoV-2 virus.

Criteria for passing the HTRF primary screen were that the antibody bound RBD domain, the NTD subunit, and the S2 subunit of SARS-CoV-2 virus with a ΔF value set out in Table E14-1.

	Screening batch 1: 303 clones		**Screening batch 2: 299 clones**	
Assay	**Selection criteria**	**No. hits**	**Selection criteria**	**No. hits**
RBD	Delta F > 11	120	Delta F > 9.5	69
NTD	Delta F > 7	73	Delta F > 5	93
S2	Delta F > 30	54	Delta F > 4.2	129

Table E14-1. Summary of number of clones meeting primary screening selection criteria for binding to RBD, NTD, and S2 subunits. Table details number of antibodies screened, number of positive hits, and associated cut-off values.

Based on these data, we characterised clones which met the HTRF binding criteria for RBD, NTD, or S2 subunits. Binding data (presented as delta F) for a selection of these antibody clones are shown in Table E14-2.

Clone	**Binding RBD**	**Binding NTD**	**Binding S2**
YANG-1112	1790.31	2.23	6.22
YANG-1301	24.45	560.30	11.65
YANG-1302	-2.72	1255.41	28.18
YANG-1401	1124.53	137.53	6.56
YANG-2107	1853.07	2.40	-2.19
YANG-2108	2124.30	-5.78	-7.69
YANG-2111	858.86	-0.02	-2.48
YANG-2203	6.05	3.20	2247.39

YANG-2204	-3.24	-6.44	1988.25
YANG-2205	-0.88	-2.91	1952.91
YANG-2206	-4.93	-3.96	2117.65
YANG-2207	7.00	2.37	1631.78
YANG-2208	5.09	-0.40	2124.64
YANG-2301	-4.07	715.56	-1.50
YANG-2302	-3.86	913.80	6.63
YANG-2303	0.38	1229.03	-1.33

Table E14-2: HTRF binding to SARS-CoV-2 spike protein subunits. HTRF delta F values for binding of representative antibody clones to the RBD domain, NTD, and S2 subunits of SARS-CoV-2 virus.

Materials and Methods

Supernatants collected from suspension Expi293 cells transfected with expression vectors encoding human IgG1 heavy and light chains were screened for binding to the RBD domain (Acro Biosystems SPD-C52H3), the NTD subunit (Acro Biosystems S1D-C52H6), and the S2 subunit (Acro Biosystems S2N-C52H5) of SARS-CoV-2 virus. All purchased proteins were in-house labelled with AF647 for HTRF assay. 5µL/well of supernatants normalised to 0.5µg/mL were plated into 384 well white HTRF plates (Greiner 784904-012). 5µL/well of positive control (In-house produced mAb A for RBD binding assay; Leinco Technologies anti-SARS-COV-2 Spike NTD LT2000 for NTD binding assay; IMPI-013 for S2 binding assay) and negative control (non-binding human IgG1, in-house) antibodies were added to the required wells in Expi293 expression medium (Gibco A1435-01) to give the final concentration of 1nM. 5µL/well of RBD diluted at 80nM, NTD at 80nM, or S2 at 80nM in HTRF buffer (PBS (Corning, 21-040-CMR, 0.1% BSA (Sigma SI-A7906), 0.53M KF (Sigma, UR-42216-500G) were added on top on the supernatants to give final concentrations of 20nM. 10 µL/well of polyclonal Ab anti-human IgG-Eu Cyrptate (Cisbio 61HFCKLB) diluted at 0.25 ug/mL in HTRF buffer were added to wells. Plates were left at room temperature and incubated in the dark for 3 hours for RBD, NTD, and S2 binding assay. Plates were then read on a ClarioStar (BMG Labtech) using 330nm excitation and detecting emission at 620 and 670 nm.

EXAMPLE 15: HTRF RBD:ACE2 NEUTRALIZATION ASSAYS

An HTRF assay was designed to screen for capacity of the recovered antibodies (see Example 12) to neutralize the binding between the RBD domain of the spike protein of SARS-CoV-2 virus and its ligand the human ACE2 protein. All antibodies were screened as supernatants at a single concentration of 10 ug/mL.

The 602 selected antibodies from Example 12 were screened and 51 clones showed neutralisation activity, based on a criterion of < 50% effect in this assay.

Materials and Methods

Supernatants collected from suspension Expi293F transfected with expression vectors encoding human IgG1 heavy and light chains as above were screened for neutralising the binding between the RBD domain (Acro Biosystems SPD-C52H3) of the spike protein of SARS-CoV-2 virus and its ligand the human ACE2 protein, used here directly labelled with Alexa Fluor 647. 5µL/well of supernatants normalised to 10 µg/mL were plated into 384 well white HTRF plates (Greiner 784904-012). 5µL/well of positive (mAB A) and negative control (non-binding human IgG1, in-house) antibodies were added to the required wells in Expi293 expression medium (Gibco A1435-01). Positive and negative control antibodies were added at 40nM to give a final concentration of 10nM. 5µL/well of RBD protein diluted at 40nM in HTRF buffer (PBS (Corning, 21-040-CMR, 0.1% BSA (Sigma SI-A7906), 0.53M KF (Sigma, UR-42216-500G)) were added on top on the supernatants to give a final concentration of 10nM. After a 30-min incubation at room temperature, 5µL/well of AF647-labelled human ACE2 diluted at 20nM in HTRF buffer to give a final concentration of 5 nM was added to the wells followed 1-hour later, by the addition of 5 µL/well of an anti-Histidine europium cryptate monoclonal antibody (Cisbio 61HISKLB) diluted at 5.3nM in HTRF buffer to the wells. Plates were left to incubate at room temperature for 2 hours and then read on a ClarioStar (BMG Labtech) using 330nm excitation and detecting emission at 620 and 670 nm.

Calculation of % of Effect for HTRF neutralisation assay:

$$\%\ \text{Effect} = \frac{(\text{HTRF}\ Ratio_{sample} - \text{HTRF}\ Ratio_{minimum})}{(\text{HTRF}\ Ratio_{maximum} - \text{HTRF}\ Ratio_{minimum})} \times 100$$

Wells containing 5nM of AF647 ACE2, 10nM of spike RBD and 10nM of human IgG1 isotype control are referred to as maximum signal (HTRF Ratiomaximum) and wells containing 5nM of AF647 ACE2, 10nM of spike RBD and 10nM of positive control antibody (Sino Biological 40590-D001) as minimum signal (HTRF Ratiominimum).

EXAMPLE 16: PSEUDOVIRUS NEUTRALISATION ASSAY

We screened all recovered antibodies (see Example 12) to evaluate their activity in pseudovirus neutralization assay using non-replication-competent pseudoviral particles with SARS-CoV-2 spike protein bearing furin mutation and truncation in retention sequence presented in the pseudoviral envelope.

The 602 selected antibodies from Example 12 were initially tested as two-point titrations (7nM and 0.7nM) in the pseudovirus neutralization assay. All tested antibodies were classified into 3 groups, RBD, NTD, and S2 binders, based on the results from HTRF subunit binding assay. In each category, antibodies were ranked by the activity of pseudovirus neutralization assay. The top 10 percent of the antibodies in each category, which in total is 59 antibodies out of 602 recovered antibodies, were selected and taken into a secondary screening phase.

Materials and Methods

Generation of SARS-CoV-2 recombinant pseudotype virus

Non-replicative pseudoparticles were generated using plasmids obtained from RNAi core, Academia Sinica, Taiwan. In brief, 293T stably expressing spike with furin mutation and truncation at the retention sequence, was seeded overnight in a 175T flask for reaching to 80% confluency. The following day, the cells were transfected with 55µg package plasmid (gag-pol), and 55µg pLAS2w.FLuc.Ppuro (a DNA plasmid encoding firefly luciferase as a reporter gene) using the Lipo3000 (Gibco L300-015) according to manufacturer's instructions. After overnight incubation, the culture medium was removed and replenished with DMEM medium containing 1% BSA to enhance the yield of virus. The virus containing supernatant, collected at 24 and 48 hours post transfection, was sterile filtered using 0.45uM filter. The collected virus was aliquoted and stored at -80°C for further usage.

Two-point Pseudovirus Neutralization Assay in primary screen

Antibodies purified from supernatant were tested for neutralisation of the SARS-CoV-2 spike pseudovirus in a 96-well format, cell-based viral neutralization assay. All antibodies were initially tested as two-point titrations (7nM and 0.7nM of final concentration). Antibody titrations were incubated with SARS-CoV-2 pseudovirus particles encoding firefly luciferase at 37°C with 5% CO2 for 1 hour before adding 50 thousand cells of 293T stable cell-line expressing human recombinant ACE2 and TMPRSS2. TMPRSS2 is a protease which cleaves the spike protein into its S1 and S2 subunits to allow the virus to attach to ACE2 and enter the cell. When the genome of the pseudovirus particles integrates into the host cell genome after entry into cells, firefly luciferase expression is proportional to the number of cells that were transduced. After 48 hrs incubation, the cells are lysed and comparison between the luciferase signals detected in cells only, in cells transduced with pseudotype virus only, and in cells transduced with pseudotype virus in the presence of antibodies, enables determination of neutralization activity against the pseudotype tested.

EXAMPLE 17*:* EPITOPE BINNING

For a competition study, a premix assay with anti-hIgG Fc capture (AHC) biosensor was used and performed on Octet (Fortebio). First, 10 ug/mL of purified spike ECD was mixed with 50 ug/mL of monoclonal antibody (Ab2) at room temperature for 30 minute to form complex. Purified monoclonal antibody (Ab1) at 15 ug/mL was captured by AHC biosensor for 400 s to saturated. AHC sensor was then blocked with 15 ug/mL irrelevant control hIgG antibody for 200 s. Ag-Ab2 complex was added to Ab1 loaded biosensor to measure binding for 200s. Results were analyzed with Data Analysis HT 10.0 software.

The 59 antibodies met the selection criteria described in Example 17 were analysed for competition with reference antibodies. Among them, there were 32 anti-RBD antibodies, 12 anti-NTD antibodies, and 15 anti-S2 antibodies. Reference antibodies used for competition were IMPI-059 and mAb B for RBD, mAb E for NTD, and IMP-013 for S2.

The tested anti-RBD antibodies could be grouped into IMPI-059-like, mAb B-like, cross bin and unique antibodies. The anti-NTD and anti-S2 antibodies did not compete with the reference antibodies mAb E and IMPI-013 respectively.

	IMPI-059-like	mAb B-like	Cross bin	Unique antibody
No. of antibodies	17	3	9	3

Table E17-1. Anti-RBD antibodies grouped as competing binding against reference antibodies.

EXAMPLE 18: 11-point titration Pseudovirus Neutralization Assay in secondary screen

Antibodies were tested in the pseudovirus neutralization assay with 11-point titrations. The purified antibodies were initially diluted 3-fold in DMEM media containing 10% heat-inactivated fetal bovine serum (Gibco) in a 96-well plate. Antibodies were then further titrated into a 96 well plate at 11-point dilution in duplicates starting from 100nM of final concentration. Positive (mAb A, mAb B, and IMPI-059) control antibodies were also diluted at the same concentrations. 30µL/well of titrated antibodies were plated into IsoplateTM 96 well TC plates (PekinElmer 6005071). The following controls were used: cells only, and cells and virus (no antibody). 50µL/well of pseudotype virus was then added (except to the cells only control). The plates containing the mixture of the antibodies and pseudotype virus were left to incubate for 1 hour at 37°C with 5% CO_2. 293T cells stably expressing recombinant human ACE2 and TMPRSS2 were then added to each well to obtain a final cell number of $5x10^4$ cells per well. The plates were incubated at 37°C with 5% CO2. After 48 hours incubation, culture medium was carefully removed and 100 ul of BrightGlo (Promega cat# E2610) was added to each well as the detection reagent. The plate was read on a ClarioStar (BMG Labtech) to detect luminescence intensity. The neutralization curve and IC_{50} of each antibody was calculated using curve fitting program based on the luciferase activity, normalised to cells only (100%) and virus/cells only (no antibody) as 0%. Neutralisation potency (IC50) for representative clones against different domains is shown in Table E18-1.

Clone	IC50 (nM)	Binding domain
YANG-1112	0.52	RBD
YANG-1301	0.52	NTD
YANG-1302	0.23	NTD
YANG-1401	0.53	RBD
YANG-2107	0.3	RBD
YANG-2108	0.27	RBD
YANG-2111	1.33	RBD
YANG-2203	5.45	S2
YANG-2204	3.3	S2
YANG-2205	3.35	S2
YANG-2206	3.96	S2
YANG-2207	2.59	S2

YANG-2208	4.68	S2
YANG-2301	0.53	NTD
YANG-2302	0.61	NTD
YANG-2303	0.48	NTD

Table E18-1: Potency of antibodies in pseudovirus neutralisation assay
Neutralisation potency of selected antibodies against SARS CoV2 pseudotype virus expressed as IC50 values in nanomolar.

EXAMPLE 19: SYNCYTIA INHIBITION ASSAY

Syncytia formation was observed in SARS-CoV-2 infected cells, including *in vivo* cell model and histopathologic lung sections. Spike proteins on infected cell surface binding to ACE2 on healthy cells could induce cell fusion. Recently, syncytia formation was reported not only to facilitate virus transmission, but also induce lymphocyte loss (Zhang, Z. et al., Cell Death Differ 28, 2765–2777 (2021)). We measured the ability of selected antibodies to inhibit the syncytia formation by cell-based syncytia formation assay.

30 selected antibodies were assessed for their ability to inhibit syncytia formation. In combination with the potent anti-RBD antibody IMPI-059, eight antibodies showed comparable or superior inhibition of syncytia formation, as compared to the reference antibody combination mAb A and mAb B (Figure 14). YANG-2204, YANG-2206, and YANG-2207 were the most potent antibodies in the syncytia inhibition assay.

Materials and methods

First, 10^4 of target cells (293T – hACE2, TMPRSS2, EGFP) were seeded to poly-D-lysine coated 96 well culture plates and incubated for 5 hours. The test antibody and IMPI-059 were diluted with sterile DPBS and mix to 200nM for each antibody. Effector cells (293T – WT spike, RFP) were diluted to 2.5×10^4 cells/mL with culture medium. Mixed 40uL of effector cells and 10uL of antibody mixture and incubated for 30 minutes on ice, then added to cultured target cells. After 2 days incubation, syncytia formation was checked under inverted fluorescence microscope. Cells were stained by NucBlue™ Live ReadyProbes™ Reagent (Invitrogen, Cat. R37605), fixed with 4% paraformaldehyde and washed with PBS. Plates were covered with aluminum foil and stored in fridge for high content imaging.

Image acquisition and analysis was performed on MetaXpress High content (Molecular Devices). Images of DAPI, GFP and TexasRed channel were acquired under 4X magnification and analyzed. Nucleus was defined by DAPI channel and cell was defined by GFP/TexasRed channel. Definition mask was set by size and intensity to identify nucleus, GFP expressing cell and RFP expressing cells. GFP and RFP colocalized cell was defined as syncytium. Syncytium formation percentage was calculated as nucleus counts in syncytia divided by nucleus counts in whole field.

Conclusions from additional study:

Results of from the study described in Examples 12 to 19 above are summarised in Table E19-1 below.

mAb name	Affinity (SPR) by Octet (nM)	epitope	PV neutralization % (Ab 1 ug/mL)	PV neutralisation IC50 (nM)	PV IC50 against mutant (nM)	ACE2 inhibition assay (%)	syncytia inhibition assay combined with IMPI-059 (%)
YANG-1101	< 0.1	RBD	97.99			99.98	
YANG-1102	< 0.1	RBD	86.92	0.84		32.51	
YANG-1103	< 0.1	RBD	100.05	0.28		100.99	
YANG-1105	< 0.1	RBD	97.16			91.44	
YANG-1106	< 0.1	RBD	99.48			100.89	
YANG-1107	< 0.1	RBD	99.23			100.39	
YANG-1108	< 0.1	RBD	95.21			95.91	
YANG-1109	< 0.1	RBD	99.44	1.81		101.49	
YANG-1110	< 0.1	RBD	99.35			100.76	
YANG-1111	< 0.1	RBD	72.69	1.82		36.6	16.54
YANG-1112	<0.1	RBD	89.22	0.52	0.34	93.41	
YANG-1113	< 0.1	RBD	97.61			96.46	
YANG-1114	< 0.1	RBD	93.16			84.29	
YANG-1115	< 0.1	RBD	97.82			92.03	
YANG-1116	< 0.1	RBD	99.24			100.45	
YANG-1117	< 0.1	RBD	97.79			96.87	
YANG-1118	< 0.1	RBD	99.32	0.25	2.76	101.18	
YANG-1119	< 0.1	RBD	99.05	0.96		90.47	
YANG-1201	< 0.1	S2	40.56	N/A		5.43	14.84
YANG-1202	< 0.1	S2	51.93	N/A		3.59	32.09
YANG-1203	< 0.1	S2	41.41	N/A		3.27	22.04

mAb name	Affinity (SPR) by Octet (nM)	epitope	PV neutralization % (Ab 1 ug/mL)	PV neutralisation IC50 (nM)	PV IC50 against mutant (nM)	ACE2 inhibition assay (%)	syncytia inhibition assay combined with IMPI-059 (%)
YANG-1204	< 0.1	S2	44.76	N/A		2.86	16.95
YANG-1205	< 0.1	S2	40.18	N/A		1.14	20.76
YANG-1206	< 0.1	S2	45.87	N/A		8.71	23.69
YANG-1207	< 0.1	S2	39.94	N/A		11.03	23.42
YANG-1301	< 0.1	NTD	60.44	0.52		4.15	51.93
YANG-1302	< 0.1	NTD	60.27	0.23	0.25	-1.28	51.83
YANG-1303	< 0.1	NTD	46.26	N/A		3.51	46.57
YANG-1304	< 0.1	NTD	41.46	N/A		16.44	39.66
YANG-1305	< 0.1	NTD	60.5	0.42		6.15	41.72
YANG-1401	<0.1	RBD	91.64	0.53		3.16	
YANG-1402	< 0.1	RBD	94.45			7.18	
YANG-1403	< 0.1	RBD	99.31			9.18	
YANG-2101	< 0.1	RBD	99.96			100.79	
YANG-2102	< 0.1	RBD	99.36			100.87	
YANG-2103	< 0.1	RBD	97.66			101.96	
YANG-2104	< 0.1	RBD	99.34			101.44	
YANG-2105	< 0.1	RBD	99.61			101.46	
YANG-2106	< 0.1	RBD	93.31			99.53	
YANG-2107	<0.1	RBD	61.2	0.3		91.69	36.11
YANG-2108	<0.1	RBD	81.84	0.27	0.23	98.27	34.17
YANG-2109	< 0.1	RBD	94.97	0.5		95.13	13.43
YANG-2110	< 0.1	RBD	99.92			101.89	
YANG-2111	< 0.1	RBD	86.78	1.33	1	101.54	21.47

mAb name	Affinity (SPR) by Octet (nM)	epitope	PV neutralization % (Ab 1 ug/mL)	PV neutralisation IC50 (nM)	PV IC50 against mutant (nM)	ACE2 inhibition assay (%)	syncytia inhibition assay combined with IMPI-059 (%)
YANG-2112	<0.1	RBD	88.64	0.65		29.13	29.03
YANG-2201	< 0.1	S2	35.21	N/A		-3.21	-11.3
YANG-2202	< 0.1	S2	37.53	N/A		4.17	4.15
YANG-2203	<0.1	S2	35.69	5.45	32.46	4.38	32.15
YANG-2204	<0.1	S2	40.99	3.3	8.83	-2.49	52.03
YANG-2205	<0.1	S2	47.55	3.35		5.6	35.23
YANG-2206	<0.1	S2	41.99	3.96	100	0.33	48.12
YANG-2207	<0.1	S2	57.82	2.59	32.3	5.18	51.33
YANG-2208	<0.1	S2	38.16	4.68		-6.02	41.67
YANG-2301	< 0.1	NTD	56.43	0.53	0.4	1.45	47.9
YANG-2302	< 0.1	NTD	52.16	0.61		-6.05	43.26
YANG-2303	< 0.1	NTD	58.62	0.48		0.27	45.9
YANG-2304	< 0.1	NTD	52.82	0.74		5.58	33.77
YANG-2305	< 0.1	NTD	64.37	0.57		29.71	34.78
YANG-2306	< 0.1	NTD	60.36	0.43		25.07	41.18

Table E19-1: Results of screening assays from additional antibody generation study

In this additional study to select antibodies against COVID-19 from Kymab mice, as described above in Examples 12 to 19, eleven potent candidate antibodies were identified as a lead panel, including five antibodies against RBD and six antibodies against S2 domain. Two strong anti-RBD antibodies YANG-1112 and YANG-2111 are of interest for not competing with any reference antibodies on binding, indicating the possible unique epitopes recognized by these two antibodies. Additionally, the anti-S2 antibodies YANG-2204, YANG-2206, and YANG-2207 represent the strongest candidates to inhibit the formation of syncytia, i.e., cell fusion, that could be used to pair with an anti-RBD antibody for combination therapy.

SEQUENCES

Table 1a

Table 1a below shows amino acid sequences of antibodies and encoding nucleic acids described in this specification. All IMPI VH domains, IMPI VL domains, IMPI CDRs, IMPI heavy chains and IMPI light chains, antibodies comprising them, as well as their encoding nucleic acids, represent examples of the present invention. CDRs are determined according to IMGT method.

SEQ ID NO	Clone ID	Description	Sequence
1	IMPI-052	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG GGTCACCGTCAGTAGCAACTACATGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGGGGGTCTCAGTTATTT ATAGTGGTGGTACCACATACTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTGAGAGCCGAGGACACGGCCGTGTATTACTGTGCGAGAGATACGGTGGTCTACGG TATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
2	IMPI-052	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGVTVSSNYMNWVRQAPGKGLEGVSVIYSGGTTYYADSVKGRFTISRDNSKNT LYLQMNSLRAEDTAVYYCARDTVVYGMDVWGQGTTVTVSS
3	IMPI-052	HCDR1	GVTVSSNY
4	IMPI-052	HCDR2	IYSGGTT
5	IMPI-052	HCDR3	ARDTVVYGMDV
6	IMPI-052	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGCTCCTGATCTATACTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGCTTAATAGTTACCCGCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
7	IMPI-052	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISSYLAWYQQKPGKAPKLLIYTASTLQSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCQQLNSYPLTFGGGTKVEIK

SEQ ID NO	Clone ID	Description	Sequence
8	IMPI-052	LCDR1	QGISSY
9	IMPI-052	LCDR2	TAS
10	IMPI-052	LCDR3	QQLNSYPLT
11	IMPI-047	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG GTTCACCGTCAGTAGCAACTACATGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAGTTATT ATAGCGGTGGTAGCACATACTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTGAGAACCGAGGACACGGCCGTGTATTACTGTGCGCGAGATCTAGTGGCTTACGG TATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
12	IMPI-047	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGFTVSSNYMNWVRQAPGKGLEWVSVIYSGGSTYYADSVKGRFTISRDNSKNT LYLQMNSLRTEDTAVYYCARDLVAYGMDVWGQGTTVTVSS
13	IMPI-047	HCDR1	GFTVSSNY
14	IMPI-047	HCDR2	IYSGGST
15	IMPI-047	HCDR3	ARDLVAYGMDV
16	IMPI-047	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGGTCCTGATCTATGCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACTACTTAATAGTAACCCGCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
17	IMPI-047	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISSYLAWYQQKPGKAPKVLIYAASTLQSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCQLLNSNPLTFGGGTKVEIK
8	IMPI-047	LCDR1	QGISSY
18	IMPI-047	LCDR2	AAS

SEQ ID NO	Clone ID	Description	Sequence
19	IMPI-047	LCDR3	QLLNSNPLT
20	IMPI-003	VH domain nucleic acid sequence	GAAGTGCAGCTGGTGGAGTCTGGGGGAGGCTTGGTACAGCCTGGCAGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGCCATGCACTGGGTCCGGCAAGCTCCAGGGAAGGGCCTGGAGTGGGTCTCAGGTATTA GTTGGAATAGTGGTAGCATAGGCTATGCGGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCTGAAGACACGGCCTTATATTACTGTGCAAAAGATTTGGGACTGGG GATTGGCTTCTATTACGGTTTGGACGTCTGGGGCCAGGGGACCACGGTCACCGTCTCCTCA
21	IMPI-003	VH domain amino acid sequence	EVQLVESGGGLVQPGRSLRLSCAASGFTFDDYAMHWVRQAPGKGLEWVSGISWNSGSIGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCAKDLGLGIGFYYGLDVWGQGTTVTVSS
22	IMPI-003	HCDR1	GFTFDDYA
23	IMPI-003	HCDR2	ISWNSGSI
24	IMPI-003	HCDR3	AKDLGLGIGFYYGLDV
25	IMPI-003	VL domain nucleic acid sequence	GCCATCCAAATGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGAAATGATTTAGGCTGGTATCAGCAGAAGCCAGGGAAAGCCCCTAAGCTCCTGATCTATGATGCAT CCACTTTACAAAGTGGGGTCCCATCGAGGTTCAGCGGCAGTGGATCTGGCACAGATTTCACTCTCACCCTCAGCAGC CTGGAGCCTGAAGATTTAGCAACTTATTACTGTCTACATCACTACACTTACCCGTGGACGTTCGGCCATGGGACCAA GGTGGAACTCAAA
26	IMPI-003	VL domain amino acid sequence	AIQMTQSPSSLSASVGDRVTITCRASQGIRNDLGWYQQKPGKAPKLLIYDASTLQSGVPSRFSGSGSGTDFTLTLSS LEPEDLATYYCLHHYTYPWTFGHGTKVELK
27	IMPI-003	LCDR1	QGIRND
28	IMPI-003	LCDR2	DAS
29	IMPI-003	LCDR3	LHHYTYPWT

SEQ ID NO	Clone ID	Description	Sequence
30	IMPI-043	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGCAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTCTGG ATACAGCTTTACCAGCTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGATACCAGGAACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGC ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGCGAGGTCGTATAACTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
31	IMPI-043	VH domain amino acid sequence	EVQLVQSGAEVKKPGESLKISCKGSGYSFTSYWIGWVRQMPGKGLEWMGIIYPGDSDTRNSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCARSYNWNYFDYWGQGTLVTVSS
32	IMPI-043	HCDR1	GYSFTSYW
33	IMPI-043	HCDR2	IYPGDSDT
34	IMPI-043	HCDR3	ARSYNWNYFDY
35	IMPI-043	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAAGCTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAGCTTATTACTGTCAACAGTTTATTAGTTATCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
36	IMPI-043	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKPGKAPKLLIYDASSLESGVPSRFSGSGSGTDFTLTISS LQPEDFAAYYCQQFISYPWTFGQGTKVEIK
37	IMPI-043	LCDR1	QGISSA
28	IMPI-043	LCDR2	DAS
38	IMPI-043	LCDR3	QQFISYPWT

SEQ ID NO	Clone ID	Description	Sequence
39	IMPI-048	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCACAGACCCTGTCCCTCACCTGCACTGTCTCTGG TGGCTCCATCAGCAGTTATGGTTACTACTGGAGCTGGATCCGCCAGCACCCAGGGAAGGGCCTGGAGTGGATTGGGT ACATCTATTACAGTGGGAGCACCTACTACAACCCGTCCCTCAAGAGTCGAGCTACCATATCAGTAGACACGTCTAAG AACCAGCTCTCCCTGAGGCTGAACTCTGTCACTGCCGCGGACACGGCCGTGTATTACTGTGCGAGAGACTTCGGTGG TAACTCGAACTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
40	IMPI-048	VH domain amino acid sequence	QVQLQESGPGLVKPSQTLSLTCTVSGGSISSYGYYWSWIRQHPGKGLEWIGYIYYSGSTYYNPSLKSRATISVDTSK NQLSLRLNSVSAADTAVYYCARDFGGNSNYFDYWGQGSLVTVSS
41	IMPI-048	HCDR1	GGSISSYGYY
42	IMPI-048	HCDR2	IYYSGST
43	IMPI-048	HCDR3	ARDFGGNSNYFDY
44	IMPI-048	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCTCCATCACTTGCCGGGCAAG TCAGGTCATTAGTAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAAGCTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTACAACTTATTACTGTCAACAGTTTAATAGTTACCCTCTCACTTTCGGCGGAGGGACCAC GGTGGAGATCAAA
45	IMPI-048	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVSITCRASQVISSALAWYQQKPGKAPKLLIYDASSLESGVPSRFSGSGSGTDFTLTISS LQPEDFTTYYCQQFNSYPLTFGGGTTVEIK
46	IMPI-048	LCDR1	QVISSA
28	IMPI-048	LCDR2	DAS
47	IMPI-048	LCDR3	QQFNSYPLT

SEQ ID NO	Clone ID	Description	Sequence
48	IMPI-014	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCACAGACCCTGTCCCTCACCTGCACTGTCTCTGG TGGCTCCATCAGCAGTTATAGTTACTACTGGAGCTGGATCCGCCAGCACCCAGGGAAGGGCCTGGAGTGGATTGGGT ACATCTATTACAGTGGGAGCACCTACTACAACCCGTCCCTCAAGAGTCGAGCTACCATATCAGTAGACACGTCTAAG AACCAGCTCTCCCTGAGGCTGAACTCTGTCACTGCCGCGGACACGGCCGTGTATTACTGTGCGAGAGACTTCGGTGG TAACTCGAACTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
49	IMPI-014	VH domain amino acid sequence	QVQLQESGPGLVKPSQTLSLTCTVSGGSISSYGYYWSWIRQHPGKGLEWIGYIYYSGSTYYNPSLKSRATISVDTSK NQLSLRLNSVSAADTAVYYCARDFGGNSNYFDYWGQGTLVTVSS
41	IMPI-014	HCDR1	GGSISSYGYY
42	IMPI-014	HCDR2	IYYSGST
43	IMPI-014	HCDR3	ARDFGGNSNYFDY
50	IMPI-014	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGGGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGTAAAGCTCCTAAGCTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTACAACTTATTACTGTCAACAGTTTAATAGTTACCCTCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
51	IMPI-014	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKPGKAPKLLIYDASSLESGVPSRFSGSGSGTDFTLTISS LQPEDFTTYYCQQFNSYPLTFGGGTKVEIK
37	IMPI-014	LCDR1	QGISSA
28	IMPI-014	LCDR2	DAS
47	IMPI-014	LCDR3	QQFNSYPLT

SEQ ID NO	Clone ID	Description	Sequence
52	IMPI-059	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCGGGGGGGTCCCTGAGACTCTCCTGTGGCAGCCTCTGG GTTCACCGTCAGTAGCATCTACATGAGCTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAATTATTT ATAGCCGTGGTAGTACAGACTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACATTTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTGAGAGCCGAGGACACGGCCGTGTATTACTGTGCGAGAGATGGGACTATGGTTCG GGGAGTTCATGCTTTTGATATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
53	IMPI-059	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGFTVSSIYMSWVRQAPGKGLEWVSIIYSRGSTDYADSVKGRFTISRDISKNT LYLQMNSLRAEDTAVYYCARDGTMVRGVHAFDIWGQGTMVTVSS
54	IMPI-059	HCDR1	GFTVSSIY
55	IMPI-059	HCDR2	IYSRGST
56	IMPI-059	HCDR3	ARDGTMVRGVHAFDI
57	IMPI-059	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCAACCCTCCCTGTCTGCATCTATAGGAGACAGAGTCACCATCACTTGCCAGGCGAG TCAGGACATTAGCAACTATTTAAATTGGTATCAGCAGAAACCAGGGAAAGCCCCTAAGCTCCTGATCTACGATGCAT CCAATTTGGAAACAGGGGTCCCATCAAGGTTCAGTGGAAGTGGATCTGGGACAGATTTTACTCTCACCATCAGCAAC CTGCAGCCTGAAGATATTGTAACATATTACTGTCAACAGTATGATAAATCTCCCGAGCAGTTTTGGCCAGGGGACCAA GCTGGAGATCAAA
58	IMPI-059	VL domain amino acid sequence	DIQMTQSPPSLSASIGDRVTITCQASQDISNYLNWYQQKPGKAPKLLIYDASNLETGVPSRFSGSGSGTDFTLTISN LQPEDIVTYYCQQYDNLPSSFGQGTKLEIK
59	IMPI-059	LCDR1	QDISNY
28	IMPI-059	LCDR2	DAS
60	IMPI-059	LCDR3	QQYDNLPSS

SEQ ID NO	Clone ID	Description	Sequence
61	IMPI-057	VH domain nucleic acid sequence	GAAGTGCAGCTGGTGGAGTCTGGGGGAGGCTTGGTACAGCCTGGCAGGTCCCTGAGACTCTCCTGTGGCAGCCTCTGG ATTCACCTTTGATGATTATGCCATACACTGGGTCCGGCAAGCTCCAGGGAAGGGCCTGGAATGGGTCTCAGGTATTA CTTGGAATAGTGGTAGCATAGGCTATGCGGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCTGAGGATACGGCCTTGTATTACTGTGCAAAAGATCTCCAGGGGGA CTACTACTACTACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
62	IMPI-057	VH domain amino acid sequence	EVQLVESGGGLVQPGRSLRLSCAASGFTFDDYAIHWVRQAPGKGLEWVSGITWNSGSIGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCAKDLQGDYYYYGMDVWGQGTTVTVSS
22	IMPI-057	HCDR1	GFTFDDYA
63	IMPI-057	HCDR2	ITWNSGSI
64	IMPI-057	HCDR3	AKDLQGDYYYYGMDV
65	IMPI-057	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGGCTAG TCAGGACATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAAGCAGGGAAAGCTCCTAAGCTCCTGATCTATGATGGCT CCAGTTTTAAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTAGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTATTAGTTACCCGCTCACTTTCGGCGGAGGGACCAG GGTGGAGATCAAA
66	IMPI-057	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQDISSALAWYQQKAGKAPKLLIYDGSSFKSGVPSRFSGSRSGTDFTLTISS LQPEDFATYYCQQFISYPLTFGGGTRVEIK
67	IMPI-057	LCDR1	QDISSA
68	IMPI-057	LCDR2	DGS
69	IMPI-057	LCDR3	QQFISYPLT

SEQ ID NO	Clone ID	Description	Sequence
70	IMPI-015	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGCAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTCTGG ATACAGCTTTACCATCTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGATACCAGATACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGC ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGCGAGGTCGTATAACTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
71	IMPI-015	VH domain amino acid sequence	EVQLVQSGAEVKKPGESLKISCKGSGYSFTIYWIGWVRQMPGKGLEWMGIIYPGDSDTRYSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCARSYNWNYFDYWGQGTLVTVSS
72	IMPI-015	HCDR1	GYSFTIYW
33	IMPI-015	HCDR2	IYPGDSDT
34	IMPI-015	HCDR3	ARSYNWNYFDY
73	IMPI-015	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAACAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAAACTCCTAAACTCCTAATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTAATAGTTACCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
74	IMPI-015	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGINSALAWYQQKPGKTPKLLIYDASSLESGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQFNSYPWTFGQGTKVEIK
75	IMPI-015	LCDR1	QGINSA
28	IMPI-015	LCDR2	DAS
76	IMPI-015	LCDR3	QQFNSYPWT

SEQ ID NO	Clone ID	Description	Sequence
77	IMPI-025	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGCAGGAGTACCTGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAA TCTCTCATAGTGGGAGCACCCAGTACAACCCGTCCCTCAAGAGTCGAGTCACCATATCACTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAACTCTGTGACCGCCGCGGACACGGCCGTATATTACTGTGCGGGAGAGGGGTATAACTG GAACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
78	IMPI-025	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGGSISRSTWWSWVRQPPGKGLEWIGEISHSGSTQYNPSLKSRVTISLDKSKN QFSLKLNSVTAADTAVYYCAGEGYNWNYWGQGTLVTVSS
79	IMPI-025	HCDR1	GGSISRSTW
80	IMPI-025	HCDR2	ISHSGST
81	IMPI-025	HCDR3	AGEGYNWNY
82	IMPI-025	VL domain nucleic acid sequence	GATGTTGTAATGACTCAGTCTCCACTCTCCCTGCCCGTCACCCTTGGACAGCCGGCCTCCATCTCCTGCAGGTCTAG TCAAAGCCTCGTATACAGTGATGGAAACACCTACTTGAGTTGGTTTCAGCAGAGGCCAGGCCAATCTCCAAGGCGCC TAATTTATAAGGTTTCTAAGTGGGACTCTGGGGTCCCAGACAGATTCAGCGGCAGTGGGTCAGGCACTGATTTCACA CTGAAAATCAGCAGGGTGGAGGCTGAGGATGTTGGGATTTATTACTGCATGCAAGGTACACACTGGCCGCTCACTTT CGGCGGAGGGACCAAGGTGGAGATCAAA
83	IMPI-025	VL domain amino acid sequence	DVVMTQSPLSLPVTLGQPASISCRSSQSLVYSDGNTYLSWFQQRPGQSPRRLIYKVSKWDSGVPDRFSGSGSGTDFT LKISRVEAEDVGIYYCMQGTHWPLITFGGGTKVEIK
84	IMPI-025	LCDR1	QSLVYSDGNTY
85	IMPI-025	LCDR2	KVS
86	IMPI-025	LCDR3	MQGTHWPLT

SEQ ID NO	Clone ID	Description	Sequence
87	IMPI-051	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGCAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTCTGA ATACAGATTTACCAGCTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGATACCAGATACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGC ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGCGAGGTCGTATAACTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
88	IMPI-051	VH domain amino acid sequence	EVQLVQSGAEVKKPGESLKISCKGSEYRFTSYWIGWVRQMPGKGLEWMGIIYPGDSDTRYSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCARSYNWNYFDYWGQGTLVTVSS
89	IMPI-051	HCDR1	EYRFTSYW
33	IMPI-051	HCDR2	IYPGDSDT
34	IMPI-051	HCDR3	ARSYNWNYFDY
90	IMPI-051	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCTTCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGCCAAG TCAGGGCATTAGCAGTGGTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAACCTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAGGATTTTGCAACTTATTACTGTCAACAGTTTAAAAGTTACCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
91	IMPI-051	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRPSQGISSGLAWYQQKPGKAPNLLIYDASSLESGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQFKSYPWTFGQGTKVEIK
92	IMPI-051	LCDR1	QGISSG
28	IMPI-051	LCDR2	DAS
93	IMPI-051	LCDR3	QQFKSYPWT

SEQ ID NO	Clone ID	Description	Sequence
94	IMPI-031	VH domain nucleic acid sequence	GAAGTGCAGCTGGTGGAGTCTGGGGGAGGCTTGGTACAGCCTGGCAGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGCCATGCACTGGGTCCGGCAATCTCCAGGGAAGGGCCTGGAGTGGGTCTCAGGTATTA GTTGGAATAGTGGTTCCATAGGCTATGCGGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCTGAGGACACGGCCTTGTATTACTGTGCAAAAGATCTCCAGGGGGA CGACTACTACTACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
95	IMPI-031	VH domain amino acid sequence	EVQLVESGGGLVQPGRSLRLSCAASGFTFDDYAMHWVRQSPGKGLEWVSGISWNSGSIGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCAKDLQGDDYYYGMDVWGQGTTVTVSS
22	IMPI-031	HCDR1	GFTFDDYA
23	IMPI-031	HCDR2	ISWNSGSI
96	IMPI-031	HCDR3	AKDLQGDDYYYGMDV
97	IMPI-031	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAAGCTCCTGATCTTTGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTTTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAGCTTTTTACTGTCAACAGTTTATTAGTTACCCGCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
98	IMPI-031	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKPGKAPKLLIFDASSLESGVPSRFSGSGSGTDFTFTISS LQPEDFAAFYCQQFISYPLTFGGGTKVEIK
37	IMPI-031	LCDR1	QGISSA
28	IMPI-031	LCDR2	DAS
69	IMPI-031	LCDR3	QQFISYPLT

SEQ ID NO	Clone ID	Description	Sequence
99	IMPI-045	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCACAGACCCTGTCCCTCACCTGCACTGTCTCTGG TGGCTCCATCAGCAGTTATGGTTTCTACTGGAGCTGGATCCGCCAGCACCCAGGGAAGGGCCTGGAGTGGATTGGGT TCATCTATTACAGTGGGAGCACCTACTACAACCCGTCCCTCAAGAGTCGAGCTACCATATCAGTAGACACGTCTAAG AACCAGCTCTCCCTGAGGCTGAACTCTGTCACTGCCGCGGACACGGCCGTGTATTACTGTGCGAGAGACTTCGGTGG TAACTCGAACTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
100	IMPI-045	VH domain amino acid sequence	QVQLQESGPGLVKPSQTLSLTCTVSGGSISSYGFYWSWIRQHPGKGLEWIGFIYYSGSTYYNPSLKSRATISVDTSK NQLSLRLNSVSAADTAVYYCARDFGGNSNYFDYWGQGTLVTVSS
101	IMPI-045	HCDR1	GGSISSYGFY
42	IMPI-045	HCDR2	IYYSGST
43	IMPI-045	HCDR3	ARDFGGNSNYFDY
102	IMPI-045	VL domain nucleic acid sequence	GCCATCCAATTGACCCAGTCTCCATCCTCCCTGTCTGCGTCTGTTGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTCTCAGCTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCGAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTAATAGTTACCCTCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
103	IMPI-045	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKPGKAPQLLIYDASSLESGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQFNSYPLTFGGGTKVEIK
37	IMPI-045	LCDR1	QGISSA
28	IMPI-045	LCDR2	DAS
47	IMPI-045	LCDR3	QQFNSYPLT

SEQ ID NO	Clone ID	Description	Sequence
104	IMPI-005	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGGCAGCCTCTGG GTTCACCGTCAGTAGCAACTATATGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAGTTATTT ATAGCGGTGGTAGCACATACTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTTTCTTCAAATGAACAGCCTGAGAGCCGAGGACTCGGCCGTGTATTACTGTGCGAGAGATTTGGGACCCTACGG TGTGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
105	IMPI-005	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGFTVSSNYMNWVRQAPGKGLEWVSVIYSGGSTYYADSVKGRFTISRDNSKNT LFLQMNSLRAEDSAVYYCARDLGPYGVDVWGQGTTVTVSS
13	IMPI-005	HCDR1	GFTVSSNY
14	IMPI-005	HCDR2	IYSGGST
106	IMPI-005	HCDR3	ARDLGPYGVDV
107	IMPI-005	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGCTCCTGATCTATGCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAAGAGCTTAATAGTTACCCTCTCACCTTCGGCCAAGGGACACG ACTGGAGATTAAA
108	IMPI-005	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISSYLAWYQQKPGKAPKLLIYAASTLQSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCQELNSYPLTFGQGTRLEIK
8	IMPI-005	LCDR1	QGISSY
18	IMPI-005	LCDR2	AAS
109	IMPI-005	LCDR3	QELNSYPLT

SEQ ID NO	Clone ID	Description	Sequence
110	IMPI-038	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGGAGTCTGGGGGAGGCGTGGTCCAGCCTGGGAGGTCCCTGAGACTCTCCTGTGGCAGCCTCTGG ATTCACCTTCAGTAGCTATGGCATGCACTGGGTCCGCCAGGCTCCAGGCAAGGGGCTGGAGTGGGTGGCAGTTATAT CATATGATGGAAGTGATAAATACTATGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAAC ACGCTGTATCTGCAAATGAACAGCCTGAGAGCTGAGGACACGGCTGTGTATTACTGTGCGAAAACAGTGGCTGGTTA TTACTACTACTACTACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
111	IMPI-038	VH domain amino acid sequence	QVQLVESGGGVVQPGRSLRLSCAASGFTFSSYGMHWVRQAPGKGLEWVAVISYDGSDKYYADSVKGRFTISRDNSKN TLYLQMNSLRAEDTAVYYCAKTVAGYYYYYYGMDVWGQGTTVTVSS
112	IMPI-038	HCDR1	GFTFSSYG
113	IMPI-038	HCDR2	ISYDGSDK
114	IMPI-038	HCDR3	AKTVAGYYYYYYGMDV
115	IMPI-038	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCTTCCGTGTCTGCATCTGTTGGAGACAGAGTCACCGTCACTTGTCGGGCGAG TCAGGATATTAGTAGCTGGTTTAGCCTGGTTTCAGCAGAAACCAGGGAAAGCCCCTAAATTCCTGATCTATGATGCAT CCAATTTGGAAAATGGAGTCCCATCAAGGTTCAGTGGCAGTGGATCTGGGACAGATTTCACCCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTACTATTGTCAACAAGCTAAAAGTTTCCCGTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAC
116	IMPI-038	VL domain amino acid sequence	DIQMTQSPSSVSASVGDRVTVTCRASQDISWLAWFQQKPGKAPKFLIYDASNLENGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQAKSFPWTFGQGTKVEIN
117	IMPI-038	LCDR1	QDISSW
28	IMPI-038	LCDR2	DAS
118	IMPI-038	LCDR3	QQAKSFPWT

SEQ ID NO	Clone ID	Description	Sequence
119	IMPI-036	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGGTCTCCTGCAAGGCTTCTGG ATACACCTTCACCAGTTATGATATCAACTGGGTGCGACAGGCCACTGGCCAAGGGCTTGAGTGGATGGGATGGATGA ACCCTATCAGTGGTAACACAGGCTATGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGAACACCTCCATAAGC ACAGCCTACATGGAGCTGAGCAGCCTGAGATCTGAGGACACGGCCGTGTATTTCTGTGCGAGAGGCGGGCGATATTG TAGTGGTGTTAGCTGCTACTCCGGAGAGCCTTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
120	IMPI-036	VH domain amino acid sequence	QVQLVQSGAEVKKPGASVKVSCKASGYTFTSYDINWVRQATGQGLEWMGWMNPISGNTGYAQKFQGRVTMTRNTSIS TAYMELNSLRSEDTAVYFCARGGRYCSGVSCYSGEPFDYWGQGTLVTVSS
121	IMPI-036	HCDR1	GYTFTSYD
122	IMPI-036	HCDR2	MNPISGNT
123	IMPI-036	HCDR3	ARGGRYCSGVSCYSGEPFDY
124	IMPI-036	VL domain nucleic acid sequence	GAAATTGTGCTGACTCAGTCTCCAGACTTTCAGTCTGTGACTCCAAAGGAGAAAGTCACCATCACCTGCCGGGCCAG TCAGAGCATTGGTAGTAGCTTACACTGGTACCAGCAGAAACCAGATCAGTCTCCAAAGCTCCTCATCAAGTATGCTT CCCAGTCCATCTCAGGGGTCCCCTCGAGGTTCAGTGGCAGTGGATCTGGGACAGATTTCACCCTCACCATCAATAGC CTGGAAGCTGAAGATGCTGCAGCGTATTATTGTCATCAGAGTAGTAGTTTACCTCACACTTTCGGCCCTGGGACCAA AGTGGAGATCAAA
125	IMPI-036	VL domain amino acid sequence	EIVLTQSPDFQSVTPKEKVTITCRASQSIGSSLHWYQQKPDQSPKLLIKYASQSISGVPSRFSGSGSGTDFTLTINS LEAEDAAAYYCHQSSSLPHTFGPGTKVEIK
126	IMPI-036	LCDR1	QSIGSS
127	IMPI-036	LCDR2	YAS
128	IMPI-036	LCDR3	HQSSSLPHT

SEQ ID NO	Clone ID	Description	Sequence
129	IMPI-023	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGCAGTAATAACTGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGTCTGGAGTGGATTGGGGAAA TCGATCATAGTGGGAGCACCATGTACAACCCGTCCCTCAAGAGTCGAGTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAACTCTGTGACCGCCGCGGACACGGCCGTGTATTACTGTACGGGAGAGGGGTATAACTG GAACTACTGGGGCCAGGGGACCCTGGTCACCGTCTCCTCA
130	IMPI-023	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGGSISSNNWSWVRQPPGKGLEWIGEIDHSGSTMYNPSLKSRVTISVDKSKN QFSLKLNSVTAADTAVYYCTGEGYNWNYWGQGTLVTVSS
131	IMPI-023	HCDR1	GGSISSNNW
132	IMPI-023	HCDR2	IDHSGST
133	IMPI-023	HCDR3	TGEGYNWNY
134	IMPI-023	VL domain nucleic acid sequence	GTTGTTGTGATGACTCAGTCTCCACTCTCCCTGCCCGTCACCCTTGGACAGCCGGCCTCCATCTCCTGCAGGTCTAG TCAAAGCCTCCTATACACTGATGGAAACACCTACTTGAGTTGGTTTCAGCAGAGGCCAGGCCAATCTCCAAGGCGCC TAATTTATAAGGTTTCTAACTGGGACTCTGGGGTCCCAGACAGATTCAGCGGCAGTGGGTCAGGCACTGATTTCACA CTGAAAATCAGCAGGGTGGAGGCTGAAGATGTTGGGATTTATTACTGCATGCAAGGTACACACTGGCCGCTCACTTT CGGCGGAGGGACCAAGGTGGAGATCAAA
135	IMPI-023	VL domain amino acid sequence	VVVMTQSPLSLPVTLGQPASISCRSSQSLLYTDGNTYLSWFQQRPGQSPRRLIYKVSNWDSGVPDRFSGSGSGTDFT LKISRVEAEDVGIYYCMQGTHWPLTFGGGTKVEIK
136	IMPI-023	LCDR1	QSLLYTDGNTY
85	IMPI-023	LCDR2	KVS
86	IMPI-023	LCDR3	MQGTHWPLT

SEQ ID NO	Clone ID	Description	Sequence
137	IMPI-019	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGATAAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGCAGTAATACCTGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGTCTGGAGTGGATTGGGGAAA TCTATCATAGTGGGAGCACCATGTACAACCCGTCCCTCAAGAGTCGAGTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGTTGAACTCTGTGACCGCCGCGGACACGGCCGTGTATTACTGTACGGGAGAGGGGCATAACTG GAACTACTGGGGCCAGGGGACCCTGGTCACCGTCTCCTCA
138	IMPI-019	VH domain amino acid sequence	QVQLQESGPGLIKPSGTLSLTCAVSGGSISSNTWWSWVRQPPGKGLEWIGEIYHSGSTMYNPSLKSRVTISVDKSKN QFSLKLNSVTAADTAVYYCTGEGHNWNYWGQGTLVTVSS
139	IMPI-019	HCDR1	GGSISSNTW
140	IMPI-019	HCDR2	IYHSGST
141	IMPI-019	HCDR3	TGEGHNWNY
142	IMPI-019	VL domain nucleic acid sequence	GATGTTGTGTTGACTCAGTCTCCACTCTCCCTGCCCGTCACCCTTGGACAGCCGGCCTCCATCTCCTGCAGGTCTAG TCAAAGCCTCGTATACACTGATGGAAACACCTACTTGAGTTGGTTTCAGCAGAGGCCAGGCCAATCTCCAAGGCGCC TAATTTATAAGGTTTCTAACTGGGAATCTGGGGTCCCAGACAGATTCAGCGGCAGTGGGTCAGGCACTGATTTCACA CTGAAAATCAGCAGGGTGGAGGCTGAAGATGTTGGGATTTATTACTGCATGCAAGGTACACACTGGCCGCTCACTTT CGGCGGAGGGACCAAGGTGGAGATCAAA
143	IMPI-019	VL domain amino acid sequence	DVVLTQSPLSLPVTLGQPASISCRSSQSLVYTDGNTYLSWFQQRPGQSPRRLIYKVSNWESGVPDRFSGSGSGTDFT LKISRVEAEDVGIYYCMQGTHWPLTFGGGTKVEIK
144	IMPI-019	LCDR1	QSLVYTDGNTY
85	IMPI-019	LCDR2	KVS
86	IMPI-019	LCDR3	MQGTHWPLT

SEQ ID NO	Clone ID	Description	Sequence
145	IMPI-008	VH domain nucleic acid sequence	GAAGTGCAGCTGGTGGAGTCTGGGGGAGGCTTGGTACAGCCTGGCAGGTCCCTGAGACTCTCCTGTGGCAGCCTCTGG ATTCACCTTTGATGATTATGCCATGCACTGGGTCCGGCAAGCTCCAGGGAAGGGCCTGGAGTGGGTCTCAGGTATTA GTTGGAATAGTGGTAGCATAGGTTATGCGGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGTTGAGGACACGGCCTTGTATTACTGTGCAAAAGATCTCCAGGGGGA CTACTACTACTACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
146	IMPI-008	VH domain amino acid sequence	EVQLVESGGGLVQPGRSLRLSCAASGFTFDDYAMHWVRQAPGKGLEWVSGISWNSGSIGYADSVKGRFTISRDNAKN SLYLQMNSLRVEDTALYYCAKDLQGDYYYYGVDVWGQGTTVTVSS
22	IMPI-008	HCDR1	GFTFDDYA
23	IMPI-008	HCDR2	ISWNSGSI
147	IMPI-008	HCDR3	AKDLQGDYYYYGVDV
148	IMPI-008	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAACCTCCTAAGCTCCTGATCTATGATGCCT CCAGTTTGGTAAGTGGGGTCCCATCAAGATTCAGCGGCAGTAGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAACCTGAGGATTTTGCAACTTATTACTGTCAACAGTTTATTAGTTACCCGCTCACTTTCGGCGGAGGGACCAG GGTGGAGATCAAA
149	IMPI-008	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKPGKPPKLLIYDASSLVSGVPSRFSGSRSGTDFTLTISS LQPEDFATYYCQQFISYPLTFGGGTRVEIK
37	IMPI-008	LCDR1	QGISSA
28	IMPI-008	LCDR2	DAS
69	IMPI-008	LCDR3	QQFISYPLT

SEQ ID NO	Clone ID	Description	Sequence
150	IMPI-004	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGGAGTCTGGGGGAGGCGTGGTCCAGCCTGGGAGGTCCCTGAGACTCTCCTGTGGCAGCGTCTGG ATTCACCTTCAGTAGCTATGGCATGCACTGGGTCCGCCAGGCTCCAGGCAAGGGGCTGGAGTGGGTGGCAGTTATAT GGTATGATGGAGGTAATAAATACTATGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCTAAGAAC ACGCTGTATCTGCAAATGAACAGCCTGAGAGCCGAGGACACGGCTGTGTATTACTGTGCGAGAGTTAATGTACTAAT GGGCTACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
151	IMPI-004	VH domain amino acid sequence	QVQLVESGGGVVQPGRSLRLSCAASGFTFSSYGMHWVRQAPGKGLEWVAVIWYDGGNKYYADSVKGRFTISRDNSKN TLYLQMNSLRAEDTAVYYCARVNVLMGYGMDVWGQGTTVTVSS
112	IMPI-004	HCDR1	GFTFSSYG
152	IMPI-004	HCDR2	IWYDGGNK
153	IMPI-004	HCDR3	ARVNVLMGYGMDV
154	IMPI-004	VL domain nucleic acid sequence	GAAATTGTGTTGACGCAGTCTCCAGGCACCCTGTCTTTGTCTCCAGGGGATAAAGCCACCCTCTCCTGCAGGGCCAG TCAGAGTATCATCAGCAGCTTCTTAGCCTGGTACCAGCAGAAACCTGGCCAGGCTCCCAGGCTCCTCATCTATGGTG CATCCAGCAGGGCCACTGGCATCCCAGACAGGTTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGC AGACTGGAACCTGAAGATTTTGCAGTGTATTACTGTCAGCAGTATGGTAGCTCGCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
155	IMPI-004	VL domain amino acid sequence	EIVLTQSPGTLSLSPGDKATLSCRASQSIISFLAWYQQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTIS RLEPEDFAVYYCQQYGSSLTFGGGTKVEIK
156	IMPI-004	LCDR1	QSIISSF
157	IMPI-004	LCDR2	GAS
158	IMPI-004	LCDR3	QQYGSSLT

SEQ ID NO	Clone ID	Description	Sequence
159	IMPI-012	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGGCAGCCTCTGG GATCACCGTCAGTAGCAACTACATGAGCTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAGTTATTT ATAGCGGTGGTACTACAAACTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTGAGAGCCGAGGACACGGCCGTGTATTACTGTGCGAGAGATACGGTGGTCTACGG TATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
160	IMPI-012	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGITVSSNYMSWVRQAPGKGLEWVSVIYSGGTTNYADSVKGRFTISRDNSKNT LYLQMNSLRAEDTAVYYCARDTVVYGMDVWGQGTTVTVSS
161	IMPI-012	HCDR1	GITVSSNY
4	IMPI-012	HCDR2	IYSGGTT
5	IMPI-012	HCDR3	ARDTVVYGMDV
162	IMPI-012	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGCTCCTGATCTATGCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGCTTAATAGTCACCCGCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
163	IMPI-012	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISSYLAWYQQKPGKAPKLLIYAASTLQSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCQQLNSHPLTFGGGTKVEIK
8	IMPI-012	LCDR1	QGISSY
18	IMPI-012	LCDR2	AAS
164	IMPI-012	LCDR3	QQLNSHPLT

SEQ ID NO	Clone ID	Description	Sequence
165	IMPI-010	VH domain nucleic acid sequence	GAAGTGCAGCTGGTGGAGTCTGGGGGAGGCTTGGTACAGCCTGGCAGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGCCATGCACTGGGTCCGGCAAGCTCCAGGGAAGGGCCTGGAGTGGGTCTCAGGTATTA GTTGGAATAGTGGTAGCATAGGCTATGCGGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCTGAGGACACGGCCTTGTATTACTGTGCAAAAGATCTCCAGGGGGA CGACTACTACTACGGTGTGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
166	IMPI-010	VH domain amino acid sequence	EVQLVESGGGLVQPGRSLRLSCAASGFTFDDYAMHWVRQAPGKGLEWVSGISWNSGSIGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCAKDLQGDDYYYGVDVWGQGTTVTVSS
22	IMPI-010	HCDR1	GFTFDDYA
23	IMPI-010	HCDR2	ISWNSGSI
167	IMPI-010	HCDR3	AKDLQGDDYYYGVDV
168	IMPI-010	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGACATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAAGCTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTAGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAACCTGAAGATTTTGCAAATTATTACTGTCAACAGTTTATTAGTTACCCGCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
169	IMPI-010	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQDISSALAWYQQKPGKAPKLLIYDASSLESGVPSRFSGSRSGTDFTLTISS LQPEDFANYYCQQFISYPLTFGGGTKVEIK
67	IMPI-010	LCDR1	QDISSA
28	IMPI-010	LCDR2	DAS
69	IMPI-010	LCDR3	QQFISYPLT
170	IMPI-017	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCGGGGGGGGTCCCTGAGACTCTCCTGTGCAGCCGCTGG GTTAACCGTCAGTAGCAACTATATGAACTGGGTCCGCCAGGTTCCAGGGAAGGGGCTGGAGTGGGTCTCAGTTATTT ATAGCGGTGGTAGCACATACTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGTCTGAGAGCCGAGGACACGGCCGTGTATTACTGTGCGAGAGATCTGGGTACCCTGGG TATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA

SEQ ID NO	Clone ID	Description	Sequence
171	IMPI-017	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAAAGLTVSSNYMNWVRQVPGKGLEWVSVIYSGGSTYYADSVKGRFTISRDNSKNT LYLQMNSLRAEDTAVYYCARDLGTLGMDVWGQGTTVTVSS
172	IMPI-017	HCDR1	GLTVSSNY
14	IMPI-017	HCDR2	IYSGGST
173	IMPI-017	HCDR3	ARDLGTLGMDV
174	IMPI-017	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCACTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGCTCCTGATCTATGCTGCAT CCACTTTGCAGAGCGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAGCAGCTTAACAGTTACCTTCCGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
175	IMPI-017	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISTYLAWYQQKPGKAPKLLIYAASTLQSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCQQLNSYLPTFGQGTKVEIK
176	IMPI-017	LCDR1	QGISTY
18	IMPI-017	LCDR2	AAS
177	IMPI-017	LCDR3	QQLNSYLPT
178	IMPI-037	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGGGGAGGCTTGGTAAAGCCTGGGGGGTCCCTTAGACTCTCCTGTGCAGCCTCTGG ATTCACTTTCAGTAACGCCTGGATGAGCTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTTGGCCGTATTA AAAACAAAGCTGATGGTGGGACAACAGACTACGCTGCACCCGTGAAAGGCAGATTCACCATCTCAAGAGATGATTCA AAAAACACGTTGTATCTGCAAATGAACAGCCTGAAAACCGAGGACACAGCCGTGTATTACTGTACCACAGAGGAATT ACTATGGTTCGGGGAGTCGCCCTTTGACTGCTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
179	IMPI-037	VH domain amino acid sequence	EVQLVESGGGLVKPGGSLRLSCAASGFTFSNAWMSWVRQAPGKGLEWVGRIKNKADGGTTDYAAPVKGRFTISRDDS KNTLYLQMNSLKTEDTAVYYCTTEELLWFGESPFDCWGQGTLVTVSS

SEQ ID NO	Clone ID	Description	Sequence
180	IMPI-037	HCDR1	GFTFSNAW
181	IMPI-037	HCDR2	IKNKADGGTT
182	IMPI-037	HCDR3	TTEELLWFGESPFDC
183	IMPI-037	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAACAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGCTCCTGATCTATGCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTACAACTTATTACTGTCAACAATTTAATGATTACCCTCGGACGTTCGGCCCAGGGACCAA GGTGGAAATCAAA
184	IMPI-037	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGINSYLAWYQQKPGKAPKLLIYAASTLQSGVPSRFSGSGSGTEFTLTISS LQPEDFTTYYCQQFNDYPRTFGPGTKVEIK
185	IMPI-037	LCDR1	QGINSY
18	IMPI-037	LCDR2	AAS
186	IMPI-037	LCDR3	QQFNDYPRT
187	IMPI-022	VH domain nucleic acid sequence	GAAGTGCAGCTGGTGGAGTCTGGGGGAGGCTTGGTACAGCCTGGCAGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGCCATGCACTGGGTCCGGCAAGCTCCAGGGAAGGGCCTGGAGTGGGTCTCAGGTATTA CTTGGAATAGTGGTAGCATAGGTTATGCGGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCACATGAACAGTCTGAGAGTTGAGGACACGGCCTTGTATTACTGTGCAAAAGATCTCCAGGGGGA CTACTACTACTACGGTGTGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
188	IMPI-022	VH domain amino acid sequence	EVQLVESGGGLVQPGRSLRLSCAASGFTFDDYAMHWVRQAPGKGLEWVSGITWNSGSIGYADSVKGRFTISRDNAKN SLYLHMNSLRVEDTALYYCAKDLQGDYYYYGVDVWGQGTTVTVSS
22	IMPI-022	HCDR1	GFTFDDYA
63	IMPI-022	HCDR2	ITWNSGSI

SEQ ID NO	Clone ID	Description	Sequence
147	IMPI-022	HCDR3	AKDLQGDYYYYGVDV
189	IMPI-022	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAGCCAGGGAAAGCTCCTAAACTCCTGCTCTATGATGCCT CCAGTTTGGTAAGTGGGGTCCCATCAAGATTCAGCGGCAGTAGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAACCTGAGGATTTTGCAACTTATTACTGTCAACAGTTTATTAGTTACCCGCTCACTTTCGGCGGAGGGACCAG GGTGGAGATCAAA
190	IMPI-022	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKPGKAPKLLLYDASSLVSGVPSRFSGSRSGTDFTLTISS LQPEDFATYYCQQFISYPLTFGGGTRVEIK
37	IMPI-022	LCDR1	QGISSA
28	IMPI-022	LCDR2	DAS
69	IMPI-022	LCDR3	QQFISYPLT
191	IMPI-058	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGCAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTCTGG ATACAGCTTTAGCAGCTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGAAACCAGATACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGC ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGCGAGGTCGTATAACTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
192	IMPI-058	VH domain amino acid sequence	EVQLVQSGAEVKKPGESLKISCKGSGYSFSSYWIGWVRQMPGKGLEWMGIIYPGDSETRYSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCARSYNWNYFDYWGQGTLVTVSS
193	IMPI-058	HCDR1	GYSFSSYW
194	IMPI-058	HCDR2	IYPGDSET
34	IMPI-058	HCDR3	ARSYNWNYFDY

SEQ ID NO	Clone ID	Description	Sequence
195	IMPI-058	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGGGACAGAGTCATCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCTTAAACTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCACCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTAGTAGTTACCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
196	IMPI-058	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVIITCRASQGISSALAWYQQKPGKALKLLIYDASSLESGVPSRFSGSGSGTDFTLTITS LQPEDFATYYCQQFSSYPWTFGQGTKVEIK
37	IMPI-058	LCDR1	QGISSA
28	IMPI-058	LCDR2	DAS
197	IMPI-058	LCDR3	QQFSSYPWT
198	IMPI-024	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGCAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTCTGG ATACAGCTTTACCAGCTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGATACCAGATACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGC ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGTGAGGTCGTATAATTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
199	IMPI-024	VH domain amino acid sequence	EVQLVQSGAEVKKPGESLKISCKGSGYSFTSYWIGWVRQMPGKGLEWMGIIYPGDSDTRYSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCVRSYNWNYFDYWGQGTLVTVSS
32	IMPI-024	HCDR1	GYSFTSYW
33	IMPI-024	HCDR2	IYPGDSDT
200	IMPI-024	HCDR3	VRSYNWNYFDY
201	IMPI-024	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGGTTTAGCCTGGTATCAGCAGAAAGCAGGGAAAGCTCCTAAGCTCCTGATCTATGATGTCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTCTTAGTTACCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA

SEQ ID NO	Clone ID	Description	Sequence
202	IMPI-024	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSGLAWYQQKAGKAPKLLIYDVSSLESGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQFLSYPWTFGQGTKVEIK
92	IMPI-024	LCDR1	QGISSG
203	IMPI-024	LCDR2	DVS
204	IMPI-024	LCDR3	QQFLSYPWT
205	IMPI-039	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGAGACCCTGTCCCTCACCTGCGCTGTCTCGGG TGGCTCCATCAGCAGAAGTACCTGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAA TCTCTCATAGTGGGAGTACCAAATACAACCCGTCCCTCAAGAGTCGAGTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAGCTCTGTGACCGCCGCGGACACGGCCGTATATTACTGTGCGGGAGAGGGGTCTAACTG GAGTTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
206	IMPI-039	VH domain amino acid sequence	QVQLQESGPGLVKPSETLSLTCAVSGGSISRSTWWSWVRQPPGKGLEWIGEISHSGSTKYNPSLKSRVTISVDKSKN QFSLKLSSVTAADTAVYYCAGEGSNWSYWGQGTLVTVSS
79	IMPI-039	HCDR1	GGSISRSTW
80	IMPI-039	HCDR2	ISHSGST
207	IMPI-039	HCDR3	AGEGSNWSY
208	IMPI-039	VL domain nucleic acid sequence	GATGTTGTGATGACTCAGTCTCCACACTCCCTGCCCGTCACCCTTGGACAGCCGGCCTCCATCTCCTGCAGGTCTAG TCAAAGCCTCGTATACAGTGATGGAAACACATATTTGAGTTGGTTTCAGCAGAGGCCAGGCCAATCTCCAAGGCGCC TAATTTATAAGGTTTCTAAATGGGACGCTGGGGTCCCAGACAGATTCAGCGGCAGTGGGTCAGGCACTGATTTCACA CTGAAAATCAGCAGGGTGGAGGCTGAGGATATTGGGATTTATTACTGCATGCAAGGTACACACTGGCCGCTCACTTT CGGCGGAGGGACCAAGGTGGAGCTCAAA
209	IMPI-039	VL domain amino acid sequence	DVVMTQSPHSLPVTLGQPASISCRSSQSLVYSDGNTYLSWFQQRPGQSPRRLIYKVSKWDAGVPDRFSGSGSGTDFT LKISRVEAEDIGIYYCMQGTHWPLTFGGGTKVELK

SEQ ID NO	Clone ID	Description	Sequence
84	IMPI-039	LCDR1	QSLVYSDGNTY
85	IMPI-039	LCDR2	KVS
86	IMPI-039	LCDR3	MQGTHWPLT
210	IMPI-020	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGCAGTAGTAACTGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAA TCTATCATAGTGGGAGCACCATGTACAACCCGTCCCTCAAGAGTCGAGTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAGCTCTGTGACCGCCGCGGACACGGCCGTGTATTACTGTACGGGAGAGGGGTATAACTG GAACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
211	IMPI-020	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGGSISSSNWWSWVRQPPGKGLEWIGEIYHSGSTMYNPSLKSRVTISVDKSKN QFSLKLSSVTAADTAVYYCTGEGYNWNYWGQGTLVTVSS
212	IMPI-020	HCDR1	GGSISSSNW
140	IMPI-020	HCDR2	IYHSGST
133	IMPI-020	HCDR3	TGEGYNWNY
213	IMPI-020	VL domain nucleic acid sequence	GATGTTGTGTTGACTCAGTCTCCACTCTCCCTGCCCGTCACCCTTGGACAGCCGGCCTCCATCTCCTGCAGGTCTAG TCAAAGCCTCGTATACAGTGATGGAAACACCTACTTGAGTTGGTTTCAACAGAGGCCAGGCCAATCTCCAAGGCGCC TAATTTATAAGGTTTCTAACTGGGACTCTGGGGTCCCAGACAGATTCAGCGGCAGTGGGTCAGGCTCTGATTTCACA CTGAAGATCAGCAGGGTGGAGGCTGAGGATGTTGGGGTTTATTACTGCATGCAAGGTACACACTGGCCGCTCACTTT CGGCGGAGGGACCAAGGTGGAGATCAAA
214	IMPI-020	VL domain amino acid sequence	DVVLTQSPLSLPVTLGQPASISCRSSQSLVYSDGNTYLSWFQQRPGQSPRRLIYKVSNWDSGVPDRFSGSGSGSDFT LKISRVEAEDVGVYYCMQGTHWPLTFGGGTKVEIK
84	IMPI-020	LCDR1	QSLVYSDGNTY
85	IMPI-020	LCDR2	KVS

SEQ ID NO	Clone ID	Description	Sequence
86	IMPI-020	LCDR3	MQGTHWPLT
215	IMPI-053	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAACCTTCGGAGACCCTGTCCCTCACCTGCGCTGTCTCGGG TGGCTCCATCAGCAGAAGTACCTGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAA TCTATCATAGTGGGAGCACCAAATACAACCCGTCCCTCAAGAGTCGAGTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAGCTCTGTGACCGCCGCGGACACGGCCGTGTATTACTGTGCGGGAGAGGGGTCTAACTG GAGCTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
216	IMPI-053	VH domain amino acid sequence	QVQLQESGPGLVKPSETLSLTCAVSGGSISRSTWWSWVRQPPGKGLEWIGEIYHSGSTKYNPSLKSRVTISVDKSKN QFSLKLSSVTAADTAVYYCAGEGSNWSYWGQGTLVTVSS
79	IMPI-053	HCDR1	GGSISRSTW
140	IMPI-053	HCDR2	IYHSGST
207	IMPI-053	HCDR3	AGEGSNWSY
217	IMPI-053	VL domain nucleic acid sequence	GATGTTGTGATGACTCAGTCTCCAGTCTCCCTGCCCGTCACCCTTGGACAGCCGGCCTCCATCTCCTGCAGGTCTAG TCAAAGCCTCATATACAGTGATGGAAACACCTACTTGAGTTGGTTTCAGCAGAGGCCAGGCCAATCTCCAAGGCGCC TAATTTATAAGGTTTCTAACTGGGACTCTGGGGTCCCAGACAGATTCAGCGGCAGTGGGTCAGGCACTGATTTCACA CTGAAAATCAGCAGGGTGGAGGCTGAGGATATTGGGATTTATTACTGCATGCAAGGTACACACTGGCCGCTCACTTT CGGCGGAGGGACCAAGGTGGAGCTCAAA
218	IMPI-053	VL domain amino acid sequence	DVVMTQSPVSLPVTLGQPASISCRSSQSLIYSDGNTYLSWFQQRPGQSPRRLIYKVSNWDSGVPDRFSGSGSGTDFT LKISRVEAEDIGIYYCMQGTHWPLTFGGGTKVELK
219	IMPI-053	LCDR1	QSLIYSDGNTY
85	IMPI-053	LCDR2	KVS
86	IMPI-053	LCDR3	MQGTHWPLT

SEQ ID NO	Clone ID	Description	Sequence
220	IMPI-021	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGGCAGCCTCTGG GGTCACCGTCAGTAGCAACTACATGAGCTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAGTTATTT ATAGCGGTGGTAGCACATTCTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTGAGAGCCGAGGACACGGCCGTGTATTACTGTGCGAGAGATCTCCTACTACGG TATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
221	IMPI-021	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGVTVSSNYMSWVRQAPGKGLEWVSVIYSGGSTFYADSVKGRFTISRDNSKNT LYLQMNSLRAEDTAVYYCARDLSYYGMDVWGQGTTVTVSS
3	IMPI-021	HCDR1	GVTVSSNY
14	IMPI-021	HCDR2	IYSGGST
222	IMPI-021	HCDR3	ARDLSYYGMDV
223	IMPI-021	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGCTCCTGATCTATGCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAAATTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGCTTAATAGTTACCCGTGCAGTTTTGGCCAGGGGACCAA GCTGGAGATCAAA
224	IMPI-021	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISSYLAWYQQKPGKAPKLLIYAASTLQSGVPSKFSGSGSGTEFTLTISS LQPEDFATYYCQQLNSYPCSFGQGTKLEIK
8	IMPI-021	LCDR1	QGISSY
18	IMPI-021	LCDR2	AAS
225	IMPI-021	LCDR3	QQLNSYPCS
226	IMPI-032	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGCAGTAATAAGTGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGTCTGGAGTGGATTGGGGAAA TCGATCATAGTGGGAGCACCATGTACAACCCGTCCCTCAAGAGCCGAGTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAACTCTGTGACCGCCGCGGACACGGCCGTGTATTACTGTACGGGAGAGGGGTATAACTG GAACTACTGGGGCCAGGGAACCCGGTCACCGTCTCCTCA

SEQ ID NO	Clone ID	Description	Sequence
227	IMPI-032	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGGSISSNKWWSWVRQPPGKGLEWIGEIDHSGSTMYNPSLKSRVTISVDKSKN QFSLKLNSVTAADTAVYYCTGEGYNWNYWGQGTRVTVSS
228	IMPI-032	HCDR1	GGSISSNKW
132	IMPI-032	HCDR2	IDHSGST
133	IMPI-032	HCDR3	TGEGYNWNY
229	IMPI-032	VL domain nucleic acid sequence	GATGTTGTGATGACTCAGTCTCCACTCTCCCTGCCCGTCACCCTTGGACAGACGGCCTCCATCTCCTGCAGGTCTAG TCAAAGCCTCCTATACACTGATGGAAATACCTACTTGAGTTGGTTTCAGCAGAGGCCAGGCCAATCTCCAAGGCGCC TAATTTATAAGGTTTCTAAGTGGGAATCTGGGGTCCCAGACAGATTCAGCGGCAGTGGGTCAGGCACTGATTTCACA CTGAAAATCAGCAGGGTGGAGGCTGAAGATGTTGGGATTTATTACTGCATGCAAGGTACACACTGGCCGCTCACTTT CGGCGGAGGGACCAAGGTGGAGATCAAA
230	IMPI-032	VL domain amino acid sequence	DVVMTQSPLSLPVTLGQTASISCRSSQSLLYTDGNTYLSWFQQRPGQSPRRLIYKVSKWESGVPDRFSGSGSGTDFT LKISRVEAEDVGIYYCMQGTHWPLTFGGGTKVEIK
136	IMPI-032	LCDR1	QSLLYTDGNTY
85	IMPI-032	LCDR2	KVS
86	IMPI-032	LCDR3	MQGTHWPLT
226	IMPI-001	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGCAGTAATAAGTGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGTCTGGAGTGGATTGGGGAAA TCGATCATAGTGGGAGCACCATGTACAACCCGTCCCTCAAGAGCCGAGTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAACTCTGTGACCGCCGCGGACACGGCCGTGTATTACTGTACGGGAGAGGGGTATAACTG GAACTACTGGGGCCAGGGGACCCGGGTCACCGTCTCCTCA
227	IMPI-001	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGGSISSNKWWSWVRQPPGKGLEWIGEIDHSGSTMYNPSLKSRVTISVDKSKN QFSLKLNSVTAADTAVYYCTGEGYNWNYWGQGTRVTVSS

SEQ ID NO	Clone ID	Description	Sequence
228	IMPI-001	HCDR1	GGSISSNKW
132	IMPI-001	HCDR2	IDHSGST
133	IMPI-001	HCDR3	TGEGYNWNY
231	IMPI-001 nucleic acid sequence	VL domain	GATGTTGTGCTGACTCAGTCTCCACTCTCCCTGCCCGTCACCCTTGGACAGACGGCCTCCATCTCCTGCAGGTCTAG TCAAAGCCTCGTATACACTGATGGAAATACCTACTTGAGTTGGTTTCAGCAGAGGCCAGGCCAATCTCCAAGGCGCC TAATTTATAAGGTTTCTAAGTGGGAATCTGGGGTCCCAGACAGATTCAGCGGCAGTGGGTCAGGCACTGATTTCACC CTGAAAATCAGCAGGGTGGAGGCTGAAGATGTTGGGATTTATTACTGCATGCAAGGTACACACTGGCCGCTCACTTT CGGCGGAGGGACCATGGTGGAGATCACA
232	IMPI-001 amino acid sequence	VL domain	DVVLTQSPLSLPVTLGQTASISCRSSQSLVYTDGNTYLSWFQQRPGQSPRRLIYKVSKWESGVPDRFSGSGSGTDFT LKISRVEAEDVGIYYCMQGTHWPLTFGGGTMVEIT
144	IMPI-001	LCDR1	QSLVYTDGNTY
85	IMPI-001	LCDR2	KVS
86	IMPI-001	LCDR3	MQGTHWPLT
233	IMPI-041 nucleic acid sequence	VH domain	CAGGTGCAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGGTCTCCTGCAAGGCTTCTGG ATACACCTTCACCAGTTATGATATCAACTGGGTGCGACAGGCCACTGGACAAGGGCTTGAGTGGATGGGATGGA ACCCTAACAGTGGTAACACAGCTATGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGAAACACCTCCATAAGC ACAGCCTACATGGAGCTGAGCAGCCTGAGATCTGAGGACACGGCCGTGTATTTCTGTGCGAGAGGCGGGCGATATTG TAGTGATGTTAGCTGCTACTCCGGAGAGCCTTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
234	IMPI-041 amino acid sequence	VH domain	QVQLVQSGAEVKKPGASVKVSCKASGYTFTSYDINWVRQATGQGLEWMGWMNPNSGNTGYAQKFQGRVTMTRNTSIS TAYMELSSLRSEDTAVYFCARGGRYCSDVSCYSGEPFDYWGQGTLVTVSS
121	IMPI-041	HCDR1	GYTFTSYD
235	IMPI-041	HCDR2	MNPNSGNT

SEQ ID NO	Clone ID	Description	Sequence
236	IMPI-041	HCDR3	ARGGRYCSDVSCYSGEPFDY
237	IMPI-041	VL domain nucleic acid sequence	GAAATTGTGCTGACTCAGTCTCCAGACTTTCAGTCTGTGACTCCAAAGGAGAAAAGTCACCATCACCTGCCGGGCCAG TCAGAGCATTGGTAGTAGCTTACACTGGTTCCAGCAGAAACCAGATCAGTCTCCAAAGCTCCTCATCAAGTATACTT CCCAGTCCATCTCAGGGGTCCCCTCGAGGTTCAGTGGCAGTGGATCTGGGACAGATTTCACCCTCACCATCAATAGC CTGGAAGCTGAAGATGCTGCAGCGTATTATTGTCATCAGAGTAGTAGTTTACCTCACACTTTCGGCCCTGGGACCAA AGTGGAGATCAAA
238	IMPI-041	VL domain amino acid sequence	EIVLTQSPDFQSVTPKEKVTITCRASQSIGSSLHWFQQKPDQSPKLLIKYTSQSISGVPSRFSGSGSGTDFTLTINS LEAEDAAAYYCHQSSSLPHTFGPGTKVEIK
126	IMPI-041	LCDR1	QSIGSS
239	IMPI-041	LCDR2	YTS
128	IMPI-041	LCDR3	HQSSSLPHT
240	IMPI-029	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG GGTCACCGTCAGTAGCAACTATATGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAGTTATTT ATAGCGGTGGTAGCACATACTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTTTCTTCAAATGAACAGCCTGAGAGCCGAGGACTCGGCCGTGTATTACTGTGCGAGAGATTTGGGACCCTACGG TGTGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
241	IMPI-029	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGVTVSSNYMNWVRQAPGKGLEWVSVIYSGGSTYYADSVKGRFTISRDNSKNT LFLQMNSLRAEDSAVYYCARDLGPYGVDVWGQGTTVTVSS
3	IMPI-029	HCDR1	GVTVSSNY
14	IMPI-029	HCDR2	IYSGGST
106	IMPI-029	HCDR3	ARDLGPYGVDV

SEQ ID NO	Clone ID	Description	Sequence
107	IMPI-029	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGCTCCTGATCTATGCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAAGAGCTTAATAGTTACCCTCTCACCTTCGGCCAAGGGACACG ACTGGAGATTAAA
108	IMPI-029	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISSYLAWYQQKPGKAPKLLIYAASTLQSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCQELNSYPLTFGQGTRLEIK
8	IMPI-029	LCDR1	QGISSY
18	IMPI-029	LCDR2	AAS
109	IMPI-029	LCDR3	QELNSYPLT
242	IMPI-009	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGTAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTCTGG ATACAGCTTTACCAGCTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGATACCAGATACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGT ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGCGAGGTCGTATAACTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
243	IMPI-009	VH domain amino acid sequence	EVQLVQSGVEVKKPGESLKISCKGSGYSFTSYWIGWVRQMPGKGLEWMGIIYPGDSDTRYSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCARSYNWNYFDYWGQGTLVTVSS
32	IMPI-009	HCDR1	GYSFTSYW
33	IMPI-009	HCDR2	IYPGDSDT
34	IMPI-009	HCDR3	ARSYNWNYFDY
244	IMPI-009	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGGTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTGAGCTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTTATAGTTACCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA

SEQ ID NO	Clone ID	Description	Sequence
245	IMPI-009	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSGLAWYQQKPGKAPELLIYDASSLESGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQFYSYPWTFGQGTKVEIK
92	IMPI-009	LCDR1	QGISSG
28	IMPI-009	LCDR2	DAS
246	IMPI-009	LCDR3	QQFYSYPWT
247	IMPI-006	VH domain nucleic acid sequence	CAGCTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGAGACCCTGTCCCTCACCTGCACTGTCTCTGG TGGCTCCATCAGTAATAGTAATTACTACTGGGGCTGGATCCGCCAGCCCCCAGGGAAGGGGCTGGAGTGGATTGGGA GTATCTATTATAGTGGGAGAACCTACTACAACCCGTCCCTCAAGAGTCGAGTCACCATATCCGTAGACACGTCCAAG AACCAGTTCTCCCTGAAGTTGAGCTCTGTGACCGCCGCAGACACGGCTGTGTATTACTGTGCGAGAATGGGATTACT ATGGTTCGGGGAGTTCTACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
248	IMPI-006	VH domain amino acid sequence	QLQLQESGPGLVKPSETLSLTCTVSGGSISNSNYYWGWIRQPPGKGLEWIGSIYYSGRTYYNPSLKSRVTISVDTSK NQFSLKLSSVTAADTAVYYCARMGLLWFGEFYGMDVWGQGTTVTVSS
249	IMPI-006	HCDR1	GGSISNSNYY
250	IMPI-006	HCDR2	IYYSGRT
251	IMPI-006	HCDR3	ARMGLLWFGEFYGMDV
252	IMPI-006	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCCTCACTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGTCGGGCGAG TCAGGGTATTAGCAGCTGGTTAGCCTGGTATCAGCAGAAACCAGAGAAAGCCCCTAAGTCCCTGATCTATGATGCAT CCAGTTTACAAAGAGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCATCTTATTACTGCCAACAGTATAATAGTTACCCGCTCACTTTCGGCGGAGGGACCAG GGTGGAGATCAAA
253	IMPI-006	VL domain amino acid sequence	DIQMTQSPSSLSASVGDRVTITCRASQGISSWLAWYQQKPEKAPKSLIYDASSLQRGVPSRFSGSGSGTDFTLTISS LQPEDFASYYCQQYNSYPLTFGGGTRVEIK

SEQ ID NO	Clone ID	Description	Sequence
254	IMPI-006	LCDR1	QGISSW
28	IMPI-006	LCDR2	DAS
255	IMPI-006	LCDR3	QQYNSYPLT
256	IMPI-054	VH domain nucleic acid sequence	GAGGTGCAACTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG GCTCACCGTCAGTAGCAACTACATGAGCTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAATTATTT ATAGCGGTGGTAGCACATACTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTGAGAGCCGAGGACACGGCCGTGTATTACTGTGCGAGGCTAGGGGGGTACTACTA CTACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
257	IMPI-054	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGLTVSSNYMSWVRQAPGKGLEWVSIIYSGGSTYYADSVKGRFTISRDNSKNT LYLQMNSLRAEDTAVYYCARLGGYYYYGMDVWGQGTTVTVSS
172	IMPI-054	HCDR1	GLTVSSNY
14	IMPI-054	HCDR2	IYSGGST
258	IMPI-054	HCDR3	ARLGGYYYYGMDV
259	IMPI-054	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGAAAGAGTCACCATCACTTGCCAGGCGAG TCAGGACATTAGAAACTATTTAAATTGGTATCAGAAGAAACCAGGGAAAGCCCCTAAGCTCCTGATCTACGATTCAT CCAATTTGGAAACAGGGGTCCCATCAAGGTTCAGTGGAAGTGGATCTGGGACAGATTTTACTTTCACCATCAGCAGC CTGCAGCCTGAAGATATTGCAACATATTACTGTCAACAGTATGATAATCTCCCGATCACCTTCGGCCAAGGGACACG ACTGGAGATTAAA
260	IMPI-054	VL domain amino acid sequence	DIQMTQSPSSLSASVGERVTITCQASQDIRNYLNWYQKKPGKAPKLLIYDSSNLETGVPSRFSGSGSGTDFTFTISS LQPEDIATYYCQQYDNLPITFGQGTRLEIK
261	IMPI-054	LCDR1	QDIRNY
262	IMPI-054	LCDR2	DSS

SEQ ID NO	Clone ID	Description	Sequence
263	IMPI-054	LCDR3	QQYDNLPIT
264	IMPI-044	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGCAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTCTGG ATACAGCTTTACCAGCTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGATACCAGATACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGC ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGCGAGGTCGTATAACTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
265	IMPI-044	VH domain amino acid sequence	EVQLVQSGAEVKKPGESLKISCKGSGYSFTSYWIGWVRQMPGKGLEWMGIIYPGDSDTRYSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCARSYNWNYFDYWGQGTLVTVSS
32	IMPI-044	HCDR1	GYSFTSYW
33	IMPI-044	HCDR2	IYPGDSDT
34	IMPI-044	HCDR3	ARSYNWNYFDY
266	IMPI-044	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTTGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGTAGTGGTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAAGCTCCTGATCTATGATGTCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTCTTAGTTACCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
267	IMPI-044	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSGLAWYQQKPGKAPKLLIYDVSSLESGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQFLSYPWTFGQGTKVEIK
92	IMPI-044	LCDR1	QGISSG
203	IMPI-044	LCDR2	DVS
204	IMPI-044	LCDR3	QQFLSYPWT

SEQ ID NO	Clone ID	Description	Sequence
268	IMPI-002	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGGCAGCCTCTGG GGTCACCGTCAGTAGCAACTACATGAGCTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGGGGGTCTCAGTTATTT ATAGTGGTGGTAGCACATACTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTGAGAGCCGAGGACACGGCCGTGTATTACTGTGCGAGAGATACGGTGGTCTACGG TATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
269	IMPI-002	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGVTVSSNYMSWVRQAPGKGLEGVSVIYSGGSTYYADSVKGRFTISRDNSKNT LYLQMNSLRAEDTAVYYCARDTVVYGMDVWGQGTTVTVSS
3	IMPI-002	HCDR1	GVTVSSNY
14	IMPI-002	HCDR2	IYSGGST
5	IMPI-002	HCDR3	ARDTVVYGMDV
270	IMPI-002	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGCTCCTGATCTATGCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGCTTAATAGTTACCCGCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
271	IMPI-002	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISSYLAWYQQKPGKAPKLLIYAASTLQSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCQQLNSYPLTFGGGTKVEIK
8	IMPI-002	LCDR1	QGISSY
18	IMPI-002	LCDR2	AAS
10	IMPI-002	LCDR3	QQLNSYPLT
272	IMPI-027	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCACAGACCCTGTCCCTCACCTGCACTGTCTCTGG TGGCTCCATCAGCAGTTATGGTTACTACTGGAACTGGATCCGCCAGCACCCAGGGAAGGGCCTGGAGTGGATTGGGT ACATCTATTACAGTGGGAGCACCTACTACAACCCGTCCCTCAAGAGTCGAGTTACCATATCAGTAGACACGTCTAAG AACCAGCTCTCCCTGAGGCTGAACTCTGTCACTGCCGCGGACACGGCCGTGTATTACTGTGCGAGAGACTTCGGTGG TAACTCGAACTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA

SEQ ID NO	Clone ID	Description	Sequence
273	IMPI-027	VH domain amino acid sequence	QVQLQESGPGLVKPSQTLSLTCTVSGGSISSYGYYWNWIRQHPGKGLEWIGYIYYSGSTYYNPSLKSRVTISVDTSK NQLSLRLNSVSAADTAVYYCARDFGGNSNYFDYWGQGTLVTVSS
41	IMPI-027	HCDR1	GGSISSYGYY
42	IMPI-027	HCDR2	IYYSGST
43	IMPI-027	HCDR3	ARDFGGNSNYFDY
274	IMPI-027	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGACAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAACAGAAACCAGGGAAAGCTCCTAAACTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTAATAGTTACCCTCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
275	IMPI-027	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRTSQGISSALAWYQQKPGKAPKLLIYDASSLESGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQFNSYPLTFGGGTKVEIK
37	IMPI-027	LCDR1	QGISSA
28	IMPI-027	LCDR2	DAS
47	IMPI-027	LCDR3	QQFNSYPLT
264	IMPI-011	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGCAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTCTGG ATACAGCTTTACCAGCTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGATACCAGATACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGC ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGCGAGGTCGTATAACTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
265	IMPI-011	VH domain amino acid sequence	EVQLVQSGAEVKKPGESLKISCKGSGYSFTSYWIGWVRQMPGKGLEWMGIIYPGDSDTRYSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCARSYNWNYFDYWGQGTLVTVSS

SEQ ID NO	Clone ID	Description	Sequence
32	IMPI-011	HCDR1	GYSFTSYW
33	IMPI-011	HCDR2	IYPGDSDT
34	IMPI-011	HCDR3	ARSYNWNYFDY
276	IMPI-011	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGGTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAAACTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAATTTATTACTGTCAACAGTTTAATAGTTATCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
277	IMPI-011	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSGLAWYQQKPGKAPKLLIYDASSLESGVPSRFSGSGSGTDFTLTISS LQPEDFAIYYCQQFNSYPWTFGQGTKVEIK
92	IMPI-011	LCDR1	QGISSG
28	IMPI-011	LCDR2	DAS
76	IMPI-011	LCDR3	QQFNSYPWT
278	IMPI-033	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCACAGACCCTGTCCCTCACCTGCACTGTCTCTGG TGGCTCCATCAGCAGTTATGGTTACTACTGGAGCTGGATCCGCCAGCACCCAGGGAAGGGCCTGGAGTGGATTGGAT ACATCTATTACAGTGGGAGCACCTACTACAACCCGTCCCTCAAGAGTCGAGTTACCATGTCAGTTGACACGTCTAAG AACCAGCTCTCCCTGAGGCTGAACTCTGTCACTGCCGCGGACACGGCCGTGTATTACTGTGCGAGAGACTTCGGTGG TAACTCGAACTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
279	IMPI-033	VH domain amino acid sequence	QVQLQESGPGLVKPSQTLSLTCTVSGGSISSYGYYWSWIRQHPGKGLEWIGYIYYSGSTYYNPSLKSRVTMSVDTSK NQLSLRLNSVSAADTAVYYCARDFGGNSNYFDYWGQGTLVTVSS
41	IMPI-033	HCDR1	GGSISSYGYY
42	IMPI-033	HCDR2	IYYSGST

SEQ ID NO	Clone ID	Description	Sequence
43	IMPI-033	HCDR3	ARDFGGNSNYFDY
280	IMPI-033	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAACCTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTAATAGTTCCCCTCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
281	IMPI-033	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKPGKAPNLLIYDASSLESGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQFNSSPLTFGGGTKVEIK
37	IMPI-033	LCDR1	QGISSA
28	IMPI-033	LCDR2	DAS
282	IMPI-033	LCDR3	QQFNSSPLT
283	IMPI-055	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGGTCTCCTGCAAGGCTTCTGG ATACACCTTCACCAGTTATGATATCAACTGGGTGCGACAGGCCACTGGACAAGGGCTTGAGTGGATGGGATGGATGA ACCCTAACAGTGGTAACACAGGCTATGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGAGACACCTCCATAAAC ACAGCCTACATGGAGCTGAGCAGCCTGAGATCTGAGGACACGGCCGTGTATTTCTGTGCGAGAGGCGGGCGATATTG TAGTGATGTTACCTGCTACTCCGGAGAGCCTTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
284	IMPI-055	VH domain amino acid sequence	QVQLVQSGAEVKKPGASVKVSCKASGYTFTSYDINWVRQATGQGLEWMGWMNPNSGNTGYAQKFQGRVTMTRDTSIN TAYMELSSLRSEDTAVYFCARGGRYCSDVTCYSGEPFDYWGQGTLVTVSS
121	IMPI-055	HCDR1	GYTFTSYD
235	IMPI-055	HCDR2	MNPNSGNT
285	IMPI-055	HCDR3	ARGGRYCSDVTCYSGEPFDY

SEQ ID NO	Clone ID	Description	Sequence
286	IMPI-055	VL domain nucleic acid sequence	GAAATTATGCTGACTCAGTCTCCAGACTTTCAGTCTGTGACTCCAAAGGAGAAAGTCACCATCACCTGCCGGGCCAG TCAGAGCATTGGTAGTAGCTTACACTGGTACCAGCAGAAACCAGATCAGTCTCCAAAACTCCTCATCAAGTTTGCTT CCCAGTCCATCTCAGGGGTCCCCTCGAGGTTCAGTGGCAGTGGATCTGGGACAGATTTCACCCTCACCATCAATAGC CTGGAAGCTGAAGATGCTGCAGCGTATTATTGTCATCAGAGTAGTAGTTTACCTCACACTTTCGGCCCTGGGACCAA AGTGGAGATCAAA
287	IMPI-055	VL domain amino acid sequence	EIMLTQSPDFQSVTPKEKVTITCRASQSIGSSLHWYQQKPDQSPKLLIKFASQSISGVPSRFSGSGSGTDFTLTINS LEAEDAAAYYCHQSSSLPHTFGPGTKVEIK
126	IMPI-055	LCDR1	QSIGSS
288	IMPI-055	LCDR2	FAS
128	IMPI-055	LCDR3	HQSSSLPHT
198	IMPI-049	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGCAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTCTGG ATACAGCTTTACCAGCTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGATACCAGATACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGC ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGTGAGGTCGTATAATTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
199	IMPI-049	VH domain amino acid sequence	EVQLVQSGAEVKKPGESLKISCKGSGYSFTSYWIGWVRQMPGKGLEWMGIIYPGDSDTRYSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCVRSYNWNYFDYWGQGTLVTVSS
32	IMPI-049	HCDR1	GYSFTSYW
33	IMPI-049	HCDR2	IYPGDSDT
200	IMPI-049	HCDR3	VRSYNWNYFDY
289	IMPI-049	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGGTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAAGCTCCTGATCTATGATGTCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTCTTAGTTACCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA

SEQ ID NO	Clone ID	Description	Sequence
267	IMPI-049	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSGLAWYQQKPGKAPKLLIYDVSSLESGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQFLSYPWTFGQGTKVEIK
92	IMPI-049	LCDR1	QGISSG
203	IMPI-049	LCDR2	DVS
204	IMPI-049	LCDR3	QQFLSYPWT
290	IMPI-042	VH domain nucleic acid sequence	GAGGTGCAACTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG GCTCACCGTCAGTAGCAACTACATGAGCTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAATTATTT ATAGCGGTGGTAGCACATACTATGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTGAGAGCCGAGGACACGGCCGTGTATTACTGTGCGAGGCTAGGGGGGTACTACTA CTACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
257	IMPI-042	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGLTVSSNYMSWVRQAPGKGLEWVSIIYSGGSTYYADSVKGRFTISRDNSKNT LYLQMNSLRAEDTAVYYCARLGGYYYYGMDVWGQGTTVTVSS
172	IMPI-042	HCDR1	GLTVSSNY
14	IMPI-042	HCDR2	IYSGGST
258	IMPI-042	HCDR3	ARLGGYYYYGMDV
291	IMPI-042	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGAAAGAGTCACCATCACTTGCCAGGCGAG TCAGGACATTAGAAACTATTTAAATTGGTATCAGAAGAAACCAGGGAAAGCCCCTAAACTCCTGATCTACGATTCAT CCAATTTGGAAACAGGGGTCCCATCAAGGTTCAGTGGAGGTGGATCTGGGACAGATTTTACTTTCACCATCAGCAGC CTGCAGCCTGAAGATATTGCAACATATTACTGTCAACAGTATGATAATCTCCCGATCACCTTCGGCCAAGGGACACG ACTGGAGATTAAA
292	IMPI-042	VL domain amino acid sequence	DIQMTQSPSSLSASVGERVTITCQASQDIRNYLNWYQKKPGKAPKLLIYDSSNLETGVPSRFSGGGSGTDFTFTISS LQPEDIATYYCQQYDNLPITFGQGTRLEIK

SEQ ID NO	Clone ID	Description	Sequence
261	IMPI-042	LCDR1	QDIRNY
262	IMPI-042	LCDR2	DSS
263	IMPI-042	LCDR3	QQYDNLPIT
293	IMPI-035	VH domain nucleic acid sequence	GAAGTGCAGCTGGTGGAGTCTGGGGGAGACTTGGTACAGCCTGGCAGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGCCATGCACTGGGTCCGGCAAGCTCCAGGGAAGGGCCTGGAGTGGGTCTCAGGTATTA GTTGGAATAGTGGTAGCATAGGCTATGCGGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCTGAGGACACGGCCTTGTATTACTGTGCAAAAGATCTCCAGGGGGA CTACTACTACTACGGTGTGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
294	IMPI-035	VH domain amino acid sequence	EVQLVESGGDLVQPGRSLRLSCAASGFTFDDYAMHWVRQAPGKGLEWVSGISWNSGSIGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCAKDLQGDYYYYGVDVWGQGTTVTVSS
22	IMPI-035	HCDR1	GFTFDDYA
23	IMPI-035	HCDR2	ISWNSGSI
147	IMPI-035	HCDR3	AKDLQGDYYYYGVDV
295	IMPI-035	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAATCAGGAAAAGCTCCTAAGCTCCTGATCTATGATGCCT CCAGTTTGGGAAGTGGGTCCCATCAAGGTTCAGCGGCAGTAGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAACCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTATTAGTTACCCGCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
296	IMPI-035	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKSGKAPKLLIYDASSLGSGVPSRFSGSRSGTDFTLTISS LQPEDFATYYCQQFISYPLTFGGGTKVEIK
37	IMPI-035	LCDR1	QGISSA
28	IMPI-035	LCDR2	DAS

SEQ ID NO	Clone ID	Description	Sequence
69	IMPI-035	LCDR3	QQFISYPLT
297	IMPI-028	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGGCAGCCTCTGG GTTCACCGTCAGTAGCAACTACATGAGCTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAGTTATTT ATAGCGGTGGTAGCACATACTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTGAGAGCCGAGGACACGGCCGTGTATTACTGTGCGAGAGACTACGGTGACCTATA CTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
298	IMPI-028	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGFTVSSNYMSWVRQAPGKGLEWVSVIYSGGSTYYADSVKGRFTISRDNSKNT LYLQMNSLRAEDTAVYYCARDYGDLYFDYWGQGTLVTVSS
13	IMPI-028	HCDR1	GFTVSSNY
14	IMPI-028	HCDR2	IYSGGST
299	IMPI-028	HCDR3	ARDYGDLYFDY
300	IMPI-028	VL domain nucleic acid sequence	GAAATTGTGTTGACGCAGTCTCCAGGCACCCTGTCTTTGTCTCCAGGGGAAAGAGCCACCCTCTCCTGCAGGGCCAG TCAGAGTATTAGCAGCTACTTAGCCTGGTACCAGCAGAAACCTGGCCAGGCTCCCAGGCTCCTCATCTATGGTGCAT CCAGCAGGGCCACTGGCATCCCAGACAAATTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGCAGA CTGGAGCCTGAAGATTTTGCAGTGTATTACTGTCAGCAGTATGGTAGCTCACCTCGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
301	IMPI-028	VL domain amino acid sequence	EIVLTQSPGTLSLSPGERATLSCRASQSISSYLAWYQQKPGQAPRLLIYGASSRATGIPDKFSGSGSGTDFTLTISR LEPEDFAVYYCQQYGSSPRTFGQGTKVEIK
302	IMPI-028	LCDR1	QSISSY
157	IMPI-028	LCDR2	GAS
303	IMPI-028	LCDR3	QQYGSSPRT

SEQ ID NO	Clone ID	Description	Sequence
304	IMPI-018	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCACAGACCCTGTCCCTCACCTGCACTGTCTCTGG TGACTCCATCAGCCGTGGTGGTTTCTACTGGAGCTGGATCCGCCAGCACCCAGGGAAGGGCCTGGAGTGGATTGGGT ACATCTATTACAGTGGGAGCACCTACTACAACCCGTCCCTCAAGGGTCGAGTTACCATATCAGTAGACACGTCTAAG AACCAGTTCTCCCTGAAGCTGACCTCTGTGACTGCCGCGGACACGGCCGTGTATTACTGTGCGAGAGACTACGGTGG TAACTCGAACTACTTTGACTACTGGGGCCAGGGGACCCTGGTCACCGTCTCCTCA
305	IMPI-018	VH domain amino acid sequence	QVQLQESGPGLVKPSQTLSLTCTVSGDSISRGGFYWSWIRQHPGKGLEWIGYIYYSGSTYYNPSLKGRVTISVDTSK NQFSLKLTSVTAADTAVYYCARDYGGNSNYFDYWGQGTLVTVSS
306	IMPI-018	HCDR1	GDSISRGGFY
42	IMPI-018	HCDR2	IYYSGST
307	IMPI-018	HCDR3	ARDYGGNSNYFDY
308	IMPI-018	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAAGCTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCACCTTATTACTGTCAACAGTTTAATAGTTACCCTCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAGG
309	IMPI-018	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKPGKAPKLLIYDASSLESGVPSRFSGSGSGTDFTLTISS LQPEDFAPYYCQQFNSYPLTFGGGTKVEIR
37	IMPI-018	LCDR1	QGISSA
28	IMPI-018	LCDR2	DAS
47	IMPI-018	LCDR3	QQFNSYPLT
264	IMPI-050	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGCAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTCTGG ATACAGCTTTACCAGCTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGATACCAGATACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGC ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGCGAGGTCGTATAACTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA

SEQ ID NO	Clone ID	Description	Sequence
265	IMPI-050	VH domain amino acid sequence	EVQLVQSGAEVKKPGESLKISCKGSGYSFTSYWIGWVRQMPGKGLEWMGIIYPGDSDTRYSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCARSYNWNYFDYWGQGTLVTVSS
32	IMPI-050	HCDR1	GYSFTSYW
33	IMPI-050	HCDR2	IYPGDSDT
34	IMPI-050	HCDR3	ARSYNWNYFDY
310	IMPI-050	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAACAATGGTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAAGCTCCTGATCTATGATGTCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGAGAGATTCCACTCTCACCATCAGCAGT CTGCAGTCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTAAAAGTTACCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
311	IMPI-050	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGINNGLAWYQQKPGKAPKLLIYDVSSLESGVPSRFSGSGSGRDSTLTISS LQSEDFATYYCQQFKSYPWTFGQGTKVEIK
312	IMPI-050	LCDR1	QGINNG
203	IMPI-050	LCDR2	DVS
93	IMPI-050	LCDR3	QQFKSYPWT
264	IMPI-016	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGCAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTCTGG ATACAGCTTTACCAGCTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGATACCAGATACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGC ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGCGAGGTCGTATAACTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
265	IMPI-016	VH domain amino acid sequence	EVQLVQSGAEVKKPGESLKISCKGSGYSFTSYWIGWVRQMPGKGLEWMGIIYPGDSDTRYSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCARSYNWNYFDYWGQGTLVTVSS

SEQ ID NO	Clone ID	Description	Sequence
32	IMPI-016	HCDR1	GYSFTSYW
33	IMPI-016	HCDR2	IYPGDSDT
34	IMPI-016	HCDR3	ARSYNWNYFDY
313	IMPI-016	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGGTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAAGCTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAAC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTAATAGTTACCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
314	IMPI-016	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSGLAWYQQKPGKAPKLLIYDASSLESGVPSRFSGSGSGTDFTLTISN LQPEDFATYYCQQFNSYPWTFGQGTKVEIK
92	IMPI-016	LCDR1	QGISSG
28	IMPI-016	LCDR2	DAS
76	IMPI-016	LCDR3	QQFNSYPWT
315	IMPI-040	VH domain nucleic acid sequence	CAGGTGCAGCTACAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGCAGTAATAACTGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGTCTGGAGTGGATTGGGGAAA TCTATCATAGTGGGAGCACCATGTACAACCCGTCCCTCAAGAGTCGAGTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAACTCTGTGACCGCCGCGGACACGGCCGTGTATTACTGTACGGGAGAGGGGTCTAACTG GAACTACTGGGGCCAGGGGACCCTGGTCACCGTCTCCTCA
316	IMPI-040	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGGSISSNNWWSWVRQPPGKGLEWIGEIYHSGSTMYNPSLKSRVTISVDKSKN QFSLKLNSVTAADTAVYYCTGEGSNWNYWGQGTLVTVSS
131	IMPI-040	HCDR1	GGSISSNNW
140	IMPI-040	HCDR2	IYHSGST

SEQ ID NO	Clone ID	Description	Sequence
317	IMPI-040	HCDR3	TGEGSNWNY
318	IMPI-040	VL domain nucleic acid sequence	GATGTTGTGATGACTCAGTCTCCACTCTCCCTGCCCGTCACCCTTGGACAGCCGGCCTCCATCTCCTGCAGGTCTAG TCAAAGCCTCGTATATACTGATGGAAACACCTACTTGAGTTGGTTTCAGCAGAGGCCAGGCCAATCTCCAAGGCGCC TACTTTATAAGGTTTCTAACTGGGACTCTGGGGTCCCAGACAGATTCAGCGGCAGTGGGTCAGGCACTGATTTCACA CTGAAAATCAGCAGGGTGGAGGCTGAAGATGTTGGGATTTATTATTGCATGCAAGGTACACACTGGCCGCTCACTTT CGGCGGAGGGACCAAGGTGGAGATCAAA
319	IMPI-040	VL domain amino acid sequence	DVVMTQSPLSLPVTLGQPASISCRSSQSLVYTDGNTYLSWFQQRPGQSPRRLLYKVSNWDSGVPDRFSGSGSGTDFT LKISRVEAEDVGIYYCMQGTHWPLTFGGGTKVEIK
144	IMPI-040	LCDR1	QSLVYTDGNTY
85	IMPI-040	LCDR2	KVS
86	IMPI-040	LCDR3	MQGTHWPLT
77	IMPI-030	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGCAGGAGTACCTGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAA TCTCTCATAGTGGGAGCACCCAGTACAACCCGTCCCTCAAGAGTCGAGTCACCATATCACTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAACTCTGTGACCGCCGCGGACACGGCCGTATATTACTGTGCGGGAGAGGGGTATAACTG GAACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
78	IMPI-030	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGGSISRSTWWSWVRQPPGKGLEWIGEISHSGSTQYNPSLKSRVTISLDKSKN QFSLKLNSVTAADTAVYYCAGEGYNWNYWGQGTLVTVSS
79	IMPI-030	HCDR1	GGSISRSTW
80	IMPI-030	HCDR2	ISHSGST
81	IMPI-030	HCDR3	AGEGYNWNY

SEQ ID NO	Clone ID	Description	Sequence
320	IMPI-030	VL domain nucleic acid sequence	GATGTTGTAATGACTCAGTCTCCACTCTCCCTGCCCGTCACCCTTGGACAGCCGGCCTCCATCTCCTGCAGGTCTAG TCAAAGCCTCGTATACAGTGATGGAAACACCTACTTGAGTTGGTTTCAGCAGAGGCCAGGCCAATCTCCAAGGCGCC TAATTTATAAGGTTTCTAAGTGGGACTCTGGGGTCCCAGACAGATTCAGCGGCAGTGGGTCAGGCACTGATTTCACA CTGAAAATCAGCAGGGTGGAGGCTGAGGATGTTGGGGTTTATTACTGCATGCAAGGTACACACTGGCCGCTCACTTT CGGCGGAGGGACCAAGGTGGAGATCAAA
321	IMPI-030	VL domain amino acid sequence	DVVMTQSPLSLPVTLGQPASISCRSSQSLVYSDGNTYLSWFQQRPGQSPRRLIYKVSKWDSGVPDRFSGSGSGTDFT LKISRVEAEDVGVYYCMQGTHWPLTFGGGTKVEIK
84	IMPI-030	LCDR1	QSLVYSDGNTY
85	IMPI-030	LCDR2	KVS
86	IMPI-030	LCDR3	MQGTHWPLT
264	IMPI-034	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGCAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTCTGG ATACAGCTTTACCAGCTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGATACCAGATACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGC ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGCGAGGTCGTATAACTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
265	IMPI-034	VH domain amino acid sequence	EVQLVQSGAEVKKPGESLKISCKGSGYSFTSYWIGWVRQMPGKGLEWMGIIYPGDSDTRYSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCARSYNWNYFDYWGQGTLVTVSS
32	IMPI-034	HCDR1	GYSFTSYW
33	IMPI-034	HCDR2	IYPGDSDT
34	IMPI-034	HCDR3	ARSYNWNYFDY
322	IMPI-034	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAACAGTGGTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGGTCTTAAGCTCCTGATCTATGATGTCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGAGAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTAAAAGTTACCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA

SEQ ID NO	Clone ID	Description	Sequence
323	IMPI-034	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGINSGLAWYQQKPGKGLKLLIYDVSSLESGVPSRFSGSGSGRDFTLTISS LQPEDFATYYCQQFKSYPWTFGQGTKVEIK
324	IMPI-034	LCDR1	QGINSG
203	IMPI-034	LCDR2	DVS
93	IMPI-034	LCDR3	QQFKSYPWT
325	IMPI-013	VH domain nucleic acid sequence	GAAGTGCAGCTGGTGGAGTCTGGGGGAGGCTTGGTACAGCCTGGCAGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGCCATGCACTGGGTCCGGCAAACTCCAGGGAAGGGCCTGGAGTGGGTCTCAGGTATTA GTTGGAATAGTGGTAGCATAGGCTATGCGGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCTGAAGACACGGCCTTATATTACTGTACAAAAGATTTGGGACTGGG GATTGGCTTCTACTACGGTTTGGACGTCTGGGGCCAGGGGACCACGGTCACCGTCTCCTCA
326	IMPI-013	VH domain amino acid sequence	EVQLVESGGGLVQPGRSLRLSCAASGFTFDDYAMHWVRQTPGKGLEWVSGISWNSGSIGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCTKDLGLGIGFYYGLDVWGQGTTVTVSS
22	IMPI-013	HCDR1	GFTFDDYA
23	IMPI-013	HCDR2	ISWNSGSI
327	IMPI-013	HCDR3	TKDLGLGIGFYYGLDV
328	IMPI-013	VL domain nucleic acid sequence	GCCATCCAAATGACCCAGTCTCCATCCTCCCTGTCTACATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGAAATGATTTAGGCTGGTATCAGCTGAAGCCAGGGAAAGCCCCTAAGCTCCTGATCTATGATGCAT CCACTTTACAAAGTGGGGTCCCATCGAGGTTCAGCGGCAGTGGATCTGGCACAGATTTCACTCTCACCATCAGCAGC CTGGAGCCTGAAGATTTAGCAACTTATTACTGTCTACATCACTACACTTACCCGTGGACGTTCGGCCATGGGACCAA GGTGGAACTCAAA
329	IMPI-013	VL domain amino acid sequence	AIQMTQSPSSLSTSVGDRVTITCRASQGIRNDLGWYQLKPGKAPKLLIYDASTLQSGVPSRFSGSGSGTDFTLTISS LEPEDLATYYCLHHYTYPWTFGHGTKVELK

SEQ ID NO	Clone ID	Description	Sequence
27	IMPI-013	LCDR1	QGIRND
28	IMPI-013	LCDR2	DAS
29	IMPI-013	LCDR3	LHHYTYPWT
330	IMPI-026	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGCAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTTTGG ATACAGCTTTACCAGCTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGATACCAGATACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGC ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGCGAGGTCGTATAACTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
331	IMPI-026	VH domain amino acid sequence	EVQLVQSGAEVKKPGESLKISCKGFGYSFTSYWIGWVRQMPGKGLEWMGIIYPGDSDTRYSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCARSYNWNYFDYWGQGTLVTVSS
32	IMPI-026	HCDR1	GYSFTSYW
33	IMPI-026	HCDR2	IYPGDSDT
34	IMPI-026	HCDR3	ARSYNWNYFDY
332	IMPI-026	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAAGCTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAGGATTTTGCAACTTATTACTGTCAACAGTTTAATAGTTACCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
333	IMPI-026	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKPGKAPKLLIYDASSLESGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQFNSYPWTFGQGTKVEIK
37	IMPI-026	LCDR1	QGISSA
28	IMPI-026	LCDR2	DAS

SEQ ID NO	Clone ID	Description	Sequence
76	IMPI-026	LCDR3	QQFNSYPWT
334	IMPI-007	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCGAG TGGCTCCATCAGCAGAAGTACCTGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAA TCTATCATAGTGGGAGCACCCAATACAACCCGTCCCTCAAGAGTCGAGTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAGTTCTGCGACCGCCGCGGACACGGCCGTGTATTACTGTGCGGGAGAGGGGTCTAACTG GAACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
335	IMPI-007	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSSGSISRSTWWSWVRQPPGKGLEWIGEIYHSGSTQYNPSLKSRVTISVDKSKN QFSLKLSSATAADTAVYYCAGEGSNWNYWGQGTLVTVSS
336	IMPI-007	HCDR1	SGSISRSTW
140	IMPI-007	HCDR2	IYHSGST
337	IMPI-007	HCDR3	AGEGSNWNY
338	IMPI-007	VL domain nucleic acid sequence	GATGTTGTGATGACTCAGTCTCCACTCTCCCTGCCCGTCACCCTTGGACAGCCGGCCTCCATCTCCTGCAGGTCTAG TCAAAGCCTCGTATACAGTGATGGAAACACCTACTTGAGTTGGTTTCAGCAGAGGCCAGGCCAATCTCCAAGGCGCC TAATTTATAAGGTTTCTAACTGGGACTCTGGGGTCCCAGACAGATTCAGCGGCAGTGGGTCAGGCACTGATTTCACA CTGAGAATCAGCAGGGTGGAGGCTGAGGATATTGGGGTTTATTACTGCATGCAAGGTACACACTGGCCGCTCACTTT CGGCGGAGGGACCAAGGTGGAGCTCAAA
339	IMPI-007	VL domain amino acid sequence	DVVMTQSPLSLPVTLGQPASISCRSSQSLVYSDGNTYLSWFQQRPGQSPRRLIYKVSNWDSGVPDRFSGSGSGTDFT LRISRVEAEDIGVYYCMQGTHWPLTFGGGTKVELK
84	IMPI-007	LCDR1	QSLVYSDGNTY
85	IMPI-007	LCDR2	KVS
86	IMPI-007	LCDR3	MQGTHWPLT

SEQ ID NO	Clone ID	Description	Sequence
340	IMPI-046	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGCAGTCTGGAGCAGAGGTGAAAAAGCCCGGGGAGTCTCTGAAGATCTCCTGTAAGGGTTCTGG ATACAGATTTACCAGTTACTGGATCGGCTGGGTGCGCCAGATGCCCGGGAAAGGCCTGGAGTGGATGGGGATCATCT ATCCTGGTGACTCTGATACCAGATACAGCCCGTCCTTCCAAGGCCAGGTCACCATCTCAGCCGACAAGTCCATCAGC ACCGCCTACCTGCAGTGGAGCAGCCTGAAGGCCTCGGACACCGCCATGTATTACTGTGCGAGGTCGTATAACTGGAA CTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
341	IMPI-046	VH domain amino acid sequence	EVQLVQSGAEVKKPGESLKISCKGSGYRFTSYWIGWVRQMPGKGLEWMGIIYPGDSDTRYSPSFQGQVTISADKSIS TAYLQWSSLKASDTAMYYCARSYNWNYFDYWGQGTLVTVSS
342	IMPI-046	HCDR1	GYRFTSYW
33	IMPI-046	HCDR2	IYPGDSDT
34	IMPI-046	HCDR3	ARSYNWNYFDY
343	IMPI-046	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAAGCTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCACCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTAATAGTTACCCTTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
344	IMPI-046	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKPGKAPKLLIYDASSLESGVPPRFSGSGSGTDFTLTISS LQPEDFATYYCQQFISYPWTFGQGTKVEIK
37	IMPI-046	LCDR1	QGISSA
28	IMPI-046	LCDR2	DAS
38	IMPI-046	LCDR3	QQFISYPWT
220	IMPI-060	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG GGTCACCGTCAGTAGCAACTACATGAGCTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAGTTATTT ATAGCGGTGGTAGCACATTCTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTGAGAGCCGAGGACACGGCCGTGTATTACTGTGCGAGAGATCTCTCCTACTACGG TATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA

SEQ ID NO	Clone ID	Description	Sequence
221	IMPI-060	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGVTVSSNYMSWVRQAPGKGLEWVSVIYSGGSTFYADSVKGRFTISRDNSKNT LYLQMNSLRAEDTAVYYCARDLSYYGMDVWGQGTTVTVSS
3	IMPI-060	HCDR1	GVTVSSNY
14	IMPI-060	HCDR2	IYSGGST
222	IMPI-060	HCDR3	ARDLSYYGMDV
345	IMPI-060	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGCTCCTGATCTATGCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAAATTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGCTTAATAGTTACCCGAGCAGTTTTGGCCAGGGGACCAA GCTGGAGATCAAA
346	IMPI-060	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISSYLAWYQQKPGKAPKLLIYAASTLQSGVPSKFSGSGSGTEFTLTISS LQPEDFATYYCQQLNSYPSSFGQGTKLEIK
8	IMPI-060	LCDR1	QGISSY
18	IMPI-060	LCDR2	AAS
347	IMPI-060	LCDR3	QQLNSYPSS
348	IMPI-056	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG GCTCACCGTCAGTAGCAACTACATGAACTGGGTCCGCCAGGCTCCAGGGAAAAAACTGGAGTGGGTCTCAGTTATTT ATAGCGGAGGTAGCACATTTTACGCAGACTCCGTGAGGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTTTCTTCAAATGAACAGCCTGAGAGCCGAGGACTCGGCCGTGTATTACTGTGCGAGAGATTTGGGACCCTACGG TGTGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
349	IMPI-056	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGLTVSSNYMNWVRQAPGKKLEWVSVIYSGGSTFYADSVRGRFTISRDNSKNT LFLQMNSLRAEDSAVYYCARDLGPYGVDVWGQGTTVTVSS

SEQ ID NO	Clone ID	Description	Sequence
172	IMPI-056	HCDR1	GLTVSSNY
14	IMPI-056	HCDR2	IYSGGST
106	IMPI-056	HCDR3	ARDLGPYGVDV
350	IMPI-056	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAACTCCTGATCTATGCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGCTTAATAGTTACCCTCTCACCTTCGGCCAAGGGACACG ACTGGAGATTAAA
351	IMPI-056	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISSYLAWYQQKPGKAPKLLIYAASTLQSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCQQLNSYPLTFGQGTRLEIK
8	IMPI-056	LCDR1	QGISSY
18	IMPI-056	LCDR2	AAS
10	IMPI-056	LCDR3	QQLNSYPLT
352	IMPI-061	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGGGGAGGTGTGGTACGGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGGCATGAGCTGGGTCCGCCAAGCTCCAGGGAAGGGGCTGGAGTGGGTCTCTGGTATTT ATTGGAATGGTGGTAGCACAGGTTATGCAGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCCGAGGACACGGCCTTGTATTACTGTGCGAGAGGAGTGGGAGCTAC AGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
353	IMPI-061	VH domain amino acid sequence	EVQLVESGGGVVRPGGSLRLSCAASGFTFDDYGMSWVRQAPGKGLEWVSGIYWNGGSTGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCARGVGATDYWGQGTLVTVSS
354	IMPI-061	HCDR1	GFTFDDYG
355	IMPI-061	HCDR2	IYWNGGST

SEQ ID NO	Clone ID	Description	Sequence
356	IMPI-061	HCDR3	ARGVGATDY
357	IMPI-061	VL domain nucleic acid sequence	GAAATTGTGTTGACGCAGTCTCCAGGCACCCTGTCTTTGTCTCCAGGGGAAAGAGCCACCCTCTCCTGCAGGGCCAG TCAGAGTGTTAGCGGCAGCCTCTTAGCCTGGTACCAGCAGAAACCTGGCCAGGCTCCCAGGCTCCTCATCTATGGTG CATCCAGAAGGGCCACTGGCATCCCAGACAGGTTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGC AGACTGGAGCCTGAAGATTTTGCAGTGTATTACTGTCAGCAATATGGTAACTCACCCATGTGCAGTTTTGGCCAGGG GACCAAGCTGGAGAGCAAA
358	IMPI-061	VL domain amino acid sequence	EIVLTQSPGTLSLSPGERATLSCRASQSVSGSLLAWYQQKPGQAPRLLIYGASRRATGIPDRFSGSGSGTDFTLTIS RLEPEDFAVYYCQQYGNSPMCSFGQGTKLESK
359	IMPI-061	LCDR1	QSVSGSL
157	IMPI-061	LCDR2	GAS
360	IMPI-061	LCDR3	QQYGNSPMCS
361	IMPI-062	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGGGGAGGTGTGGTACGGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGGCATGAGCTGGGTCCGCCAAGCTCCAGGGAAGGGGCTGGAGTGGGTCTCTGGTATTT ATTGGAATGGTGGTAGTACAGGTTATGCAGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCCGAGGACACGGCCTTGTATTACTGTGCGAGAGGAGTGGGAGCTAC AGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
353	IMPI-062	VH domain amino acid sequence	EVQLVESGGGVVRPGGSLRLSCAASGFTFDDYGMSWVRQAPGKGLEWVSGIYWNGGSTGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCARGVGATDYWGQGTLVTVSS
354	IMPI-062	HCDR1	GFTFDDYG
355	IMPI-062	HCDR2	IYWNGGST
356	IMPI-062	HCDR3	ARGVGATDY

SEQ ID NO	Clone ID	Description	Sequence
362	IMPI-062	VL domain nucleic acid sequence	GAAATTGTGTTGACGCAGTCTCCAGGCACCCTGTCTTTGTCTCCAGGGGAAAGAGCCACCCTCTCCTGCAGGGCCAG TCAGAGTGTTAGAGGCAGCTTCTTAGCCTGGTACCAGCAGAAACCTGGCCAGGCTCCCAGGCTCCTCATCTATGGTG CATCCAGGAGGGCCACTGGCATCCCAGACAGGTTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGC AGACTGGAGCCTGAAGATTTTGCAGTGTATTACTGTCAGCAATATGGTAACTCACCCATGTGCAGTTTTGGCCAGGG GACCAAGCTGGAGATCAAA
363	IMPI-062	VL domain amino acid sequence	EIVLTQSPGTLSLSPGERATLSCRASQSVRGSFLAWYQQKPGQAPRLLIYGASRRATGIPDRFSGSGSGTDFTLTIS RLEPEDFAVYYCQQYGNSPMCSFGQGTKLEIK
364	IMPI-062	LCDR1	QSVRGSF
157	IMPI-062	LCDR2	GAS
360	IMPI-062	LCDR3	QQYGNSPMCS
365	IMPI-063	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGGGGGAGGTGTGGTACGGCCTGGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGGCATGAGCTGGGTCCGCCAAGCTCCAGGGAAGGGGCTGGAGTGGGTCTCTGGTATTT ATTGGAATGGTGGTAGCACAGGTTATGCAGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCCGAGGACATGGCCTTGTATTACTGTGCGAGAGGAGTGGGAGCTAC AGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
366	IMPI-063	VH domain amino acid sequence	EVQLVESGGGVVRPGGSLRLSCAASGFTFDDYGMSWVRQAPGKGLEWVSGIYWNGGSTGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDMALYYCARGVGATDYWGQGTLVTVSS
354	IMPI-063	HCDR1	GFTFDDYG
355	IMPI-063	HCDR2	IYWNGGST
356	IMPI-063	HCDR3	ARGVGATDY
367	IMPI-063	VL domain nucleic acid sequence	GAAATTGTGTTGACGCAGTCTCCAGGCACCCTGTCTTTGTCTTCAGGGGAAAGAGCCACCCTCGCCTGCAGGGCCAG TGAGAGTGTTAGAGGCAGCTTCTTAGCCTGGTACCAGCAGAAACCTGGCCAGGCTCCCAGGCTCCTCATCTATGGTG CATCCAGGAGGGCCACTGGCATCCCAGACAGGTTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGC AGACTGGAGCCTGAGGATTTTGCAGTGTATTACTGTCAGCAATATGGTAATTCACCCATGTGCAGTTTTGGCCAGGG GACCAAGCTGGAGATCAAA

SEQ ID NO	Clone ID	Description	Sequence
368	IMPI-063	VL domain amino acid sequence	EIVLTQSPGTLSLSSGERATLACRASESVRGSFLAWYQQKPGQAPRLLIYGASRRATGIPDRFSGSGSGTDFTLTIS RLEPEDFAVYYCQQYGNSPMCSFGQGTKLEIK
369	IMPI-063	LCDR1	ESVRGSF
157	IMPI-063	LCDR2	GAS
360	IMPI-063	LCDR3	QQYGNSPMCS
370	IMPI-064	VH domain nucleic acid sequence	GAGGTGCAACTGGTGGAGTCTGGGGGAGGTGTGGTACGGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGGCATGAGCTGGGTCCGCCAAGCTCCAGGGAAGGGGCTGGAGTGGGTCTCTGGTATTT ATTGGAATGGTGGTAGCACAGGTTATGCAGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCCGAGGACACGGCCTTGTATTACTGTGCGAGAGGAGTGGGAGCTAC AGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
353	IMPI-064	VH domain amino acid sequence	EVQLVESGGGVVRPGGSLRLSCAASGFTFDDYGMSWVRQAPGKGLEWVSGIYWNGGSTGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCARGVGATDYWGQGTLVTVSS
354	IMPI-064	HCDR1	GFTFDDYG
355	IMPI-064	HCDR2	IYWNGGST
356	IMPI-064	HCDR3	ARGVGATDY
371	IMPI-064	VL domain nucleic acid sequence	GAAATTGTGTTGACGCAGTCTCCAGGCACCCTTTTTTTGTCTCCAGGGGAAAGAGCCACCCTCTCCTGCAGGGCCAG TCAGAGTGTTCGCGGCAGCTTCTTAGCCTGGTATCAACAGAAACCTGGCCAGGCTCCCAGGCTCCTCATCTATGGTG CATCCAGGAGGGCCACTGGCATCCCAGACAGGTTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGT AGACTGGAGCCTGAAGATTTTGCAGTGTATTACTGTCAGCAATATGGTCACTCACCCATGTGCAGTTTTGGCCAGGG GACCAAGCTGGAGATCAAA
372	IMPI-064	VL domain amino acid sequence	EIVLTQSPGTLFLSPGERATLSCRASQSVRGSFLAWYQQKPGQAPRLLIYGASRRATGIPDRFSGSGSGTDFTLTIS RLEPEDFAVYYCQQYGHSPMCSFGQGTKLEIK

SEQ ID NO	Clone ID	Description	Sequence
364	IMPI-064	LCDR1	QSVRGSF
157	IMPI-064	LCDR2	GAS
373	IMPI-064	LCDR3	QQYGHSPMCS
352	IMPI-065	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGGGGAGGTGTGGTACGGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGGCATGAGCTGGGTCCGCCAAGCTCCAGGGAAGGGGCTGGAGTGGGTCTCTGGTATTT ATTGGAATGGTGGTAGCACAGGTTATGCAGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCCGAGGACACGGCCTTGTATTACTGTGCGAGAGGAGTGGGAGCTAC AGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
353	IMPI-065	VH domain amino acid sequence	EVQLVESGGGVVRPGGSLRLSCAASGFTFDDYGMSWVRQAPGKGLEWVSGIYWNGGSTGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCARGVGATDYWGQGTLVTVSS
354	IMPI-065	HCDR1	GFTFDDYG
355	IMPI-065	HCDR2	IYWNGGST
356	IMPI-065	HCDR3	ARGVGATDY
374	IMPI-065	VL domain nucleic acid sequence	GAAATTGTGTTGACGCAGTCTCCAGGCACCCTGTCTTTGTCTCCAGGGGAAAGAGCCACCCTCTCCTGTAGGGCCAG TCAGAGTGTTAGGGGCAGCTTCTTAGCCTGGTACCAGCAGAAACCTGGCCAGGCTCCCAGGCTCCTCATCTATGGTG CATCCAGCAGGGCCACTGGCATCCCAGACAGGTTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGC AGACTGGAGCCTGAAGATTTTGCAGTGTATTACTGTCAGCAATATGGTAAAATCACCCATGTGCAGTTTTGGCCAGGG GACCAACCTGGAGATCAAA
375	IMPI-065	VL domain amino acid sequence	EIVLTQSPGTLSLSPGERATLSCRASQSVRGSFLAWYQQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTIS RLEPEDFAVYYCQQYGKSPMCSFGQGTNLEIK
364	IMPI-065	LCDR1	QSVRGSF
157	IMPI-065	LCDR2	GAS

SEQ ID NO	Clone ID	Description	Sequence
376	IMPI-065	LCDR3	QQYGKSPMCS
377	IMPI-066	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGGGGAGGTGTGGTACGGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGGCATGACCTGGGTCCGCCAAGCTCCAGGGAAGGGGCTGGAGTGGGTCTCTGGTATTA ATTGGAATGGAGGTAGCACAGGTTCTGCAGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTGTCTGCAAATGAACAGTCTGAGAGCCGAGGACACGGCCTTGTATTACTGTGCGAGAGGAGTGGGAGCTAC AGATTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
378	IMPI-066	VH domain amino acid sequence	EVQLVESGGGVVRPGGSLRLSCAASGFTFDDYGMTWVRQAPGKGLEWVSGINWNGGSTGSADSVKGRFTISRDNAKN SLCLQMNSLRAEDTALYYCARGVGATDYWGQGTLVTVSS
354	IMPI-066	HCDR1	GFTFDDYG
379	IMPI-066	HCDR2	INWNGGST
356	IMPI-066	HCDR3	ARGVGATDY
380	IMPI-066	VL domain nucleic acid sequence	GAAATTGTGTTGACGCAGTCTCCAGGCACCCTGTCTTTGTCTCCAGGGGAAAGAGCCACCCTCTCCTGCAGGGCCAG TCAGAGTGTTAGCAGCAGCTTCTTAGCCTGGTACCAGCAAAAACCTGGCCAGGCTCCCAGGCTCCTCATCTATGGTG CATCCCGCAGGTCCACTGGCATCCCAGACAGGTTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGC AGACTGGAGCCTGAAGATTTTGCAGTGTATTACTGTCAGCAGTATGGTAGCTCACCCATGTCCAGTTTTGGCCAGGG GACCAAGCTGGAGATCAAA
381	IMPI-066	VL domain amino acid sequence	EIVLTQSPGTLSLSPGERATLSCRASQSVSSSFLAWYQQKPGQAPRLLIYGASRRSTGIPDRFSGSGSGTDFTLTIS RLEPEDFAVYYCQQYGSSPMSSFGQGTKLEIK
382	IMPI-066	LCDR1	QSVSSSF
157	IMPI-066	LCDR2	GAS
383	IMPI-066	LCDR3	QQYGSSPMSS

SEQ ID NO	Clone ID	Description	Sequence
384	IMPI-067	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGGAGTCTGGGGGAGGCGTGGTCCAGCCTGGGACGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTCAATAGCTTTGGCATGCACTGGGTCCGCCAGGCTCCAGGCAAGGGGCTGGAGTGGGTGGCAGTTATAT CATATGATGGAAGTAGTAAATACTATGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAAC ACGCTGTATCTGCAAATGAACAGCCTGAGAGCGGAGGACACGGCTGTGTATTACTGTGCGAAAGATGAGGGGGACTA CGACGACTACTACTACGGTATGGACGTCTGGGGCCAGGGGACCACGGTCACCGTCTCCTCA
385	IMPI-067	VH domain amino acid sequence	QVQLVESGGGVVQPGTSLRLSCAASGFTFNSFGMHWVRQAPGKGLEWVAVISYDGSSKYYADSVKGRFTISRDNSKN TLYLQMNSLRAEDTAVYYCAKDEGDYDDYYYGMDVWGQGTTVTVSS
386	IMPI-067	HCDR1	GFTFNSFG
387	IMPI-067	HCDR2	ISYDGSSK
388	IMPI-067	HCDR3	AKDEGDYDDYYYGMDV
389	IMPI-067	VL domain nucleic acid sequence	GAAATTGTGTTGACGCAGTCTCCAGGCAGTCTGTCTTTGTCTCCAGGGGAAAGAGCCACCCTCTCCTGCAGGGCCAG TCAGAGTCTTAGCAGCAGATACTTGGCCTGGTACCACCAGAAACCTGGCCAGGCTCCCAGGCTCCTCATCTATGGTG CATCCAGCAGGGCCACTGGCATCCCAGACAGGTTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGC GGACTGGAGCCTGAAGATTTTGCAGTGTATTACTGTCAGCAGTATGGCAACTCAATCACTTTCGGCGGAGGGACCAA GGTGGAAATCAAA
390	IMPI-067	VL domain amino acid sequence	EIVLTQSPGSLSLSPGERATLSCRASQSLSSRYLAWYHQKPGQAPRLLIYGASSRATGIPDRFSGSGSGTDFTLTIS GLEPEDFAVYYCQQYGNSITFGGGTKVEIK
391	IMPI-067	LCDR1	QSLSSRY
157	IMPI-067	LCDR2	GAS
392	IMPI-067	LCDR3	QQYGNSIT
393	IMPI-068	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGGAGTCTGGGGGAGACGTGGTCCAGCCTGGGAGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTCAGTCGCTATGGCATGCACTGGGTCCGCCAGGCTCCAGGCAAGGGGCTGGAGTGGGTGGCAGTTATAT CATATGATGGAAGTGATAAATACTATGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAAC ACGCTGTATCTGCAAATGAACAGCCTGAGAGCTGAGGACACGGCTGTGTATTACTGTGCGAAACAGCTGCCCCTTTA CTACTACTACTACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA

SEQ ID NO	Clone ID	Description	Sequence
394	IMPI-068	VH domain amino acid sequence	QVQLVESGGDVVQPGRSLRLSCAASGFTFSRYGMHWVRQAPGKGLEWVAVISYDGSDKYYADSVKGRFTISRDNSKN TLYLQMNSLRAEDTAVYYCAKQLPLYYYYYGMDVWGQGTTVTVSS
395	IMPI-068	HCDR1	GFTFSRYG
113	IMPI-068	HCDR2	ISYDGSDK
396	IMPI-068	HCDR3	AKQLPLYYYYYGMDV
397	IMPI-068	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAACCTCCTAATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGTTTAATATTTACCCTCACACTTTCGGCCCTGGGACCAA AGTGGATATCAAA
398	IMPI-068	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKPGKAPNLLIYDASSLESGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQFNIYPHTFGPGTKVDIK
37	IMPI-068	LCDR1	QGISSA
28	IMPI-068	LCDR2	DAS
399	IMPI-068	LCDR3	QQFNIYPHT
400	IMPI-069	VH domain nucleic acid sequence	GAGGTGCAACTGGTGGAGTCTGGGGGAGGTGTGGTACGGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGGCATGACCTGGGTCCGCCAAGCTCCAGGGAAGGGGCTGGAGTGGGTCTCTGGTATTT ATTGGAATGGTGGTAGCACAGGTTATGCAGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCCGAGGACACGGCCTTGTATTACTGTGCGAGAGGAGTGGGAGCTAC AGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
401	IMPI-069	VH domain amino acid sequence	EVQLVESGGGVVRPGGSLRLSCAASGFTFDDYGMTWVRQAPGKGLEWVSGIYWNGGSTGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCARGVGATDYWGQGTLVTVSS

SEQ ID NO	Clone ID	Description	Sequence
354	IMPI-069	HCDR1	GFTFDDYG
355	IMPI-069	HCDR2	IYWNGGST
356	IMPI-069	HCDR3	ARGVGATDY
402	IMPI-069	VL domain nucleic acid sequence	GAAATTGTGTTGACGCAGTCTCCAGGCACCCTGTTTTTGTCTCCAGGGGAAAGAGCCACCCTCTCCTGCAGGACCAG TCAGAATATTAGCGGCAGCTTCTTAGCCTGGTACCAGCAGAAATCTGGCCAGGTTCCCAGGCTCCTCATCTATGGTG CATCCAGGAGGGCCACTGGCATCCCAGACAGGTTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGC AGACTGGAGCCTGAAGATTTTGCAGTGTATTACTGTCAGCAATATGGTAACTCACCCATGTGCAGTTTTGGCCAGGG GACCAAGCTGGAGATCAAA
403	IMPI-069	VL domain amino acid sequence	EIVLTQSPGTLFLSPGERATLSCRTSQNISGSFLAWYQQKSGQVPRLLIYGASRRAIGIPDRFSGSGSGTDFTLTIS RLEPEDFAVYYCQQYGNSPMCSFGQGTKLEIK
404	IMPI-069	LCDR1	QNISGSF
157	IMPI-069	LCDR2	GAS
360	IMPI-069	LCDR3	QQYGNSPMCS
370	IMPI-070	VH domain nucleic acid sequence	GAGGTGCAACTGGTGGAGTCTGGGGGAGGTGTGGTACGGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGGCATGAGCTGGGTCCGCCAAGCTCCAGGGAAGGGGCTGGAGTGGGTCTCTGGTATTT ATTGGAATGGTGGTAGCACAGGTTATGCAGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCCGAGGACACGGCCTTGTATTACTGTGCGAGAGGAGTGGGAGCTAC AGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
353	IMPI-070	VH domain amino acid sequence	EVQLVESGGGVVRPGGSLRLSCAASGFTFDDYGMSWVRQAPGKGLEWVSGIYWNGGSTGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCARGVGATDYWGQGTLVTVSS
354	IMPI-070	HCDR1	GFTFDDYG
355	IMPI-070	HCDR2	IYWNGGST

SEQ ID NO	Clone ID	Description	Sequence
356	IMPI-070	HCDR3	ARGVGATDY
405	IMPI-070	VL domain nucleic acid sequence	GAAAATGTGTTGACGCAGTCTCCAGGCACCCTGTTTTTGTCTCCAGGGGAAAGAGCCACCCTCTCCTGCAGGGCCAG TCAGAGTGTTAGCGGCAGCTTCTTAGCCTGGTACCAGCAGAAACCTGGCCAGGCTCCCAGGCTCCTCATTTATGGTG CATCCAGGAGGGCCACTGGCATCCCAGACAGGTTCAGTGGCAGTGGGGCTGGGACAGACTTCACTCTCACCATCAGC AGACTGGAGCCTGAAGATTTTGCAGTGTATTACTGTCAGCAATATAATAACTCACCCATGTGCAGTTTTGGCCAGGG GACCAAGCTGGAGATCAAA
406	IMPI-070	VL domain amino acid sequence	ENVLTQSPGTLFLSPGERATLSCRASQSVSGSFLAWYQQKPGQAPRLLIYGASRRATGIPDRFSGSGAGTDFTLTIS RLEPEDFAVYYCQQYNNSPMCSFGQGTKLEIK
407	IMPI-070	LCDR1	QSVSGSF
157	IMPI-070	LCDR2	GAS
408	IMPI-070	LCDR3	QQYNNSPMCS
370	IMPI-071	VH domain nucleic acid sequence	GAGGTGCAACTGGTGGAGTCTGGGGGGAGGTGTGGTACGGCCTGGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGGCATGAGCTGGGTCCGCCAAGCTCCAGGGAAGGGGCTGGAGTGGGTCTCTGGTATTT ATTGGAATGGTGGTAGCACAGGTTATGCAGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCCGAGGACACGGCCTTGTATTACTGTGCGAGAGGAGTGGGAGCTAC AGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
353	IMPI-071	VH domain amino acid sequence	EVQLVESGGGVVRPGGSLRLSCAASGFTFDDYGMSWVRQAPGKGLEWVSGIYWNGGSTGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCARGVGATDYWGQGTLVTVSS
354	IMPI-071	HCDR1	GFTFDDYG
355	IMPI-071	HCDR2	IYWNGGST
356	IMPI-071	HCDR3	ARGVGATDY

SEQ ID NO	Clone ID	Description	Sequence
409	IMPI-071	VL domain nucleic acid sequence	GAAATTGTGTTGACGCAGTCTCCAGGCACCCTGTTTTTGTCTCCAGGGGAAAGAGCCACCCTCTCCTGCAGGGCCAG TCAGAGTGTTCGCGGCAGCTTCTTAGCCTGGTATCAGCAGAAACCTGGCCAGGCTCCCAGGCTCCTCATCAATGGTG CATCCAGGAGGGCCACTGGCATCCCAGACAGGTTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGT AGACTGGAGCCTGAAGATTTTGCAGTGTATTACTGTCAGCAATATGGTAACTCACCCATGTGCAGTTTTGGCCAGGG GACCAAGCTGGAGATCAAA
410	IMPI-071	VL domain amino acid sequence	EIVLTQSPGTLFLSPGERATLSCRASQSVRGSFLAWYQQKPGQAPRLLINGASRRATGIPDRFSGSGSGTDFTLTIS RLEPEDFAVYYCQQYGNSPMCSFGQGTKLEIK
364	IMPI-071	LCDR1	QSVRGSF
157	IMPI-071	LCDR2	GAS
360	IMPI-071	LCDR3	QQYGNSPMCS
411	IMPI-072	VH domain nucleic acid sequence	CAGGTGCAACTGGTGGAGTCTGGGGGGAGGCGTGGTCCAGCCTGGGAGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTCAGTAGCTTTGGCATGCACTGGGTCCGCCAGGCTCCAGGCAAGGGGCTGGAGTGGGTGGCAGTTATAT CATATGATGGAAGTAGTAAAGACTATGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAAC ACGCTGTATCTGCAAATGAACAGCCTGGGAGCGGAGGACACGGCTGTGTATTACTGTGCGAAAGATGAGGGGGACTA CGACGACTACTATTACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
412	IMPI-072	VH domain amino acid sequence	QVQLVESGGGVVQPGRSLRLSCAASGFTFSSFGMHWVRQAPGKGLEWVAVISYDGSSKDYADSVKGRFTISRDNSKN TLYLQMNSLGAEDTAVYYCAKDEGDYDDYYYGMDVWGQGTTVTVSS
413	IMPI-072	HCDR1	GFTFSSFG
387	IMPI-072	HCDR2	ISYDGSSK
388	IMPI-072	HCDR3	AKDEGDYDDYYYGMDV
414	IMPI-072	VL domain nucleic acid sequence	GAAATTGTGTTGACGCAGTCTCCAGGCACCCTGTCTTTGTCTCCAGGGGAAAGAGCCACCCTCTCCTGCAGGGCCAG TCAGAGTCTTAGCAGCAGATACTTGGCCTGGTACCACCAGAAACCTGGCCAGGCTCCCAGGCTCTTCATCTATGGTG CATCCATCAGGGCCACTGGCATCCCAGACAGGTTCAGTGGCAGTGGGTCTGGGACGGACTTCACTCTCACCATCAGC GGACTGGAGCCTGAAGATTTTGCAGTGTATTACTGTCAGCAGTATGGTAGTTCAATCACTTTCGGCAGAGGGACCAA GGTGGAGATCAAA

SEQ ID NO	Clone ID	Description	Sequence
415	IMPI-072	VL domain amino acid sequence	EIVLTQSPGTLSLSPGERATLSCRASQSLSSRYLAWYHQKPGQAPRLFIYGASIRATGIPDRFSGSGSGTDFTLTIS GLEPEDFAVYYCQQYGSSITFGRGTKVEIK
391	IMPI-072	LCDR1	QSLSSRY
157	IMPI-072	LCDR2	GAS
416	IMPI-072	LCDR3	QQYGSSIT

Table 1b

Table 1b below shows further amino acid sequences of antibodies and encoding nucleic acids described in this specification. All YANG VH domains, YANG VL domains, YANG CDRs, YANG heavy chains and YANG light chains, antibodies comprising them, as well as their encoding nucleic acids, represent examples of the present invention. CDRs are determined according to IMGT method.

SEQ ID NO	Clone ID	Description	Sequence
486	YANG-1101	VH domain nucleic acid sequence	CAGCTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGAGACCCTGTCCCTCACCTGCACTGTCTCTGG TGGCTCCATCAGCAGTAGTAGTTACTACTGGGGCTGGATCCGCCAGCCCCCAGGGAAGGGGCTGGAGTGGATTGGGA GTATCTATTATAGTGGGAGCATTTACTACAACCCGTCCCTCAAGAGTCGAGTCACCATATCCGTTGACACGTCCAAG AACCAGTTCTCCCTGAAGCTGAGCTCTGTGACCGCCGCAGACACGGCTGTGTATTACTGTGCGAGCTGGTTCGGGGA GTTCTTGAAAGCCGATGCTTTTGATATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
487	YANG-1101	VH domain amino acid sequence	QLQLQESGPGLVKPSETLSLTCTVSGGSISSSSYYWGWIRQPPGKGLEWIGSIYYSGSIYYNPSLKSRVTISVDTSK NQFSLKLSSVTAADTAVYYCASWFGEFLKADAFDIWGQGTMVTVSS
488	YANG-1101	HCDR1	GGSISSSSYY
489	YANG-1101	HCDR2	IYYSGSI

SEQ ID NO	Clone ID	Description	Sequence
490	YANG-1101	HCDR3	ASWFGEFLKADAFDI
491	YANG-1101	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCTGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG CAGTGATGTTGGTGGTTATAGCTATGTCTCCTGGTACCAACACGCCCAGGCAAAGCCCCCAAACTCATGATTTATG ATGTCAGTAAGCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGCTGATTATTACTGCTGCTCATATGCAGGTGGTAGCACTTCGTGGTATTCGG CGGAGGGACCAAGCTGACCGTCCTA
492	YANG-1101	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGGYSYVSWYQQHPGKAPKLMIYDVSKRPSGVSNRFSGSKSGNTASLTI SGLQAEDEADYYCCSYAGSTFVVFGGGTKLTVL
493	YANG-1101	LCDR1	SSDVGGYSY
203	YANG-1101	LCDR2	DVS
494	YANG-1101	LCDR3	CSYAGGSTFVV
495	YANG-1102	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGCACAACTAATTGGTGGAGTTGGGTCCGCCAGTCCCCAGGGAGGGGGCTGGAGTGGATTGGGGAAA TCTTTCATATTGGATATACCAACTACAACCCGTCCCTCAAGAGTCGAGTCACCATATCAGTAGACAAGTCCAAGAAC CAATTCTCCCTGAAGCTGAATTCCGTGACCGTCGCGGACACGGCCGTGTATTACTGTGCGAGAAGAGTGGTCATGGA CACAGCTATGGCCCACTTTGACTGCTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
496	YANG-1102	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGGSISTTNWWSWVRQSPGRGLEWIGEIFHIGYTNYNPSLKSRVTISVDKSKN QFSLKLNSVTVADTAVYYCARRVVMDTAMAHFDCWGQGTLVTVSS
497	YANG-1102	HCDR1	GGSISTTNW
498	YANG-1102	HCDR2	IFHIGYT
499	YANG-1102	HCDR3	ARRVVMDTAMAHFDC

SEQ ID NO	Clone ID	Description	Sequence
500	YANG-1102	VL domain nucleic acid sequence	CAGTCTGTGCTGACGCAGCCGCCCTCAGTGTCTGGGGCCCCAGGGCAGAGGGTCACCATCTCCTGCACTGGGAGCAG CTCCAACATCGGGGCAGGTTATGATGTACACTGGTACCAGCACCTTCCAGGAACAGCCCCCAAACTCCTCATCTATA TTAACATCAATCGGCCCTCAGGGGTCCCTGACCGATTCTCTGGCTCCAAGTCTGGCACCTCAGCCTCCCTGGTCATC GCTGGGCTCCAGGCTGAAGATGGGGCTGATTATTACTGCCAGTCCTATGACAGCAGTCTGAGTGGTTGGGTGTTCGG CGGGGGGACCAGGCTGACCGTCCTA
501	YANG-1102	VL domain amino acid sequence	QSVLTQPPSVSGAPGQRVTISCTGSSSNIGAGYDVHWYQHLPGTAPKLLIYININRPSGVPDRFSGSKSGTSASLVI AGLQAEDGADYYCQSYDSSLSGWVFGGGTRLTVL
502	YANG-1102	LCDR1	SSNIGAGYD
503	YANG-1102	LCDR2	INI
504	YANG-1102	LCDR3	QSYDSSLSGWV
505	YANG-1103	VH domain nucleic acid sequence	GAGGTGCAGATGGTGGAGTCTGGAGGAGGCTTGATCCAGCCGGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG GCTCACCGTCAGTAGTAATTACATGAGCTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAGTTATTT ATAGCGGTGGTAGCACATTCTACGCAGACTCCGTGAAGGACCGATTCACCATCTCCAGGGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTGAGAGCCGAAGACACGGCCGTATATTACTGTGCGCGAGAAAACTGGAACTACGT TTTTGACTGCTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
506	YANG-1103	VH domain amino acid sequence	EVQMVESGGGLIQPGGSLRLSCAASGLTVSSNYMSWVRQAPGKGLEWVSVIYSGGSTFYADSVKDRFTISRDNSKNT LYLQMNSLRAEDTAVYYCARENWNYVFDCWGQGTLVTVSS
172	YANG-1103	HCDR1	GLTVSSNY
14	YANG-1103	HCDR2	IYSGGST
507	YANG-1103	HCDR3	ARENWNYVFDC

SEQ ID NO	Clone ID	Description	Sequence
508	YANG-1103	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGCTCCTGATCTATGCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGCTTAATAGTCACCCTATCATCTTCGGCCAAGGGACACG ACTGGAGATTAAA
509	YANG-1103	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISSYLAWYQQKPGKAPKLLIYAASTLQSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCQQLNSHPIIFGQGTRLEIK
8	YANG-1103	LCDR1	QGISSY
18	YANG-1103	LCDR2	AAS
510	YANG-1103	LCDR3	QQLNSHPII
511	YANG-1105	VH domain nucleic acid sequence	GAGGTGCAGGTGGTAGAATCTGGAGGAGGCTTGATCCAGCCGGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG AATCACCGTCAGTAGAAACTACATGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAGTTATTT ATAGCGGTGGTAGCACATTCTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTGAGAGCCGATGACACGGGCGTGTATTACTGTGCGAGAGAAGGGTACGGTATGGA CGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
512	YANG-1105	VH domain amino acid sequence	EVQVVESGGGLIQPGGSLRLSCAASGITVSRNYMNWVRQAPGKGLEWVSVIYSGGSTFYADSVKGRFTISRDNSKNT LYLQMNSLRADDTGVYYCAREGYGMDVWGQGTTVTVSS
513	YANG-1105	HCDR1	GITVSRNY
14	YANG-1105	HCDR2	IYSGGST
514	YANG-1105	HCDR3	AREGYGMDV

SEQ ID NO	Clone ID	Description	Sequence
515	YANG-1105	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGCTCCTGATTTATTCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAACAGC CTGCAGCCTGAAGATTTTGCAACTTATTATTGTCAACAGCTTAATAGTCACCCGTGCAGTTTTGGCCAGGGGACCAA GCTGGAGATCAAA
516	YANG-1105	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISSYLAWYQQKPGKAPKLLIYSASTLQSGVPSRFSGSGSGTEFTLTINS LQPEDFATYYCQQLNSHPCSFGQGTKLEIK
8	YANG-1105	LCDR1	QGISSY
517	YANG-1105	LCDR2	SAS
518	YANG-1105	LCDR3	QQLNSHPCS
519	YANG-1106	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCCTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGA ATTCATCGTCAGTCGCAACTACATGAGTTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAATGGGTCTCAGTTATTT ATAGCGGTGGTAGCACATTCTACGCAGACTCCGTGAGGGGCCGATTCACCATCTCCAGAGACAATTCCAAAAACACG CTGTATCTTCAAATGAACAGCCTGAGAGCCGAGGACACGGCCGTGTATTACTGTGCGAGAGACTACGGTGACCAGTA CTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
520	YANG-1106	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASEFIVSRNYMSWVRQAPGKGLEWVSVIYSGGSTFYADSVRGRFTISRDNSKNT LYLQMNSLRAEDTAVYYCARDYGDQYFDYWGQGTLVTVSS
521	YANG-1106	HCDR1	EFIVSRNY
14	YANG-1106	HCDR2	IYSGGST
522	YANG-1106	HCDR3	ARDYGDQYFDY

SEQ ID NO	Clone ID	Description	Sequence
523	YANG-1106	VL domain nucleic acid sequence	GAAATGGTGATGACGGCAGTCTCCAGCCACCCTGTCTGTCTCCAGGGGAAAAAGCCACCCTCTCCTGCAGGGCCAG TCAGACTGTTAGCACCAACTTAGCCTGGTACCAACAGAAACCTGGCCAGTCTCCCAGGCTCCTCATCTATGGTGCAT CCACCAGGGCCACTGGTATCCCAGCCAGGTTCAGTGGCAGTGGGTCTGGGACAGAGTTCACTCTCACCATCAGCAGC CTGCAGTCTGAAGATTTTGCAATTTATTACTGTCAGCAATATGTTGACTGGCCTCGGACGTTCGGCCAAGGGACCAC GGTGGAAATCAAA
524	YANG-1106	VL domain amino acid sequence	EMVMTQSPATLSVSPGERATLSCRASQTVSTNLAWYQQKPGQSPRLLIYGASTRATGIPARFSGSGSGTEFTLTISS LQSEDFAIYYCQQYVDWPRTFGQGTTVEIK
525	YANG-1106	LCDR1	QTVSTN
157	YANG-1106	LCDR2	GAS
526	YANG-1106	LCDR3	QQYVDWPRT
527	YANG-1107	VH domain nucleic acid sequence	GAGGTGCAGATGGTGGAGTCTGGAGGAGGCTTGATCCAGTCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG GCTCAGCGTCAGTAGCAACTACATGAGTTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAATGGGTCGCAGTTATTT ATAGCGGTGGTAGTATATTCTATGCAGACTCCGTGAAGGACCGATTCACCATCTCCAGGGACAATTCCAAGAACACG CTTTATCTTCAAATGAACAGCCTGAGAGCCGAGGACACGGCCGTATATTACTGTGCGAGAGAGAACTGGAACTACGT TTTTGACTGCTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
528	YANG-1107	VH domain amino acid sequence	EVQMVESGGGLIQSGGSLRLSCAASGLSVSNYMSWVRQAPGKGLEWVAVIYSGGSIFYADSVKDRFTISRDNSKNT LYLQMNSLRAEDTAVYYCARENWNYVFDCWGQGTLVTVSS
529	YANG-1107	HCDR1	GLSVSSNY
530	YANG-1107	HCDR2	IYSGGSI
507	YANG-1107	HCDR3	ARENWNYVFDC

SEQ ID NO	Clone ID	Description	Sequence
531	YANG-1107	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTTGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCACTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGCTCCTGATCTATGGCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGCTTAGTAGTCACCCTATCATCTTCGGCCAAGGGACACG ACTGGAGATTAAA
532	YANG-1107	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISTYLAWYQQKPGKAPKLLIYAASTLQSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCQQLSSHPIIFGQGTRLEIK
176	YANG-1107	LCDR1	QGISTY
18	YANG-1107	LCDR2	AAS
533	YANG-1107	LCDR3	QQLSSHPII
534	YANG-1108	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGGAATCTGGGGGAGGCGTGGTCCACCCTGGGAGGTCCCTGAGACTCTCCTGTGTAGTCTCTGG ATTCACCTTCAGTGGCTATGGCATGTACTGGGTCCGCCAGGCTCCAGGCAAGGGGCTGGAGTGGGTGGCAGTCATAT CAAAGGATGGAAGTGATAAATACTATGCAGACTCCGTGAAGGGCCGATTCACCATTTCCAGAGACAATTCCAAGAAC ACACTGAATCTGCAAATGAACAGCCTGAGAGCTGAGGACACGGCTGTGTTTTACTGTGTGCGAAAGAAAGGACTTTCCA AGGTTCGGGGAGTTATTATAACAACTACTTTTATTATGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCT CCTCA
535	YANG-1108	VH domain amino acid sequence	QVQLVESGGGVVHPGRSLRLSCVVSGFTFSGYGMYWVRQAPGKGLEWVAVISKDGSDKYYADSVKGRFTISRDNSKN TLNLQMNSLRAEDTAVFYCAKERTFQGSGSYYNNYFYYGMDVWGQGTTVTVSS
536	YANG-1108	HCDR1	GFTFSGYG
537	YANG-1108	HCDR2	ISKDGSDK
538	YANG-1108	HCDR3	AKERTFQGSGSYYNNYFYYGMDV

SEQ ID NO	Clone ID	Description	Sequence
539	YANG-1108	VL domain nucleic acid sequence	GCCATCCAGTTGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGCAGTGCTTTAGCCTGGTATCAGCAGAAACCAGGGAAAGCTCCTAACCTCCTGATCTATGATGCCT CCAGTTTGGAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATTTGGGACAGATTTCACTCTCACCATCAACAGC CTGCAGCCTGAAGATTTTGCAAGTTATTATTGTCAACAGTTTAAGAGTTATCCGCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAG
540	YANG-1108	VL domain amino acid sequence	AIQLTQSPSSLSASVGDRVTITCRASQGISSALAWYQQKPGKAPNLLIYDASSLESGVPSRFSGSGFGTDFTLTINS LQPEDFASYYCQQFKSYPLTFGGGTKVEIK
541	YANG-1108	LCDR1	QGISSA
28	YANG-1108	LCDR2	DAS
542	YANG-1108	LCDR3	QQFKSYPLT
543	YANG-1109	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGGAGTCTCAGG ACTCACCGTCAGTAGAAACTATATGAATTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAGTTATTT ATAGCGGTGGTAGCACATTCTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAACTCCAAAAACACG CTGTATCTTCAAATGATCAGCCTGAGAGCCGAGGACTCGGGCGTGTATTACTGTGCGCGAGAAGGATTTGGTATGGA CGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
544	YANG-1109	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCGVSGLTVSRNYMNWVRQAPGKGLEWVSVIYSGGSTFYADSVKGRFTISRDNSKNT LYLQMISLRAEDSGVYYCAREGFGMDVWGQGTTVTVSS
545	YANG-1109	HCDR1	GLTVSRNY
14	YANG-1109	HCDR2	IYSGGST
546	YANG-1109	HCDR3	AREGFGMDV

SEQ ID NO	Clone ID	Description	Sequence
547	YANG-1109	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCAATTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGCTCCTGATCTATTCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAAC CTGCAGCCTGCAGATATTGCAACTTATTACTGTCAACTCCTTAATAGTCATCCGTGCAGTTTTGGCCAGGGGACCAA GCTGGAGATCAAA
548	YANG-1109	VL domain amino acid sequence	DIQLTQSPSFLSASVGDRVTITCWASQGISNYLAWYQQKPGKAPKLLIYSASTLQSGVPSRFSGSGSGTEFTLTISN LQPADIATYYCQLLNSHPCSFGQGTKLEIK
549	YANG-1109	LCDR1	QGISNY
517	YANG-1109	LCDR2	SAS
550	YANG-1109	LCDR3	QLLNSHPCS
551	YANG-1110	VH domain nucleic acid sequence	CAGGTGCAGCTGGCGGAGTCTGGGGGAGGCGTGGTCCAGCCTGGGAGGTCCCTGAGACTCTCCTGTGTAGTCTCTGG ATTCACCTTCAGTAACTATGGCATGCACTGGGTCCGCCAGGCTCCAGGCAAGGGCCTGGAGTGGGTGGTATTTATAT CAAATGATGGAAGTAATGAAGACTTTGTAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAAC ACGCTGTATCTGCAAATGAACAGCCTGAGAGCTGAGGACACGGCTGTGTATTACTGTGTGCGAAAGGAGGGTATTTCTA TGGTTCGGGGAATTATTACTACTACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
552	YANG-1110	VH domain amino acid sequence	QVQLAESGGGVVQPGRSLRLSCVVSGFTFSNYGMHWVRQAPGKGLEWVFISNDGSNEDFVDSVKGRFTISRDNSKN TLYLQMNSLRAEDTAVYYCAKGGYFYGSGNYYYYYGMDVWGQGTTVTVSS
553	YANG-1110	HCDR1	GFTFSNYG
554	YANG-1110	HCDR2	ISNDGSNE
555	YANG-1110	HCDR3	AKGGYFYGSGNYYYYYGMDV

SEQ ID NO	Clone ID	Description	Sequence
556	YANG-1110	VL domain nucleic acid sequence	CAGCCTGTGCTGACTCAATCATCCTCTGCCTCTGCTTCCCTGGGATCCTCGGTCAAGCTCACCTGCACTCTGAGCAG TGTGCACAGTAACCACATCATCGCATGGCATCAGCAGCCAGGGAAGGCCCCTCGGTACTTGATGAAGCTTGAAG GTAGTGGAAGGTACAGTAAGGGGAGCGGAGTTCCTGATCGCTTCTCAGGCTCCAGCTCTGAGGCTGACCGCTACCTC ACCATCTCCAACCTCCAGTCTGAGGATGAGGCTGATTATTACTGTGAGACCTGGGACAATAATACTTATGTCTTCGG ATCTGGGACCAAAGTCACCGTCCTA
557	YANG-1110	VL domain amino acid sequence	QPVLTQSSSASASLGSSVKLTCTLSSVHSNHIAWHQQQPGKAPRYLMKLEGSGRYSKGSGVPDRFSGSSSEADRYL TISNLQSEDEADYYCETWDNNTVVFGSGTKVTVL
558	YANG-1110	LCDR1	SVHSNHI
559	YANG-1110	LCDR2	LEGSGRY
560	YANG-1110	LCDR3	ETWDNNTYV
561	YANG-1111	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGGGGAGGCTTGATACAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTCAGTAGCTATAGCATAAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTTTCATTCATTA GTGGTAGTAGTACTACCATATACTACGCAGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAGTGCCAAGAAC TCACTGTATCTGCAAATGAACAGCCTGAGAGACGAGGACACGGCTGTGTATTACTGTGCGAGAGGCCTCCGATCGAG TATAGCACCTCGTCCGGACTACTTTGACTCCTGGGGCCAGGGAATTTTGGTCACCGTCTCCTCA
562	YANG-1111	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGFTFSSYSINWVRQAPGKGLEWVSFISGSSTITYYADSVKGRFTISRDSAKN SLYLQMNSLRDEDTAVYYCARGLRSSIAPRPDYFDSWGQGILVTVSS
563	YANG-1111	HCDR1	GFTFSSYS
564	YANG-1111	HCDR2	ISGSSTTI
565	YANG-1111	HCDR3	ARGLRSSIAPRPDYFDS

SEQ ID NO	Clone ID	Description	Sequence
566	YANG-1111	VL domain nucleic acid sequence	TCCTATGTACTGACTCAGCCACCCTCAGTGTCAGTGGCCCCAGGAAAGACGGGCCAGGATTACCTGTGGGGGAAACAA CATTGGAAGTAAAGGTGTACACTGGTACCAGCAGAAGCCAGGCCCAGGCCCCTGTACTGGTCATCTATTATATGATAGCG ACCGGCCCTCAGGGATCCCTGAGCGATTCTCTGGCTCCAACTCTGGGAACACGGCCACCCTGACCATCAGCAGGGTC GAAGCCGGGGATGAGGCCGACTATTCCTGTCAGGTGTGGGATAGTAGTAGTGATCATCCGGTATTCGGCGGAGGGAC CAAGCTGACCGTCCAA
567	YANG-1111	VL domain amino acid sequence	SYVLTQPPSVSVAPGKTARITCGGNNIGSKGVHWYQQKPGQAPVLVIYYDSDRPSGIPERFSGSNSGNTATLTISRV EAGDEADYSCQVWDSSSDHPVFGGGTKLTVQ
2364	YANG-1111	LCDR1	NIGSKG
568	YANG-1111	LCDR2	YDS
569	YANG-1111	LCDR3	QVWDSSSDHPV
570	YANG-1112	VH domain nucleic acid sequence	CAGATCACCTTGAAGGAGTCTGGTCCTACGCTGGTGAAACCCACACAGACCCTCACGCTGACCTGCACCTTCTCTGG GTTCTCACTCAGCACTGGTGGAGTGGCTGTGGGCTGGATCCGTCAGCCCCCAGGAAAGGCCCTGGAGTGGCTTGCAA TCATTTATTGGGATGATGATAAGCGTTACAGCCCATCTCTGAAGAGCAGGCTCACCATCACCAAGGACACCTCCAAA AACCAGGTGGTCCTTACAATGACCAACATGGACCCTGTGGACACAGCCACATATTACTGTGCACACTGGGGAAAAGA TTCTTTTGATATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
571	YANG-1112	VH domain amino acid sequence	QITLKESGPTLVKPTQTLTLTCTFSGFSLSTGGVAVGWIRQPPGKALEWLAIIYWDDDKRYSPSLKSRLTITKDTSK NQVVLTMTNMDPVDTATYYCAHWGKDSFDIWGQGTMVTVSS
572	YANG-1112	HCDR1	GFSLSTGGVA
573	YANG-1112	HCDR2	IYWDDDK
574	YANG-1112	HCDR3	AHWGKDSFDI

SEQ ID NO	Clone ID	Description	Sequence
575	YANG-1112	VL domain nucleic acid sequence	TCCTATGAGCTGACACAGCCACCCTCGGTGTCAGTGTCCCCAGGACAAACGGGCCAGGATCACCTGCTCTGGAGATGC ATTGCCAAGAAAATATGCTTATTTGGTACCAGCAGAAGTCAGGCCAGGCCCCTGTGCTGGTCATCTATGAGGACAAATA ACCGACCCTCCGGGATCCCTGAGAGATTCTCTGGCTCCAGCTCAGGGACAACGGCCACCTTGACTGTCAGTGGGGCC CAGGTGGAAGATGAAGCTGACTACTACTGTTACTCAACAGACACCAGTGGTTATGTGGTATTCGGCGGAGGGACCAA GTTGACCGTCCTA
576	YANG-1112	VL domain amino acid sequence	SYELTQPPSVSVSPGQTARITCSGDALPRKYAYWYQQKSGQAPVLVIYEDNNRPSGIPERFSGSSSGTTATLTVSGA QVEDEADYYCYSTDTSGYVVFGGGTKLTVL
577	YANG-1112	LCDR1	ALPRKY
578	YANG-1112	LCDR2	EDN
579	YANG-1112	LCDR3	YSTDTSGYVV
580	YANG-1112a	VH domain nucleic acid sequence	CAGATCACCTTGAAGGAGTCTGGTCCTACGCTGGTGAAACCCACACAGACCCTCACGGTGACCTGCACCTTCTCTGG GTTCTCACTCACCACTGGTGGAGAGGCTGTGGGCTGGATCCGTCAGCCCCCAGGAAAGGCCCTGGAGTGGCTTGCAA TCATTTATTGGGATGATGATAAGCGTTACAGCCCATCTCTGAAGAGCAGGCTCACCATCACCAAGGACACCTCCAGA AACCAGGTGGTCCTTATAATGACCAACATGGACCCTATGGACACAGCCACATATTACTGTGCACACTGGGGAAAAGA TTCTTTTGATATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
581	YANG-1112a	VH domain amino acid sequence	QITLKESGPTLVKPTQTLTVTCTFSGFSLTTGGEAVGWIRQPPGKALEWLAIIYWDDDKRYSPSLKSRLTITKDTSR NQVVLIMTNMDPMDTATYYCAHWGKDSFDIWGQGTMVTVSS
582	YANG-1112a	HCDR1	GFSLITTGGEA
583	YANG-1112a	HCDR2	IYWDDDK
584	YANG-1112a	HCDR3	AHWGKDSFDI

SEQ ID NO	Clone ID	Description	Sequence
585	YANG-1112a	VL domain nucleic acid sequence	TCCCATGAGCTGACACAGCCACCCTCGGTGTCAGTGTCCCCAGGACAAACGGCCAGGATCACCTGCTCTGGAGATGA ATTGTCAAGAAAAATATGCTTATTGGTACCAGCAGAAGTCAGGCCAGGCCCCTGTGCTGGTCATCTATGAGGACAAACA AACGACCCTCCGGGATCCCTGAGAGATTCTCTGGCTCCAGCTCAGGGACAACGGCCACCTTGACTGTCAGTGGGGCC CAGGTGGACGATGAAGCTGACTACTACTGTTACTCAACAGACACCAGTGGTTATGTGGTATTCGGCGGAGGGACCAA GTTGACCGTCCTA
586	YANG-1112a	VL domain amino acid sequence	SHELTQPPSVSVSPGQTARITCSGDELSRKYAYWYQQKSGQAPVLVIYEDNKRPSGIPERFSGSSSGTTATLTVSGA QVDDEADYYCYSTDTSGYVVFGGGTKLTVL
587	YANG-1112a	LCDR1	ELSRKY
578	YANG-1112a	LCDR2	EDN
588	YANG-1112a	LCDR3	YSTDTSGYVV
589	YANG-1112b	VH domain nucleic acid sequence	CAGATCACCTTGAAGGAGTCTGGTCCTACGCTGGTGAAACCCACACAGACCCTCACGCTGACCTGCACCTTCTCTGG GTTCTCACTCACCACTGCTGGAGCGGCTGTGGGCTGGATCCGTCAGCCCCCAGGAAAGGCCCTGGAATGGCTTGCAA TCATTTACTGGGATGATGATAAGCGTTACAGTCCATCTCTGAAGAACAGGCTCACCATCACCAAGGACACCTCCAAA AACCAGGTTGTCCTTACAATGACCAACATGGACCCTGTGGACACAGCCACATATTACTGTGCACACTGGGGAAAAGA TTCTTTTGATATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
590	YANG-1112b	VH domain amino acid sequence	QITLKESGPTLVKPTQTLTLTCTFSGFSLTTAGAAVGWIRQPPGKALEWLAIIYWDDDKRYSPSLKNRLTITKDTSK NQVVLTMTNMDPVDTATYYCAHWGKDSFDIWGQGTMVTVSS
591	YANG-1112b	HCDR1	GFSLTTAGAA
592	YANG-1112b	HCDR2	IYWDDDK
593	YANG-1112b	HCDR3	AHWGKDSFDI

SEQ ID NO	Clone ID	Description	Sequence
594	YANG-1112b	VL domain nucleic acid sequence	TCCTATGAGCTGACACAGCCACCCTCGGTGTCAGTGCCCCCAGGACAAACGGGCCAGGATCACCTGCTCTGGAGATGC ATTGCCAACAAAATATGCTTATTTGGTACCAGCAGAAGTCAGGCCAGGCCCCTGTGCTGGTCATCTATGAGGACAAACA AACGACCCTCCGGGATCCCTGAGAGATTCTCTGGCTCCAGCTCAGGGACAACGGCCACCTTGACTGTCAGTGGGGCC CAGGTGGAGGATGAAGCTGACTTCTACTGTTATTCAACAGACACCAGTGGTTATGTAGTATTCGGCGGAGGGACCAA GTTGACCGTCCTA
595	YANG-1112b	VL domain amino acid sequence	SYELTQPPSVSVPPGQTARITCSGDALPTKYAYWYQQKSGQAPVLVIYEDNKRPSGIPERFSGSSSGTTATLTVSGA QVEDEADFYCYSTDTSGYVVFGGGTKLTVL
596	YANG-1112b	LCDR1	ALPTKY
578	YANG-1112b	LCDR2	EDN
597	YANG-1112b	LCDR3	YSTDTSGYVV
598	YANG-1112c	VH domain nucleic acid sequence	CAGATCACCTTGAAGGAGTCTGGTCCTACGCTGGTGAAACCCACACAGACCCTCACGGTGACCTGCACCTTCTCTGG GTTCTCACTCAGCACTGGTGGAGAGGCTGTGGGCTGGATCCGTCAGCCCCCAGGAAAGGCCCTGGAGTGGCTTGCAA TCATTTATTGGGATGATGATAAGCGTTACAGCCCATCTCTGAAGAGTAGGCTCACCATCACCAAGGACACCTCCAAA AACCAGGTGGTCCTTACAATGACCAACATGGACCCTATGGACACAGCCACATATTACTGTGCACACTGGGGAAAAGA TTCTTTTGATATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
599	YANG-1112c	VH domain amino acid sequence	QITLKESGPTLVKPTQTLTVTCTFSGFSLSTGGEAVGWIRQPPGKALEWLAIIYWDDDKRYSPSLKSRLTITKDTSK NQVVLTMTNMDPMDTATYYCAHWGKDSFDIWGQGTMVTVSS
600	YANG-1112c	HCDR1	GFSLSTGGEA
601	YANG-1112c	HCDR2	IYWDDDK
602	YANG-1112c	HCDR3	AHWGKDSFDI

SEQ ID NO	Clone ID	Description	Sequence
603	YANG-1112c	VL domain nucleic acid sequence	TCCCATGAGCTGACACAGCCACCCTCGGTGTCAGTGTCCCCAGGACAAACGGCCAGGATCACCTGCTCTGGAGATGA ATTGTCAAGAAAAATATGCTTATTGGTACCAGCAGAAGTCAGGCCAGGCCCCTGTGCTGGTCATCTATATGAGGACAACA AACGACCCTCCGGGATCCCTGAGAGATTCTCTGGCTCCAGCTCAGGGACAACGGCCACCTTGACTGTCAGTGGGGCC CAGGTGGACGATGAAGCTGACTACTGTTACTCAACAGACACCAGTGGTTATGTGGTATTCGGCGGAGGGACCAA GTTGACCGTCCTA
604	YANG-1112c	VL domain amino acid sequence	SHELTQPPSVSVSPGQTARITCSGDELSRKYAYWYQQKSGQAPVLVIYEDNKRPSGIPERFSGSSSGTTATLTVSGA QVDDEADYYCYSTDTSGYVVFGGGTKLTVL
605	YANG-1112c	LCDR1	ELSRKY
578	YANG-1112c	LCDR2	EDN
606	YANG-1112c	LCDR3	YSTDTSGYVV
607	YANG-1113	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGGGGAGGCCTGGTCAAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTCAGTAGCTATAGCATGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCATCCATTA GTACTGGTAGTAGTTACATATTCTACGCAGACTCAGTGAAGGGCCGATTCACCATGTCCAGAGACAACGCCAAGAAC TCACTGTATCTACAAATGAACAGCCTGAGAGCCGAAGACACAGCTGTGTATTACTGTGCGAAAACTGGGGATCTTCC TTTCTTTGACTACTGGGGCCAGGGAACCCCGGTCACCGTCTCCTCA
608	YANG-1113	VH domain amino acid sequence	EVQLVESGGGLVKPGGSLRLSCAASGFTFSSYSMNWVRQAPGKGLEWVSSISTGSSYIFYADSVKGRFTMSRDNAKN SLYLQMNSLRAEDTAVYYCAKTGDLPFFDYWGQGTPVTVSS
609	YANG-1113	HCDR1	GFTFSSYS
610	YANG-1113	HCDR2	ISTGSSYI
611	YANG-1113	HCDR3	AKTGDLPFFDY

SEQ ID NO	Clone ID	Description	Sequence
612	YANG-1113	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCTGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG CAGTGACGTTGGTCGTTATAACTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG AGGTCAGTAATCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACCATC TCTGGGCTCCAGGCTGAGGACGAGGCTGATTATTACTGCAGCTCATATACAAGCAGCACTATGGTATTCGGCGG AGGGACCAAGTTGACTGTCTTA
613	YANG-1113	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGRYNYVSWYQQHPGKAPKLMIYEVSNRPSGVSNRFSGSKSGNTASLTI SGLQAEDEADYYCSSYTSSSTMVFGGGTKLTVL
614	YANG-1113	LCDR1	SSDVGRYNY
615	YANG-1113	LCDR2	EVS
616	YANG-1113	LCDR3	SSYTSSSTMV
617	YANG-1114	VH domain nucleic acid sequence	GAGGTGCAGCCTGGTGGAGTCTGTGGGAGGCCTGGTCAAGCCGGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTCAGTAGCTATAGCATGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCATCCATTA GTACTGGGAGTAGTTACATATTCTACGCAGACTCAGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCACTGTATCTGCAAATGAACAGCCTGAGAGCCGAGGACACAGCTGTGTATTACTGTGCGAAAACTGGGGATCTTCC TTTCTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
618	YANG-1114	VH domain amino acid sequence	EVHLVESVGGLVKPGGSLRLSCAASGFTFSSYSMNWVRQAPGKGLEWVSSISTGSSYIFYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTAVYYCAKTGDLPFFDYWGQGTLVTVSS
619	YANG-1114	HCDR1	GFTFSSYS
620	YANG-1114	HCDR2	ISTGSSYI
621	YANG-1114	HCDR3	AKTGDLPFFDY

SEQ ID NO	Clone ID	Description	Sequence
622	YANG-1114	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCTGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG CAGTGACGTTGGTCGTTATAACTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG AGGTCAGTAATCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACCATC TCTGGGCTCCAGGCTGAGGACGAGGCTGATTATTACTGCAGCTCATATACAAGCAGCACTATGGTATTCGGCGG AGGGACCAAGCTGACCGTCCTA
623	YANG-1114	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGRYNYVSWYQQHPGKAPKLMIYEVSNRPSGVSNRFSGSKSGNTASLTI SGLQAEDEADYYCSSYTSSSTMVFGGGTKLTVL
624	YANG-1114	LCDR1	SSDVGRYNY
615	YANG-1114	LCDR2	EVS
616	YANG-1114	LCDR3	SSYTSSSTMV
2365	YANG-1115	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGGGGAGGCCTGGTCAAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTCAGTAGCTATAGCATGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCGTCCATTA GTACTGGTAGTAGTTACATATTCTACGCAGACTCAGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCACTGTATCTGCAAATGAACAGCCTGAGAGCCGAGGACACAGCTGTATATTACTGTGCGAAAACTGGGGATCTTCC TTTCTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
2366	YANG-1115	VH domain amino acid sequence	EVQLVESGGGLVKPGGSLRLSCAASGFTFSSYSMNWVRQAPGKGLEWVSSISTGSSYIFYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTAVYYCAKTGDLPFFDYWGQGTLVTVSS
619	YANG-1115	HCDR1	GFTFSSYS
620	YANG-1115	HCDR2	ISTGSSYI
621	YANG-1115	HCDR3	AKTGDLPFFDY

SEQ ID NO	Clone ID	Description	Sequence
2367	YANG-1115	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCTGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG CAGTGACGTTGGTCGTTATAACTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG AGGTCAGTAATCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACCATC TCTGGGCTCCAGGCTGAGGACGAGGCTGATTATTACTGCAGCTCATATACAAGCAGCACTATGGTATTCGGCGG AGGGACCAAGCTGTCCGTCCTA
2368	YANG-1115	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGRYNYVSWYQQHPGKAPKLMIYEVSNRPSGVSNRFSGSKSGNTASLTI SGLQAEDEADYYCSSYTSSSTMVFGGGTKLSVL
624	YANG-1115	LCDR1	SSDVGRYNY
615	YANG-1115	LCDR2	EVS
625	YANG-1115	LCDR3	SSYTSSSTMV
626	YANG-1116	VH domain nucleic acid sequence	GAGGTACAGCTGGTGGAGTCTGGGGGAGGCCTGGTCAAGCCTGGGGGGTCCCTGAGACTCTCCTGTGAAGCCTCTGG ATTCAATTTCAGAAGCTATGCCCTGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCATCCATTA GTACTGGTAGTAGTTACATATTCTACGCAGACTCAGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCACTGTCTCTGCAAATGAACAGCCTGAGAGCCGAGGACACAGCTGTGTATTACTGTGCGAAAACTGGGGATCTTCC TTTCTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
627	YANG-1116	VH domain amino acid sequence	EVQLVESGGGLVKPGGSLRLSCEASGFNFRSYALNWVRQAPGKGLEWVSSISTGSSYIFYADSVKGRFTISRDNAKN SLSLQMNSLRAEDTAVYYCAKTGDLPFFDYWGQGTLVTVSS
628	YANG-1116	HCDR1	GFNFRSYA
629	YANG-1116	HCDR2	ISTGSSYI
630	YANG-1116	HCDR3	AKTGDLPFFDY

SEQ ID NO	Clone ID	Description	Sequence
631	YANG-1116	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCTGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG CAGTGACGTTGGTCGTTATAACTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG AGGTCAGTAATCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACCATC TCTGGGCTCCAGGCTGAGGACGAGGCTGATTATTACTGCATCTCATATACAAGCAGCACTATGGTATTCGGCGG AGGGACCAAGCTGACCGTCCTA
632	YANG-1116	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGRYNYVSWYQQHPGKAPKLMIYEVSNRPSGVSNRFSGSKSGNTASLTI SGLQAEDEADYYCISYTSSSTMVFGGGTKLTVL
633	YANG-1116	LCDR1	SSDVGRYNY
615	YANG-1116	LCDR2	EVS
634	YANG-1116	LCDR3	ISYTSSSTMV
635	YANG-1117	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGGGGAGGCCTGGTCAAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTCAGTAGCTATAGCGTGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCATCCATTA GTACTGGTAGTAGTTACATTTTCTACGCAGACTCAGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCACTGTATCTGCAAATGAACAGCCTGAGAGCCGAGGACACAGCTGTGTATTACTGTGTGAAAACTGGGGATCTTCC TTTCTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
636	YANG-1117	VH domain amino acid sequence	EVQLVESGGGLVKPGGSLRLSCAASGFTFSSYSVNWVRQAPGKGLEWVSSISTGSSYIFYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTAVYYCVKTGDLPFFDYWGQGTLVTVSS
637	YANG-1117	HCDR1	GFTFSSYS
638	YANG-1117	HCDR2	ISTGSSYI
639	YANG-1117	HCDR3	VKTGDLPFFDY

SEQ ID NO	Clone ID	Description	Sequence
640	YANG-1117	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCTGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG AAGTGACGTTGGTCGTTATAACTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG AGGTCACTAATCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACCATC TCTGGGCTCCAGGCTGAGGACGAGGCTGATTATTACTGCAGCTCATATACAAACAACAGCACTATGGTATTCGGCGG AGGGACCAAGCTGACCGTCCTA
641	YANG-1117	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTRSDVGRYNYVSWYQQHPGKAPKLMIYEVTNRPSGVSNRFSGSKSGNTASLTI SGLQAEDEADYYCSSYTNNSTMVFGGGTKLTVL
642	YANG-1117	LCDR1	RSDVGRYNY
643	YANG-1117	LCDR2	EVT
644	YANG-1117	LCDR3	SSYTNNSTMV
645	YANG-1118	VH domain nucleic acid sequence	GAGGTACAGCTGGTGGAGTCTGGGGGAGGCCTGGTCAAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTCAGTAGCTATGCCCTGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCATCCATTA GTACTGGTAGTAGTTACATATTCTACGCAGACTCAGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGCAC TCACTGTCTCTGCAAATGAACAGCCTGAGAGCCGAGGACACAGCTGTGTATTACTGTGCGAAAACTGGGGATCTTCC TTTCTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
646	YANG-1118	VH domain amino acid sequence	EVQLVESGGGLVKPGGSLRLSCAASGFTFSSYALNWVRQAPGKGLEWVSSISTGSSYIFYADSVKGRFTISRDNAKH SLSLQMNSLRAEDTAVYYCAKTGDLPFFDYWGQGTLVTVSS
647	YANG-1118	HCDR1	GFTFSSYA
648	YANG-1118	HCDR2	ISTGSSYI
649	YANG-1118	HCDR3	AKTGDLPFFDY

SEQ ID NO	Clone ID	Description	Sequence
650	YANG-1118	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCTGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG CAGTGACGTTGGTCGTTATAACTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG AGGTCAGTAATCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACCATC TCTGGGCTCCAGGCTGAGGACGAGGCTGATTATTACTGCATCTCATATACAAGCAGCACTATGGTGTTCGGCGG AGGGACCAAGTTGACCGTCCTA
651	YANG-1118	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGRYNYVSWYQQHPGKAPKLMIYEVSNRPSGVSNRFSGSKSGNTASLTI SGLQAEDEADYYCISYTSSSTMVFGGGTKLTVL
652	YANG-1118	LCDR1	SSDVGRYNY
615	YANG-1118	LCDR2	EVS
653	YANG-1118	LCDR3	ISYTSSSTMV
654	YANG-1119	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGGGGAGGCCTGGTCAAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTCAGTAGCTATAGCATGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCATCCATTA GTACTGGTAGTAGTTACATATTCTACGCAGACTCAGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCACTGTATCTGCAAATGAACAGCCTGAGAGCCGAGGACACAGCTGTGTATTACTGTGCGAAAACTGGGGATCTTCC TTTCTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
655	YANG-1119	VH domain amino acid sequence	EVQLVESGGGLVKPGGSLRLSCAASGFTFSSYSMNWVRQAPGKGLEWVSSISTGSSYIFYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTAVYYCAKTGDLFFFDYWGQGTLVTVSS
656	YANG-1119	HCDR1	GFTFSSYS
657	YANG-1119	HCDR2	ISTGSSYI
658	YANG-1119	HCDR3	AKTGDLFFFDY

SEQ ID NO	Clone ID	Description	Sequence
659	YANG-1119	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCTGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG CAGTGACGTTGGTCGTTATAACTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG AGGTCAGTAATCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACCATC TCTGGGCTCCAGGCTGAGGACGAGGCTGATTATTACTGCAGCTCATATACAAGCAGTAGCACGATGGTATTCGGCGG AGGGACCAAGCTGACCGTCCTA
660	YANG-1119	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGRYNYVSWYQQHPGKAPKLMIYEVSNRPSGVSNRFSGSKSGNTASLTI SGLQAEDEADYYCSSYTSSSTMVFGGGTKLTVL
661	YANG-1119	LCDR1	SSDVGRYNY
615	YANG-1119	LCDR2	EVS
662	YANG-1119	LCDR3	SSYTSSSTMV
663	YANG-1201	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGACTCCATCAGTAATAGTAAATGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAA TCTTTCATAGTGGGAGCACCAACTACAACCCGTCCCTCAAGAGTCGAGTCACCATTTCAGTAGACAAGTCCCAGAAC CAGTTCTCCCTGAAGCTGAACTCTGTGACCGCCGCGGACACGGCCGTGTATTACTGTGCGAGATCAGCATCTCTTTA TTACTACTACGGTGTGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
664	YANG-1201	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGDSISNSKWWSWVRQPPGKGLEWIGEIFHSGSTNYNPSLKSRVTISVDKSQN QFSLKLNSVTAADTAVYYCARSASLYYYYGVDVWGQGTTVTVSS
665	YANG-1201	HCDR1	GDSISNSKW
666	YANG-1201	HCDR2	IFHSGST
667	YANG-1201	HCDR3	ARSASLYYYYGVDV

SEQ ID NO	Clone ID	Description	Sequence
668	YANG-1201	VL domain nucleic acid sequence	GAAATTGTCTTGACGCAGTCTCCAGGCACCCTGTCTTTGTCTCCAGGGGAGAGCCACCCTCTCCTGCAGGGCCAG TCAGAGTGTTAGCAACAACTACTTAGCTTGGTACCAGCAGAAACCTGGCCAGGCTCCCAGGCTCCTCATCTATGGTA CATCCAGGAGGGACACTGGCATCCCAGACAGGTTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGC AGACTGGAGCCTGAGGATTTTGCAGTGTATTACTGTGAGCAGTATGGTAGTTTGCCTCGGACGTTCGGCCAAGGGAC CAAGGTGGAAATCAAA
669	YANG-1201	VL domain amino acid sequence	EIVLTQSPGTLSLSPGERATLSCRASQSVSNNYLAWYQQKPGQAPRLLIYGTSRRDTGIPDRFSGSGSGTDFTLTIS RLEPEDFAVYYCEQYGSLPRTFGQGTKVEIK
670	YANG-1201	LCDR1	QSVSNNY
671	YANG-1201	LCDR2	GTS
672	YANG-1201	LCDR3	EQYGSLPRT
673	YANG-1202	VH domain nucleic acid sequence	GAGATGCAGCTGGTGGAGTCTGGGGGAGGCTTGGTCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTAGTAGTTTTTGGATGCGCTGGGTCCGTCAGGCTCCAGGGAAGGGGCTGGAGTGGGTGGCCAATATAA AGCAAGATGGAACTGAGAAATACTATGTGGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCACTGTATCTGCAAATGAACAGTCTGAGAGCCGAGGACACGGCTGTATATTACTGTGTGAGAGATCGGGTCGGGGG GGACTATTACTACTACGATATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
674	YANG-1202	VH domain amino acid sequence	EMQLVESGGGLVQPGGSLRLSCAASGFTFSSFWMRWVRQAPGKGLEWVANIKQDGTEKYYVDSVKGRFTISRDNAKN SLYLQMNSLRAEDTAVYYCVRDRVGGDYYYYYDMDVWGQGTTVTVSS
675	YANG-1202	HCDR1	GFTFSSFW
676	YANG-1202	HCDR2	IKQDGTEK
677	YANG-1202	HCDR3	VRDRVGGDYYYYDMDV

SEQ ID NO	Clone ID	Description	Sequence
678	YANG-1202	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCCTCACTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGTCGGGCGAG TCAGGACATTAGCAATTATTTAGCCTGGTTTCAGCAGAAACCAGGGAAAGCCCCTAAGTCCCTGATCTATGCTGCAT CCAGTTTGCAAAGCGGGGTCCCATCAAAGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCGGC CTGCAGCCTGAAGATTCTGCAACTTATTACTGTCAACAGTATAATAGTTACCCTCGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
679	YANG-1202	VL domain amino acid sequence	DIQMTQSPSSLSASVGDRVTITCRASQDISNYLAWFQQKPGKAPKSLIYAASSLQSGVPSKFSGSGSGTDFTLTISG LQPEDSATYYCQQYNSYPRTFGQGTKVEIK
680	YANG-1202	LCDR1	QDISNY
18	YANG-1202	LCDR2	AAS
681	YANG-1202	LCDR3	QQYNSYPRT
682	YANG-1203	VH domain nucleic acid sequence	GAAGTGCGGCTGGTGGAGTCTGGGGGAGCCTTGGTACAGCCTGGCAGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCATCTTTGATGGTTATGCCATGCACTGGGTCCGGCAAGTTCCAGGGAAGGGCCTGGAGTGGGTCTCAGGTATTA GTTGGAATAGTGGTAACATAGGCTATGCGGACTCTGTGAAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAACAGTCTGAGAGCTGAGGACACGGCCTTGTATTACTGTGCAAAAGATATAAGGCCTTC GGGAAAGTACTATTACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
683	YANG-1203	VH domain amino acid sequence	EVRLVESGGALVQPGRSLRLSCAASGFIFDGYAMHWVRQVPGKGLEWVSGISWNSGNIGYADSVKGRFTISRDNAKN SLYLQMNSLRAEDTALYYCAKDIRPSGKYYYGMDVWGQGTTVTVSS
684	YANG-1203	HCDR1	GFIFDGYA
685	YANG-1203	HCDR2	ISWNSGNI
686	YANG-1203	HCDR3	AKDIRPSGKYYYGMDV

SEQ ID NO	Clone ID	Description	Sequence
687	YANG-1203	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCAGGCAAG TCAGGACATTAGAAACTATTTAAATTGGTATCAGCAGAAACCAGGGAAAGCCCCTAAGCTCCTGATCTACGATGCAT CCAATTTGGAAACAGGGGTCCCATCGAGGTTCAGTGGAAGTGGATCTGGGACAGATTTTACTTTCACCATCAGCAGC CTGCAGCCTGAAGATATTGCAACATATTACTGTCAACAGTATGATAAGCTCCTTTTCATTTTCGGCCCTGGGACCAA AGTGGATATCAAA
688	YANG-1203	VL domain amino acid sequence	DIQMTQSPSSLSASVGDRVTITCQASQDIRNYLNWYQQKPGKAPKLLIYDASNLETGVPSRFSGSGSGTDFTFTISS LQPEDIATYYCQQYDKLLFIFGPGTKVDIK
689	YANG-1203	LCDR1	QDIRNY
28	YANG-1203	LCDR2	DAS
690	YANG-1203	LCDR3	QQYDKLLFI
691	YANG-1204	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGGAGTCTGGGGGAGGCGTGGTCCAGCCTGGGAGGTCCCTGAGACTCTCCTGTGCAGTCTCTGG ATTCACCTTCAGTAACTATGGCATACACTGGGTCCGCCAGGCTCCAGGCAAGGGGCTGGTGTGGGTGGCAGTTATAT CATATGAAGGAAGTATTAAATATTATGGAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAAC ACGCTGTATCTGCAAATGAACAGCCTGAGAGCCGAGGACACGGCTGTGTATTACTGTGCGAGAGGGGCAGTGGCTGG CAATGATGCTTTTGATATCTGGGGCCAAGGTACAATGGTCACCGTCTCTTCA
692	YANG-1204	VH domain amino acid sequence	QVQLVESGGGVVQPGRSLRLSCAVSGFTFSNYGIHWVRQAPGKGLVWVAVISYEGSIKYYGDSVKGRFTISRDNSKN TLYLQMNSLRAEDTAVYYCARGAVAGNDAFDIWGQGTMVTVSS
693	YANG-1204	HCDR1	GFTFSNYG
694	YANG-1204	HCDR2	ISYEGSIK
695	YANG-1204	HCDR3	ARGAVAGNDAFDI

SEQ ID NO	Clone ID	Description	Sequence
696	YANG-1204	VL domain nucleic acid sequence	GATGTTGTGATGACTCAGTCTCCACTCTCCCTGCCCGTCACCCTTGGACAGCCGGCCTCCATCTCCTGCAGGTCTAG TCAAGCCTCGTATACAGTGATGGAAACACCTACTTGATTTGGTTTCAGCAGAGGCCAGGCCAATCTCCAAGGCGCC TAATTTATAAGGTTTCTAATCGGGACTCTGGGGTCCCAGACAGATTCAGCGGCGGTGGGTCAGGCACTGATTTCACA CTGAAAATCAGCAGGGTGGAGGCTGAGGATGTTGGGGTTTATTACTGCATGCAAGGTACACACTGGCCTCTCACTTT CGGCGGAGGGACCAAGGTGGAGATCAAA
697	YANG-1204	VL domain amino acid sequence	DVVMTQSPLSLPVTLGQPASISCRSSQSLVYSDGNTYLIWFQQRPGQSPRRLIYKVSNRDSGVPDRFSGGGSGTDFT LKISRVEAEDVGVYYCMQGTHWPLTFGGGTKVEIK
698	YANG-1204	LCDR1	QSLVYSDGNTY
85	YANG-1204	LCDR2	KVS
699	YANG-1204	LCDR3	MQGTHWPLT
700	YANG-1205	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGGTTTCCTGCAAGGCATCTGG ATACACCTTCACCAGCTACTGTATACACTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGAATAATCA ACCCTAGTGGTGGTGGCACAATCTTCGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGACC ACAGTCTACATGGAGTTGGGCAGCCTGAGATCTGACGACACGGCCCTGTATTACTGTGCGCGAGGGTGGTCTTACGA TTTTTGGAGTGGCCCTGACTACTGGGGCCAGGGAACCCTGGTCTCCGTCTCCTCT
701	YANG-1205	VH domain amino acid sequence	QVQLVQSGAEVKKPGASVKVSCKASGYTFTSYCIHWVRQAPGQGLEWMGIINPSGGGTIFAQKFQGRVTMTRDTSTT TVYMELGSLRSDDTALYYCARGWSYDFWSGPDYWGQGTLVSVSS
702	YANG-1205	HCDR1	GYTFTSYC
703	YANG-1205	HCDR2	INPSGGGT
704	YANG-1205	HCDR3	ARGWSYDFWSGPDY
705	YANG-1205	VL domain nucleic acid sequence	GATATTGTGATGACCCAGACTCCACTCTCTCTGTCCGTCACCCCTGGACAGCCGGCCTCCATCTCCTGCAAGTCTAG TCAGAGCCTCCTGCATAGTGATGGAAAGACCTATTTGTATTGGTACCTGCAGAAGCCAGGCCAGCCTCCACAGCTCC TGATCTATGAAGTTTCCAACCGGTTCTCTGGAGTGCCAGATAGGTTCAGTGGCAGCGGGTCAGGGACAGATTTCACA CTGAAAATCAGCCGGGTGGAGGCTGAGGATGTTGGGATTTATTATTGCATGCAAGTATAAAGCTTCCTCCGACGTT CGGCCAAGGGACCAAGGTGGAAATCAAA

SEQ ID NO	Clone ID	Description	Sequence
706	YANG-1205	VL domain amino acid sequence	DIVMTQTPLSLSVTPGQPASISCKSSQSLLHSDGKTYLYWYLQKPGQPPQLLIYEVSNRFSGVPDRFSGSGSGTDFT LKISRVGAEDVGIYYCMHSIKLPPTFGQGTKVEIK
707	YANG-1205	LCDR1	QSLLHSDGKTY
615	YANG-1205	LCDR2	EVS
708	YANG-1205	LCDR3	MHSIKLPPT
709	YANG-1206	VH domain nucleic acid sequence	CAGGTGCACCTGGTGGAGTCTGGGGGAGGCATGGTCCAGCCTGGGAGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTCAGTATCTATGCCATGCACTGGGTCCGCCAGGCTCCAGGCAAGGGGCTGGAGTGGGTGGCAGTTATAT CATATGATGGAAGTAATAAATATTATGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAAC ACGCTGTATCTGCAAATGAACAGCCTGAGAGCTGAGGACACGGCTGTGTATTACTGTGCGAAAGTCTATGGTGGGAG CTACTGGGGGGGCTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
710	YANG-1206	VH domain amino acid sequence	QVHLVESGGGMVQPGRSLRLSCAASGFTFSIYAMHWVRQAPGKGLEWVAVISYDGSNKYYADSVKGRFTISRDNSKN TLYLQMNSLRAEDTAVYYCAKVYGGSYWGGFDYWGQGTLVTVSS
711	YANG-1206	HCDR1	GFTFSIYA
712	YANG-1206	HCDR2	ISYDGSNK
713	YANG-1206	HCDR3	AKVYGGSYWGGFDY
714	YANG-1206	VL domain nucleic acid sequence	CAGTCTGTGCTGACGCAGCCGCCCTCAGTGTCTGGGGCCCCAGGGCAGAGGGTCACCATCTCCTGCACTGGGACCAG CTCCAACATCGGGTCAATTTATGATGTACACTGGTACCAGCAGCTTCCAGGAACAGCCCCCAAACTCCTCATCTATG GTAACAGCAATCGGCCCTCAGGGGTCCCTGACCGATTCTCTGGCTCCAAGTCTGGCACCTCGGCCTCCCTGGCCATC ACTGGGCTCCAGGCTGAGGATGAGGCTGATTATTACTGCCAGTCCTATGACACCAGCCTGAGTGGTTCTTGGGTGTT CGGCGGAGGGACCAAGCTGAACGTCCTA
715	YANG-1206	VL domain amino acid sequence	QSVLTQPPSVSGAPGQRVTISCTGTSSNIGSIYDVHWYQQLPGTAPKLLIYGNSNRPSGVPDRFSGSKSGTSASLAI TGLQAEDEADYYCQSYDTSLSGSWVFGGGTKLNVL

SEQ ID NO	Clone ID	Description	Sequence
716	YANG-1206	LCDR1	SSNIGSIYD
717	YANG-1206	LCDR2	GNS
718	YANG-1206	LCDR3	QSYDTSLSGSWV
719	YANG-1207	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGGAGTCTGGGGGAGGCGTGGTCCAGCCTGGGAGGTCCCTGAGACTCTCCTGTGCAGCGTCTGG ATTCACCTTCAGTAGTTATGGCATGCACTGGGTCCGCCAGGCTCCAGGCAAGGGGCTGGAGTGGGTGTCAGTTATAT GGTATGATGGAACTAATAAATACTATGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAAC ACGCTGTATCTGCAAATGAACAGCCTGAGAGCCGAGGACACGGCTGTGTATTACTGTGCGAGAGAGGGAGTGGAATT CACTGGGTACTTTGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
720	YANG-1207	VH domain amino acid sequence	QVQLVESGGGVVQPGRSLRLSCAASGFTFSSYGMHWVRQAPGKGLEWVSVIWYDGTNKYYADSVKGRFTISRDNSKN TLYLQMNSLRAEDTAVYYCAREGVEFTGYFDYWGQGTLVTVSS
721	YANG-1207	HCDR1	GFTFSSYG
722	YANG-1207	HCDR2	IWYDGTNK
723	YANG-1207	HCDR3	AREGVEFTGYFDY
724	YANG-1207	VL domain nucleic acid sequence	TCCTATGAGCTGACTCAGCCACCCTCAGTGTCCGTGTCCCCAGGACAGACAGCCAGCATCACCTGCTCTGGAGATAA ATTGGGGGATAAATATGCTTGCTGGTATCAGCAGAAGCCAGGCCAGTCCCCCTGTGCTGGTCATCTATCAAGATAGCA AGCGGCCCTCAGGGATCCCTGAGCGATTCTCTGGCTCCAACTCTGGGAACACAGCCACTCTGACCATCAGCGGGACC CAGGCTATGGATGAGGCTGACTATTACTGTCAGGCGTGGACCAGCAACACTGCAGTGGTATTCGGCGGAGGGACCAA GCTGACCGTCCTA
725	YANG-1207	VL domain amino acid sequence	SYELTQPPSVSVSPGQTASITCSGDKLGDKYACWYQQKPGQSPVLVIYQDSKRPSGIPERFSGSNSGNTATLTISGT QAMDEADYYCQAWTSNTAVVFGGGTKLTVL
726	YANG-1207	LCDR1	KLGDKY
727	YANG-1207	LCDR2	QDS

SEQ ID NO	Clone ID	Description	Sequence
728	YANG-1207	LCDR3	QAWTSNTAVV
729	YANG-1301	VH domain nucleic acid sequence	CAGGTGCAGCTCGTGGAGTCTGGGGGAGGCGTGGTCCAGCCTGGGAGGTCCCTGAGACTCTCCTGTGCAGCGTCTGG ATTCACCTTCAGTAGTTATGGCATGCACTGGGTCCGCCAGGCTCCAGGCAAGGGGCTGGAGTGGGTGGCAGTTATCT GGTATGATGGAAGTAATAAATTCTATGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAAC ACACTGTATCTGCAAATGAACAGCCTAAAAGCCGAAGACACGGCTGTGTATTACTGTGCGAGAGATACCTGGATCGG GGAGTCCGATACTAGCTGGCTCGACCCCTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
730	YANG-1301	VH domain amino acid sequence	QVQLVESGGGVVQPGRSLRLSCAASGFTFSSYGMHWVRQAPGKGLEWVAVIWYDGSNKFYADSVKGRFTISRDNSKN TLYLQMNSLKAEDTAVYYCARDTWIGESDTSWLDPWGQGTLVTVSS
731	YANG-1301	HCDR1	GFTFSSYG
732	YANG-1301	HCDR2	IWYDGSNK
733	YANG-1301	HCDR3	ARDTWIGESDTSWLDP
734	YANG-1301	VL domain nucleic acid sequence	TCCTATGAGCTGACTCAGCCACCCTCAGTGTCCGTGTCCCCGGGACAGACAGCCAGCATCACCTGCTCTGGAGATAAA ATTGGGGGATATAAATATGCTTGCTGGTATCAACAGAAGCCAGGCCAGTCCCCTGTATTAATCGTCTATCAAGATAGCA AGCGGCCCTCAGGGATCCCTGAGCGATTCTCTGGCTCCAACTCTGGGAACACAGCCACTCTGACCATCAGCGGGACC CAGGCTATGGATGAGGCTGATTATTACTGTCAGGCGTGGGACAGCTTCACTGCCGTGGTATTCGGCGGAGGGACCAA GCTGACCGTCCTA
735	YANG-1301	VL domain amino acid sequence	SYELTQPPSVSVSPGQTASITCSGDKLGDKYACWYQQKPGQSPVLIVYQDSKRPSGIPERFSGSNSGNTATLTISGT QAMDEADYYCQAWDSFTAVVFGGGTKLTVL
736	YANG-1301	LCDR1	KLGDKY
727	YANG-1301	LCDR2	QDS
737	YANG-1301	LCDR3	QAWDSFTAVV

SEQ ID NO	Clone ID	Description	Sequence
738	YANG-1302	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGGAGTCTGGGGGAGGCGCGGTCCAGCCTGGGAGGTCCCTGAGACTCTCCTGTAGAGCGTCTGG ATTCACCTTCAGTAGTTTTGGCATGAATTGGGTCCGCCAGGTTCCAGGCAAGGGGCTGGTATGGGTGGCAGGTATAT GGTATGATGGAAGGAATAAGTACTATGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGAGAATTCCAAGAAT ATGCTGTATCTGCAAATGAACAGTCTGAGAGCCGAGGACACGGCTGTGTATTACTGTGCGAGAGATCAAGATAGTGG TTTCGATGGCAACTGGTTCGGCCCCTGGGGCCAGGGAACCATGGTCACCGTCTCCTCA
739	YANG-1302	VH domain amino acid sequence	QVQLVESGGGAVQPGRSLRLSCRASGFTFSSFGMNWVRQVPGKGLVWVAGIWYDGRNKYYADSVKGRFTISRENSKN MLYLQMNSLRAEDTAVYYCARDQDSGFDGNWFGPWGQGTMVTVSS
740	YANG-1302	HCDR1	GFTFSSFG
741	YANG-1302	HCDR2	IWYDGRNK
742	YANG-1302	HCDR3	ARDQDSGFDGNWFGP
743	YANG-1302	VL domain nucleic acid sequence	TCCTATGAACTGACTCAGCCACCCTCAATGTCCGTGTCCCCAGGACAGACAGCCAGCATCACCTGCTCTGGAGATAA CTTGGGGGATAAATATGTTTGCTGGTATCAACAGAGGCCAGGCCAGTCCCCTGTGATGGTCATCTTTCAAGATAGCA CGCGGCCCTCAGGGATCCCTGAGCGATTCTCTGGCTCCAACTCTGGAAACACAGCCACTCTGACCATCAGCGGGACC CAGGCTATGGATGAGGCTGACTATTACTGTCAGGCGTGGGACAGCAACACTGCGGTATTCGGCGGAGGGACCAAGCT GACCGTCCTA
744	YANG-1302	VL domain amino acid sequence	SYELTQPPSMSVSPGQTASITCSGDNLGDKYVCWYQQRPGQSPVMVIFQDSTRPSGIPERFSGSNSGNTATLTISGT QAMDEADYYCQAWDSNTAVFGGGTKLTVL
745	YANG-1302	LCDR1	NLGDKY
727	YANG-1302	LCDR2	QDS
746	YANG-1302	LCDR3	QAWDSNTAV
747	YANG-1303	VH domain nucleic acid sequence	CAGGTTCAGCTGGTGCAGTCTGGAACTGAGATGAAGGAGCCTGGGGCCTCAGTGAAGGTCTCCTGCAAGGCTTCTGG TTACACCTTTACCAACTATGGTATCACCTGGGTGCGACAGGCCCCTGGACAAGGGCTTGAGTGGATGGGATGGCTCA ACACTAACAATGGGGACACAAACTATGCTCAGAAACTCCAGGGCAGAGTCACCATGACCACAGACACATCCACGAGC ACAGCCTACATGGAACTGAGGAGCCTGAGATCTGACGACACGGCCGTGTATTATTGTGCGCGAGACTCGGTGACTAC GTATGACTACTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA

SEQ ID NO	Clone ID	Description	Sequence
748	YANG-1303	VH domain amino acid sequence	QVQLVQSGTEMKEPGASVKVSCKASGYTFTNYGITWVRQAPGQGLEWMGWLNTNNGDTNYAQKLQGRVTMTTDTSTS TAYMELRSLRSDDTAVYYCARDSVTTYDYWGQGTLVTVSS
749	YANG-1303	HCDR1	GYTFTNYG
750	YANG-1303	HCDR2	LNTNNGDT
751	YANG-1303	HCDR3	ARDSVTTYDY
752	YANG-1303	VL domain nucleic acid sequence	TCCTATGAACTGACACAGCCACCCTCGGTGTCAGTGTCCCCAGGACAAACGGCCAGGATCACCTGCTCTGGAGATGC ATTGCCAAAAAAAATATGCTTATTGGTTCCAGCAGAAGTCAGCCCAGGCCCCTGTGCTGGTCATCTATGAGGACAGCA AACGACCCTCCGGGATCCCTGAGAGATTCTCTGGCTCCAGCTCAGGGACAAATGGCCACCTTGACTATCAATGGGGCC CAGGTGGAGGATGAAGCTGCCTACTACTGTTATTCATTGGACAGCAGTGGTAATCATTGGGTGTTCGGCGGAGGGAC CAAGTTGACCGTCCTA
753	YANG-1303	VL domain amino acid sequence	SYELTQPPSVSVSPGQTARITCSGDALPKKYAYWFQQKSAQAPVLVIYEDSKRPSGIPERFSGSSSGTMATLTINGA QVEDEAAYYCYSLDSSGNHWVFGGGTKLTVL
754	YANG-1303	LCDR1	ALPKKY
755	YANG-1303	LCDR2	EDS
756	YANG-1303	LCDR3	YSLDSSGNHWV
757	YANG-1304	VH domain nucleic acid sequence	CAGGTTCAAACTACAGCAGTGGGGCGCAGGACTGGTGAAGACTTCGGAGACCCTGTCCCTCACCTGCGCTGTCTATGG TGGGTCTTTCAATGATCACTATTGGAGCTGGATCCGACAGCCCCCAGGAAAGGGACTGGAGTGGATTGGGGAAATCA ATCATAGTGGAAGCACCAACTACAATCCGTCCCTCAAGAGTCGAGTCACCATGTCACTGGACACGTCCAAGAACCAG TTCTCCCTCAAGTTGAGGTCTTTGACCGCCGCGGACACGGCTATGTATTACTGTGCGATTGAGGGAATCTGGGGCCA GGGAGCCATGGTCACCGTCTCCTCA
758	YANG-1304	VH domain amino acid sequence	QVQLQQWGAGLVKTSETLSLTCAVYGGSFNDHYWSWIRQPPGKGLEWIGEINHSGSTNYNPSLKSRVTMSLDTSKNQ FSLKLRSLTAADTAMYYCAIEGIWGQGAMVTVSS

SEQ ID NO	Clone ID	Description	Sequence
759	YANG-1304	HCDR1	GGSFNDHY
760	YANG-1304	HCDR2	INHSGST
761	YANG-1304	HCDR3	AIEGI
762	YANG-1304	VL domain nucleic acid sequence	TCCTATGAGCTGACACAGCCACCCTCGGTGTCAGTGTCCCCAGGACAAACGGCCAGGATCACCTGCTCTGGAGAATGC ATTGCCAATTAAATATGTTCATTGGTACCAGCAGAAGTCAGGCCAGGCCCCTGTGCTGGTCATCTATGAGGACAGCA AACGACCCTCCGGGATCCCTGAGAGAATCTCTGGCTCCAGCTCAGGGACAATGGCCACCTTGACTATGAGTGGGGCC CAGGTGGAGGATGAAGCTGACTACTACTGTTACTCAACAGACAGCAGTGGTAATCATTGGGTGTTCGGCGGAGGGAC CAAGCTGACCGTCCTA
763	YANG-1304	VL domain amino acid sequence	SYELTQPPSVSVSPGQTARITCSGDALPIKYVHWYQQKSGQAPVLVIYEDSKRPSGIPERISGSSSGTMATLTMSGA QVEDEADYYCYSTDSSGNHWVFGGGTKLTVL
764	YANG-1304	LCDR1	ALPIKY
755	YANG-1304	LCDR2	EDS
765	YANG-1304	LCDR3	YSTDSSGNHWV
766	YANG-1305	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGGAGTCTGGGGGAGGCGTGGTCCAGCCTGGGAAGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCGCCTTCAGTAGCTTTGGCATGCACTGGGTCCGCCAGGCTCCAGGCACGGGGGCTGGAGTGGTTGGCAATTATAT CATTTGAAGGAACTAAAAAAATACTATGCAGACTCCATGAAGGGCCGAATCACCATCTCCAGAGACAATTCCAAGAAC ACGCTGTATCTGCAAATGAACAGTTTGAGAGCTGAGGACACGGCTGTGTATTACTGTGCGGCTGACTATGGTGACTA CGACGACTATTACTACGGTGTGCACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
767	YANG-1305	VH domain amino acid sequence	QVQLVESGGGVVQPGKSLRLSCAASGFAFSSFGMHWVRQAPGTGLEWLAIISFEGTKKYYADSMKGRITISRDNSKN TLYLQMNSLRAEDTAVYYCAADYGDYDDYYYGVHVWGQGTTVTVSS
768	YANG-1305	HCDR1	GFAFSSFG
769	YANG-1305	HCDR2	ISFEGTKK

SEQ ID NO	Clone ID	Description	Sequence
770	YANG-1305	HCDR3	AADYGDYDDYYYGVHV
771	YANG-1305	VL domain nucleic acid sequence	GACATCCAAATGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCGAG TCAGGGCATTGCCAATTATTTAGCCTGGTATCAGCAGAAACCGGGGAAAGTTCCTAAGCTCCTGATCTATGCTACAT CCACTTTGCAATCAGGGGTCCCATCTCGGTTCAGTGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATGTTGCAACTTTATTACTGTCAAAAGTATGACAGTGCCCCATTCACTTTCGGCCCTGGGACCAA AGTGGATTTCAAA
772	YANG-1305	VL domain amino acid sequence	DIQMTQSPSSLSASVGDRVTITCRASQGIANYLAWYQQKPGKVPKLLIYATSTLQSGVPSRFSGSGSGTDFTLTISS LQPEDVAIYYCQKYDSAPFTFGPGTKVDFK
773	YANG-1305	LCDR1	QGIANY
774	YANG-1305	LCDR2	ATS
775	YANG-1305	LCDR3	QKYDSAPFT
776	YANG-1401	VH domain nucleic acid sequence	CAGGTGCACCTGCAGGAGTCGGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCTTCAGCCAGATTAACTGGTGGAGTTGGGTCCGCCAGTCCCCAGGAAAGGGGCTGGAGTGGATTGGGGAAA TCTATCATAGTGGGAGTACCAACTACAACCCGTCCCTCAAGAGTCGAGTCACCATGTCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGGCGCTGAACTCTGTGACCGCCGCGGACACGGCCGTATATTACTGTGCGAGGGGGTATTATGGTGA CAACTGGTTCGACTCCTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
777	YANG-1401	VH domain amino acid sequence	QVHLQESGPGLVKPSGTLSLTCAVSGGSFSQINWWSWVRQSPGKGLEWIGEIYHSGSTNYNPSLKSRVTMSVDKSKN QFSLALNSVTAADTAVYYCARGYYGDNWFDSWGQGTLVTVSS
778	YANG-1401	HCDR1	GGSFSQINW
779	YANG-1401	HCDR2	IYHSGST
780	YANG-1401	HCDR3	ARGYYGDNWFDS

SEQ ID NO	Clone ID	Description	Sequence
781	YANG-1401	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCCTCACTGTCTGCTTCTATAGGCGACAGAGTCACCATCACTTGTCGGGCGAG TCAGGGTATTAGCAACTGGTTAGTCTGGTATCAGCAGAAACCAGAGAAAGCCCCTAAGTCCCTGATCTATGCTGCAT CCAGTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCATCCTGAAGATTTTGCAACTTATTACTGCCAACAGTATAGTGATTACCCTCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
782	YANG-1401	VL domain amino acid sequence	DIQMTQSPSSLSASIGDRVTITCRASQGISNWLVWYQQKPEKAPKSLIYAASSLQSGVPSRFSGSGSGTDFTLTISS LHPEDFATYYCQQYSDYPLTFGGGTKVEIK
783	YANG-1401	LCDR1	QGISNW
18	YANG-1401	LCDR2	AAS
784	YANG-1401	LCDR3	QQYSDYPLT
785	YANG-1401a	VH domain nucleic acid sequence	CAGGTGCACCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCTTCAGCCAGATTAACTGGTGGAGTTGGGTCCGCCAGTCCCCAGGAAAGGGGCTGGAGTGGATTGGGGAAA TCTATCATAGTGGGAACACCAACTACAACCCGTCCCTCAAGAGTCGAGTCACCATGTCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGGCGCTGAACTCTGTGACCGCCGCGGACACGGCCGTGTATTATTGTGCGAGGGGGTATTATGGTGA CAACTGGTTCGACTCCTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
786	YANG-1401a	VH domain amino acid sequence	QVHLQESGPGLVKPSGTLSLTCAVSGGSFSQINWWSWVRQSPGKGLEWIGEIYHSGNTNYNPSLKSRVTMSVDKSKN QFSLALNSVTAADTAVYYCARGYYGDNWFDSWGQGTLVTVSS
787	YANG-1401a	HCDR1	GGSFSQINW
788	YANG-1401a	HCDR2	IYHSGNT
789	YANG-1401a	HCDR3	ARGYYGDNWFDS
790	YANG-1401a	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCCTCACTGTCTGCTTCTATAGGCGACAGAGTCACCATCACTTGTCGGGCGAG TCAGGGTATTAGCAGCTGGTTAGTCTGGTATCAGCAGAAACCAGAGAAAGCCCCTAAGTCCCTGATCTATGCTGCAT CCAGTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCATCCTGAAGATTTTGCAACTTATTACTGCCAACAGTATAGTGATTACCCTCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA

SEQ ID NO	Clone ID	Description	Sequence
791	YANG-1401a	VL domain amino acid sequence	DIQMTQSPSSLSASIGDRVTITCRASQGISSWLVWYQQKPEKAPKSLIYAASSLQSGVPSRFSGSGSGTDFTLTISS LHPEDFATYYCQQYSDYPLTFGGGTKVEIK
792	YANG-1401a	LCDR1	QGISSW
18	YANG-1401a	LCDR2	AAS
793	YANG-1401a	LCDR3	QQYSDYPLT
794	YANG-1401b	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGTTGTCTCTGG TGGCTCCTTCAGCAATACTACTAATTGGTGGAGTTGGGTCCGCCAGCCCCCAGAAAAGGGGCTGGAGTGGATTGGGGAAG TCTATCATAGTGGGAGCACCAACTACAACCCGTCCCTCATGAATCGAGTCACCATATCAGTAGACAAGTCCAGGAAC CAGTTCTCCCTGAACCTGAGTTCTGTGACCGCCGCGGACACGGCCGTGTATTTCTGTGCGAGGGGGTATTATGGTGA CAATTGGTTCGACTCCTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
795	YANG-1401b	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCVVSGGSFSNTNWSWVRQPPEKGLEWIGEVYHSGSTNYNPSLMNRVTISVDKSRN QFSLNLSSVTAADTAVYFCARGYYGDNWFDSWGQGTLVTVSS
796	YANG-1401b	HCDR1	GGSFSNTNW
797	YANG-1401b	HCDR2	VYHSGST
798	YANG-1401b	HCDR3	ARGYYGDNWFDS
799	YANG-1401b	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCCTCACTGTCTGCATCTGTAGGAGACAGAGTCATCATCACTTGTCGGGCGAG TCAGGGTATTAGCAGTTGGTTAGCCTGGTATCAGCAGAAACCAGAGAAAGCCCCTAAGTCCCTGATCTATTCTGCAT CCACTTTGCAAAGTGGAGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGCCAACAGTCTAATAGTTACCCTCTCACTTTCGGCGGAGGGACCAA GGTCGAGATCAAA
800	YANG-1401b	VL domain amino acid sequence	DIQMTQSPSSLSASVGDRVIITCRASQGISSWLAWYQQKPEKAPKSLIYSASTLQSGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQSNSYPLTFGGGTKVEIK

SEQ ID NO	Clone ID	Description	Sequence
801	YANG-1401b	LCDR1	QGISSW
517	YANG-1401b	LCDR2	SAS
802	YANG-1401b	LCDR3	QQSNSYPLT
803	YANG-1401c	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGTTGTCTCTGG TGGCTCCTTCACCAATACTAATTGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAG TCTATCATAGTGGGAGCACCAACTACAACCCGTCCCTCAAGAGTCGAGTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAACCTGACTTCTGTGACCGCCGCGGACACGGCCGTGTATTACTGTGCGAGGGGGTATTATATGGTGA CAATTGGTTCGACTCCTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
804	YANG-1401c	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCVVSGGSFTNTNWSWVRQPPGKGLEWIGEVYHSGSTNYNPSLKSRVTISVDKSKN QFSLNLTSVTAADTAVYYCARGYYGDNWFDSWGQGTLVTVSS
805	YANG-1401c	HCDR1	GGSFTNTNW
806	YANG-1401c	HCDR2	VYHSGST
807	YANG-1401c	HCDR3	ARGYYGDNWFDS
808	YANG-1401c	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCCTCACTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGTCGGGCGAG TCAGGGTATTAGCAGCTGGTTAGCCTGGTATCAGCAGAAACCAGAGAAAGCCCCTAAGTCCCTGATCTATTCTGCAT CCACTTTGCAAAGTGGAGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGCCAACAGTCTAATAGTTACCCTCTCACTTTCGGCGGAGGGACCAA GGTCGAGATCAAA
809	YANG-1401c	VL domain amino acid sequence	DIQMTQSPSSLSASVGDRVTITCRASQGISSWLAWYQQKPEKAPKSLIYSASTLQSGVPSRFSGSGSGTDFTLTISS LQPEDFATYYCQQSNSYPLTFGGGTKVEIK
810	YANG-1401c	LCDR1	QGISSW
517	YANG-1401c	LCDR2	SAS

SEQ ID NO	Clone ID	Description	Sequence
811	YANG-1401c	LCDR3	QQSNSYPLT
812	YANG-1401d	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGTTGTCTCTGG TGGCTCCTTCAGCAATACTAATTGGTGGAGTTGGGTCCGCCAGCCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAG TCTTTCATAGTGGGAGCACCAACTACAACCCGTCCCTCAAGAGTCGAGTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAACCTGAGTTCTGTGACCGCCGCGGACACGGCCGTGTATTACTGTGCGAGGGGGTATTATGGTGA CAATTGGTTCGACTCCTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
813	YANG-1401d	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCVVSGGSFSNTNWSWVRQPPGKGLEWIGEVFHSGSTNYNPSLKSRVTISVDKSKN QFSLNLSSVTAADTAVYYCARGYYGDNWFDSWGQGTLVTVSS
814	YANG-1401d	HCDR1	GGSFSNTNW
815	YANG-1401d	HCDR2	VFHSGST
816	YANG-1401d	HCDR3	ARGYYGDNWFDS
817	YANG-1401d	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCCTCACTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGTCGGGCGAG TCAGGGTATTAGCAGCTGGTTGGCCTGGTATCAGCAGAAACCAGAGAAAGCCCCTAAGGCCCTGATCTATTCTGCAT CCACTTTGCAAAGTGGAGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATGTTGCGACTTATTACTGCCAACAGTCTAGTAGTTACCCTCTCACTTTCGGCGGAGGGACCAA GGTCGAGATCAAA
818	YANG-1401d	VL domain amino acid sequence	DIQMTQSPSSLSASVGDRVTITCRASQGISSWLAWYQQKPEKAPKALIYSASTLQSGVPSRFSGSGSGTDFTLTISS LQPEDVATYYCQQSSSYPLTFGGGTKVEIK
819	YANG-1401d	LCDR1	QGISSW
517	YANG-1401d	LCDR2	SAS
820	YANG-1401d	LCDR3	QQSSSYPLT

SEQ ID NO	Clone ID	Description	Sequence
821	YANG-1401e	VH domain nucleic acid sequence	CAGGTGCACCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCTTCAGCCAGATTAACTGGTGGAGTTGGGTCCGCCAGTCCCCAGGAAAGGGGCTGGAGTGGATTGGAGAAA TCTATCATAGTGGGAGCACCAACTACAACCCGTCCCTCAAGAGTCGAGTCACCATGTCCGTAGACAAGTCCAAGAAC CACTTCTCCCTGGCGTTGAATTCTGTGACCGCCGCGGACACGGCCGTGTATTATTGTGCGCGGGGGTATTATGGTGA CAACTGGTTCGACTCATGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
822	YANG-1401e	VH domain amino acid sequence	QVHLQESGPGLVKPSGTLSLTCAVSGGSFSQINWWSWVRQSPGKGLEWIGEIYHSGSTNYNPSLKSRVTMSVDKSKN HFSLALNSVTAADTAVYYCARGYYGDNWFDSWGQGTLVTVSS
823	YANG-1401e	HCDR1	GGSFSQINW
824	YANG-1401e	HCDR2	IYHSGST
825	YANG-1401e	HCDR3	ARGYYGDNWFDS
826	YANG-1401e	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCCTCACTGTCTGCTTCTATAGGCGACAGAGTCACCATCACTTGTCGGGCGAG TCAGGGTATTAGCAACTGGTTAGTCTGGTATCAGCAGAAACCAGAGAAAGCCCCTAAGTCCCTGATCTATGCTGCTT CCAGTTTGCAAAGTGGGGTCCCATCACGGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCATCCTGAAGATTTTGCAACTTATTACTGCCAACAGTATAGTGATTACCCTCTCACTTTCGGCGGCGGGACCAG GGTGGAGATCAAA
827	YANG-1401e	VL domain amino acid sequence	DIQMTQSPSSLSASIGDRVTITCRASQGISNWLVWYQQKPEKAPKSLIYAASSLQSGVPSRFSGSGSGTDFTLTISS LHPEDFASYYCQQYSDYPLTFGGGTRVEIK
828	YANG-1401e	LCDR1	QGISNW
18	YANG-1401e	LCDR2	AAS
829	YANG-1401e	LCDR3	QQYSDYPLT
830	YANG-1402	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG GGTCACCGTCAGTAGTAACTACATGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAGTTATTT ATAGCGGTGGTAGCACATACTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTAAGAGTCGAGGACACGGCCGTATATTACTGTGCGAGAGACATAGGGGACTACGG TATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA

SEQ ID NO	Clone ID	Description	Sequence
831	YANG-1402	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGVTVSSNYMNWVRQAPGKGLEWVSVIYSGGSTYYADSVKGRFTISRDNSKNT LYLQMNSLRVEDTAVYYCARDIGDYGMDVWGQGTTVTVSS
832	YANG-1402	HCDR1	GVTVSSNY
14	YANG-1402	HCDR2	IYSGGST
833	YANG-1402	HCDR3	ARDIGDYGMDV
834	YANG-1402	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGGCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGACTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGCAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAAGATCCTGATCTATGCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCAACAGCTTAATAGTTACCCGCTCATTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
835	YANG-1402	VL domain amino acid sequence	DIQLTQAPSFLSASVGDRLTITCWASQGISSYLAWYQQKPGKAPKILIYAASTLQSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCQQLNSYPLIFGGGTKVEIK
8	YANG-1402	LCDR1	QGISSY
18	YANG-1402	LCDR2	AAS
836	YANG-1402	LCDR3	QQLNSYPLI
837	YANG-1403	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGGAGTCTGGGGGAGGCGTGGTCCAGCCTGGGAGGTCCCTGAGACTCTCCTGTGCAGCGTCTGG ATTCACCTTCAGTAATTATGGCATGCACTGGGTCCGCCAGGCTCCAGGCAAGGGGCTGGAGTGGGTGGCAGTTATAT GGTATGATGGAAGTAATAAATACTATGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAAC ACGCTGTATCTGCAAATGAACAGCCTGAGAGCCGAGGACACGGCTGTTTATTTCTGTGTGAGAGAAACTGTTACGGA CGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCCTA
838	YANG-1403	VH domain amino acid sequence	QVQLVESGGGVVQPGRSLRLSCAASGFTFSNYGMHWVRQAPGKGLEWVAVIWYDGSNKYYADSVKGRFTISRDNSKN TLYLQMNSLRAEDTAVYFCVRETVTDGMDVWGQGTTVTVSL

SEQ ID NO	Clone ID	Description	Sequence
839	YANG-1403	HCDR1	GFTFSNYG
840	YANG-1403	HCDR2	IWYDGSNK
841	YANG-1403	HCDR3	VRETVTDGMDV
842	YANG-1403	VL domain nucleic acid sequence	AACATCCAGATGACCCAGTCTCCATCTGCCATGTCTGCATCTGTGGGAGACAGAGTCACCATCACTTGTCGGGCGAG GCAGGACATTAGCAATTATTTAGCCTGGTTTCAGCAGAAACCAGGGAAAGTCCCTAAGCACCTGATCTATGCTGCAT CCAGTTTGCTAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCTACACCATAATGGTTACCCGTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
843	YANG-1403	VL domain amino acid sequence	NIQMTQSPSAMSASVGDRVTITCRARQDISNYLAWFQQKPGKVPKHLIYAASSLLSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCLHHNGYPWTFGQGTKVEIK
844	YANG-1403	LCDR1	QDISNY
18	YANG-1403	LCDR2	AAS
845	YANG-1403	LCDR3	LHHNGYPWT
846	YANG-2101	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGGGGAGGTTTGGTACAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTCAGTCTCTACGACATGCACTGGGTCCGTCAAGCAACAGGAAAAGGTCTGGAGTGGGTCGCAGGTGTTG GTATTGCCGGTGACACCATCTATCCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGAAGAATGCCAAGAACTCC TTCTTTCTTCAAATGAACAGACTGAGAGCCGGGGACACGGCTGTGTATTACTGTGTAAGAGGAGGAACTGGAACAAC TTTCTTTTGATTACTGGGGCCAGGGAGTCCTGGTCACCGTCTCCTCT
847	YANG-2101	VH domain amino acid sequence	EVQLVESGGGLVQPGGSLRLSCAASGFTFSLYDMHWVRQATGKGLEWVAGVGIAGDTIYPDSVKGRFTISRENAKNS FFLQMNRLRAGDTAVYYCVRGGTGTFEDYWGQGVLVTVSS
848	YANG-2101	HCDR1	GFTFSLYD
849	YANG-2101	HCDR2	VGIAGDT

SEQ ID NO	Clone ID	Description	Sequence
850	YANG-2101	HCDR3	VRGGTGTTFFDY
851	YANG-2101	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCTTTCACTGTCTCTGCATCTGTAGGAGACAGAGTCACCGTCACTTGTCGGGCGAG TCAGGACATTACCAATTATTTAGCCTGGTTTCAGCAGAAACCAGGGAAAGCCCCTAAGTCCCTGATCTATAGTGCAT CCAGTTTGCAAGGTGGGACCCCCTCAAAGTTCAGCGGCAGTGGATCTGGGACAGAATTCACTCTCACCATCAGCAGC CTCCAGCCTGAAGATTTTGCAACTTATTACTGCCAGCAGTATAATAGTTTCCCGCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
852	YANG-2101	VL domain amino acid sequence	DIQMTQSPSSLSASVGDRVTVTCRASQDITNYLAWFQQKPGKAPKSLIYSASSLQGGTPSKFSGSGSGTEFTLTISS LQPEDFATYYCQQYNSFPLTFGGGTKVEIK
853	YANG-2101	LCDR1	QDITNY
517	YANG-2101	LCDR2	SAS
854	YANG-2101	LCDR3	QQYNSFPLT
855	YANG-2102	VH domain nucleic acid sequence	GAGGTGAAGCTGGTGGAGTCTGGGGGAGGCTTGGTACAGCGGGGGGGGTCCCTGAGACTCTCCTGTGGCAGCCTCTGG ATTCACCTTCAGTAGCCAGGCCATGTACTGGGTCCGTCAAATTCCAGGAAAAGGTCTGGAGTGGGTCGCAGGTATTG GTGTTGCTGGCGACACATTTTATCCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGAAAATGCCAACAACTCC TTGTCTCTTCAAATGGACAGCCTGAGAACCGGGACACGGCTATATATTACTGTGTCAGAGATGGTTATAGTGGGAG CTACCCTTACCACTACTACGGTATGGACGTCTGGGGCCAAGGGATCACGGTCGTCGTCTCCTCA
856	YANG-2102	VH domain amino acid sequence	EVKLVESGGGLVQRGGSLRLSCAASGFTFSSHAMYWVRQIPGKGLEWVAGIGVAGDTFYPDSVKGRFTIS RENANNSLSLQMDSLRTGDTAIYYCVRDGYSGSYPYHYYGMDVWGQGITVVVSS
857	YANG-2102	HCDR1	GFTFSSHA
858	YANG-2102	HCDR2	IGVAGDT
859	YANG-2102	HCDR3	VRDGYSGSYPYHYYGMDV

SEQ ID NO	Clone ID	Description	Sequence
860	YANG-2102	VL domain nucleic acid sequence	GACATCCAGTTGACCCAGTCTCCATCCTCACTGTCTGCATCTGTAGGAGACAGTGTCACCATCACTTGTCGGGCGAG TCAGGGCATTGACACTTATTTAGCCTGGTTTCAGCAGAAACCAGGGAAAGCCCCTAAGTCCCTGATCTATGTTGCAT CCAGTTTACAGAGTGGGGTCCCATCAAAATTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCTGCCTGAAGATTTTGCAACTTATTACTGCCAACAGTATAAGAGTTACCCGTGGACGTTCGGCCAAGGGACCAA GGTGGAGATCAAA
861	YANG-2102	VL domain amino acid sequence	DIQLTQSPSSLSASVGDSVTITCRASQGIDTYLAWFQQKPGKAPKSLIYVASSLQSGVPSKFSGSGSGTD FTLTISSLLPEDFATYYCQQYKSYPWTFGQGTKVEIK
862	YANG-2102	LCDR1	QGIDTY
863	YANG-2102	LCDR2	VAS
864	YANG-2102	LCDR3	QQYKSYPWT
865	YANG-2103	VH domain nucleic acid sequence	GAGGCGCAGTTGGTGGAGTCTGGAGGAGGCTTGATCCAGTCTGGGGGGTCCCTGAGACTCTCCTGTATAGCCTCTGG ATTAACCGTCAATAGCAACTACATGAACTGGGTCCGCCAGGCTCCAGGGAAGGGACTGGAGTGGGTCTCAGTTATTT ATAGCGGTGGTACCACATTCTACGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGACTAGTCTGAGAGCCGAGGACACGGCCGTGTATTATTGTGCGAGAGAGGGATACGGTATGGA CGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
866	YANG-2103	VH domain amino acid sequence	EAQLVESGGGLIQSGGSLRLSCIASGLTVNSNYMNWVRQAPGKGLEWVSVIYSGGTTFYADSVKGRFTISRDNSKNT LYLQMTSLRAEDTAVYYCAREGYGMDVWGQGTTVTVSS
867	YANG-2103	HCDR1	GLTVNSNY
868	YANG-2103	HCDR2	IYSGGTT
514	YANG-2103	HCDR3	AREGYGMDV
869	YANG-2103	VL domain nucleic acid sequence	TCCTATGTGCTGACTCAGCCACCCTCAGTGTCAGTGGCCCCAGGAAAGACGGCCAGGATAAACTGTGGGGGAAATAA TTTTGGAAGTAAAAGTGTGCACTGGTACCAGCAGAAGCCAGGCCAGGCCCCTGTGCTGGTCATCTATTATGATAGCG ACCGGCCCTCAGGGATCCCTGAGCGATTCTCTGGCTCCAACTCAGGGAACACGGCCACCCTGACCATCAGCAGGGTC GAAGCCGGGGATGAGGCCGACTATTACTGTCAGGTGTGGGATAATAGTAGTGATCATTTTGTCTTCGGAGCTGGGAC CAAGGTCACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
870	YANG-2103	VL domain amino acid sequence	SYVLTQPPSVSVAPGKTARINCGGNNFGSKSVHWYQQKPGQAPVLVIYYDSDRPSGIPERFSGSNSGNTATLTISRV EAGDEADYYCQVWDNSSDHFVFGAGTKVTVL
871	YANG-2103	LCDR1	NFGSKS
568	YANG-2103	LCDR2	YDS
872	YANG-2103	LCDR3	QVWDNSSDHFV
873	YANG-2104	VH domain nucleic acid sequence	GAAGTGAAGTTGGTGGAGTCTGGGGGAGGCTTGGTACAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACATTCAGTAGCCACGCCATGTACTGGGTCCGTCAAGTCCAGGAAAAGGTCTGGAGTGGGTCTCAGGTATTG GTGTTGCTGGTGACACATTTTATGTAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGAAAATGCCAGGAACTCC TTGTCTCTTCAAATGAACAGCCTGAGAGCCGGGGACACGGCTGTTTATTACTGTGCCAGAGATGGTTATAGTGGGAC CCACCCTTACCACTTCTACGGTATGGACGTCTGGGGCCAAGGGATCACGGTCGTCGTCTCCTCA
874	YANG-2104	VH domain amino acid sequence	EVKLVESGGGLVQPGGSLRLSCAASGFTFSSHAMYWVRQSPGKGLEWVSGIGVAGDTFYVDSVKGRFTISRENARNS LSLQMNSLRAGDTAVYYCARDGYSGTHPYHFYGMDVWGQGITVVVSS
875	YANG-2104	HCDR1	GFTFSSHA
876	YANG-2104	HCDR2	IGVAGDT
877	YANG-2104	HCDR3	ARDGYSGTHPYHFYGMDV
878	YANG-2104	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCCTCACTGTCTGCATCTGTAGGAGACAGTGTCACCATCACTTGTCGGGCGAG TCAGGACATTAACACTTATTTAGCCTGGTTTCAGCAGAAACCAGGGAAAGCCCCTAAGTCCCTGATCTATGTTGCAT CCAGTTTACAGAGTGGGGTCCCATCAAAGTTCAGCGGCAGTGGATCTGGGACAGATTTCACTCTCACCATCAGCAGC CTGCTGCCTGAAGATTTTGCAACTTATTATTGCCAACAGTATAAAAGTTACCCGTGGACGTTCGGCCAAGGGACCAA GGTGGAGATCAAA
879	YANG-2104	VL domain amino acid sequence	DIQMTQSPSSLSASVGDSVTITCRASQDINTYLAWFQQKPGKAPKSLIYVASSLQSGVPSKFSGSGSGTDFTLTISS LLPEDFATYYCQQYKSYPWTFGQGTKVEIK

SEQ ID NO	Clone ID	Description	Sequence
880	YANG-2104	LCDR1	QDINTY
863	YANG-2104	LCDR2	VAS
881	YANG-2104	LCDR3	QQYKSYPWT
882	YANG-2105	VH domain nucleic acid sequence	GAGGTGCAACTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG GCTCACCGTCAGTAGCAATTACATGAACTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGAGTGGGTCTCAGTTATT ATAGCGGTGGTAGTACATTCTACACAGATTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAACTCCAAGAACACG CTGAATCTTCAAATGAACAGTCTGCGAGCCGAGGACACGGCCGTGTATTATTGTGCGAGAGATCTGGGGATACGCGG GGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
883	YANG-2105	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGLTVSSNYMNWVRQAPGKGLEWVSVIYSGGSTFYTDSVKGRFTISRDNSKNT LNLQMNSLRAEDTAVYYCARDLGIRGGMDVWGQGTTVTVSS
172	YANG-2105	HCDR1	GLTVSSNY
14	YANG-2105	HCDR2	IYSGGST
884	YANG-2105	HCDR3	ARDLGIRGGMDV
885	YANG-2105	VL domain nucleic acid sequence	GACATCCAGTTGATCCAGTCTCCATCCTTCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCTGGGCCAG TCAGGGCATTAGTAGTTATTTAGCCTGGTATCAGCAAAAACCAGGGAAAGCCCCTAACCTCCTGATCTATGCTGCAT CCACTTTGCAAAGTGGGGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAGTTCACTCTCACAATCAGCAGC CTGCAGCCTGAGGATTTTGCAACTTATTACTGTCAACAGCTTGATGGTTCCCTCACTTTCGGCGGAGGGACCAAGGT GGAGATCAAA
886	YANG-2105	VL domain amino acid sequence	DIQLIQSPSFLSASVGDRVTITCWASQGISSYLAWYQQKPGKAPNLLIYAASTLQSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCQQLDGSLTFGGGTKVEIK
8	YANG-2105	LCDR1	QGISSY
18	YANG-2105	LCDR2	AAS

SEQ ID NO	Clone ID	Description	Sequence
887	YANG-2105	LCDR3	QQLDGSLT
888	YANG-2106	VH domain nucleic acid sequence	CAGGTGCAGGTAGTGGAGTCTGGGGGAGGCGTGGTCCAGCCTGGGAGGTCCCTGAGACTCTCCTGTTCAGCGTCTGG ATTCACCTTCAGCACCTATGGCATGCACTGGGTCCGCCAGGCTCCAGGCAAGGGGCTGGAGTGGGTGGCAGTTATAT GGTATGATGGAAGTAATAAGTACTATGCAGACTCCGTGAAGGGCCGATTCATCATCTCCAGAGACAATTCCAAGAAC ACGCTGTATCTGCAAATGAGCAGTCTGAGACCCGATGACACGGCTGTGTATTATTGTGTGAGAGAGGGAGTGGCTGA CGGTATGGGCGTCTGGGGCCAAGGGACCACAGTCACCGTCTCTTCA
889	YANG-2106	VH domain amino acid sequence	QVQVVESGGGVVQPGRSLRLSCSASGFTFSTYGMHWVRQAPGKGLEWVAVIWYDGSNKYYADSVKGRFIISRDNSKN TLYLQMSSLRPDDTAVYYCVREGVADGMGVWGQGTTVTVSS
890	YANG-2106	HCDR1	GFTFSTYG
891	YANG-2106	HCDR2	IWYDGSNK
892	YANG-2106	HCDR3	VREGVADGMGV
893	YANG-2106	VL domain nucleic acid sequence	AACATCCAGATGACCCAGTCTCCATCTGCCATGTCTGCATCTGTGGGAGACAGAGTCACCATCACTTGTCGGGCGAG GCAGGACATTAGCACTTACTTAGCCTGGTTTCAGCAGAAACCAGGGAAAGTCCCTAAGCACCTGATCTATGCTGCGT CTACTTTGCTAAGTGGGGTCCCATCAAGGTTCGGCGGCAGTGGTTCTGGGACAGAATTCACTCTCACAATCACCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCTACACCATAATAATTATCCGTGGACGTTCGGCCAAGGGACCAA GGTGGAAATCAAA
894	YANG-2106	VL domain amino acid sequence	NIQMTQSPSAMSASVGDRVTITCRARQDISTYLAWFQQKPGKVPKHLIYAASTLLSGVPSRFGGSGSGTEFTLTITS LQPEDFATYYCLHHNNYPWTFGQGTKVEIK
895	YANG-2106	LCDR1	QDISTY
18	YANG-2106	LCDR2	AAS
896	YANG-2106	LCDR3	LHHNNYPWT

SEQ ID NO	Clone ID	Description	Sequence
897	YANG-2107	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATTAGAAGTAGTAACTGGTGGATTTGGGTCCGCCAGTCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAA TCTATCATGGTGGGAATACCAACTATAACCCGTCCCTCAAGAGTCGAGTCACCTTGTCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAGTTCTGTGACCGCCGCGGACACGGCCGTATATTATTGTGCGAGAGCTCTTTACGATAT CGGGGGAGTTTTTGATATTTGGGGCCAGGGGACTATGGTCACCGTCTCTTCA
898	YANG-2107	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGGSIRSSNWWIWVRQSPGKGLEWIGEIYHGGNTNYNPSLKSRVTLSVDKSKN QFSLKLSSVTAADTAVYYCARALYDIGGVFDIWGQGTMVTVSS
899	YANG-2107	HCDR1	GGSIRSSNW
900	YANG-2107	HCDR2	IYHGGNT
901	YANG-2107	HCDR3	ARALYDIGGVFDI
902	YANG-2107	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGATCTCCATCTCCTGCACTGGAACCAG CAGTGATATTGGTGGTTATAACTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG ATGTCAGTGAGCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGGTGATTATTACTGCTCATATGCAGCTAATAGTAATGTGGTATTCGGCGG AGGGACCAAACTGTCCGTCCTA
903	YANG-2107	VL domain amino acid sequence	QSALTQPASVSGSPGQSISISCTGTSSDIGGYNYVSWYQQHPGKAPKLMIYDVSERPSGVSNRFSGSKSGNTASLTI SGLQAEDEGDYYCCSYAANSNVVFGGGTKLSVL
904	YANG-2107	LCDR1	SSDIGGYNY
203	YANG-2107	LCDR2	DVS
905	YANG-2107	LCDR3	CSYAANSNVV
906	YANG-2108	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACAGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGAAGTAGTAACTGGTGGATTTGGGTCCGCCAGCCCCCAGGGAAGGGTCTGGAGTGGATTGGGGAAA TCTATCATGGTGGAAACACCAACTACAGCCCGTCCCTCAAGAGTCGAGTCTCCATATCAGTAGACAAGTCCAAGAAC CACTTCTCCCTGAACCTGACCTCTGTGACCGCCGCGGACACGGCCGTATATTACTGTGCGAGAGCTCTTTACGATGT CGGGGGAGTTTTTGATATTTGGGGCCAAGGGACTATGGTCACCGTCTCTTCA

SEQ ID NO	Clone ID	Description	Sequence
907	YANG-2108	VH domain amino acid sequence	QVQLQESGPGQVKPSGTLSLTCAVSGGSIRSSNWWIWVRQPPGKGLEWIGEIYHGGNTNYSPSLKSRVSISVDKSKN HFSLNLTSVTAADTAVYYCARALYDVGGVFDIWGQGTMVTVSS
908	YANG-2108	HCDR1	GGSIRSSNW
909	YANG-2108	HCDR2	IYHGGNT
910	YANG-2108	HCDR3	ARALYDVGGVFDI
911	YANG-2108	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAAGCAG CAGTGATGTTGGTGGTTATAATTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG ATGTCAGTGAGCGGCCCTCAGGGGTTTCTAATCGCTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGGTGATTATTACTGCTGCTCATATGCAGCTAATAGCAATGTGGTATTCGGCGG AGGGACCAAACTGTCCGTCCTA
912	YANG-2108	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGSSSDVGGYNYVSWYQQHPGKAPKLMIYDVSERPSGVSNRFSGSKSGNTASLTI SGLQAEDEGDYYCCSYAANSNVVFGGGTKLSVL
913	YANG-2108	LCDR1	SSDVGGYNY
203	YANG-2108	LCDR2	DVS
914	YANG-2108	LCDR3	CSYAANSNVV
915	YANG-2108a	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGGCCCAGGACAGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG AGGCTCCATCAGAAGTAGTAACTGGTGGATTTGGGGTCCGCCAGTCCCCCGGGAAGGGGTCTGGAGTGGATTGGGGAAA TCTATCATGGTGGGAACACCAACTACAATCCGTCCCTCAAGAGTCGACTCACCATATCAATAGACAAGTCCAAGAAC CACTTCTCCCATGAAGCTGCACTCTGTGACCGCCGCGGACACGGCCGTATATTACTGTGCGAGAACTCTTTACGATAT CGGGGGAGTTTTTGATATTTGGGGCCAAGGGACTTTGGTCACCGTCTCTTCA
916	YANG-2108a	VH domain amino acid sequence	QVQLQESGPGQVKPSGTLSLTCAVSGGSIRSSNWWIWVRQSPGKGLEWIGEIYHGGNTNYNPSLKSRLTISIDKSKN HFSMKLHSVTAADTAVYYCARTLYDIGGVFDIWGQGTILVTVSS

SEQ ID NO	Clone ID	Description	Sequence
917	YANG-2108a	HCDR1	GGSIRSSNW
918	YANG-2108a	HCDR2	IYHGGNT
919	YANG-2108a	HCDR3	ARTLYDIGGVFDI
920	YANG-2108a	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG CAGTGATGTTGGTGGTTATAACTATGTCTCCTGGTACCAACACCCAGGCAAAGCCCCCAAACTCATGATTTATG ATGTTAGTGAGCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGGTGATTATTACTGCTGCTCATATGCAGCTAATAGCAATGTGGTATTCGGCGG AGGGACCAAACTGTCCGTCCTA
921	YANG-2108a	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGGYNYVSWYQHHPGKAPKLMIYDVSERPSGVSNRFSGSKSGNTASLTI SGLQAEDEGDYYCCSYAANSNVVFGGGTKLSVL
922	YANG-2108a	LCDR1	SSDVGGYNY
203	YANG-2108a	LCDR2	DVS
923	YANG-2108a	LCDR3	CSYAANSNVV
924	YANG-2108b	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGTTCCATTAGAAGTAGTAACTGGTGGATTTGGGTCCGCCAGTCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAA TCTATCATGGTGGGAATACCAACTATAACCCGTCCCTCAAGAGTCGAGTCACCATGTCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAGTTCTGTGACCGCCGCGGACACGGCCGTATATTACTGTGCGAGACCTCTTTACGATAT CGGGGGAGTTTTTGATATTTGGGGCCAGGGGACTATGGTCACCGTCTCTTCA
925	YANG-2108b	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGGSIRSSNWWIWVRQSPGKGLEWIGEIYHGGNTNYNPSLKSRVTMSVDKSKN QFSLKLSSVTAADTAVYYCARPLYDIGGVFDIWGQGTMVTVSS
926	YANG-2108b	HCDR1	GGSIRSSNW
927	YANG-2108b	HCDR2	IYHGGNT

SEQ ID NO	Clone ID	Description	Sequence
928	YANG-2108b	HCDR3	ARPLYDIGGVFDI
929	YANG-2108b	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGATCTCCATCTCCTGCACTGGAACCAA CAGTGATATTGGTGGTTATAACTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG ATGTCAGTGAGCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGGTGATTATTACTGCTGCTCATATGCAAGTAATAGTAATGTGGTATTCGGCGG AGGGACCAAACTGTCCGTCCTA
930	YANG-2108b	VL domain amino acid sequence	QSALTQPASVSGSPGQSISISCTGTNSDIGGYNYVSWYQQHPGKAPKLMIYDVSERPSGVSNRFSGSKSGNTASLTI SGLQAEDEGDYYCCSYASNSNVVFGGGTKLSVL
931	YANG-2108b	LCDR1	NSDIGGYNY
203	YANG-2108b	LCDR2	DVS
932	YANG-2108b	LCDR3	CSYASNSNVV
933	YANG-2108c	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGGCCCAGGACAGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGAAGTAGTAACTGGTGGATTTGGGTCCGCCAGCCCCCAGGGAAGGGTCTGGAGTGGATTGGGGAAA TCTATCATGGTGGGAATACCAACTACAAGCCGTCCCTCAAGAGTCGAGTCACCATATCAGTTGACAAGTCCAAGAAC CAGTTCTCCCTCCAGTTGACTTCTGTGACCGCCGCGGACACGGCCGTATACTACTGTGCGAGAGCTCTTTATGATAT CGGGGGAGTTTTTGATATTTGGGGCCAAGGGACGATGGTCACCGTCTCTTCA
934	YANG-2108c	VH domain amino acid sequence	QVQLQESGPGQVKPSGTLSLTCAVSGGSIRSSNWWIWVRQPPGKGLEWIGEIYHGGNTNYKPSLKSRVTISVDKSKN QFSLQLTSVTAADTAVYYCARALYDIGGVFDIWGQGTMVTVSS
935	YANG-2108c	HCDR1	GGSIRSSNW
936	YANG-2108c	HCDR2	IYHGGNT
937	YANG-2108c	HCDR3	ARALYDIGGVFDI

SEQ ID NO	Clone ID	Description	Sequence
938	YANG-2108c	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG CAGTGATGTTGGTGGTTATAACTATGTCTCCTGGTACCAACAGTATCCAGGCAAAGCCCCCAAACTCATGATTTATG ATGTCAGTGAGCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGGTGATTATTACTGCTCATATGCAACTAATAGCAATGTGGTATTCGGCGG AGGGACCAAACTGTCCGTCCTA
939	YANG-2108c	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGGYNYVSWYQQYPGKAPKLMIYDVSERPSGVSNRFSGSKSGNTASLTI SGLQAEDEGDYYCCSYATNSNVVFGGGTKLSVL
940	YANG-2108c	LCDR1	SSDVGGYNY
203	YANG-2108c	LCDR2	DVS
941	YANG-2108c	LCDR3	CSYATNSNVV
942	YANG-2108d	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATTAGAAGTAGTAACTGGTGGATTTGGGTCCGCCAGTCCCCAGGGAAGGGACTGGAGTGGATTGGGGAAA TCTATCATGGTGGGAATACCAAGTATAATCCGTCCCTCAAGAGTCGAGTCACCATGTCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAGTTCTGTGACCGCCGCGGACACGGCCGTATATTACTGTGCGAGAGCTCTTTACGATAT CGGGGGAGTTTTTTGATATTTGGGGCCAGGGGACTATGGTCACCGTCTCTTCA
943	YANG-2108d	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGGSIRSSNWWIWVRQSPGKGLEWIGEIYHGGNTKYNPSLKSRVTMSVDKSKN QFSLKLSSVTAADTAVYYCARALYDIGGVFDIWGQGTMVTVSS
944	YANG-2108d	HCDR1	GGSIRSSNW
945	YANG-2108d	HCDR2	IYHGGNT
946	YANG-2108d	HCDR3	ARALYDIGGVFDI
947	YANG-2108d	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGATCTCCATCTCCTGCACTGGAACCAG CAGTAATATTGGTGGTTATAACTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG ATGTCAGTGAGCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGGTGATTATTACTGCTCATATGGAAGTAATAGTAATGTGGTTTTCGGCGG AGGGACCAAACTGTCCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
948	YANG-2108d	VL domain amino acid sequence	QSALTQPASVSGSPGQSISISCTGTSSNIGGYNYVSWYQQHPGKAPKLMIYDVSERPSGVSNRFSGSKSGNTASLTI SGLQAEDEGDYYCCSYGSNSNVVFGGGTKLSVL
949	YANG-2108d	LCDR1	SSNIGGYNY
203	YANG-2108d	LCDR2	DVS
950	YANG-2108d	LCDR3	CSYGSNSNVV
951	YANG-2108e	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACAGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGAAGTAGTAACTGGTGGATTTGGGTCCGCCAGTCCCCCGGGAAGGGTCTGGAGTGGATTGGGGAAA TCTATCATGGTGGGAACACCAACTACAACCCGTCCCTCAAGAGTCGACTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCATGAAGCTGAGCTCTGTGACCGCCGCGGACACGGCCGTATATTACTGTGCGAGAGCTCTTTACGATAT CGGGGGAGTTTTTTGATATTTGGGGCCAAGGGACTATGGTCACCGTCTCTTCA
952	YANG-2108e	VH domain amino acid sequence	QVQLQESGPGQVKPSGTLSLTCAVSGGSIRSSNWWIWVRQSPGKGLEWIGEIYHGGNTNYNPSLKSRLTISVDKSKN QFSMKLSSVTAADTAVYYCARALYDIGGVFDIWGQGTMVTVSS
953	YANG-2108e	HCDR1	GGSIRSSNW
954	YANG-2108e	HCDR2	IYHGGNT
955	YANG-2108e	HCDR3	ARALYDIGGVFDI
956	YANG-2108e	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG CAGTGATGTTGGTGGTTATAACTATGTCTCCTGGTACCAACAGCACACAGGCAAAGCCCCCAAATTCATGATTTATG ATGTTAGTGAGCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGGTGATTATTACTGCTCATATGCAGCTGATAGCAATGTGGTTTTCGGCGG AGGGACCAAACTGTCCGTCCTA
957	YANG-2108e	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGGYNYVSWYQQHTGKAPKFMIYDVSERPSGVSNRFSGSKSGNTASLTI SGLQAEDEGDYYCCSYAADSNVVFGGGTKLSVL

SEQ ID NO	Clone ID	Description	Sequence
958	YANG-2108e	LCDR1	SSDVGGYNY
203	YANG-2108e	LCDR2	DVS
959	YANG-2108e	LCDR3	CSYAADSNVV
960	YANG-2108f	VH domain nucleic acid sequence	CAAATGCAGCTGCAGGAGTCGGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGAAGTAGTAACTGGTGGATTTGGGTCCGCCAGCCCCCAGGGAAGGGACTGGAGTGGATTGGGGAAA TCTCTCACGGTGGGAACACCAACTACAACCCGTCCCTCAAAAGTCGAGTCACCATAACTGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAACTGCCCTCTATGACCGCCGCGGACACGGCCATATATTACTGTGCGAGAGCTCTTTACGATAT CGGGGGAGTCTTTGATATTTGGGGCCCAGGGACTATGGTCACCGTCTCTTCA
961	YANG-2108f	VH domain amino acid sequence	QMQLQESGPGLVKPSGTLSLTCAVSGGSIRSSNWWIWVRQPPGKGLEWIGEISHGGNTNYNPSLKSRVTITVDKSKN QFSLKLPSMTAADTAIYYCARALYDIGGVFDIWGPGTMVTVSS
962	YANG-2108f	HCDR1	GGSIRSSNW
963	YANG-2108f	HCDR2	ISHGGNT
964	YANG-2108f	HCDR3	ARALYDIGGVFDI
965	YANG-2108f	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGATCACCATGTCCTGCACTGGAACCAA CAGTGATGTTGGTGGTTACAACTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG ATGTCAGTGAGCGGCCCTCAGGACTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAATACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGGTGATTATTACTGCTGCTCATTTGCAGCTAATAGCAATGTGGTTTTCGGCGG GGGGACCAAGTTGTCCGTCCTA
966	YANG-2108f	VL domain amino acid sequence	QSALTQPASVSGSPGQSITMSCTGTNSDVGGYNYVSWYQQHPGKAPKLMIYDVSERPSGLSNRFSGSKSGNTASLTI SGLQAEDEGDYYCCSFAANSNVVFGGGTKLSVL
967	YANG-2108f	LCDR1	NSDVGGYNY
203	YANG-2108f	LCDR2	DVS

SEQ ID NO	Clone ID	Description	Sequence
968	YANG-2108f	LCDR3	CSFAANSNVV
2369	YANG-2108g	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGCAGTCGGGGCCCAGGACTGCTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGAAGTAGTAACTGGTGGATTTGGGTCCGCCAGTCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAA TCTATCATGGTGGGAACACCAATTACAACCCGTCCCTCAAGAGTCGAGTCACCATATCAGTCGACAAGTCCAAGCAC CAGTTCTCCCTGAAGCTGACCTCTGTGACCGCCGCGGACACGGCCGTCTATTACTGTGCGAGAGCTCTTTACGATAT CGGGGGAGTTTTTTGATCTTTGGGGCCAAGGGACTATGGTCACCGTCTCTTCA
2370	YANG-2108g	VH domain amino acid sequence	QVQLQQSGPGLLKPSGTLSLTCAVSGGSIRSSNWWIWVRQSPGKGLEWIGEIYHGGNTNYNPSLKSRVTISVDKSKH QFSLKLTSVTAADTAVYYCARALYDIGGVFDLWGQGTMVTVSS
969	YANG-2108g	HCDR1	GGSIRSSNW
970	YANG-2108g	HCDR2	IYHGGNT
971	YANG-2108g	HCDR3	ARALYDIGGVFDL
972	YANG-2108g	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG CAGTGATGTTGGTGGTTATAACTATGTCTCCTGGTACCAACACACCCAGGCAAAGCCCCCAAACTCATGATTTATG ATGTCAGTGAGCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGGTGATTATTACTGCTGCTCATATGCAGCTAATAGCAGTGTTGTATTCGGCGG AGGGACCAAACTGTCCGTCCTA
973	YANG-2108g	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGGYNYVSWYQQHPGKAPKLMIYDVSERPSGVSNRFSGSKSGNTASLTI SGLQAEDEGDYYCCSYAANSSVVFGGGTKLSVL
974	YANG-2108g	LCDR1	SSDVGGYNY
203	YANG-2108g	LCDR2	DVS
975	YANG-2108g	LCDR3	CSYAANSSVV

SEQ ID NO	Clone ID	Description	Sequence
976	YANG-2108h	VH domain nucleic acid sequence	CAGGTACAGCTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGTGCTGTCTCTGG TGGCTCCATCAGAAGTAGTAACTGGTGGATTTGGGTCCGCCAGCCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAA TCTATCATGGTGGGAACACCAACTACAACCCGTCCCTCCAGAGTCGAGTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAATCTGAGTTCTGTGACCGCCGCGGACACGGCCGTATATTACTGTGCGAGAGCTCTTTACGATAT CGGGGGAGTTTTTGATATTTGGGGCCAAGGGACTTTGGTCACCGTCTCTTCA
977	YANG-2108h	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGGSIRSSNWWIWVRQPPGKGLEWIGEIYHGGNTNYNPSLQSRVTISVDKSKN QFSLNLSSVTAADTAVYYCARALYDIGGVFDIWGQGTLVTVSS
978	YANG-2108h	HCDR1	GGSIRSSNW
979	YANG-2108h	HCDR2	IYHGGNT
980	YANG-2108h	HCDR3	ARALYDIGGVFDI
981	YANG-2108h	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGACCACCATCTCCTGCACTGGAACCAG CAGTGATGTTGGTGGTTATAACTATGTCTCCTGGTACCAACACACCCAGGCAAAGCCCCCAAACTCATGATTTATG ATGTCAGTGAGCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGGTGATTATTACTGCTCATATGCAGCTAATAGCAATGTGCTATTCGGCGG AGGGACCAAACTGTCCGTCCTA
982	YANG-2108h	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGGYNYVSWYQQHPGKAPKLMIYDVSERPSGVSNRFSGSKSGNTASLTI SGLQAEDEGDYYCCSYAANSNVLFGGGTKLSVL
983	YANG-2108h	LCDR1	SSDVGGYNY
203	YANG-2108h	LCDR2	DVS
984	YANG-2108h	LCDR3	CSYAANSNVL
985	YANG-2108i	VH domain nucleic acid sequence	CAGGTGCAACTGCAGGAGTCGGGCCCAGGACTGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGAAGTAGTAACTGGTGGATTTGGGTCCGCCAGTCCCCAGGGAAGGGGCTGGAGTGGATTGGGGAAA TCTATCATGGTGGGAACACCAACTACAACCCGTCCCTCAAGAGTCGAGTCACCACATTAGTAGACAAGTCCAAAAAC CAATTCTCCCTGAAATTGAGTTCTGTGACCGCCGCGGACACGGCCGTATATTACTGTGCGAGAGCTCTTTACGATAT CGGGGGAGTTTTTGATATTTGGAGCCAAGGGACGATGGTCACCGTCTCTTCA

SEQ ID NO	Clone ID	Description	Sequence
986	YANG-2108i	VH domain amino acid sequence	QVQLQESGPGLVKPSGTLSLTCAVSGGSIRSSNWWIWVRQSPGKGLEWIGEIYHGGNTNYNPSLKSRVTTLVDKSKN QFSLKLSSVTAADTAVYYCARALYDIGGVFDIWSQGTMVTVSS
987	YANG-2108i	HCDR1	GGSIRSSNW
988	YANG-2108i	HCDR2	IYHGGNT
989	YANG-2108i	HCDR3	ARALYDIGGVFDI
990	YANG-2108i	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAT CAGTGATGTTGGTGGTTATAACTATGTCTCTTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG ATGTCAGTGAGCGGCCCTCAGGGATTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACAATC TCTGGGCTCCAGACTGAGGACGAGGGTGATTATTACTGCTGCTCATATGCAGCTAATAGCAATGTGGTATTCGGCGG AGGGACCAAACTGTCCGTCCTA
991	YANG-2108i	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTISDVGGYNYVSWYQQHPGKAPKLMIYDVSERPSGISNRFSGSKSGNTASLTI SGLQTEDEGDYYCCSYAANSNVVFGGGTKLSVL
992	YANG-2108i	LCDR1	ISDVGGYNY
203	YANG-2108i	LCDR2	DVS
993	YANG-2108i	LCDR3	CSYAANSNVV
994	YANG-2108j	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGGCCCAGGACAGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGAAGTAGTAACTGGTGGATTTGGGGTCCGCCAGTCCCCAGGGAAGGGTCTGGAGTGGATTGGGGAAA TCTATCATGGTGGAAACACCAACTACAACCCGTCCCTCAAGAGTCGAGTCACCATATCATTAGACAAGTCCAAGAAC CAGTTCTCCCTGAACCTGACCTCTGTGACCGCCGCGGACACGGCCGTATATTACTGTGCGAGAGCTCTTTACGATAT CGGGGGAGTTTTTGATATTTGGGGCCAAGGGACTATGGTCATCGTCTCTTCA
995	YANG-2108j	VH domain amino acid sequence	QVQLQESGPGQVKPSGTLSLTCAVSGGSIRSSNWWIWVRQSPGKGLEWIGEIYHGGNTNYNPSLKSRVTISLDKSKN QFSLNLTSVTAADTAVYYCARALYDIGGVFDIWGQGTMVTVSS

SEQ ID NO	Clone ID	Description	Sequence
996	YANG-2108j	HCDR1	GGSIRSSNW
997	YANG-2108j	HCDR2	IYHGGNT
998	YANG-2108j	HCDR3	ARALYDIGGVFDI
999	YANG-2108j	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAAGCAG CAGTGATGTTGGTGGTTATAACTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG ATGTCAGTGAGCGGCCCTCAGGGGTTTCTAGTCGATTTTCTGGCTCCAAGTCTGGCAGCACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGGTGATTATTACTGCTGCTCATATGCAATTAATAGCGATGTGGTTTTCGGCGG AGGGACCAAACTGTCCGTCCTA
1000	YANG-2108j	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGSSSDVGGYNYVSWYQQHPGKAPKLMIYDVSERPSGVSSRFSGSKSGSTASLTI SGLQAEDEGDYYCCSYAINSDVVFGGGTKLSVL
1001	YANG-2108j	LCDR1	SSDVGGYNY
1002	YANG-2108j	LCDR2	DVS
1003	YANG-2108j	LCDR3	CSYAINSDVV
1004	YANG-2108k	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGCCCAGGACAGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGAAGTAGTAACTGGTGGATTTGGGTCCGCCAGTCCCCCGGGAAGGGTCTGGAGTGGATTGGGGAAA TCTATCATGGTGGGAAGACCAACTACAACCCGTCCCTCAAGAGTCGACTCACCATATCAGTAGACAAGTCCAAGAAC CAGTTCTCCCTGAAGCTGAGCTCTGTGACCGCCGCGGACACGGCCGTATATCACTGTGCGAGAACTCTTTATGATAT CGGGGGAGTTTTTGATATTTGGGGCCAAGGGACTATGGTCACCGTCTCTTCA
1005	YANG-2108k	VH domain amino acid sequence	QVQLQESGPGQVKPSGTLSLTCAVSGGSIRSSNWWIWVRQSPGKGLEWIGEIYHGGKTNYNPSLKSRLTISVDKSKN QFSMKLSSVTAADTAVYHCARTLYDIGGVFDIWGQGTMVTVSS
1006	YANG-2108k	HCDR1	GGSIRSSNW
1007	YANG-2108k	HCDR2	IYHGGKT

SEQ ID NO	Clone ID	Description	Sequence
1008	YANG-2108k	HCDR3	ARTLYDIGGVFDI
1009	YANG-2108k	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG CAGTGATGTTGGTGGTTATAACTATGTCTCCTGGTACCAACACCACACAGGCAAAGCCCCCAAACTCATGATTTATG ATGTTAGTGAGCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGGTGATTATTACTGCTGCTCATATGCAGCTGATAGCAATGTGGTTTCGGCGG AGGGACCAAACTGTCCGTCCTA
1010	YANG-2108k	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGGYNYVSWYQHHTGKAPKLMIYDVSERPSGVSNRFSGSKSGNTASLTI SGLQAEDEGDYYCCSYAADSNVVFGGGTKLSVL
1011	YANG-2108k	LCDR1	SSDVGGYNY
1012	YANG-2108k	LCDR2	DVS
1013	YANG-2108k	LCDR3	CSYAADSNVV
1014	YANG-21081	VH domain nucleic acid sequence	CAGGTGCAGCTGCAGGAGTCGGGGCCCAGGACAGGTGAAGCCTTCGGGGACCCTGTCCCTCACCTGCGCTGTCTCTGG TGGCTCCATCAGAAGTAGTAACTGGTGGATTTGGGTCCGCCAGCCCCCAGGGAAGGGTCTGGAGTGGATTGGGGAAA TCTATCATGGTGGAAATACCAACTACAAGCCGTCCCTCAAGAGTCGAGTCACCATATCAGTTGACATGTCCAAGAAC CAGTTCTCCCTGCAGTTGACTTCTGTGACCGCCGCGGACACGGCCGTATACTACTGTGCGAGAGCTCTTTATGATAT CGGGGGAGTCTTTGATATTTGGGGCCAAGGGACGATGGTCACCGTCTCTTCA
1015	YANG-21081	VH domain amino acid sequence	QVQLQESGPGQVKPSGTLSLTCAVSGGSIRSSNWWIWVRQPPGKGLEWIGEIYHGGNTNYKPSLKSRVTISVDMSKN QFSLQLTSVTAADTAVYYCARALYDIGGVFDIWGQGTMVTVSS
1016	YANG-21081	HCDR1	GGSIRSSNW
1017	YANG-21081	HCDR2	IYHGGNT
1018	YANG-21081	HCDR3	ARALYDIGGVFDI

SEQ ID NO	Clone ID	Description	Sequence
1019	YANG-21081	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTGCCTCCGTGTCGGGGTCTCCTGGACAGTCGATCACCATCTCCTGCACTGGAACCAG CAGTGATGTTGGTGGTTATAACTATGTCTCCTGGTACCAACAGTATCCAGGCAAAGCCCCCAAACTCATGATTTATG ATGTCAGTGAGCGGCCCTCAGGGGTTTCTAATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACAATC TCTGGGCTCCAGGCTGAGGACGAGGGTGATTATTACTGCTGCTCATATGCAGCTAATAGCAATGTGGTATTCGGCGG AGGGACCAAACTGTCCGTCCTA
1020	YANG-21081	VL domain amino acid sequence	QSALTQPASVSGSPGQSITISCTGTSSDVGGYNYVSWYQQYPGKAPKLMIYDVSERPSGVSNRFSGSKSGNTASLTI SGLQAEDEGDYYCCSYAANSNVVFGGGTKLSVL
1021	YANG-21081	LCDR1	SSDVGGYNY
1022	YANG-21081	LCDR2	DVS
1023	YANG-21081	LCDR3	CSYAANSNVV
1024	YANG-2109	VH domain nucleic acid sequence	CAGGTCCAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGTCCTCGGTGAAGGTCTCCTGTAAGGCTTCTGG AGGCACCTTCAGCGGTTATACTATCAGCTGGATTCGACAGGCCCCTGGACAGGGACTTGAGTGGATGGGAGGGATCA TCCCTAGCTTTGGCTCATTAAACTATGGACAGAAGTTCCAGGACAGAGTCTCGATTACCACGGACGAATTAAAGAGC ACTGTGTACATGGAGCTGAGCAGCCTGAATTCTGAGGACACGGCCATATATTATTGTACGAGAGAATCAATAACTTC GGGCTACTATTACGGTATGGCCGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
1025	YANG-2109	VH domain amino acid sequence	QVQLVQSGAEVKKPGSSVKVSCKASGGTFSGYTISWIRQAPGQGLEWMGGIIPSFGSLNYGQKFQDRVSITTDELKS TVYMELSSLNSEDTAIYYCTRESITSGYYYGMAVWGQGTTVTVSS
1026	YANG-2109	HCDR1	GGTFSGYT
1027	YANG-2109	HCDR2	IIPSFGSL
1028	YANG-2109	HCDR3	TRESITSGYYYGMAV
1029	YANG-2109	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCCTCCCTGTCTGCATCTGTAGGAGACAGAGTCACCATCACTTGCCGGGCAAG TCAGGGCATTAGAGATGATTTAGGCTGGTTTCAGCAGAAACCAGGGAAAGCCCCTAAGCGCCTGATCTCTGCTGCAT CCAGTTTGCAAAGTGGAGTCCCATCAAGGTTCAGCGGCAGTGGATCTGGGACAGAAATTCACTCTCACAATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTATTACTGTCTACAGCATAATAGTTACCCGCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAGA

SEQ ID NO	Clone ID	Description	Sequence
1030	YANG-2109	VL domain amino acid sequence	DIQMTQSPSSLSASVGDRVTITCRASQGIRDDLGWFQQKPGKAPKRLISAASSLQSGVPSRFSGSGSGTEFTLTISS LQPEDFATYYCLQHNSYPLTFGGGTKVEIR
1031	YANG-2109	LCDR1	QGIRDD
1032	YANG-2109	LCDR2	AAS
1033	YANG-2109	LCDR3	LQHNSYPLT
1034	YANG-2110	VH domain nucleic acid sequence	GAGGTGCAGCTGGTGGAGTCTGGAGGAGGCTTGATCCAGCCTGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG GTTCATCGTCAGTCGCAATTATATGAGTTGGGTCCGCCAGGCTCCAGGGAAGGGGCTGGACTGGGTCTCAGTTATTT ATAGCGGTGGCAGCACATACTACGCAGACTCCGTGAAGGGCCGATTTACCATCTCCAGAGACAATTCCAAGAACACG CTGTATCTTCAAATGAACAGCCTGAGAGCCGAGGACACGGCCGTCTATTACTGTGCGAGGTCTATAGCAGTGGCTGG TGAGGGGCTTGACTCCTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
1035	YANG-2110	VH domain amino acid sequence	EVQLVESGGGLIQPGGSLRLSCAASGFTVSRNYMSWVRQAPGKGLDWVSVIYSGGSTYYADSVKGRFTISRDNSKNT LYLQMNSLRAEDTAVYYCARSIAVAGEGLDSWGQGTLVTVSS
1036	YANG-2110	HCDR1	GFIVSRNY
1037	YANG-2110	HCDR2	IYSGGST
1038	YANG-2110	HCDR3	ARSIAVAGEGLDS
1039	YANG-2110	VL domain nucleic acid sequence	GAAATTGTAATGACACAGTCTCCAGCCACCCTGTCTTTGTCTCCAGGGGACAGAGCCACCCTCTCCTGCAGGGCCAG TCAGAGTGTTAGCAACATCTTCATATCCTGGTACCAGCAGAAACCTGGGCAGGCTCCCAGGCTCCTCATTATATGGTG CATCCATCAGGGCCACTGACATCCCAGCCAGGTTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGC AGCCTGCAGCCTGAAGATTTTGCAATTTATTCTGTCAGCAGGATTATAACTTACCGCTCACTTTCGGCGGAGGGAC CAAGGTGGAGATCAAA
1040	YANG-2110	VL domain amino acid sequence	EIVMTQSPATLSLSPGDRATLSCRASQSVSNIFISWYQQKPGQAPRLLIYGASIRATDIPARFSGSGSGTDFTLTIS SLQPEDFAIYFCQQDYNLPLTFGGGTKVEIK

SEQ ID NO	Clone ID	Description	Sequence
1041	YANG-2110	LCDR1	QSVSNIF
1042	YANG-2110	LCDR2	GAS
1043	YANG-2110	LCDR3	QQDYNLPLT
1044	YANG-2111	VH domain nucleic acid sequence	GGAGTCCAACTGGTGGAGTCTGGGGGAGGCTTGGTACAGCCTGGCAGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTGATGATTATGCCTTACACTGGGTCCGGCAAGTTCCAGGGAAGGGCCTGGAGTGGGTCTCAAGCATTA GTTGGAATAGTGATGACCTAGGCTATGCGGACTCTGTGGAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAGCAGTCTGAGAACTGAGGACACGGCCTTGTATTACTGTGTAAAGGATACTAGGGCGCA TTACGATATTTTGGCTGGTTATAGAGGGCTTGACTCTTGGGGCCAGGGAACCCTGGTCACCGTCTCTTCA
1045	YANG-2111	VH domain amino acid sequence	GVQLVESGGGLVQPGRSLRLSCAASGFTFDDYALHWVRQVPGKGLEWVSSISWNSDDLGYADSVEGRFTISRDNAKN SLYLQMSSLRTEDTALYYCVKDTRAHYDILAGYRGLDSWGQGTLVTVSS
1046	YANG-2111	HCDR1	GFTFDDYA
1047	YANG-2111	HCDR2	ISWNSDDL
1048	YANG-2111	HCDR3	VKDTRAHYDILAGYRGLDS
1049	YANG-2111	VL domain nucleic acid sequence	GATATTGTGATGACTCAGTCTCCACTCTCCCTGCCCGTCACCCCTGGAGAGCCGGCCTCCATCTCCTGCAGGTCTAC TCAGAGCCTCCTACATAGTAATGGATACAACTTTTTGGATTGGTACCTGCAGAAGCCAGGGCAGTCTCCACAACTCC TGATCTATTTGGGTTCTAATCGGGCCTCCGGGGTCCCTGACAGGTTCAGTGGCAGTGGATCAGGCACAGATTTTCA CTGAAAATCAGCAGAGTGGAGGCTGAGGATATTGGAATTTATTACTGCATACAAGGTCTGCAAACTCCTATCACCTT CGGCCAAGGGACACGACTGGAGATTAAA
1050	YANG-2111	VL domain amino acid sequence	DIVMTQSPLSLPVTPGEPASISCRSTQSLLHSNGYNFLDWYLQKPGQSPQLLIYLGSNRASGVPDRFSGSGSGTDFS LKISRVEAEDIGIYYCIQGLQTPITFGQGTRLEIK
1051	YANG-2111	LCDR1	QSLLHSNGYNF
1052	YANG-2111	LCDR2	LGS

SEQ ID NO	Clone ID	Description	Sequence
1053	YANG-2111	LCDR3	IQGLQTPIT
1054	YANG-2111a	VH domain nucleic acid sequence	GAAGTGGAGCTGGTGGAGTCTGGGGGAGGCTTGGTACAGCCTGGCAGGTCCCTGAGACTCTCCTGTGCTGCCTCTGG CTTCATCTTTGATGATTATGCCTTTACACTGGGTCCGGCAAATTCCAGGGAAGGGCCTGGAGTGGGTCTCAAGTATTA GTTGGAATAGTGATGACGTAGGCTATGCGGACTCTGTGGAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAGCAGTCTGAGAGCTGAGGACACGGCCTTATATTACTGTGTAAAGGATGTTAGGGCTCA TTACGATATTTTGGCTGCTTATAGAGGACTTGACTATTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
1055	YANG-2111a	VH domain amino acid sequence	EVELVESGGGLVQPGRSLRLSCAASGFIFDDYALHWVRQIPGKGLEWVSSISWNSDDVGYADSVEGRFTISRDNAKN SLYLQMSSLRAEDTALYYCVKDVRAHYDILAAYRGLDYWGQGTLVTVSS
1056	YANG-2111a	HCDR1	GFIFDDYA
1057	YANG-2111a	HCDR2	ISWNSDDV
1058	YANG-2111a	HCDR3	VKDVRAHYDILAAYRGLDY
1059	YANG-2111a	VL domain nucleic acid sequence	GATGTTGTGATGACTCAGTCTCCGCTCTCCCTGCCCGTCACCCCTGGAGAGCCGGCCTCCATCTCCTGCAGGTCTAG TCAGAGCCTCCTGCATAGCAATGGATACAACTATTTGGATTGGTACCTGCAGAAGCCAGGGCAGTCTCCACAACTCC TGATCTATTTGGGTTCTAATCGGGCCTCCGGGGTCCCTGACAGGTTCAGTGGCAGTGGATCAGGCACAGATTTTACA CTGAAGATCAGTAGAATGGAGGCTGAGGATGTTGGGGTTTATTACTGCATGCAAGGTCTACAAACTCCTATCACCTT CGGCCAAGGGACACGACTGGAGATTAAG
1060	YANG-2111a	VL domain amino acid sequence	DVVMTQSPLSLPVTPGEPASISCRSSQSLLHSNGYNYLDWYLQKPGQSPQLLIYLGSNRASGVPDRFSGSGSGTDFT LKISRMEAEDVGVYYCMQGLQTPITFGQGTRLEIK
1061	YANG-2111a	LCDR1	QSLLHSNGYNY
1062	YANG-2111a	LCDR2	LGS
1063	YANG-2111a	LCDR3	MQGLQTPIT

SEQ ID NO	Clone ID	Description	Sequence
1064	YANG-2111b	VH domain nucleic acid sequence	GAAGTGCAACTGGTGGAGTCTGGGGGAGGCTTGGTACAGCCTGGCAGGTCCCTGAGACTCTCCTGTGGCAGCCTCTGG CTTCATCTTTGATGATTATGCCTTACACTGGGTCCGGCAAGTTCCAGGGAAGGGCCTGGAGTGGGTCTCAAGTATTA GTTGGAATAGTGATGACATAGGCTATGCGGACTCTGTGGAGGGCCGATTCACCATCTCCAGAGACAACGCCAAGAAC TCCCTGTATCTGCAAATGAGTAGTCTGAGAGCTGAGGACACGGCCTTATATTACTGTGTAAAGGATGTTAGGGCGCA TTACGATATTTTGGCTGCTTATAGAGGACTTGACTATTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
1065	YANG-2111b	VH domain amino acid sequence	EVQLVESGGGLVQPGRSLRLSCAASGFIFDDYALHWVRQVPGKGLEWVSSISWNSDDIGYADSVEGRFTISRDNAKN SLYLQMSSLRAEDTALYYCVKDVRAHYDILAAYRGLDYWGQGTLVTVSS
1066	YANG-2111b	HCDR1	GFIFDDYA
1067	YANG-2111b	HCDR2	ISWNSDDI
1068	YANG-2111b	HCDR3	VKDVRAHYDILAAYRGLDY
1069	YANG-2111b	VL domain nucleic acid sequence	GATATTGTGATGACTCAGTCTCCACTCTCCCTGCCCGTCACCCCTGGAGAGCCGGCCTCCATCTCCTGCAGGTCTAG TCAGAGCCTCCTGCATAGCAATGGATACAACTATTTGGATTGGTACCTGCAGAAGCCAGGGCAGTCTCCACAACTCC TGATCTATTTGGGTTCTAATCGGGCCTCCGGGGTCCCTGACAGGTTCAGTGTCAGTGGATCAGGCACAGATTTTACA CTGAAAATCAGCAGAGTGGCGGCTGAGGATGTTGGGGTTTATTACTGCATGCAAGGTCTACAAACTCCTATCACCTT CGGCCAAGGGACACGACTGGAGATTACA
1070	YANG-2111b	VL domain amino acid sequence	DIVMTQSPLSLPVTPGEPASISCRSSQSLLHSNGYNYLDWYLQKPGQSPQLLIYLGSNRASGVPDRFSVSGSGTDFT LKISRVAAEDVGVYYCMQGLQTPITFGQGTRLEIT
1071	YANG-2111b	LCDR1	QSLLHSNGYNY
1072	YANG-2111b	LCDR2	LGS
1073	YANG-2111b	LCDR3	MQGLQTPIT

SEQ ID NO	Clone ID	Description	Sequence
1074	YANG-2112	VH domain nucleic acid sequence	CAGGTCCAACTGGTACAGTCTGGGGCTGAAGTGAAGAAGCCTGGGGCCTCAGTGAAGGTCTCCTGCAAGGTTTCCGG GTTCACCCTCACTCACTTATCCATTCACTGGGTGCGACAGGCTCCTGGAAGAGGACTTGAGTGGATGGGAGGTTTTG ATCCTGTGGATGGTCAAACAGTCTACGCACAGAACTTCCAGGGCAGAGTCACCATGACCGAGGACACATCTACAGAC ACAGCCAACATGGACCTGAACAACCTGAAATCTGAGGACACGGCCGTTTATTACTGTGCGACGGGTGTAGTAGTACC AGCTGCCCCTTACTACTACTCCTCCGGAATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
1075	YANG-2112	VH domain amino acid sequence	QVQLVQSGAEVKKPGASVKVSCKVSGFTLTHLSIHWVRQAPGRGLEWMGGFDPVDGQTVYAQNFQGRVTMTEDTSTD TANMDLNNLKSEDTAVYYCATGVVVPAAPYYYSSGMDVWGQGTTVTVSS
1076	YANG-2112	HCDR1	GFTLTHLS
1077	YANG-2112	HCDR2	FDPVDGQT
1078	YANG-2112	HCDR3	ATGVVVPAAPYYYSSGMDV
1079	YANG-2112	VL domain nucleic acid sequence	CAGTCTGTGCTGACTCAGCCACCCTCAACGTCTGGGACCCCCGGGCAGAGGGTCACCATCTCTTGCTCTGGAAGCAG CTCCAACATCGCAAAAAATTATGTATACTGGTACCAACAACTCCCAGGAACGGCCCCCAAACTCCTCATCTATAGGA CTAATCAGCGGCCCTCTGGGGTCCCTGACCGATTCTCTGGCTCCAGGTCTGGCACCTCAGCCTCCCTGGCCATCAGT GGGCTCCGGTCCGAGGATGAGGCTACTTATTACTGTGCAACATGGGATGACACCCTGAGTGTGATATTCGGCGGAGG GACCAACCTGACCGTCCTG
1080	YANG-2112	VL domain amino acid sequence	QSVLTQPPSTSGTPGQRVTISCSGSSSNIAKNYVYWYQQLPGTAPKLLIYRTNQRPSGVPDRFSGSRSGTSASLAIS GLRSEDEATYYCATWDDTLSVIFGGGTNLTVL
1081	YANG-2112	LCDR1	SSNIAKNY
1082	YANG-2112	LCDR2	RTN
1083	YANG-2112	LCDR3	ATWDDTLSVI
1084	YANG-2201	VH domain nucleic acid sequence	CAGGAGCAGCTGGTGGAGTCTGGGGGAGGCGTGGTCCAGCCTGGGATGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTCAGTAACTATGGCATGCACTGGGTCCGCCAGTCTCCCGGCAAGGGGCTGGAATGGGTGACTTTTATAT CATATGATGGAAATAATGAATACTATGTAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAAC ACGCTGTTTCTGCAAATGAACAGCCTGAGAGCTGAGGACGCGGCTGTGTATTACTGTGCGAAAGATCGTGCATTGAA CCTTTACTACTTTGATTCCTGGGGCCCGGGAACCCTGGTCACCGTCTCCTCA

SEQ ID NO	Clone ID	Description	Sequence
1085	YANG-2201	VH domain amino acid sequence	QEQLVESGGGVVQPGMSLRLSCAASGFTFSNYGMHWVRQSPGKGLEWVTFISYDGNNEYYVDSVKGRFTISRDNSKN TLFLQMNSLRAEDAAVYYCAKDRALNLYYFDSWGPGTLVTVSS
1086	YANG-2201	HCDR1	GFTFSNYG
1087	YANG-2201	HCDR2	ISYDGNNE
1088	YANG-2201	HCDR3	AKDRALNLYYFDS
1089	YANG-2201	VL domain nucleic acid sequence	GATATTGTGATGACTCAGCCTCCACTCTCCCTGTCCCGTCACTCCTGGAGAGCCGGCCTCCATCTCCTGCAGGTCTAG TCAGAGCCTCCTGCATAATAATGCCTACAACCATTTGAATTGGTATCTGCAGAAGCCAGGGCAGTCTCCACAGTTCC TGATCTATTTGGGTTCTAATCGGGCCTCCGGGGTCCCTGACAGGTTCAGTGGCAGTGGATCAGGCACAGATTTTACA CTGAAAATCAGCAGAGTGGAGGCTGAGGATGTTGGGGTTTATTACTGCATGCAATCTCTACAAATTCCGATCACCTT CGGCCAAGGGACACGACTGGAAATTAAA
1090	YANG-2201	VL domain amino acid sequence	DIVMTQPPLSLPVTPGEPASISCRSSQSLLHNNAYNHLNWYLQKPGQSPQFLIYLGSNRASGVPDRFSGSGSGTDFT LKISRVEAEDVGVYYCMQSLQIPITFGQGTRLEIK
1091	YANG-2201	LCDR1	QSLLHNNAYNH
1092	YANG-2201	LCDR2	LGS
1093	YANG-2201	LCDR3	MQSLQIPIT
1094	YANG-2202	VH domain nucleic acid sequence	GAGGTGCAATTGGTGGAGTCTGGGGGAGGCTTGGTTCAGCCGGGGGGGTCCCTGAGACTCTCCTGTGCAGCCTCTGG ATTCACCTTTAGCAGTTTTGCCATGAGTTGGGTCCGCCAGGCTCCAGGGAAGGGACTTGAGTGGGTCGCAGCCTTCA GTGGTCGTGGTGCGATTACACACTACACAGACTCCGTGAAGGGCCGGTTCACCATCTCCAGAGACAATTCCAAGAAC ACGCTGTATCTGCAAATGAACAGCCTGAGAGCCGAGGACACGGCCGTATATTACTGTGCGACTTATAATTGGAACCC CTACTACTTTGACTTCTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
1095	YANG-2202	VH domain amino acid sequence	EVQLVESGGGLVQPGGSLRLSCAASGFTFSSFAMSWVRQAPGKGLEWVAAFSGRGAITHYTDSVKGRFTISRDNSKN TLYLQMNSLRAEDTAVYYCATYNWNPYYFDFWGQGTLVTVSS

SEQ ID NO	Clone ID	Description	Sequence
1096	YANG-2202	HCDR1	GFTFSSFA
1097	YANG-2202	HCDR2	FSGRGAIT
1098	YANG-2202	HCDR3	ATYNWNPYYFDF
1099	YANG-2202	VL domain nucleic acid sequence	GACATCCAGATGACCCAGTCTCCATCTTCCGTGTCTGCATCTATAGGAGACAGAGTCACCATCACCTGTCGGGCGAG TCAGGATATTAATATCTGGTTGGCCTGGTATCAGCAGAAACCAGGGAAAGCCCCTAATCTCCTGATCTTTGATACAT CCAATTTACAGAGTGGGGTCCCATCAAGGTTCAGTGGCAGTGGATCTGGGTCAGATTTCACTCTCACCATCAGCAGC CTGCAGCCTGAAGATTTTGCAACTTACTATTGTCAACAGGGTAACAGTTTCCCTCGGACCTTCGGCCAGGGGACACG ACTGGAAATTAAA
1100	YANG-2202	VL domain amino acid sequence	DIQMTQSPSSVSASIGDRVTITCRASQDINIWLAWYQQKPGKAPNLLIFDTSNLQSGVPSRFSGSGSGSDFTLTISS LQPEDFATYYCQQGNSFPRTFGQGTRLEIK
1101	YANG-2202	LCDR1	QDINIW
1102	YANG-2202	LCDR2	DTS
1103	YANG-2202	LCDR3	QQGNSFPRT
1104	YANG-2203	VH domain nucleic acid sequence	CAGGTGCAACTGGTGCAGTCTGGGGCTGAGGTGAAGCAGCCTGGGGCCTCAGTGAAGGTTTCCTGCAGGGCATCTGG ATACGCCCTCACCAGCTTCTATGTTCACTGGGTGCGACAGGCCCCTGGACAAGGGCTTGAGTGGATGGGCATAATCA AACCCAGTGGTGGTGACACAATCTACGCTCAGAATCTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACATTCTACGTGGAACTGAGCAGCCTGAGATCTGAGGACACGGCCCTATATTACTGTGCGATCAGTGGGAACACTAG GGCTTTTGAAATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTTA
1105	YANG-2203	VH domain amino acid sequence	QVQLVQSGAEVKQPGASVKVSCRASGYALTSFYVHWVRQAPGQGLEWMGIIKPSGGDTIYAQNLQGRVTMTRDTSTN TFYVELSSLRSEDTALYYCAISGNTRAFEIWGQGTMVTVSL
1106	YANG-2203	HCDR1	GYALTSFY
1107	YANG-2203	HCDR2	IKPSGGDT

SEQ ID NO	Clone ID	Description	Sequence
1108	YANG-2203	HCDR3	AISGNTRAFEI
1109	YANG-2203	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGCTCCCAGGAATGGTCCCCAAACTCCTCATTTATGCCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACTTGGGATAGTAGTCGGAGTGCTGTGCTTTCGGCGG AGGGACCAAGATGACCGTCCTA
1110	YANG-2203	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQLPGMVPKLLIYANNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYYCGTWDSSRSAVLFGGGTKMTVL
1111	YANG-2203	LCDR1	SSNIGNNF
1112	YANG-2203	LCDR2	ANN
1113	YANG-2203	LCDR3	GTWDSSRSAVL
1114	YANG-2203a	VH domain nucleic acid sequence	CAGGTGCAACTGGTGCAGTCTGGGGCTGAGGTGAAGCAGCCTGGGGCCTCAGTGAAGGTTTCCTGCAGGGCATCTGG ATACGCCCTCACCAGCTTCTATGTTCACTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCCAGTGGTGGTGACACAATCTACGCTCAGAAATCTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACATTCTACGTGGAACTGAGCAGCCTGAGATCTGAGGACACGGCCCTATATTACTGTGCGATCAATGGGGACACTAG GGCTTTTGAAATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTTA
1115	YANG-2203a	VH domain amino acid sequence	QVQLVQSGAEVKQPGASVKVSCRASGYALTSFYVHWVRQAPGQGLEWMGIIKPSGGDTIYAQNLQGRVTMTRDTSTN TFYVELSSLRSEDTALYYCAINGDTRAFEIWGQGTMVTVSL
1116	YANG-2203a	HCDR1	GYALTSFY
1117	YANG-2203a	HCDR2	IKPSGGDT
1118	YANG-2203a	HCDR3	AINGDTRAFEI

SEQ ID NO	Clone ID	Description	Sequence
1119	YANG-2203a	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGCTCCCAGGAATGGTCCCCAAACTCCTCATTTATGCCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACTTGGGATAGTAGTCGGAGTGCTGTGCTTTTCGGCGG AGGGACCAAGATGACCGTCCTA
1120	YANG-2203a	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQLPGMVPKLLIYANNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYYCGTWDSSRSAVLFGGGTKMTVL
1121	YANG-2203a	LCDR1	SSNIGNNF
1122	YANG-2203a	LCDR2	ANN
1123	YANG-2203a	LCDR3	GTWDSSRSAVL
1124	YANG-2203b	VH domain nucleic acid sequence	CAGGTGCAACTGGTGCAGTCTGGGGCTGAGGTGAAGCAGCCTGGGGCCTCAGTGAAGGTTTCCTGCAGGGCATCTGG ATACGCCCTCACCAACTTCTATGTTCACTGGGTGCGACAGGCCCCTGGACAAAAACTTGAGTGGATGGGCATAATCA AACCCAGTGGTGGTGACACAATCTACGCTCAGAAATCTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAT ACATTCTACGTGGAACTGAGCAGCCTGAGATCTGAGGACACGGCCCTATATTACTGTGCGATCAGTGGGAACACTAG GGCTTTTGAAATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTTA
1125	YANG-2203b	VH domain amino acid sequence	QVQLVQSGAEVKQPGASVKVSCRASGYALTNFYVHWVRQAPGQKLEWMGIIKPSGGDTIYAQNLQGRVTMTRDTSTN TFYVELSSLRSEDTALYYCAISGNTRAFEIWGQGTMVTVSL
1126	YANG-2203b	HCDR1	GYALTNFY
1127	YANG-2203b	HCDR2	IKPSGGDT
1128	YANG-2203b	HCDR3	AISGNTRAFEI
1129	YANG-2203b	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTATATCCTGGTACCAGCAGCTCCCAGGAATGGTCCCCAAACTCCTCATTTATGCCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTTCTGCGGAACTTGGGATAGTAGTCGGAGTGCTGTGCTTTTCGGCGG AGGGACCAAGATGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
1130	YANG-2203b	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFISWYQQLPGMVPKLLIYANNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYFCGTWDSSRSAVLFGGGTKMTVL
1131	YANG-2203b	LCDR1	SSNIGNNF
1132	YANG-2203b	LCDR2	ANN
1133	YANG-2203b	LCDR3	GTWDSSRSAVL
1134	YANG-2203c	VH domain nucleic acid sequence	CAGGTGCAACTGGTGCAGTCTGGGGCTGAGGTGAAGCAGCCTGTGGCCTCAGTGAAGGTTTCCTGTCGGGCATCTGG TTACGCCCTCACCAGCTTCTATGTTCACTGGGTGCGACAGGCCCCTGGACAAGGGCTTGAGTGGATGGGCATAATCA AACCCAGTGGTGGTGACACAATCTACGCTCAGAAATCTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACATTCTACGTGGAACTGAGCAGCCTGAGATCTGAGGACACGGCCCTATATTACTGTGCGATCAGTGGGAACACTAG GGCTTTTGAAATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTTA
1135	YANG-2203c	VH domain amino acid sequence	QVQLVQSGAEVKQPVASVKVSCRASGYALTSFYVHWVRQAPGQGLEWMGIIKPSGGDTIYAQNLQGRVTMTRDTSTN TFYVELSSLRSEDTALYYCAISGNTRAFEIWGQGTMVTVSL
1136	YANG-2203c	HCDR1	GYALTSFY
1137	YANG-2203c	HCDR2	IKPSGGDT
1138	YANG-2203c	HCDR3	AISGNTRAFEI
1139	YANG-2203c	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGCTCCCAGGAATGGTCCCCAAACTCCTCATTTATGCCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACTTGGGATAGTAGTCGGAGTGCTGTGCTTTTCGGCGG AGGGACCAAGATGACCGTCCTA
1140	YANG-2203c	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQLPGMVPKLLIYANNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYYCGTWDSSRSAVLFGGGTKMTVL

SEQ ID NO	Clone ID	Description	Sequence
1141	YANG-2203c	LCDR1	SSNIGNNF
1142	YANG-2203c	LCDR2	ANN
1143	YANG-2203c	LCDR3	GTWDSSRSAVL
1144	YANG-2203d	VH domain nucleic acid sequence	CAGGTGCAACTGGTGCAGTCTGGGGCTGAGGTGAAGCAGCCTGGGGCCTCAGTGAAGGTTCCTGTAGGGCAATCTGG ATACGCCCTCACCAGCTTCTATGTTCACTGGGTGCGACAGGCCCCTGGACAAGGGCTTGAGTGGATGGGCATAATCA AACCCAGTGGTGGTGACACAATCTACGCTCAGAATCTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACATTCTACGTGGAACTGAGCAGCCTGAGATCTGAGGACACGGCCCTATATTACTGTGCGATCAGTGGGAACACTAG GGCTTTTGAAATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTTA
1145	YANG-2203d	VH domain amino acid sequence	QVQLVQSGAEVKQPGASVKVSCRASGYALTSFYVHWVRQAPGQGLEWMGIIKPSGGDTIYAQNLQGRVTMTRDTSTN TFYVELSSLRSEDTALYYCAISGNTRAFEIWGQGTMVTVSL
1146	YANG-2203d	HCDR1	GYALTSFY
1147	YANG-2203d	HCDR2	IKPSGGDT
1148	YANG-2203d	HCDR3	AISGNTRAFEI
1149	YANG-2203d	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGTTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTCTCCTGGTACCAGCAGCTCCCAGGAATGGTCCCCAAACTCCTCATTTATGCCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACTTGGGATAGTAGTCGGAGTGTTGTGCTTTTCGGCGG AGGGACCAAGATGACCGTCCTA
1150	YANG-2203d	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQLPGMVPKLLIYANNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYYCGTWDSSRSVVLFGGGTKMTVL
1151	YANG-2203d	LCDR1	SSNIGNNF
1152	YANG-2203d	LCDR2	ANN

SEQ ID NO	Clone ID	Description	Sequence
1153	YANG-2203d	LCDR3	GTWDSSRSVVL
1154	YANG-2203e	VH domain nucleic acid sequence	CAGGTGCAACTGGTGCAGTCTGGGGCTGAGGTGAAGCAGCCTGGGGCCTCAGTGAAGGTTTCCTGCAAGGCATCTGG ATACGCCCTCACCAGCTTCTATGTTCACTGGGTGCGACAGGCCCCTGGACAAGGGCTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCTCAGAAATTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACATTCTACGTGGAACTGAACAGCCTGAGATCTGAGGACACGGCCCTATATTACTGTGCGATCAGTGGGAACACTAG GGCTTTTGAAATCTGGGGCCAGGGGACAATGGTCACCGTCTCTTCA
1155	YANG-2203e	VH domain amino acid sequence	QVQLVQSGAEVKQPGASVKVSCKASGYALTSFYVHWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TFYVELNSLRSEDTALYYCAISGNTRAFEIWGQGTMVTVSS
1156	YANG-2203e	HCDR1	GYALTSFY
1157	YANG-2203e	HCDR2	IKPSGGNT
1158	YANG-2203e	HCDR3	AISGNTRAFEI
1159	YANG-2203e	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCAGTTCCCAGGAATAGTCCCCAAACTCCTCATTTATGCCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGACATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACTTGGGATAGCAGCCGGAGTGCTGTGCTTTTCGGCGG AGGGACCAAGATGACCGTCCTA
1160	YANG-2203e	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNYVSWYQQFPGIVPKLLIYANNKRPSGIPDRFSGSRSGTSATLDIT GLQTGDEADYYCGTWDSSRSAVLFGGGTKMTVL
1161	YANG-2203e	LCDR1	SSNIGNNY
1162	YANG-2203e	LCDR2	ANN
1163	YANG-2203e	LCDR3	GTWDSSRSAVL

SEQ ID NO	Clone ID	Description	Sequence
1164	YANG-2203f	VH domain nucleic acid sequence	CAGGTGCAACTGGTGCAGTCTGGGGCTGAGGTGAAGCAGCCGGGGGCCTCAGTGAAGGTCTCCTGCAAGGCATCTGG ATACGCCCTCACCAGCTTCTATGTTCACTGGGTGCGACAGGCCCCTGGACAAGGGCTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCTCAGAATTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACATTCTACGTGGAACTAAACAGCCTGAGATCTGAGGACACGGCCCTATATTACTGTGCGATCAGTGGGAACACTAG GGCTTTTGAAATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTA
1165	YANG-2203f	VH domain amino acid sequence	QVQLVQSGAEVKQPGASVKVSCKASGYALTSFYVHWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TFYVELNSLRSEDTALYYCAISGNTRAFEIWGQGTMVTVSL
1166	YANG-2203f	HCDR1	GYALTSFY
1167	YANG-2203f	HCDR2	IKPSGGNT
1168	YANG-2203f	HCDR3	AISGNTRAFEI
1169	YANG-2203f	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCAGCTCCCAGGAATAGTCCCCAAGCTCCTCATTTATGCCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACTTGGGATAGCAGCCGGAGTGCTGTACTTTCGGCGG AGGGACCAAGATGACCGTCCTA
1170	YANG-2203f	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQLPGIVPKLLIYANNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYYCGTWDSSRSAVLFGGGTKMTVL
1171	YANG-2203f	LCDR1	SSNIGNNY
1172	YANG-2203f	LCDR2	ANN
1173	YANG-2203f	LCDR3	GTWDSSRSAVL
1174	YANG-2203g	VH domain nucleic acid sequence	CAGGTGCAACTGGTGCAGTCTGGGGCTGAGGTGAAGCAGCCTGGGGCCTCAGTGAAGGTTTCCTGCAGGGCATCTGG ATACGCCCTCACCAGCTTCTATGTTCACTGGGTGCGACAGGCCCCTGGACAAGGGCTTGAGTGGATGGGCATAATCA AACCCAGTGGTGGTGACACAATCTACGCTCAGAATCTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACATTCTACGTGGAACTGAGCAGCCTGAGATCTGAGGACACGGCCCTTTATTACTGTGCGATCAGTGGGAACACTAG GGCTTTTGAAATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTTA

SEQ ID NO	Clone ID	Description	Sequence
1175	YANG-2203g	VH domain amino acid sequence	QVQLVQSGAEVKQPGASVKVSCRASGYALTSFYVHWVRQAPGQGLEWMGIIKPSGGDTIYAQNLQGRVTMTRDTSTN TFYVELSSLRSEDTALYYCAISGNTRAFEIWGQGTMVTVSL
1176	YANG-2203g	HCDR1	GYALTSFY
1177	YANG-2203g	HCDR2	IKPSGGDT
1178	YANG-2203g	HCDR3	AISGNTRAFEI
1179	YANG-2203g	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCACTCCCAGGAATGGTCCCCAAACTCCTCATTTATGCCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACTTGGGATAGTAGTCGGAGTGCTGTGCTTTCGGCGG AGGGACCAAGATGACCGTCCTA
1180	YANG-2203g	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNLGNNFVSWYQQLPGMVPKLLIYANNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYYCGTWDSSRSAVLFGGGTKMTVL
1181	YANG-2203g	LCDR1	SSNIGNNF
1182	YANG-2203g	LCDR2	ANN
1183	YANG-2203g	LCDR3	GTWDSSRSAVL
1184	YANG-2203h	VH domain nucleic acid sequence	CAGGTGCAACTGGTGCAGTCTGGGGCTGAGGTGAAGCAGCCTGGGGCCTCAGTGAAGGTTTCCTGCAGGGCATCTGG ATACGCCCTCACCAGCTTCTATGTTCACTGGGTGCGACAGGCCCCTGGACAAGGACTTGACTGGATGGGCATAATCA AACCCAGTGGTGGTTATACAATTTACGCTCAGAATCTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACATTCTACGTGGAACTGAGCAGCCTGAGATCTGAGGACACGGCCCTATATTACTGTGCGATCAGTGGGAACACTAG GGCTTTTGAAATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTTA
1185	YANG-2203h	VH domain amino acid sequence	QVQLVQSGAEVKQPGASVKVSCRASGYALTSFYVHWVRQAPGQGLDWMGIIKPSGGYTIYAQNLQGRVTMTRDTSTN TFYVELSSLRSEDTALYYCAISGNTRAFEIWGQGTMVTVSL

SEQ ID NO	Clone ID	Description	Sequence
1186	YANG-2203h	HCDR1	GYALTSFY
1187	YANG-2203h	HCDR2	IKPSGGYT
1188	YANG-2203h	HCDR3	AISGNTRAFEI
1189	YANG-2203h	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGCTCCCAGGAATGGTCCCCAAACTCCTCATTTATGCCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACTTGGGATAGTAGTCGGAGTGCTGTGCTTTTCGGCGG AGGGACCAAGATGACCGTCCTA
1190	YANG-2203h	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQLPGMVPKLLIYANNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYYCGTWDSSRSAVLFGGGTKMTVL
1191	YANG-2203h	LCDR1	SSNIGNNF
1192	YANG-2203h	LCDR2	ANN
1193	YANG-2203h	LCDR3	GTWDSSRSAVL
1194	YANG-2203i	VH domain nucleic acid sequence	CAGGTGCAACTGGTGCAGTCTGGGGCTGAGGTGAAGCAGCCTGGGGCCTCAGTGAAGGTTTCCTGCAGGGCATCTGG ATACGCCCTCACCAACTTCTATATTCACTGGGTGCGACAGGCCCCTGGACAAGGGCTTGAGTGGATGGGCATAATCA AACCCAGTGGTGGTGACACAATCTACGCTCAGAATCTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGGAC ACATTCTACGTGGAACTGAACAGCCTGAGATCTGAGGACACGGCCCTATATTACTGTGCGATCAGTGGGAACACTAG GGCTTTTGAAATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTTA
1195	YANG-2203i	VH domain amino acid sequence	QVQLVQSGAEVKQPGASVKVSCRASGYALTNFYIHWVRQAPGQGLEWMGIIKPSGGDTIYAQNLQGRVTMTRDTSTD TFYVELNSLRSEDTALYYCAISGNTRAFEIWGQGTMVTVSL
1196	YANG-2203i	HCDR1	GYALTNFY
1197	YANG-2203i	HCDR2	IKPSGGDT

SEQ ID NO	Clone ID	Description	Sequence
1198	YANG-2203i	HCDR3	AISGNTRAFEI
1199	YANG-2203i	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGCTCCCAGGAATGGTCCCCAAACTCCTCATTTATGCCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACTTGGGATAGTAGTCGGAGTGCTGTGCTTTCGGCGG AGGGACCAAGATGACCGTCCTA
1200	YANG-2203i	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQLPGMVPKLLIYANNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYYCGTWDSSRSAVLFGGGTKMTVL
1201	YANG-2203i	LCDR1	SSNIGNNF
1202	YANG-2203i	LCDR2	ANN
1203	YANG-2203i	LCDR3	GTWDSSRSAVL
1204	YANG-2203j	VH domain nucleic acid sequence	CAGGTGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGCAGCCTGGGGCCTCAGTGAAGGTTTCCTGCAGGGCATCTGG ATACGCCCTCACCAGCTTCTATGTTCACTGGGTGCGACAGGCCCCTGGACAAGGGCTTGAGTGGATGGGCATAATCA AACCCAGTGGTGGTGACACAATCTACGCTCAGAAATCTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACATTCTACGTGGAACTGAGCAGCCTGAGATCTGAGGACACGGCCCTATATTACTGTGCGATCAGTGGGAACACTAG GGCTTTTGAAATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTTA
1205	YANG-2203j	VH domain amino acid sequence	QVQLVQSGAEVKQPGASVKVSCRASGYALTSFYVHWVRQAPGQGLEWMGIIKPSGGDTIYAQNLQGRVTMTRDTSTN TFYVELSSLRSEDTALYYCAISGNTRAFEIWGQGTMVTVSL
1206	YANG-2203j	HCDR1	GYALTSFY
1207	YANG-2203j	HCDR2	IKPSGGDT
1208	YANG-2203j	HCDR3	AISGNTRAFEI

SEQ ID NO	Clone ID	Description	Sequence
1209	YANG-2203j	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGCTCCCAGGAATGGTCCCCAAACTCCTCATTTATGCCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACTTGGGATAGTAGTCGGAGTGCTGTGCTTTTCGGCGG AGGGACCAAGATGACCGTCCTA				
1210	YANG-2203j	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNFVSWYQQLPGMVPKLLIYANNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYYCGTWDSSRSAVLFGGGTKMTVL
1211	YANG-2203j	LCDR1	SSNIGNNF
1212	YANG-2203j	LCDR2	ANN
1213	YANG-2203j	LCDR3	GTWDSSRSAVL
1214	YANG-2203k	VH domain nucleic acid sequence	CAGGTGCAACTGGTGCAGTCTGGGGCTGAGGTGAAGCAGCCTGGGGCCTCAGTGAAGGTTTCCTGCAGGGCATCTGG ATACGCCCTCACCAGACTCTATGTTCACTGGGTGCGGCAGGCCCCTGGACAAGGGCTTGAGTGGATGGGCATAATCA AACCCAGTGGTGGTGACACAATCTGCGCTCAGAAATCTCCAGGGCAGAGTCACCCTGACCAGGGACACGTCCACGAAC ACATTCTACGTGGAACTGAACAGCCTGAGATCTGAGGACACGGCCCTATATTACTGTGCGATCAGTGGGAACACTAG GGCTTTTGAAATCTGGGGCCAAGGGACAATGGTCACCGTCTCTTTA
1215	YANG-2203k	VH domain amino acid sequence	QVQLVQSGAEVKQPGASVKVSCRASGYALTRLVVHWVRQAPGQGLEWMGIIKPSGGDTICAQNLQGRVTLTRDTSTN TFYVELNSLRSEDTALYYCAISGNTRAFEIWGQGTMVTVSL
1216	YANG-2203k	HCDR1	GYALTRLY
1217	YANG-2203k	HCDR2	IKPSGGDT
1218	YANG-2203k	HCDR3	AISGNTRAFEI
1219	YANG-2203k	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGCTCCCAGGAATGGTCCCCAAACTCCTCATTTATGCCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACTTGGGATAGTAGTCGGAGTGCGGTGCTTTTCGGCGG AGGGACCAAGATGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
1220	YANG-2203k	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQLPGMVPKLLIYANNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYYCGTWDSSRSAVLFGGGTKMTVL
1221	YANG-2203k	LCDR1	SSNIGNNF
1222	YANG-2203k	LCDR2	ANN
1223	YANG-2203k	LCDR3	GTWDSSRSAVL
1224	YANG-2204	VH domain nucleic acid sequence	CAGATGCAGCTGGTACAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTATGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGCCAGTCTGAGATCTGAAGACACGGCCGTATATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1225	YANG-2204	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLTSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1226	YANG-2204	HCDR1	GYTFTNYY
1227	YANG-2204	HCDR2	IKPSGGNT
1228	YANG-2204	HCDR3	ARTGDRAFDV
1229	YANG-2204	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTCTCCTGGTACCAGCAGCTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGCCCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
1230	YANG-2204	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQLPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL

SEQ ID NO	Clone ID	Description	Sequence
1231	YANG-2204	LCDR1	SSNIGNNY
1232	YANG-2204	LCDR2	DNN
1233	YANG-2204	LCDR3	GTWDSSLGAGV
1234	YANG-2205	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGATCACCGTCTCTTCA
1235	YANG-2205	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMITVSS
1236	YANG-2205	HCDR1	GYTFTSYY
1237	YANG-2205	HCDR2	IKPSGGNT
1238	YANG-2205	HCDR3	ARTGDRAFDV
1239	YANG-2205	VL domain nucleic acid sequence	CAGTCTGTATTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAACAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1240	YANG-2205	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1241	YANG-2205	LCDR1	SSNIGNNF
1242	YANG-2205	LCDR2	DNN

SEQ ID NO	Clone ID	Description	Sequence
1243	YANG-2205	LCDR3	GTWDSSLGAGV
1244	YANG-2206	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAAACTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTTCGCACAGAAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTGTCTTCA
1245	YANG-2206	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKLSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIFAQKFQGRVTMTRDTSTN TVYMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1246	YANG-2206	HCDR1	GYTFTSYY
1247	YANG-2206	HCDR2	IKPSGGNT
1248	YANG-2206	HCDR3	ARTGDRAFDV
1249	YANG-2206	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGGTGACCGTCCTA
1250	YANG-2206	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKVTVL
1251	YANG-2206	LCDR1	SSNIGNNY
1252	YANG-2206	LCDR2	DNN
1253	YANG-2206	LCDR3	GTWDSSLGAGV

SEQ ID NO	Clone ID	Description	Sequence
1254	YANG-2207	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAATCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGGAATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA		
1255	YANG-2207	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGNRAFDVWGHGTMVTVSS		
1256	YANG-2207	HCDR1	GYTFTNYY		
1257	YANG-2207	HCDR2	IKPSGGNT		
1258	YANG-2207	HCDR3	ARTGNRAFDV		
1259	YANG-2207	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA		
1260	YANG-2207	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL		
1261	YANG-2207	LCDR1	SSNIGNNF		
1262	YANG-2207	LCDR2	DNN		
1263	YANG-2207	LCDR3	GTWDSSLGAGV		
1264	YANG-2208	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAGGAAGCCTGGGGCCTCAGTGAGGTTTCCTGCAAGACATCTGG ATACATTTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGAGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACTAAC ACAGTCTACATGGACCTGAATAATCTGAGATCTGAGGACACGGCCGTGTATTTTTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA		

SEQ ID NO	Clone ID	Description	Sequence
1265	YANG-2208	VH domain amino acid sequence	QIQLVQSGAEVRKPGASVRFSCKTSGYIFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLNNLRSEDTAVYFCARTGDRAFDVWGQGTMVTVSS
1266	YANG-2208	HCDR1	GYIFTNYY
1267	YANG-2208	HCDR2	IKPSGGNT
1268	YANG-2208	HCDR3	ARTGDRAFDV
1269	YANG-2208	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAATGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAACAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCGGCAGTTCCCCGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGGACATGGGATAGCAGCCTGAGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1270	YANG-2208	VL domain amino acid sequence	QSVLTQPPSMSAAPGQKVTISCSGNSSNIGNNFVSWYRQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLSAGVFGGGTKLTVL
1271	YANG-2208	LCDR1	SSNIGNNF
1272	YANG-2208	LCDR2	DNN
1273	YANG-2208	LCDR3	GTWDSSLSAGV
1274	YANG-2209	VH domain nucleic acid sequence	CAGATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTTCTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTGACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAACAGTCTGACATCTGAGGACACGGCCGTATATTATTGTGCGAGAATTGGGAATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1275	YANG-2209	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKFSCKTSGYTFTNFYMVWVRQAPGQGLEWMGIIKPSGGDTIYAQKFQGRVTMTRDTSTN TVYMDLNSLTSEDTAVYYCARIGNRAFDVWGHGTMVTVSS

SEQ ID NO	Clone ID	Description	Sequence
1276	YANG-2209	HCDR1	GYTFTNFY
1277	YANG-2209	HCDR2	IKPSGGDT
1278	YANG-2209	HCDR3	ARIGNRAFDV
1279	YANG-2209	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAAGTCACCATCTCCTGCTCTGGAAGCAG CTCCAATATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTTTCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATTCTAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
1280	YANG-2209	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNFVSWYQQFSGTAPKLLIYDNSKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1281	YANG-2209	LCDR1	SSNIGNNF
1282	YANG-2209	LCDR2	DNS
1283	YANG-2209	LCDR3	GTWDSSLGAGV
1284	YANG-2210	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAACAGTCTGAAATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATTGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1285	YANG-2210	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLNSLKSEDTAVYYCARTGDWAFDVWGHGTMVTVSS
1286	YANG-2210	HCDR1	GYTFTSYY
1287	YANG-2210	HCDR2	IKPSGGNT

SEQ ID NO	Clone ID	Description	Sequence
1288	YANG-2210	HCDR3	ARTGDWAFDV
1289	YANG-2210	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
1290	YANG-2210	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1291	YANG-2210	LCDR1	SSNIGNNY
1292	YANG-2210	LCDR2	DNN
1293	YANG-2210	LCDR3	GTWDSSLGAGV
1294	YANG-2211	VH domain nucleic acid sequence	CAGATACAACTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCTGTGAGGTTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATTA AACCTAGTGGTGGTAACACAATCTACGCACAGAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGACTCTGAGATCTGAGGACACGGCCGTTTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1295	YANG-2211	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVRFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TVYMDLRTILRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1296	YANG-2211	HCDR1	GYTFTNYY
1297	YANG-2211	HCDR2	IKPSGGNT
1298	YANG-2211	HCDR3	ARTGDRAFDV

SEQ ID NO	Clone ID	Description	Sequence
1299	YANG-2211	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1300	YANG-2211	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1301	YANG-2211	LCDR1	SSNIGNNF
1302	YANG-2211	LCDR2	DNN
1303	YANG-2211	LCDR3	GTWDSSLGAGV
1304	YANG-2212	VH domain nucleic acid sequence	CAGATGCAGTTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAAATTTCCTGCAAGACATCTGG ATACACCTTCATCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAATACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAGC ACAGTCTATATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1305	YANG-2212	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFINYYMWWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTS TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1306	YANG-2212	HCDR1	GYTFINYY
1307	YANG-2212	HCDR2	IKPSGGNT
1308	YANG-2212	HCDR3	ARTGDRAFDV
1309	YANG-2212	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATCATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGCCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCTGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCGGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
1310	YANG-2212	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNHKRPSGIPDRFSASKSGTSATLGIT GLLTGDEADYYCGTWDSGLGAGVFGGGTKLTVL
1311	YANG-2212	LCDR1	SSNIGNNY
1312	YANG-2212	LCDR2	DNH
1313	YANG-2212	LCDR3	GTWDSGLGAGV
1314	YANG-2213	VH domain nucleic acid sequence	CAGATACAACTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTTACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGAGGTGGTGACACAATCTACGCACAGAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA		
1315	YANG-2213	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPRGGDTIYAQNFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS		
1316	YANG-2213	HCDR1	GYTFTNYY
1317	YANG-2213	HCDR2	IKPRGGDT
1318	YANG-2213	HCDR3	ARTGDRAFDV
1319	YANG-2213	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACGAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1320	YANG-2213	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYEQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL

SEQ ID NO	Clone ID	Description	Sequence
1321	YANG-2213	LCDR1	SSNIGNNF
1322	YANG-2213	LCDR2	DNN
1323	YANG-2213	LCDR3	GTWDSSLGAGV
1324	YANG-2214	VH domain nucleic acid sequence	CAGATACAACTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAGGTTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATCATCA AACCTAGTGGTGGTAACACCATCTACGCACAGAACTTCCAGGGCAGAGTCTCCATGACCAGGGACACGTCCACGAGC ACAGTCTACATGGACCTGAGGAGTCTGACATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1325	YANG-2214	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVRFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVSMTRDTSTS TVYMDLRSLTSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1326	YANG-2214	HCDR1	GYTFTNYY
1327	YANG-2214	HCDR2	IKPSGGNT
1328	YANG-2214	HCDR3	ARTGDRAFDV
1329	YANG-2214	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTTCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1330	YANG-2214	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1331	YANG-2214	LCDR1	SSNIGNNF
1332	YANG-2214	LCDR2	DNN

SEQ ID NO	Clone ID	Description	Sequence
1333	YANG-2214	LCDR3	GTWDSSLGAGV
1334	YANG-2215	VH domain nucleic acid sequence	CAGATACAGTTGGTGCAGTCTGGGCCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1335	YANG-2215	VH domain amino acid sequence	QIQLVQSGPEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1336	YANG-2215	HCDR1	GYTFTNYY
1337	YANG-2215	HCDR2	IKPSGGNT
1338	YANG-2215	HCDR3	ARTGDRAFDV
1339	YANG-2215	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGAAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1340	YANG-2215	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNYVSWYQKFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1341	YANG-2215	LCDR1	SSNIGNNY
1342	YANG-2215	LCDR2	DNN
1343	YANG-2215	LCDR3	GTWDSSLGAGV

SEQ ID NO	Clone ID	Description	Sequence
1344	YANG-2216	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGCTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTACATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACACTCTTCGAACAGAAGTTTCAGGGTAGAGTCATCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTGTCTTCA
1345	YANG-2216	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKLSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTLFEQKFQGRVIMTRDTSTN TVYMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1346	YANG-2216	HCDR1	GYTFTSYY
1347	YANG-2216	HCDR2	IKPSGGNT
1348	YANG-2216	HCDR3	ARTGDRAFDV
1349	YANG-2216	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1350	YANG-2216	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1351	YANG-2216	LCDR1	SSNIGNNY
1352	YANG-2216	LCDR2	DNN
1353	YANG-2216	LCDR3	GTWDSSLGAGV
1354	YANG-2217	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCGTGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTTACATCTGAAGACACGGCCGTATATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCATGGGACACTGGTCACCGTCTCTTCA

SEQ ID NO	Clone ID	Description	Sequence
1355	YANG-2217	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTVTRDTSTN TVYLDLSSLTSEDTAVYYCARTGDRAFDVWGHGTLVTVSS
1356	YANG-2217	HCDR1	GYTFTNYY
1357	YANG-2217	HCDR2	IKPSGGNT
1358	YANG-2217	HCDR3	ARTGDRAFDV
1359	YANG-2217	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGAAG TTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA	
1360	YANG-2217	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGRSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1361	YANG-2217	LCDR1	SSNIGNNY
1362	YANG-2217	LCDR2	DNN
1363	YANG-2217	LCDR3	GTWDSSLGAGV
1364	YANG-2218	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGATCTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGATCACCGTCTCTTCA
1365	YANG-2218	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARSGDRAFDVWGHGTMITVSS

SEQ ID NO	Clone ID	Description	Sequence
1366	YANG-2218	HCDR1	GYTFTSYY
1367	YANG-2218	HCDR2	IKPSGGNT
1368	YANG-2218	HCDR3	ARSGDRAFDV
1369	YANG-2218	VL domain nucleic acid sequence	CAGTCTGTATTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTGTCCTGGTACCAACAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGCTTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1370	YANG-2218	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1371	YANG-2218	LCDR1	SSNIGNNF
1372	YANG-2218	LCDR2	DNN
1373	YANG-2218	LCDR3	GTWDSSLGAGV
1374	YANG-2219	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAATCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACACAAGTTTCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCCAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1375	YANG-2219	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMWWVRQAPGQGLEWMGIIKPSGGNTIYAHKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1376	YANG-2219	HCDR1	GYTFTNYY
1377	YANG-2219	HCDR2	IKPSGGNT

SEQ ID NO	Clone ID	Description	Sequence
1378	YANG-2219	HCDR3	ARTGDRAFDV
1379	YANG-2219	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAACGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1380	YANG-2219	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1381	YANG-2219	LCDR1	SSNIGNNF
1382	YANG-2219	LCDR2	DNN
1383	YANG-2219	LCDR3	GTWDSSLGAGV
1384	YANG-2220	VH domain nucleic acid sequence	CAGATACAACTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGACAGAGTCACCATGACCAGGGACACGTCCACGAAT ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCATGGGACAATGGTCACCGTCTCTTCA
1385	YANG-2220	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQDRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1386	YANG-2220	HCDR1	GYTFTNYY
1387	YANG-2220	HCDR2	IKPSGGNT
1388	YANG-2220	HCDR3	ARTGDRAFDV

SEQ ID NO	Clone ID	Description	Sequence
1389	YANG-2220	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGAAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1390	YANG-2220	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1391	YANG-2220	LCDR1	SSNIGNNF
1392	YANG-2220	LCDR2	DNN
1393	YANG-2220	LCDR3	GTWDSSLGAGV
1394	YANG-2221	VH domain nucleic acid sequence	CAGATGCAATTGCTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAGGGACAATAGTCACCGTCTCTTCA
1395	YANG-2221	VH domain amino acid sequence	QMQLLQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTIVTVSS
1396	YANG-2221	HCDR1	GYTFTNYY
1397	YANG-2221	HCDR2	IKPSGGNT
1398	YANG-2221	HCDR3	ARTGDRAFDV
1399	YANG-2221	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAACAG CTCCAACATTGGGAATAATTATGTTTCCTGGTATCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTATTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
1400	YANG-2221	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGNSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1401	YANG-2221	LCDR1	SSNIGNNY
1402	YANG-2221	LCDR2	DNN
1403	YANG-2221	LCDR3	GTWDSSLGAGV
1404	YANG-2222	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAATTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1405	YANG-2222	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMWWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1406	YANG-2222	HCDR1	GYTFTNYY
1407	YANG-2222	HCDR2	IKPSGGNT
1408	YANG-2222	HCDR3	ARTGDRAFDV
1409	YANG-2222	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTATCTGCGACCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1410	YANG-2222	VL domain amino acid sequence	QSVLTQPPSVSATPGQKVTISCSGSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL

SEQ ID NO	Clone ID	Description	Sequence
1411	YANG-2222	LCDR1	SSNIGNNF
1412	YANG-2222	LCDR2	DNN
1413	YANG-2222	LCDR3	GTWDSSLGAGV
1414	YANG-2223	VH domain nucleic acid sequence	CAGATGCAGCTGGTACAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTATGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGTAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1415	YANG-2223	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1416	YANG-2223	HCDR1	GYTFTSYY
1417	YANG-2223	HCDR2	IKPSGGNT
1418	YANG-2223	HCDR3	ARTGDRAFDV
1419	YANG-2223	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGTAC CTCCAACATTGGGAGTAATTATGTCTCCTGGTACCAGCAGCTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAGTAAGCGCCCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
1420	YANG-2223	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSTSNIGSNYVSWYQQLPGTAPKLLIYDNSKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1421	YANG-2223	LCDR1	TSNIGSNY
1422	YANG-2223	LCDR2	DNS

SEQ ID NO	Clone ID	Description	Sequence
1423	YANG-2223	LCDR3	GTWDSSLGAGV
1424	YANG-2224	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1425	YANG-2224	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1426	YANG-2224	HCDR1	GYTFTNYY
1427	YANG-2224	HCDR2	IKPSGGNT
1428	YANG-2224	HCDR3	ARTGDRAFDV
1429	YANG-2224	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGTTTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
1430	YANG-2224	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1431	YANG-2224	LCDR1	SSNIGNNF
1432	YANG-2224	LCDR2	DNN
1433	YANG-2224	LCDR3	GTWDSSLGAGV

SEQ ID NO	Clone ID	Description	Sequence
1434	YANG-2225	VH domain nucleic acid sequence	CAGATTCAGTTAGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGCTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTGTCTTCA
1435	YANG-2225	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKLSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1436	YANG-2225	HCDR1	GYTFTSYY
1437	YANG-2225	HCDR2	IKPSGGNT
1438	YANG-2225	HCDR3	ARTGDRAFDV
1439	YANG-2225	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAATATTGGGAATAATTATGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCTTCATTTATGACA ATAATAAGCGACCCTCAGGGATTTCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1440	YANG-2225	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLFIYDNNKRPSGISDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1441	YANG-2225	LCDR1	SSNIGNNY
1442	YANG-2225	LCDR2	DNN
1443	YANG-2225	LCDR3	GTWDSSLGAGV
1444	YANG-2226	VH domain nucleic acid sequence	CAGATACAGCTGGTACAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTTCCTGCAAGACATCTGG ATACACCTTCACCACCAACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTGACACAATCTACGCACAGCAATTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGACCAGTCTGACATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCGTCA

SEQ ID NO	Clone ID	Description	Sequence
1445	YANG-2226	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYWVWVRQAPGQGLEWMGIIKPSGGDTIYAQQFQGRVTMTRDTSTN TVYMDLTSLTSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1446	YANG-2226	HCDR1	GYTFTTNY
1447	YANG-2226	HCDR2	IKPSGGDT
1448	YANG-2226	HCDR3	ARTGDRAFDV
1449	YANG-2226	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCACAGCTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACG ATGGAAAGCGACCCTCAGGGATTCCTGATCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCTCCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATACCAGCCTGGGTTCTGGGGTGTTCGGCGG CGGGACCAAGTTGACCGTCCTA
1450	YANG-2226	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQLPGTAPKLLIYDDGKRPSGIPDRFSGSKSGTSASLGIT GLQTGDEADYYCGTWDTSLGSGVFGGGTKLTVL
1451	YANG-2226	LCDR1	SSNIGNNY
1452	YANG-2226	LCDR2	DDG
1453	YANG-2226	LCDR3	GTWDTSLGSGV
1454	YANG-2227	VH domain nucleic acid sequence	CAGATACAACTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTGACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATATGGACCTGAGGAGTCTGAGATCTGAAGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1455	YANG-2227	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGDTIYAQNFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS

SEQ ID NO	Clone ID	Description	Sequence
1456	YANG-2227	HCDR1	GYTFTNYY
1457	YANG-2227	HCDR2	IKPSGGDT
1458	YANG-2227	HCDR3	ARTGDRAFDV
1459	YANG-2227	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1460	YANG-2227	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1461	YANG-2227	LCDR1	SSNIGNNF
1462	YANG-2227	LCDR2	DNN
1463	YANG-2227	LCDR3	GTWDSSLGAGV
1464	YANG-2228	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAATCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGACAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1465	YANG-2228	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQDRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1466	YANG-2228	HCDR1	GYTFTNYY
1467	YANG-2228	HCDR2	IKPSGGNT

SEQ ID NO	Clone ID	Description	Sequence
1468	YANG-2228	HCDR3	ARTGDRAFDV
1469	YANG-2228	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGTCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
1470	YANG-2228	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYVNNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1471	YANG-2228	LCDR1	SSNIGNNF
1472	YANG-2228	LCDR2	VNN
1473	YANG-2228	LCDR3	GTWDSSLGAGV
1474	YANG-2229	VH domain nucleic acid sequence	CAGATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCATCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTTATACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGTAC ACAGTCTATATATGGCCCTGAGCGGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1475	YANG-2229	VH domain amino acid sequence	QMQLVQSGAEVRKPGASVKISCKTSGYTFINYYMVWVRQAPGQGLEWMGIIKPSGGYTIYAQKFQGRVTMTRDTSTY TVYMALSGLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1476	YANG-2229	HCDR1	GYTFINYY
1477	YANG-2229	HCDR2	IKPSGGYT
1478	YANG-2229	HCDR3	ARTGDRAFDV

SEQ ID NO	Clone ID	Description	Sequence
1479	YANG-2229	VL domain nucleic acid sequence	CAGTCTGTATTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATCATAAGCGACCCTCAGGTATTCCTGACCGATTCTCTGCCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCTGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCGGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1480	YANG-2229	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNHKRPSGIPDRFSASKSGTSATLGIT GLLTGDEADYYCGTWDSGLGAGVFGGGTKLTVL
1481	YANG-2229	LCDR1	SSNIGNNY
1482	YANG-2229	LCDR2	DNH
1483	YANG-2229	LCDR3	GTWDSGLGAGV
1484	YANG-2230	VH domain nucleic acid sequence	CAGATTCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCCGTGAAGATTTCGTGCAAGCCATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTATATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAGGGACAATGGTCACCGTCTCTTCA
1485	YANG-2230	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKISCKPSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1486	YANG-2230	HCDR1	GYTFTNYY
1487	YANG-2230	HCDR2	IKPSGGNT
1488	YANG-2230	HCDR3	ARTGDRAFDV
1489	YANG-2230	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGACGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAATATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGTCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGAATATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
1490	YANG-2230	VL domain amino acid sequence	QSVLTQTPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTVPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEAEYYCGTWDSSLGAGVFGGGTKLTVL
1491	YANG-2230	LCDR1	SSNIGNNY
1492	YANG-2230	LCDR2	DNN
1493	YANG-2230	LCDR3	GTWDSSLGAGV
1494	YANG-2231	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATTATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTTTATATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGATCACCGTCTCTTCA
1495	YANG-2231	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMITVSS
1496	YANG-2231	HCDR1	GYTFTSYY
1497	YANG-2231	HCDR2	IKPSGGNT
1498	YANG-2231	HCDR3	ARTGDRAFDV
1499	YANG-2231	VL domain nucleic acid sequence	CAGTCTGTATTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAACAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1500	YANG-2231	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL

SEQ ID NO	Clone ID	Description	Sequence
1501	YANG-2231	LCDR1	SSNIGNNF
1502	YANG-2231	LCDR2	DNN
1503	YANG-2231	LCDR3	GTWDSSLGAGV
1504	YANG-2232	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTGCA
1505	YANG-2232	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSA
1506	YANG-2232	HCDR1	GYTFTNYY
1507	YANG-2232	HCDR2	IKPSGGNT
1508	YANG-2232	HCDR3	ARTGDRAFDV
1509	YANG-2232	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1510	YANG-2232	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1511	YANG-2232	LCDR1	SSNIGNNF
1512	YANG-2232	LCDR2	DNN

SEQ ID NO	Clone ID	Description	Sequence
1513	YANG-2232	LCDR3	GTWDSSLGAGV
1514	YANG-2233	VH domain nucleic acid sequence	CAGATGCAACTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACCCCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTATGCACAGAAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACCAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTTTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATAGTCACCGTCTCTTCA
1515	YANG-2233	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYPFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYFCARTGDRAFDVWGHGTIVTVSS
1516	YANG-2233	HCDR1	GYPFTNYY
1517	YANG-2233	HCDR2	IKPSGGNT
1518	YANG-2233	HCDR3	ARTGDRAFDV
1519	YANG-2233	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1520	YANG-2233	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1521	YANG-2233	LCDR1	SSNIGNNY
1522	YANG-2233	LCDR2	DNN
1523	YANG-2233	LCDR3	GTWDSSLGAGV

SEQ ID NO	Clone ID	Description	Sequence
1524	YANG-2234	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGACTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCATGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCACGGGACAGTGGTCACCGTCTCTTCA
1525	YANG-2234	VH domain amino acid sequence	QMQLVQSGTEVKKPGASVKISCKTSGYTFTNYYMWWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAMYYCARTGDRAFDVWGHGTVVTVSS
1526	YANG-2234	HCDR1	GYTFTNYY
1527	YANG-2234	HCDR2	IKPSGGNT
1528	YANG-2234	HCDR3	ARTGDRAFDV
1529	YANG-2234	VL domain nucleic acid sequence	CAGTCTGTGCTGACGCAGCCGCCCTCAGTGTTTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAACAGTTCCCAGGAACAGCCCCCAAACTCCTCATCTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1530	YANG-2234	VL domain amino acid sequence	QSVLTQPPSVFAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1531	YANG-2234	LCDR1	SSNIGNNY
1532	YANG-2234	LCDR2	DNN
1533	YANG-2234	LCDR3	GTWDSSLGAGV
1534	YANG-2235	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGCTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTACTGGTGGTAACACAATCTACGCACAGAATTTCCAGGGCAGAGTCACCATGTCCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACGCGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA

SEQ ID NO	Clone ID	Description	Sequence
1535	YANG-2235	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKLSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPTGGNTIYAQNFQGRVTMSRDTSTN TVYMDLRSLRSEDAAVYYCARTGDRAFDVWGQGTMVTVSS
1536	YANG-2235	HCDR1	GYTFTNYY
1537	YANG-2235	HCDR2	IKPTGGNT
1538	YANG-2235	HCDR3	ARTGDRAFDV
1539	YANG-2235	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGACCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCGGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1540	YANG-2235	VL domain amino acid sequence	QSVLTQPPSVSATPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSGLGAGVFGGGTKLTVL
1541	YANG-2235	LCDR1	SSNIGNNF
1542	YANG-2235	LCDR2	DNN
1543	YANG-2235	LCDR3	GTWDSGLGAGV
1544	YANG-2236	VH domain nucleic acid sequence	CAGATACAACTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATTTGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTACTGGTGGTAACACAATCTACGCACAGAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGGTAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1545	YANG-2236	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYLVWVRQAPGQGLEWMGIIKPTGGNTIYAQNFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGGRAFDVWGQGTMVTVSS

SEQ ID NO	Clone ID	Description	Sequence
1546	YANG-2236	HCDR1	GYTFTNYY
1547	YANG-2236	HCDR2	IKPTGGNT
1548	YANG-2236	HCDR3	ARTGGRAFDV
1549	YANG-2236	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAACAG CTCCAATATTGGGGATAATTTTGTGTCCTGGTACCAACAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAGGCTGACCGTCCTA		
1550	YANG-2236	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGNSSNIGDNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTRLTVL
1551	YANG-2236	LCDR1	SSNIGDNF
1552	YANG-2236	LCDR2	DNN
1553	YANG-2236	LCDR3	GTWDSSLGAGV
1554	YANG-2237	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCTTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGGAC ACAGTCTACATGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1555	YANG-2237	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTD TVYMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1556	YANG-2237	HCDR1	GYTFTNYY
1557	YANG-2237	HCDR2	IKPSGGNT

SEQ ID NO	Clone ID	Description	Sequence
1558	YANG-2237	HCDR3	ARTGDRAFDV
1559	YANG-2237	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCTTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTATTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
1560	YANG-2237	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGILDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1561	YANG-2237	LCDR1	SSNIGNNY
1562	YANG-2237	LCDR2	DNN
1563	YANG-2237	LCDR3	GTWDSSLGAGV
1564	YANG-2238	VH domain nucleic acid sequence	CAGCTGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCTTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTTACACGAGCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGTAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC ATTTGATGTCTGGGGCCACGGGACAGTGGTCACCGTCTCTTCA
1565	YANG-2238	VH domain amino acid sequence	QLQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMWVRQALGQGLEWMGIIKPSGGYTSYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTVVTVSS
1566	YANG-2238	HCDR1	GYTFTNYY
1567	YANG-2238	HCDR2	IKPSGGYT
1568	YANG-2238	HCDR3	ARTGDRAFDV

SEQ ID NO	Clone ID	Description	Sequence
1569	YANG-2238	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCCTCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATCTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1570	YANG-2238	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTLSCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1571	YANG-2238	LCDR1	SSNIGNNY
1572	YANG-2238	LCDR2	DNN
1573	YANG-2238	LCDR3	GTWDSSLGAGV
1574	YANG-2239	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACATATTTCACCAACTATTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGCGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATATGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAGGGACAGTGGTCACCGTCTCTTCA
1575	YANG-2239	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYIFTNYYMWWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLSSLRYEDTAVYYCARTGDRAFDVWGHGTVVTVSS
1576	YANG-2239	HCDR1	GYIFTNYY
1577	YANG-2239	HCDR2	IKPSGGNT
1578	YANG-2239	HCDR3	ARTGDRAFDV
1579	YANG-2239	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATCTATGACA ATAATAAGCGACCCTCAGGGATTCCTGGCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
1580	YANG-2239	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1581	YANG-2239	LCDR1	SSNIGNNY
1582	YANG-2239	LCDR2	DNN
1583	YANG-2239	LCDR3	GTWDSSLGAGV
1584	YANG-2240	VH domain nucleic acid sequence	CAGATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCATCAACTACTATATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1585	YANG-2240	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFINYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1586	YANG-2240	HCDR1	GYTFINYY
1587	YANG-2240	HCDR2	IKPSGGNT
1588	YANG-2240	HCDR3	ARTGDRAFDV
1589	YANG-2240	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATCATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGCCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCGGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1590	YANG-2240	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNHKRPSGIPDRFSASKSGTSATLGIT GLQTGDEADYYCGTWDSGLGAGVFGGGTKLTVL

SEQ ID NO	Clone ID	Description	Sequence
1591	YANG-2240	LCDR1	SSNIGNNF
1592	YANG-2240	LCDR2	DNH
1593	YANG-2240	LCDR3	GTWDSGLGAGV
1594	YANG-2241	VH domain nucleic acid sequence	CAGATTCAATTGGTGCAGTCTGGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATATATCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGACC ACAGTCTATTTGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCACGGGACAGTGGTCACCGTCTCTTCA
1595	YANG-2241	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKISCKTSGYIFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTST TVYLDLNSLRSEDTAVYYCARTGDRAFDVWGHGTVVTVSS
1596	YANG-2241	HCDR1	GYIFTNYY
1597	YANG-2241	HCDR2	IKPSGGNT
1598	YANG-2241	HCDR3	ARTGDRAFDV
1599	YANG-2241	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAATTCCCAGGAACAGCCCCCAAACTCCTCATCTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTG
1600	YANG-2241	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1601	YANG-2241	LCDR1	SSNIGNNY
1602	YANG-2241	LCDR2	DNN

SEQ ID NO	Clone ID	Description	Sequence
1603	YANG-2241	LCDR3	GTWDSSLGAGV
1604	YANG-2242	VH domain nucleic acid sequence	CAGATGCAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAGTTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAATGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAATTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAT ACAGTCTTCATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAGTGGTCACCGTCTCTTCA
1605	YANG-2242	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVFMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTVVTVSS
1606	YANG-2242	HCDR1	GYTFTSYY
1607	YANG-2242	HCDR2	IKPSGGNT
1608	YANG-2242	HCDR3	ARTGDRAFDV
1609	YANG-2242	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCTGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTTTGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCTCC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCCAACTGACCGTCCTA
1610	YANG-2242	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYLQFPGTAPKLLIFDNNKRPSGIPDRFSGSKSGTSATLGIS GLQTGDEADYYCGTWDSSLGAGVFGGGTQLTVL
1611	YANG-2242	LCDR1	SSNIGNNF
1612	YANG-2242	LCDR2	DNN
1613	YANG-2242	LCDR3	GTWDSSLGAGV

SEQ ID NO	Clone ID	Description	Sequence
1614	YANG-2243	VH domain nucleic acid sequence	CAGATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAATTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1615	YANG-2243	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1616	YANG-2243	HCDR1	GYTFTNYY
1617	YANG-2243	HCDR2	IKPSGGNT
1618	YANG-2243	HCDR3	ARTGDRAFDV
1619	YANG-2243	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATCTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAACGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGGTGACCGTCCTA
1620	YANG-2243	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYLSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKVTVL
1621	YANG-2243	LCDR1	SSNIGNNY
1622	YANG-2243	LCDR2	DNN
1623	YANG-2243	LCDR3	GTWDSSLGAGV
1624	YANG-2244	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGACCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA

SEQ ID NO	Clone ID	Description	Sequence
1625	YANG-2244	VH domain amino acid sequence	QMQLVQSGAEVKKPGTSVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1626	YANG-2244	HCDR1	GYTFTNYY
1627	YANG-2244	HCDR2	IKPSGGNT
1628	YANG-2244	HCDR3	ARTGDRAFDV
1629	YANG-2244	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCACGCTGACCGTCCTA
1630	YANG-2244	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTTLTVL
1631	YANG-2244	LCDR1	SSNIGNNY
1632	YANG-2244	LCDR2	DNN
1633	YANG-2244	LCDR3	GTWDSSLGAGV
1634	YANG-2245	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGTAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACAAAC ACAGTCTACATGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTTCA
1635	YANG-2245	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS

SEQ ID NO	Clone ID	Description	Sequence
1636	YANG-2245	HCDR1	GYTFTSYY
1637	YANG-2245	HCDR2	IKPSGGNT
1638	YANG-2245	HCDR3	ARTGDRAFDV
1639	YANG-2245	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCCCCATCTCCTGCCCTGGAAGCAG CTCCAACATTGGGAATAATTATGTATCCTGGTACCACCAGTTCCCAGGGACAACCCCCAAACTCCTCATTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCCGGCTCCAAGTCTGGCACGGCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA		
1640	YANG-2245	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVPISCPGSSSNIGNNYVSWYHQFPGTTPKLLIYDNNKRPSGIPDRFSGSKSGTAATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1641	YANG-2245	LCDR1	SSNIGNNY
1642	YANG-2245	LCDR2	DNN
1643	YANG-2245	LCDR3	GTWDSSLGAGV
1644	YANG-2246	VH domain nucleic acid sequence	CAGATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCGGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGCGGTGACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGAATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1645	YANG-2246	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMWVRQAPGQGLEWMGIIKPSGGDTIYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGNRAFDVWGHGTMVTVSS
1646	YANG-2246	HCDR1	GYTFTNYY
1647	YANG-2246	HCDR2	IKPSGGDT

SEQ ID NO	Clone ID	Description	Sequence
1648	YANG-2246	HCDR3	ARIGNRAFDV
1649	YANG-2246	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1650	YANG-2246	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1651	YANG-2246	LCDR1	SSNIGNNY
1652	YANG-2246	LCDR2	DNN
1653	YANG-2246	LCDR3	GTWDSSLGAGV
1654	YANG-2247	VH domain nucleic acid sequence	CAGATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCGACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATGATCA AACCCAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATATGGACCTGAGCAGTCTGAGGTCTGAGGACACGGCCGTGTATTATTGCACAAGAACTGGGAATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1655	YANG-2247	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTDYYMVWVRQAPGQGLEWMGMIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCTRTGNRAFDVWGHGTMVTVSS
1656	YANG-2247	HCDR1	GYTFTDYY
1657	YANG-2247	HCDR2	IKPSGGNT
1658	YANG-2247	HCDR3	TRTGNRAFDV

SEQ ID NO	Clone ID	Description	Sequence
1659	YANG-2247	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGCGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTTTGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1660	YANG-2247	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIANNYVSWYQQFPGTAPKLLIFDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1661	YANG-2247	LCDR1	SSNIANNY
1662	YANG-2247	LCDR2	DNN
1663	YANG-2247	LCDR3	GTWDSSLGAGV
1664	YANG-2248	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAATCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGCCAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGACAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1665	YANG-2248	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQDRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1666	YANG-2248	HCDR1	GYTFTNYY
1667	YANG-2248	HCDR2	IKPSGGNT
1668	YANG-2248	HCDR3	ARTGDRAFDV
1669	YANG-2248	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGTCA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
1670	YANG-2248	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYVNNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1671	YANG-2248	LCDR1	SSNIGNNF
1672	YANG-2248	LCDR2	VNN
1673	YANG-2248	LCDR3	GTWDSSLGAGV
1674	YANG-2249	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAATCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAAGTACTATATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCCAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA			
1675	YANG-2249	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTKYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS			
1676	YANG-2249	HCDR1	GYTFTKYY
1677	YANG-2249	HCDR2	IKPSGGNT
1678	YANG-2249	HCDR3	ARTGDRAFDV
1679	YANG-2249	VL domain nucleic acid sequence	CAGTCTGTATTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAA CTCCAACATTGGGAATAATTTTGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAACGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1680	YANG-2249	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSNSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL

SEQ ID NO	Clone ID	Description	Sequence
1681	YANG-2249	LCDR1	NSNIGNNF
1682	YANG-2249	LCDR2	DNN
1683	YANG-2249	LCDR3	GTWDSSLGAGV
1684	YANG-2250	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGTCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAATTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1685	YANG-2250	VH domain amino acid sequence	QIQLVQSGAEVKKPGSSVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1686	YANG-2250	HCDR1	GYTFTNYY
1687	YANG-2250	HCDR2	IKPSGGNT
1688	YANG-2250	HCDR3	ARTGDRAFDV
1689	YANG-2250	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGACCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCACGTTCCCAGGAACAGCCCCCCAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCCAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1690	YANG-2250	VL domain amino acid sequence	QSVLTQPPSVSATPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPQLLIYDNNKRPSGIPDRFSGSQSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1691	YANG-2250	LCDR1	SSNIGNNF
1692	YANG-2250	LCDR2	DNN

SEQ ID NO	Clone ID	Description	Sequence
1693	YANG-2250	LCDR3	GTWDSSLGAGV
1694	YANG-2251	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAATTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTTCATGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTGTCTTCA
1695	YANG-2251	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVFMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1696	YANG-2251	HCDR1	GYTFTSYY
1697	YANG-2251	HCDR2	IKPSGGNT
1698	YANG-2251	HCDR3	ARTGDRAFDV
1699	YANG-2251	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG TTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
1700	YANG-2251	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1701	YANG-2251	LCDR1	SSNIGNNY
1702	YANG-2251	LCDR2	DNN
1703	YANG-2251	LCDR3	GTWDSSLGAGV

SEQ ID NO	Clone ID	Description	Sequence
1704	YANG-2252	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGAGCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1705	YANG-2252	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1706	YANG-2252	HCDR1	GYTFTNYY
1707	YANG-2252	HCDR2	IKPSGGNT
1708	YANG-2252	HCDR3	ARTGDRAFDV
1709	YANG-2252	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGTCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1710	YANG-2252	VL domain amino acid sequence	QSVLTQSPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1711	YANG-2252	LCDR1	SSNIGNNF
1712	YANG-2252	LCDR2	DNN
1713	YANG-2252	LCDR3	GTWDSSLGAGV
1714	YANG-2253	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCACTGAGGAATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCTTGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAACAGTCTGAGATCTGAGGACACGGCCATGTATTATTGTGCGAGAACTGGGGATAGGGC CTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA

SEQ ID NO	Clone ID	Description	Sequence
1715	YANG-2253	VH domain amino acid sequence	QMQLVQSGAEVKKPGASLRISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTLTRDTSTN TVYLDLNSLRSEDTAMYYCARTGDRAFDVWGHGTMVTVSS
1716	YANG-2253	HCDR1	GYTFTNYY
1717	YANG-2253	HCDR2	IKPSGGNT
1718	YANG-2253	HCDR3	ARTGDRAFDV
1719	YANG-2253	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAACAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGAGTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1720	YANG-2253	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRVSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1721	YANG-2253	LCDR1	SSNIGNNY
1722	YANG-2253	LCDR2	DNN
1723	YANG-2253	LCDR3	GTWDSSLGAGV
1724	YANG-2254	VH domain nucleic acid sequence	CAGATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAACAGTCTGACATCTGAGGACACGGCCGTATATTATTGTGCGAGAACTGGGAAATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1725	YANG-2254	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLNSLITSEDTAVYYCARTGNRAFDVWGHGTMVTVSS

SEQ ID NO	Clone ID	Description	Sequence
1726	YANG-2254	HCDR1	GYTFTNYY
1727	YANG-2254	HCDR2	IKPSGGNT
1728	YANG-2254	HCDR3	ARTGNRAFDV
1729	YANG-2254	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAATATTGGGAATAATTTTGTTTCCTGGTACCAGCAGTTTCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATTCTAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
1730	YANG-2254	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNFVSWYQQFPGTAPKLLIYDNSKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1731	YANG-2254	LCDR1	SSNIGNNF
1732	YANG-2254	LCDR2	DNS
1733	YANG-2254	LCDR3	GTWDSSLGAGV
1734	YANG-2255	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAATCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGACGACACGGCCGTCTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1735	YANG-2255	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMWVRQAPGQGLEWMGIIKPSGGNTIYTQKFQGRVTMTRDTSTN TVYLDLSSLRSDDTAVYYCARTGDRAFDVWGHGTMVTVSS
1736	YANG-2255	HCDR1	GYTFTNYY
1737	YANG-2255	HCDR2	IKPSGGNT

SEQ ID NO	Clone ID	Description	Sequence
1738	YANG-2255	HCDR3	ARTGDRAFDV
1739	YANG-2255	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTACTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1740	YANG-2255	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGTGVFGGGTKLTVL
1741	YANG-2255	LCDR1	SSNIGNNF
1742	YANG-2255	LCDR2	DNN
1743	YANG-2255	LCDR3	GTWDSSLGTGV
1744	YANG-2256	VH domain nucleic acid sequence	CAGATACAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGCTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGCAGTTCCAGGGCAGAGCCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTTTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACACTGGTCACCGTCTCTTCA
1745	YANG-2256	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKLSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQQFQGRATMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGHGTLVTVSS
1746	YANG-2256	HCDR1	GYTFTSYY
1747	YANG-2256	HCDR2	IKPSGGNT
1748	YANG-2256	HCDR3	ARTGDRAFDV

SEQ ID NO	Clone ID	Description	Sequence
1749	YANG-2256	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGATCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGACTCCTGACCGATTCTCTGGCTCCAAGTCTGGCGCGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTG
1750	YANG-2256	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKITISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGTPDRFSGSKSGASATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1751	YANG-2256	LCDR1	SSNIGNNF
1752	YANG-2256	LCDR2	DNN
1753	YANG-2256	LCDR3	GTWDSSLGAGV
1754	YANG-2257	VH domain nucleic acid sequence	CAGATACAGTTTGGTGCAGTCTGGGGCTGAGGTGAAGGAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AATCTAGTGGTGGTGACACAATCTACGCACAGAAGTTCCAGGGCCGAGTCACCATGACCAGGGACACGTCCACGCAC ACAGTCTACATGGACCTGAACAGTCTGACATATGAAGACACGGCCGTATATTATTGTGCGAGAAGTGGGAATAGGGC TTTTGATGTCTGGGGCCATGGGACAATGGTCACCGTCTCTTCA
1755	YANG-2257	VH domain amino acid sequence	QIQLVQSGAEVKEPGASVKFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKSSGGDTIYAQKFQGRVTMTRDTSTH TVYMDLNSLTYEDTAVYYCARSGNRAFDVWGHGTMVTVSS
1756	YANG-2257	HCDR1	GYTFTSYY
1757	YANG-2257	HCDR2	IKSSGGDT
1758	YANG-2257	HCDR3	ARSGNRAFDV
1759	YANG-2257	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAACAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATACTAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
1760	YANG-2257	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNTKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1761	YANG-2257	LCDR1	SSNIGNNF
1762	YANG-2257	LCDR2	DNT
1763	YANG-2257	LCDR3	GTWDSSLGAGV
1764	YANG-2258	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGCGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCCGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGATACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA			
1765	YANG-2258	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS			
1766	YANG-2258	HCDR1	GYTFTNYY
1767	YANG-2258	HCDR2	IKPSGGNT
1768	YANG-2258	HCDR3	ARTGDRAFDV
1769	YANG-2258	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGTAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1770	YANG-2258	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCVTWDSSLGAGVFGGGTKLTVL

SEQ ID NO	Clone ID	Description	Sequence
1771	YANG-2258	LCDR1	SSNIGNNY
1772	YANG-2258	LCDR2	DNN
1773	YANG-2258	LCDR3	VTWDSSLGAGV
1774	YANG-2259	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAATCTGGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAT AAAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCCAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAGGGGACAATGGTCACCGTCTCTTCA
1775	YANG-2259	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN KVYLDLSSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1776	YANG-2259	HCDR1	GYTFTNYY
1777	YANG-2259	HCDR2	IKPSGGNT
1778	YANG-2259	HCDR3	ARTGDRAFDV
1779	YANG-2259	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAACGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1780	YANG-2259	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1781	YANG-2259	LCDR1	SSNIGNNF
1782	YANG-2259	LCDR2	DNN

SEQ ID NO	Clone ID	Description	Sequence
1783	YANG-2259	LCDR3	GTWDSSLGAGV
1784	YANG-2260	VH domain nucleic acid sequence	CAGATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCATCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAATTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1785	YANG-2260	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFINYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARIGDRAFDVWGHGTMVTVSS
1786	YANG-2260	HCDR1	GYTFINYY
1787	YANG-2260	HCDR2	IKPSGGNT
1788	YANG-2260	HCDR3	ARIGDRAFDV
1789	YANG-2260	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATATAACTTTGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAGCTCCTCATTTATGACA ATCATAAGCGACCCTCAGGATTCCTGACCGATTCTCTGCCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCGGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1790	YANG-2260	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNFVSWYQQFPGTAPKLLIYDNHKRPSGIPDRFSASKSGTSATLGIT GLQTGDEADYYCGTWDSGLGAGVFGGGTKLTVL
1791	YANG-2260	LCDR1	SSNIGNNF
1792	YANG-2260	LCDR2	DNH
1793	YANG-2260	LCDR3	GTWDSGLGAGV

SEQ ID NO	Clone ID	Description	Sequence
1794	YANG-2261	VH domain nucleic acid sequence	CAGATTCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTAATGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAT ATAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1795	YANG-2261	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMWWVRQAPGQGLEWMGIIKPSNGNTIYAQKFQGRVTMTRDTSTN IVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1796	YANG-2261	HCDR1	GYTFTNYY
1797	YANG-2261	HCDR2	IKPSNGNT
1798	YANG-2261	HCDR3	ARTGDRAFDV
1799	YANG-2261	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAATATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGTCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGAATATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1800	YANG-2261	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTVPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEAEYYCGTWDSSLGAGVFGGGTKLTVL
1801	YANG-2261	LCDR1	SSNIGNNY
1802	YANG-2261	LCDR2	DNN
1803	YANG-2261	LCDR3	GTWDSSLGAGV
1804	YANG-2262	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAGGTTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTACATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTGACACAATCTACGCACAGAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC TCAGTCTATATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA

SEQ ID NO	Clone ID	Description	Sequence
1805	YANG-2262	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVRFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGDTIYAQNFQGRVTMTRDTSTN SVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1806	YANG-2262	HCDR1	GYTFTNYY
1807	YANG-2262	HCDR2	IKPSGGDT
1808	YANG-2262	HCDR3	ARTGDRAFDV
1809	YANG-2262	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGACGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAACGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGGCTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1810	YANG-2262	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGRSSNLGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1811	YANG-2262	LCDR1	SSNIGNNF
1812	YANG-2262	LCDR2	DNN
1813	YANG-2262	LCDR3	GTWDSSLGAGV
1814	YANG-2263	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATTCACCTTCGCCAACTACTATGTGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACTTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCACGGGACAGTGGTCACCGTCTCTTCA
1815	YANG-2263	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGFTFANYYVVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTVVTVSS

SEQ ID NO	Clone ID	Description	Sequence
1816	YANG-2263	HCDR1	GFTFANYY
1817	YANG-2263	HCDR2	IKPSGGNT
1818	YANG-2263	HCDR3	ARTGDRAFDV
1819	YANG-2263	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATCTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1820	YANG-2263	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1821	YANG-2263	LCDR1	SSNIGNNY
1822	YANG-2263	LCDR2	DNN
1823	YANG-2263	LCDR3	GTWDSSLGAGV
1824	YANG-2264	VH domain nucleic acid sequence	CAGATACAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGCTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTACATGGTCTGGGTGCGACAGGCCCCTGGACAAGGGCTTGAATGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGCCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGCAGTCTGAGATCTGAAGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACACTGGTCACCGTCTCTTCA
1825	YANG-2264	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKLSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRATMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGHGTLVTVSS
1826	YANG-2264	HCDR1	GYTFTSYY
1827	YANG-2264	HCDR2	IKPSGGNT

SEQ ID NO	Clone ID	Description	Sequence
1828	YANG-2264	HCDR3	ARTGDRAFDV
1829	YANG-2264	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCAGATCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGACTCCTGCCCGATCCTCTGGCTCCAAGTCTGGCGCGTCAGCCACCCTGGGCATCACC GGACTCCAGCCTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTG
1830	YANG-2264	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQIPGTAPKLLIYDNNKRPSGTPARSSGSKSGASATLGIT GLQPGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1831	YANG-2264	LCDR1	SSNIGNNY
1832	YANG-2264	LCDR2	DNN
1833	YANG-2264	LCDR3	GTWDSSLGAGV
1834	YANG-2265	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAACTTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGAGTCTGCGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1835	YANG-2265	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVNFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1836	YANG-2265	HCDR1	GYTFTNYY
1837	YANG-2265	HCDR2	IKPSGGNT
1838	YANG-2265	HCDR3	ARTGDRAFDV

SEQ ID NO	Clone ID	Description	Sequence
1839	YANG-2265	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1840	YANG-2265	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1841	YANG-2265	LCDR1	SSNIGNNF
1842	YANG-2265	LCDR2	DNN
1843	YANG-2265	LCDR3	GTWDSSLGAGV
1844	YANG-2266	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGCTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGCAGCCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCAGGGACAATGGTCACCGTCTCTTCA
1845	YANG-2266	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKLSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1846	YANG-2266	HCDR1	GYTFTNYY
1847	YANG-2266	HCDR2	IKPSGGNT
1848	YANG-2266	HCDR3	ARTGDRAFDV
1849	YANG-2266	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAATATTGGGAATAATTATGTATCCTGGTACCAACAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
1850	YANG-2266	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1851	YANG-2266	LCDR1	SSNIGNNY
1852	YANG-2266	LCDR2	DNN
1853	YANG-2266	LCDR3	GTWDSSLGAGV
1854	YANG-2267	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCTGCAAGACATCTGG ATACCCCTTCAGCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGCTGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAT ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGCGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA		
1855	YANG-2267	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKIFCKTSGYPFSNYYMWVRQAPGQGLEWLGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLTSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS		
1856	YANG-2267	HCDR1	GYPFSNYY
1857	YANG-2267	HCDR2	IKPSGGNT
1858	YANG-2267	HCDR3	ARTGDRAFDV
1859	YANG-2267	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG TTCCAACATTGGGAGTAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1860	YANG-2267	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGSNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL

SEQ ID NO	Clone ID	Description	Sequence
1861	YANG-2267	LCDR1	SSNIGSNY
1862	YANG-2267	LCDR2	DNN
1863	YANG-2267	LCDR3	GTWDSSLGAGV
1864	YANG-2268	VH domain nucleic acid sequence	CAGATACAACTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAGGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACACCATCTACGCACAGAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAGC ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1865	YANG-2268	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVRFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTST TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1866	YANG-2268	HCDR1	GYTFTNYY
1867	YANG-2268	HCDR2	IKPSGGNT
1868	YANG-2268	HCDR3	ARTGDRAFDV
1869	YANG-2268	VL domain nucleic acid sequence	CAGTCTGTCTTGACTCAGCCGCCCTCAGTGTCTGCTGCCCCAGGACAGAAGGTCAACATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCTCAGGAACCGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1870	YANG-2268	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVNISCSGSSSNIGNNFVSWYQQFSGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1871	YANG-2268	LCDR1	SSNIGNNF
1872	YANG-2268	LCDR2	DNN

SEQ ID NO	Clone ID	Description	Sequence
1873	YANG-2268	LCDR3	GTWDSSLGAGV
1874	YANG-2269	VH domain nucleic acid sequence	CAGATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATATATCTTCACCAAGTACTATATGGTCTGGGTGCGACAGGCCCCGGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGCGGTGACACGATCTACGCACAGAAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGAAATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1875	YANG-2269	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYIFTKYYMVWVRQAPGQGLEWMGIIKPSGGDTIYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGNRAFDVWGHGTMVTVSS
1876	YANG-2269	HCDR1	GYIFTKYY
1877	YANG-2269	HCDR2	IKPSGGDT
1878	YANG-2269	HCDR3	ARTGNRAFDV
1879	YANG-2269	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCGTCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGGCCGTCCTT
1880	YANG-2269	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTVSCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLAVL
1881	YANG-2269	LCDR1	SSNIGNNF
1882	YANG-2269	LCDR2	DNN
1883	YANG-2269	LCDR3	GTWDSSLGAGV

SEQ ID NO	Clone ID	Description	Sequence
1884	YANG-2270	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAGGTTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGCAC ACAGTCTATATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTATATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGATCACCGTCTCTTCA
1885	YANG-2270	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVRFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTH TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMITVSS
1886	YANG-2270	HCDR1	GYTFTSYY
1887	YANG-2270	HCDR2	IKPSGGNT
1888	YANG-2270	HCDR3	ARTGDRAFDV
1889	YANG-2270	VL domain nucleic acid sequence	CAGTCTGTATTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGAAATAATTTTGTATCCTGGTACCAACAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1890	YANG-2270	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1891	YANG-2270	LCDR1	SSNIGNNF
1892	YANG-2270	LCDR2	DNN
1893	YANG-2270	LCDR3	GTWDSSLGAGV
1894	YANG-2271	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGCAGAAGCCTGGGGCCTCAGTGAAGTTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTTCTATATCGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAATTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAATCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA

SEQ ID NO	Clone ID	Description	Sequence
1895	YANG-2271	VH domain amino acid sequence	QIQLVQSGAEVQKPGASVKFSCKTSGYTFTNFYIVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TIYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1896	YANG-2271	HCDR1	GYTFTNFY
1897	YANG-2271	HCDR2	IKPSGGNT
1898	YANG-2271	HCDR3	ARTGDRAFDV
1899	YANG-2271	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATCATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGTTGACCGTCCTA
1900	YANG-2271	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNHKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1901	YANG-2271	LCDR1	SSNIGNNF
1902	YANG-2271	LCDR2	DNH
1903	YANG-2271	LCDR3	GTWDSSLGAGV
1904	YANG-2272	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCATCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAAAACTGGGGATAGGGC TTTTAATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1905	YANG-2272	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVIMTRDTSTN TVYLDLNSLRSEDTAVYYCAKTGDRAFNVWGHGTMVTVSS

SEQ ID NO	Clone ID	Description	Sequence
1906	YANG-2272	HCDR1	GYTFTNYY
1907	YANG-2272	HCDR2	IKPSGGNT
1908	YANG-2272	HCDR3	AKTGDRAFNV
1909	YANG-2272	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTCGAAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCTGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTT	
1910	YANG-2272	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIRNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1911	YANG-2272	LCDR1	SSNIRNNY
1912	YANG-2272	LCDR2	DNN
1913	YANG-2272	LCDR3	GTWDSSLGAGV
1914	YANG-2273	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAATTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1915	YANG-2273	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
1916	YANG-2273	HCDR1	GYTFTNYY
1917	YANG-2273	HCDR2	IKPSGGNT

SEQ ID NO	Clone ID	Description	Sequence
1918	YANG-2273	HCDR3	ARTGDRAFDV
1919	YANG-2273	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1920	YANG-2273	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1921	YANG-2273	LCDR1	SSNIGNNF
1922	YANG-2273	LCDR2	DNN
1923	YANG-2273	LCDR3	GTWDSSLGAGV
1924	YANG-2274	VH domain nucleic acid sequence	CAGCTGCAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAGTTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAATGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAT ACAGTCTTCATGGACCTGAGGAGTCTGAGATCTGAAGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACACTGGTCACCGTCTCTACA
1925	YANG-2274	VH domain amino acid sequence	QLQLVQSGAEVKKPGASVKISCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVFMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTLVTVST
1926	YANG-2274	HCDR1	GYTFTSYY
1927	YANG-2274	HCDR2	IKPSGGNT
1928	YANG-2274	HCDR3	ARTGDRAFDV

SEQ ID NO	Clone ID	Description	Sequence
1929	YANG-2274	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTTTCCTGGTACCTGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCCAGCTGACCGTCCTA
1930	YANG-2274	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYLQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTQLTVL
1931	YANG-2274	LCDR1	SSNIGNNF
1932	YANG-2274	LCDR2	DNN
1933	YANG-2274	LCDR3	GTWDSSLGAGV
1934	YANG-2275	VH domain nucleic acid sequence	CAGATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCGGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGCGGTGACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATATGGACCTGACCAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGGAATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1935	YANG-2275	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGDTIYAQKFQGRVTMTRDTSTN TVYMDLTSLRSEDTAVYYCARTGNRAFDVWGHGTMVTVSS
1936	YANG-2275	HCDR1	GYTFTNYY
1937	YANG-2275	HCDR2	IKPSGGDT
1938	YANG-2275	HCDR3	ARTGNRAFDV
1939	YANG-2275	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAATATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAGGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
1940	YANG-2275	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSRSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1941	YANG-2275	LCDR1	SSNIGNNY
1942	YANG-2275	LCDR2	DNN
1943	YANG-2275	LCDR3	GTWDSSLGAGV
1944	YANG-2276	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTTCAGGGCAGAGTCACCATGGCCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA			
1945	YANG-2276	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMYWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMARDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1946	YANG-2276	HCDR1	GYTFTNYY
1947	YANG-2276	HCDR2	IKPSGGNT
1948	YANG-2276	HCDR3	ARTGDRAFDV
1949	YANG-2276	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCTCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGTCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATATCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1950	YANG-2276	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSVTLGIT GLQTGDEADYYCGTWDISLGAGVFGGGTKLTVL

SEQ ID NO	Clone ID	Description	Sequence
1951	YANG-2276	LCDR1	SSNIGNNY
1952	YANG-2276	LCDR2	DNN
1953	YANG-2276	LCDR3	GTWDISLGAGV
1954	YANG-2277	VH domain nucleic acid sequence	CAGATACAGTTGGTGCAGTCTGGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAATTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGCTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
1955	YANG-2277	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTADRAFDVWGQGTMVTVSS
1956	YANG-2277	HCDR1	GYTFTNYY
1957	YANG-2277	HCDR2	IKPSGGNT
1958	YANG-2277	HCDR3	ARTADRAFDV
1959	YANG-2277	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCATGTTGACCGTCCTA
1960	YANG-2277	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTMLTVL
1961	YANG-2277	LCDR1	SSNIGNNF
1962	YANG-2277	LCDR2	DNN

SEQ ID NO	Clone ID	Description	Sequence
1963	YANG-2277	LCDR3	GTWDSSLGAGV
1964	YANG-2278	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGCTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTGTCTTCA
1965	YANG-2278	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKLSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1966	YANG-2278	HCDR1	GYTFTSYY
1967	YANG-2278	HCDR2	IKPSGGNT
1968	YANG-2278	HCDR3	ARTGDRAFDV
1969	YANG-2278	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1970	YANG-2278	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1971	YANG-2278	LCDR1	SSNIGNNY
1972	YANG-2278	LCDR2	DNN
1973	YANG-2278	LCDR3	GTWDSSLGAGV

SEQ ID NO	Clone ID	Description	Sequence
1974	YANG-2279	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACGCGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTACTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1975	YANG-2279	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNAIYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
1976	YANG-2279	HCDR1	GYTFTNYY
1977	YANG-2279	HCDR2	IKPSGGNA
1978	YANG-2279	HCDR3	ARTGDRAFDV
1979	YANG-2279	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1980	YANG-2279	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
1981	YANG-2279	LCDR1	SSNIGNNY
1982	YANG-2279	LCDR2	DNN
1983	YANG-2279	LCDR3	GTWDSSLGAGV
1984	YANG-2280	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACATTTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGAGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACTAAC ACAGTCTACATGGACCTGAATAATCTGAGATCTGAGGACACGGCCGTGTATTTTTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGTCAATGGTCACCGTCTCTTCA

SEQ ID NO	Clone ID	Description	Sequence
1985	YANG-2280	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYIFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLNNLRSEDTAVYFCARTGDRAFDVWGQGSMVTVSS
1986	YANG-2280	HCDR1	GYIFTNYY
1987	YANG-2280	HCDR2	IKPSGGNT
1988	YANG-2280	HCDR3	ARTGDRAFDV
1989	YANG-2280	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAATGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCGGCAGTTCCCCGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGGACATGGGATAGCAGCCTGAGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
1990	YANG-2280	VL domain amino acid sequence	QSVLTQPPSMSAAPGQKVTISCSGSSSNIGNNFVSWYRQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLSAGVFGGGTKLTVL
1991	YANG-2280	LCDR1	SSNIGNNF
1992	YANG-2280	LCDR2	DNN
1993	YANG-2280	LCDR3	GTWDSSLSAGV
1994	YANG-2281	VH domain nucleic acid sequence	CAGATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATATATTTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCTCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAGGTTCCAGGGCAGAGTCACCATGACCAGAGACACGTCCACGAAC ACAGTCTATATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGAATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
1995	YANG-2281	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYIFTNYYMVWVRQASGQGLEWMGIIKPSGGNTIYAQRFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGNRAFDVWGHGTMVTVSS

SEQ ID NO	Clone ID	Description	Sequence
1996	YANG-2281	HCDR1	GYIFTNYY
1997	YANG-2281	HCDR2	IKPSGGNT
1998	YANG-2281	HCDR3	ARTGNRAFDV
1999	YANG-2281	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGCGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTTGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
2000	YANG-2281	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIANNYVSWYQQFPGTAPKLLIFDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2001	YANG-2281	LCDR1	SSNIANNY
2002	YANG-2281	LCDR2	DNN
2003	YANG-2281	LCDR3	GTWDSSLGAGV
2004	YANG-2282	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAGTTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
2005	YANG-2282	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
2006	YANG-2282	HCDR1	GYTFTSYY
2007	YANG-2282	HCDR2	IKPSGGNT

SEQ ID NO	Clone ID	Description	Sequence
2008	YANG-2282	HCDR3	ARTGDRAFDV
2009	YANG-2282	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATATGTATCCTGGTACCAGCAGTTTGCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCGCC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
2010	YANG-2282	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFAGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIA GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2011	YANG-2282	LCDR1	SSNIGNNY
2012	YANG-2282	LCDR2	DNN
2013	YANG-2282	LCDR3	GTWDSSLGAGV
2014	YANG-2283	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACAGCTTCATCAATTATTATATGGTCTGGGTGCGCCAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGCGCAGTCTGAGATCTGAGGACACGGCCGTATATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGATCACCGTCTCTTCA
2015	YANG-2283	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYSFINYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGHGTMITVSS
2016	YANG-2283	HCDR1	GYSFINYY
2017	YANG-2283	HCDR2	IKPSGGNT
2018	YANG-2283	HCDR3	ARTGDRAFDV

SEQ ID NO	Clone ID	Description	Sequence
2019	YANG-2283	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAA CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAACAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGTTGACCGTCCTA
2020	YANG-2283	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSNSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2021	YANG-2283	LCDR1	NSNIGNNF
2022	YANG-2283	LCDR2	DNN
2023	YANG-2283	LCDR3	GTWDSSLGAGV
2024	YANG-2284	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
2025	YANG-2284	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
2026	YANG-2284	HCDR1	GYTFTSYY
2027	YANG-2284	HCDR2	IKPSGGNT
2028	YANG-2284	HCDR3	ARTGDRAFDV
2029	YANG-2284	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGCTTCCAAGACTGGCACGTCAGCCACCCTGGGCATCACC GGACCCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
2030	YANG-2284	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSASKTGTSATLGIT GPQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2031	YANG-2284	LCDR1	SSNIGNNY
2032	YANG-2284	LCDR2	DNN
2033	YANG-2284	LCDR3	GTWDSSLGAGV
2034	YANG-2285	VH domain nucleic acid sequence	CAAATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCATCAACTACTATATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA ATCCTAGTGGTGGTAATACGGTCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
2035	YANG-2285	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFINYYMVWVRQAPGQGLEWMGIINPSGGNTVYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
2036	YANG-2285	HCDR1	GYTFINYY
2037	YANG-2285	HCDR2	INPSGGNT
2038	YANG-2285	HCDR3	ARTGDRAFDV
2039	YANG-2285	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATCATAGGCGACCCTCAGGGATTCCTGACCGATTCTCTGCCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCTGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCGGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
2040	YANG-2285	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNHRPSGIPDRFSASKSGTSATLGIT GLLITGDEADYYCGTWDSGLGAGVFGGGTKLTVL

SEQ ID NO	Clone ID	Description	Sequence
2041	YANG-2285	LCDR1	SSNIGNNY
2042	YANG-2285	LCDR2	DNH
2043	YANG-2285	LCDR3	GTWDSGLGAGV
2044	YANG-2286	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAATTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGACC ACAGTCTATTTGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
2045	YANG-2286	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTST TVYLDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
2046	YANG-2286	HCDR1	GYTFTNYY
2047	YANG-2286	HCDR2	IKPSGGNT
2048	YANG-2286	HCDR3	ARTGDRAFDV
2049	YANG-2286	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAACCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCACGGTGACCGTCCTA
2050	YANG-2286	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGTSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTTLTVL
2051	YANG-2286	LCDR1	SSNIGNNY
2052	YANG-2286	LCDR2	DNN

SEQ ID NO	Clone ID	Description	Sequence
2053	YANG-2286	LCDR3	GTWDSSLGAGV
2054	YANG-2287	VH domain nucleic acid sequence	CAGATACAACTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGACTCTGAGATCTGAGGACACGGCCGTTTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
2055	YANG-2287	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TVYMDLRTLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
2056	YANG-2287	HCDR1	GYTFTNYY
2057	YANG-2287	HCDR2	IKPSGGNT
2058	YANG-2287	HCDR3	ARTGDRAFDV
2059	YANG-2287	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGATTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAGGCTGACCGTCCTA
2060	YANG-2287	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GFQTGDEADYYCGTWDSSLGAGVFGGGTRLTVL
2061	YANG-2287	LCDR1	SSNIGNNF
2062	YANG-2287	LCDR2	DNN
2063	YANG-2287	LCDR3	GTWDSSLGAGV

SEQ ID NO	Clone ID	Description	Sequence
2064	YANG-2288	VH domain nucleic acid sequence	CAGATGCAGCTGGTACAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTATGCACAGAAGTTCCAGGGCAGAGTCAACATGACCAGGGACACGTCCACGAAC ACAGTCTATATGGACCTGAGTAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
2065	YANG-2288	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVNMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
2066	YANG-2288	HCDR1	GYTFTSYY
2067	YANG-2288	HCDR2	IKPSGGNT
2068	YANG-2288	HCDR3	ARTGDRAFDV
2069	YANG-2288	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGTAC CTCCAACATTGGGACTAATTATGTCTCCTGGTACCAGCAGCTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAGTAAGCGCCCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
2070	YANG-2288	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSTSNIGTNYVSWYQQLPGTAPKLLIYDNSKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2071	YANG-2288	LCDR1	TSNIGTNY
2072	YANG-2288	LCDR2	DNS
2073	YANG-2288	LCDR3	GTWDSSLGAGV
2074	YANG-2289	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAATGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA

SEQ ID NO	Clone ID	Description	Sequence
2075	YANG-2289	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLTSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
2076	YANG-2289	HCDR1	GYTFTNYY
2077	YANG-2289	HCDR2	IKPSGGNT
2078	YANG-2289	HCDR3	ARTGDRAFDV
2079	YANG-2289	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGAAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
2080	YANG-2289	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2081	YANG-2289	LCDR1	SSNIGNNY
2082	YANG-2289	LCDR2	DNN
2083	YANG-2289	LCDR3	GTWDSSLGAGV
2084	YANG-2290	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGACTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTGGTGGTGGTAACACGATCTACGCACAGAAATTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAACAGTCTGCGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCACGGGACAGTGGTCACCGTCTCTTCA
2085	YANG-2290	VH domain amino acid sequence	QMQLVQSGTEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPGGGNTIYAQKFQGRVTMTRDTSTN TVYLDLNSLRSEDTAVYYCARTGDRAFDVWGHGTVVTVSS

SEQ ID NO	Clone ID	Description	Sequence
2086	YANG-2290	HCDR1	GYTFTNYY
2087	YANG-2290	HCDR2	IKPGGGNT
2088	YANG-2290	HCDR3	ARTGDRAFDV
2089	YANG-2290	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATGTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATCTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
2090	YANG-2290	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTMSCSGSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2091	YANG-2290	LCDR1	SSNIGNNY
2092	YANG-2290	LCDR2	DNN
2093	YANG-2290	LCDR3	GTWDSSLGAGV
2094	YANG-2291	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTTTTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGATCACCGTCTCTTCA
2095	YANG-2291	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYFCARTGDRAFDVWGHGTMITVSS
2096	YANG-2291	HCDR1	GYTFTSYY
2097	YANG-2291	HCDR2	IKPSGGNT

SEQ ID NO	Clone ID	Description	Sequence
2098	YANG-2291	HCDR3	ARTGDRAFDV
2099	YANG-2291	VL domain nucleic acid sequence	CAGTCTGTATTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGAAATAATTTTGTATCCTGGTACCAACAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
2100	YANG-2291	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2101	YANG-2291	LCDR1	SSNIGNNF
2102	YANG-2291	LCDR2	DNN
2103	YANG-2291	LCDR3	GTWDSSLGAGV
2104	YANG-2292	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATCTCCTGCAAGACATCTGG ATACACCTTCATCAACTATTATATGGTCTGGGTGCGACAGGCCCCGGGACAAGGACTTGAGTGGATGGGCATAATCA AACCCAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
2105	YANG-2292	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFINYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
2106	YANG-2292	HCDR1	GYTFINYY
2107	YANG-2292	HCDR2	IKPSGGNT
2108	YANG-2292	HCDR3	ARTGDRAFDV

SEQ ID NO	Clone ID	Description	Sequence
2109	YANG-2292	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
2110	YANG-2292	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2111	YANG-2292	LCDR1	SSNIGNNY
2112	YANG-2292	LCDR2	DNN
2113	YANG-2292	LCDR3	GTWDSSLGAGV
2114	YANG-2293	VH domain nucleic acid sequence	CAGATGCAATTGCTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGCGAAGATTTCCTGCAAGACATCTGG ATATACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCTCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTGCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTTTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATTTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
2115	YANG-2293	VH domain amino acid sequence	QMQLLQSGAEVKKPGASAKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKCQGRVTMTRDTSTN TVYLDLNSLRSEDTAVYYCARTGDRAFDFWGHGTMVTVSS
2116	YANG-2293	HCDR1	GYTFTNYY
2117	YANG-2293	HCDR2	IKPSGGNT
2118	YANG-2293	HCDR3	ARTGDRAFDF
2119	YANG-2293	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTATCACCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTATTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
2120	YANG-2293	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYHQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2121	YANG-2293	LCDR1	SSNIGNNY
2122	YANG-2293	LCDR2	DNN
2123	YANG-2293	LCDR3	GTWDSSLGAGV
2124	YANG-2294	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGCGAAGAAGCCAGGGGCCCCAGTGAAGTTTTCTGGCAAGACATCTGG ATACAACTTCACCAACTACTACATGGNCTGTGTGCGACAGGCCCCTGAACAGGGACTTTAGTGGATGGGCATAATTA AACCTAGCGGTGGTAACACAATCTCCGCACAGAAGTACCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCAGAACAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTGTCTTCA
2125	YANG-2294	VH domain amino acid sequence	(N= unknown base) QIQLVQSGAEAKKPGAPVKFSGKTSGYNFTNYYMXCVRQAPEQGLXWMGIIKPSGGNTISAQKYQGRVTMTRDTSTN TVYMDQNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS (X= unknown amino acid)
2126	YANG-2294	HCDR1	GYNFTNYY
2127	YANG-2294	HCDR2	IKPSGGNT
2128	YANG-2294	HCDR3	ARTGDRAFDV
2129	YANG-2294	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGGCTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
2130	YANG-2294	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2131	YANG-2294	LCDR1	SSNIGNNY
2132	YANG-2294	LCDR2	DNN
2133	YANG-2294	LCDR3	GTWDSSLGAGV
2134	YANG-2295	VH domain nucleic acid sequence	CAGATGCAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAGGTTTTCCTGCAAGACATCTGG ATACACCTTCACCAGTTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAATGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAT ACAGTCTACATGGACCTGAGGAGTCTGAGCTCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
2135	YANG-2295	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVRFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLRSLSSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
2136	YANG-2295	HCDR1	GYTFTSYY
2137	YANG-2295	HCDR2	IKPSGGNT
2138	YANG-2295	HCDR3	ARTGDRAFDV
2139	YANG-2295	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGTCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCTGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGCCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTATTGCGGAACATGGGACAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCCAGCTGACCGTCCTA
2140	YANG-2295	VL domain amino acid sequence	QSVLTQPPSVSAVPGQKVTISCSGSSNIGNNFVSWYLQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSATSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTQLTVL

SEQ ID NO	Clone ID	Description	Sequence
2141	YANG-2295	LCDR1	SSNIGNNF
2142	YANG-2295	LCDR2	DNN
2143	YANG-2295	LCDR3	GTWDSSLGAGV
2144	YANG-2296	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAACAGTCTGAGATCTGAAGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGATCACCGTCTCTTCA
2145	YANG-2296	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMITVSS
2146	YANG-2296	HCDR1	GYTFTSYY
2147	YANG-2296	HCDR2	IKPSGGNT
2148	YANG-2296	HCDR3	ARTGDRAFDV
2149	YANG-2296	VL domain nucleic acid sequence	CAGTCTGTGTTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAACAGTTCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
2150	YANG-2296	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2151	YANG-2296	LCDR1	SSNIGNNF
2152	YANG-2296	LCDR2	DNN

SEQ ID NO	Clone ID	Description	Sequence
2153	YANG-2296	LCDR3	GTWDSSLGAGV
2154	YANG-2297	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTGTCTTCA
2155	YANG-2297	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
2156	YANG-2297	HCDR1	GYTFTNYY
2157	YANG-2297	HCDR2	IKPSGGNT
2158	YANG-2297	HCDR3	ARTGDRAFDV
2159	YANG-2297	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
2160	YANG-2297	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2161	YANG-2297	LCDR1	SSNIGNNY
2162	YANG-2297	LCDR2	DNN
2163	YANG-2297	LCDR3	GTWDSSLGAGV

SEQ ID NO	Clone ID	Description	Sequence
2164	YANG-2298	VH domain nucleic acid sequence	CAGATGAAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGTAAGACATCTGG ATACACCTTCATCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAATACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
2165	YANG-2298	VH domain amino acid sequence	QMKLVQSGAEVKKPGASVKISCKTSGYTFINYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
2166	YANG-2298	HCDR1	GYTFINYY
2167	YANG-2298	HCDR2	IKPSGGNT
2168	YANG-2298	HCDR3	ARTGDRAFDV
2169	YANG-2298	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAA CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATCATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGCCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCGGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
2170	YANG-2298	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSNSNIGNNYVSWYQQFPGTAPKLLIYDNHKRPSGIPDRFSASKSGTSATLGIT GLQTGDEADYYCGTWDSGLGAGVFGGGTKLTVL
2171	YANG-2298	LCDR1	NSNIGNNY
2172	YANG-2298	LCDR2	DNH
2173	YANG-2298	LCDR3	GTWDSGLGAGV
2174	YANG-2299	VH domain nucleic acid sequence	CAGATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTTCCTGCAAGACATCTGG ATACACCTTCACCAATTATTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAATGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAT ACAGTCTATATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA

SEQ ID NO	Clone ID	Description	Sequence
2175	YANG-2299	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
2176	YANG-2299	HCDR1	GYTFTNYY
2177	YANG-2299	HCDR2	IKPSGGNT
2178	YANG-2299	HCDR3	ARTGDRAFDV
2179	YANG-2299	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG TTCCAATATTTGGGAATAATTTTGTATCCTGGTACCTGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCCAGCTGACCGTCCTA
2180	YANG-2299	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYLQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTQLTVL
2181	YANG-2299	LCDR1	SSNIGNNF
2182	YANG-2299	LCDR2	DNN
2183	YANG-2299	LCDR3	GTWDSSLGAGV
2184	YANG-2299a	VH domain nucleic acid sequence	CAGATGCAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTATGCACGGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACATTGGTCACCGTCTCTTCA
2185	YANG-2299a	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYARKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGQGTLVTVSS

SEQ ID NO	Clone ID	Description	Sequence
2186	YANG-2299a	HCDR1	GYTFTSYY
2187	YANG-2299a	HCDR2	IKPSGGNT
2188	YANG-2299a	HCDR3	ARTGDRAFDV
2189	YANG-2299a	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAGTAATTATGTCTCCTGGTACCAGCAGCTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGCCCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
2190	YANG-2299a	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGSNYVSWYQQLPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2191	YANG-2299a	LCDR1	SSNIGSNY
2192	YANG-2299a	LCDR2	DNN
2193	YANG-2299a	LCDR3	GTWDSSLGAGV
2194	YANG-2299b	VH domain nucleic acid sequence	CAGATACAACTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGTCTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGGGGACACGGCCGTGTATTATTGTGCGAGAAGTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
2195	YANG-2299b	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TVYMDLRSLRSGDTAVYYCARSGDRAFDVWGQGTMVTVSS
2196	YANG-2299b	HCDR1	GYTFTNYY
2197	YANG-2299b	HCDR2	IKPSGGNT

SEQ ID NO	Clone ID	Description	Sequence
2198	YANG-2299b	HCDR3	ARSGDRAFDV
2199	YANG-2299b	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA			
2200	YANG-2299b	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2201	YANG-2299b	LCDR1	SSNIGNNF
2202	YANG-2299b	LCDR2	DNN
2203	YANG-2299b	LCDR3	GTWDSSLGAGV
2204	YANG-2299c	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAGGCTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCGAGTGGTGGTAATACAATCTACGCACAGAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAGA ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTTA
2205	YANG-2299c	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVRLSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTR TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSL
2206	YANG-2299c	HCDR1	GYTFTNYY
2207	YANG-2299c	HCDR2	IKPSGGNT
2208	YANG-2299c	HCDR3	ARTGDRAFDV

SEQ ID NO	Clone ID	Description	Sequence
2209	YANG-2299c	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGAATATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
2210	YANG-2299c	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEAEYYCGTWDSSLGAGVFGGGTKLTVL
2211	YANG-2299c	LCDR1	SSNIGNNF
2212	YANG-2299c	LCDR2	DNN
2213	YANG-2299c	LCDR3	GTWDSSLGAGV
2214	YANG-2299d	VH domain nucleic acid sequence	CAGATGCAATTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTATTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAGTGGTCACCGTCTCTTCA
2215	YANG-2299d	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMWWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTVVTVSS
2216	YANG-2299d	HCDR1	GYTFTNYY
2217	YANG-2299d	HCDR2	IKPSGGNT
2218	YANG-2299d	HCDR3	ARTGDRAFDV
2219	YANG-2299d	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATCTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGTTGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA

SEQ ID NO	Clone ID	Description	Sequence
2220	YANG-2299d	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLAIT GLQTGDEADYYCGTWDSSLGVGVFGGGTKLTVL
2221	YANG-2299d	LCDR1	SSNIGNNY
2222	YANG-2299d	LCDR2	DNN
2223	YANG-2299d	LCDR3	GTWDSSLGVGV
2224	YANG-2299e	VH domain nucleic acid sequence	CAGATGCAGCTGGTACAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAGCTATTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTATGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGTAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA			
2225	YANG-2299e	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKFSCKTSGYTFTSYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLSSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
2226	YANG-2299e	HCDR1	GYTFTSYY
2227	YANG-2299e	HCDR2	IKPSGGNT
2228	YANG-2299e	HCDR3	ARTGDRAFDV
2229	YANG-2299e	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAC CTCCAACATTGGGAGTAATTATGTCTCCTGGTACCAGCAGCTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGCCCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
2230	YANG-2299e	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSTSNIGSNYVSWYQQLPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL

SEQ ID NO	Clone ID	Description	Sequence
2231	YANG-2299e	LCDR1	TSNIGSNY
2232	YANG-2299e	LCDR2	DNN
2233	YANG-2299e	LCDR3	GTWDSSLGAGV
2234	YANG-2299f	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGGCAAGGACTTGAGTGGATGGGCATAATCA AACCTAGCGGTGGTAACACAATCTACGCACAGAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGCGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA	
2235	YANG-2299f	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
2236	YANG-2299f	HCDR1	GYTFTNYY
2237	YANG-2299f	HCDR2	IKPSGGNT
2238	YANG-2299f	HCDR3	ARTGDRAFDV
2239	YANG-2299f	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
2240	YANG-2299f	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2241	YANG-2299f	LCDR1	SSNIGNNF
2242	YANG-2299f	LCDR2	DNN

SEQ ID NO	Clone ID	Description	Sequence
2243	YANG-2299f	LCDR3	GTWDSSLGAGV
2244	YANG-2299g	VH domain nucleic acid sequence	CAGATACAACTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTGTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTGTACTTGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA			
2245	YANG-2299g	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TVYLDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
2246	YANG-2299g	HCDR1	GYTFTNYY
2247	YANG-2299g	HCDR2	IKPSGGNT
2248	YANG-2299g	HCDR3	ARTGDRAFDV
2249	YANG-2299g	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
2250	YANG-2299g	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2251	YANG-2299g	LCDR1	SSNIGNNF
2252	YANG-2299g	LCDR2	DNN
2253	YANG-2299g	LCDR3	GTWDSSLGAGV

SEQ ID NO	Clone ID	Description	Sequence
2254	YANG-2299h	VH domain nucleic acid sequence	CAGATGCAATTGCTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTAAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACAAAC ACAATCTATTTGGACCTGAGCAGTCTGAGATCTGAGGACACGGCCGTATATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA
2255	YANG-2299h	VH domain amino acid sequence	QMQLLQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLKWMGIIKPSGGNTIYAQNFQGRVTMTRDTSTN TIYLDLSSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
2256	YANG-2299h	HCDR1	GYTFTNYY
2257	YANG-2299h	HCDR2	IKPSGGNT
2258	YANG-2299h	HCDR3	ARTGDRAFDV
2259	YANG-2299h	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTATGTTTCCTGGTATCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTATTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA
2260	YANG-2299h	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2261	YANG-2299h	LCDR1	SSNIGNNY
2262	YANG-2299h	LCDR2	DNN
2263	YANG-2299h	LCDR3	GTWDSSLGAGV
2264	YANG-2299i	VH domain nucleic acid sequence	CAGATGCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGATTTCCTGCAAGACATCTGG ATACACCTTCACCAATTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACGATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTATATGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTATATTATTGTGCGAGAACTGGGGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTCTTCA

SEQ ID NO	Clone ID	Description	Sequence
2265	YANG-2299i	VH domain amino acid sequence	QMQLVQSGAEVKKPGASVKISCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQKFQGRVTMTRDTSTN TVYMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS
2266	YANG-2299i	HCDR1	GYTFTNYY
2267	YANG-2299i	HCDR2	IKPSGGNT
2268	YANG-2299i	HCDR3	ARTGDRAFDV
2269	YANG-2299i	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAATATTTGGAACTAATTCTCTTTCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAACGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGTGTTCGGCGG AGGGACCAAGGTGACCGTCCTA		
2270	YANG-2299i	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGTNSLSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKVTVL
2271	YANG-2299i	LCDR1	SSNIGTNS
2272	YANG-2299i	LCDR2	DNN
2273	YANG-2299i	LCDR3	GTWDSSLGAGV
2274	YANG-2299j	VH domain nucleic acid sequence	CAGATTCAGTTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTCCTGCAAGACATCTGG ATACACCTTCACCGGCTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTGACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAACAGTCTGAGATCTGAGGACACGGCCGTCTATTATTGTGCGAGAACTGGAGATAGGGC TTTTGATGTCTGGGGCCACGGGACAATGGTCACCGTCTTCA
2275	YANG-2299j	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTGYYMVWVRQAPGQGLEWMGIIKPSGGDTIYAQKFQGRVTMTRDTSTN TVYMDLNSLRSEDTAVYYCARTGDRAFDVWGHGTMVTVSS

SEQ ID NO	Clone ID	Description	Sequence
2276	YANG-2299j	HCDR1	GYTFTGYY
2277	YANG-2299j	HCDR2	IKPSGGDT
2278	YANG-2299j	HCDR3	ARTGDRAFDV
2279	YANG-2299j	VL domain nucleic acid sequence	CAGTCTGTGTTGACGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAA CTCCAACATTGGGAATAATTATGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAACTGACCGTCCTA				
2280	YANG-2299j	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSNSNIGNNYVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2281	YANG-2299j	LCDR1	NSNIGNNY
2282	YANG-2299j	LCDR2	DNN
2283	YANG-2299j	LCDR3	GTWDSSLGAGV
2284	YANG-2299k	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGTTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGACTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTAACACAATCTACGCACAGAGTTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC ACAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
2285	YANG-2299k	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVKFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGNTIYAQSFQGRVTMTRDTSTN TVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
2286	YANG-2299k	HCDR1	GYTFTNYY
2287	YANG-2299k	HCDR2	IKPSGGNT

SEQ ID NO	Clone ID	Description	Sequence
2288	YANG-2299k	HCDR3	ARTGDRAFDV
2289	YANG-2299k	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGAAGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAGCAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAGCGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTGCTGGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA		
2290	YANG-2299k	VL domain amino acid sequence	QSVLTQPPSVSAAPGQKVTISCSGSSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGAGVFGGGTKLTVL
2291	YANG-2299k	LCDR1	SSNIGNNF
2292	YANG-2299k	LCDR2	DNN
2293	YANG-2299k	LCDR3	GTWDSSLGAGV
2294	YANG-2299l	VH domain nucleic acid sequence	CAGATACAGCTGGTGCAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAGGTTTCCTGCAAGACATCTGG ATACACCTTCACCAACTACTATATGGTCTGGGTGCGACAGGCCCCTGGACAAGGGCTTGAGTGGATGGGCATAATCA AACCTAGTGGTGGTGACACAATCTACGCACAGAACTTCCAGGGCAGAGTCACCATGACCAGGGACACGTCCACGAAC TCAGTCTACATGGACCTGAGGAGTCTGAGATCTGAGGACACGGCCGTGTATTATTGTGCGAGAACTGGTGATAGGGC TTTTGATGTCTGGGGCCAAGGGACAATGGTCACCGTCTCTTCA
2295	YANG-2299l	VH domain amino acid sequence	QIQLVQSGAEVKKPGASVRFSCKTSGYTFTNYYMVWVRQAPGQGLEWMGIIKPSGGDTIYAQNFQGRVTMTRDTSTN SVYMDLRSLRSEDTAVYYCARTGDRAFDVWGQGTMVTVSS
2296	YANG-2299l	HCDR1	GYTFTNYY
2297	YANG-2299l	HCDR2	IKPSGGDT
2298	YANG-2299l	HCDR3	ARTGDRAFDV

SEQ ID NO	Clone ID	Description	Sequence
2299	YANG-22991	VL domain nucleic acid sequence	CAGTCTGTGTTGACGGCAGCCGCCCTCAGTGTCTGCGGCCCCAGGACAGAAGGTCACCATCTCCTGCTCTGGACGGCAG CTCCAACATTGGGAATAATTTTGTATCCTGGTACCAACAGTTCCCAGGAACAGCCCCCAAACTCCTCATTTATGACA ATAATAAACGACCCTCAGGGATTCCTGACCGATTCTCTGGCTCCAAGTCTGGCACGTCAGCCACCCTGGGCATCACC GGACTCCAGACTGGGGACGAGGCCGATTATTACTGCGGAACATGGGATAGCAGCCTGGGTACTGGGGTGTTCGGCGG AGGGACCAAGCTGACCGTCCTA
2300	YANG-22991	VL domain amino acid sequence	QSVLIQPPSVSAAPGQKVTISCSGRSSNIGNNFVSWYQQFPGTAPKLLIYDNNKRPSGIPDRFSGSKSGTSATLGIT GLQTGDEADYYCGTWDSSLGTGVFGGGTKLTVL
2301	YANG-22991	LCDR1	SSNIGNNF
2302	YANG-22991	LCDR2	DNN
2303	YANG-22991	LCDR3	GTWDSSLGTGV
2304	YANG-2301	VH domain nucleic acid sequence	CAGGTCCACCTGATACAATCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGGTCTCCTGCAAGGTTTCCGG ATACACCCTCATTGAAGTATCCGTGCACTGGGTGCGACAGGCTCCTGGAAAAGGGCTTGAGTGGATGGGAGGTTTTG ATCCTGAAGCAGCTGAAACAATCTACGCACAGAAATTCCAGGGCAGAGTCACCATGACCGAGGACACATCTACAGAC ACAGCCTACATGGACCTGAGCAGCCTGAAATCTGAAGACTCGGCCGTATATTACTGTGCAATAGGACCAGCAGTGAC TGGTAGAAACTCCGGGGAATACTATTACTATTACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTCGCCT CA
2305	YANG-2301	VH domain amino acid sequence	QVHLIQSGAEVKKPGASVKVSCKVSGYTLIEVSVHWVRQAPGKGLEWMGGFDPEAAETIYAQKFQGRVTMTEDTSTD TAYMDLSSLKSEDSAVYYCAIGPAVTGRNSGEYYYYYGMDVWGQGTTVTVAS
2306	YANG-2301	HCDR1	GYTLIEVS
2307	YANG-2301	HCDR2	FDPEAAET
2308	YANG-2301	HCDR3	AIGPAVTGRNSGEYYYYYGMDV

SEQ ID NO	Clone ID	Description	Sequence
2309	YANG-2301	VL domain nucleic acid sequence	GAAATAGTGATGACCCAGTCTCCAGCCACCCTGTCTGTCTCCAGGGGAAAGAGCCACCCTCTCTTGCAGGGCCAG TCAGAGTGTTAACAGCAACTTGGCCTGGTACCAGCAGAAGCCTGGCCAGGCCCCCAGGCTCCTCATCTATGGCTGTAT CCACCAGGGCCACTGGTCTCCCAGCCAGGTTCAGTGGCAGTGGGTCTGGGACAGAATTCACTCTCACCATCAGCAGC CTGCAGTCTGAAGACTTTGTAGTTTATTACTGTCACCAGTATAATAACTGGCCGCTCACTTTCGGCGGAGGGACCAA GGTGGAGATCAAA
2310	YANG-2301	VL domain amino acid sequence	EIVMTQSPATLSVSPGERATLSCRASQSVNSNLAWYQQKPGQAPRLLIYAVSTRATGLPARFSGSGSGTEFTLTISS LQSEDFVVYYCHQYNNWPLTFGGGTKVEIK
2311	YANG-2301	LCDR1	QSVNSN
2312	YANG-2301	LCDR2	AVS
2313	YANG-2301	LCDR3	HQYNNWPLT
2314	YANG-2302	VH domain nucleic acid sequence	CAGGTCCAACTGGTACAGTCTGGGGCTGAGGTGAGGAAGCCTGGGGCCTCAGTGAAGGTCTCCTGCAAGGTTTCCGG ATACACCCTCCCTGAATTAGCCATACACTGGGTGCGACAGGCGCCTGGAAAAGGGCTTGAGTGGATGGGGGGTTTTA TTCCTGAAGATGGTGACACAATCTACGCACAGAAGTTCCAGGGCAGAGTCACCATGACCGAGGACACATCTACAGAC ACAGCCTACATGGACCTGAGCCAGCCTGAGATCTGAGGACGCGGCCGTGTATTACTGTACATCAGGCTGGGCAGCACC TGGATACAATTACGGAATGGCCGTCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
2315	YANG-2302	VH domain amino acid sequence	QVQLVQSGAEVRKPGASVKVSCKVSGYTLPELAIHWVRQAPGKGLEWMGGFIPEDGDTIYAQKFQGRVTMTEDTSTD TAYMDLTSLRSEDAAVYYCTSGWAAPGYNYGMAVWGQGTTVTVSS
2316	YANG-2302	HCDR1	GYTLPELA
2317	YANG-2302	HCDR2	FIPEDGDT
2318	YANG-2302	HCDR3	TSGWAAPGYNYGMAV
2319	YANG-2302	VL domain nucleic acid sequence	GAAGTTGTGTTGACGCAGTCTCCAGGCACTTTGTCTTTGTCTTCAGGGGAAAGAGCCACCCTCTCCTGCAGGGCCAG TCAGAGTGTTAGCAGTAACTACTTAGCCTGGTACCAGAAGAAACCTGGCCAGGCTCCCAGGCTCCTCATTATAGGTG CATCCAGCAGGGTCACTGGCATCCCAGACAGGTTCGGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAGC AGACTGGAGCCTGAAGATTTTGCAGTGTATTACTGTCAACAATATGATGCCTCACCGTACAGTTTTGGCCAGGGGAC CAAGCTGGACATCAAA

SEQ ID NO	Clone ID	Description	Sequence
2320	YANG-2302	VL domain amino acid sequence	EVVLTQSPGTLSLSSGERATLSCRASQSVSSNYLAWYQKKPGQAPRLLIYGASSRVTGIPDRFGGSGSGTDFTLTIS RLEPEDFAVYYCQQYDASPYSFGQGTKLDIK
2321	YANG-2302	LCDR1	QSVSSNY
2322	YANG-2302	LCDR2	GAS
2323	YANG-2302	LCDR3	QQYDASPYS
2324	YANG-2303	VH domain nucleic acid sequence	CAGGTCCAGTTGGTACAGTCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAGGGTCTCCTGCAAGGTTTCCGG ATACACCCTCCCTGAATTAGCCATACACTGGGTGCGACAGGCTCCTGGAAAAGGGCTTGAGTGGATGGGAGGTTTTG ATCCTGAGGATGGTGAGACAATCTACGCACAGAAGTTCCAGGGTAGAGTCATCATGACCGAGGACACATCCACAGAC ACAGCCTACATGGACCTGAGCAGCCTGAGATCTGAGGACACGGCCGTGTATTACTGTGTAAAAACCTGGGCAGCGCC CGGATATAATTACGGTTTGGACACCTGGGGCCAAGGGACCACGGTCACCGTCTCCTCA
2325	YANG-2303	VH domain amino acid sequence	QVQLVQSGAEVKKPGASVRVSCKVSGYTLPELAIHWVRQAPGKGLEWMGGFDPEDGETIYAQKFQGRVIMTEDTSTD TAYMDLSSLRSEDTAVYYCVKTWAAPGYNYGLDTWGQGTTVTVSS
2326	YANG-2303	HCDR1	GYTLPELA
2327	YANG-2303	HCDR2	FDPEDGET
2328	YANG-2303	HCDR3	VKTWAAPGYNYGLDT
2329	YANG-2303	VL domain nucleic acid sequence	GAAATTGTGTTGACGCAGTCTCCAGGCATCCTGTCTTTGTCTCCAGGGGAAAGTGCCACCCTCTCCTGCAGGGCCAG TCAGAGTATTGCCAGCAACTACTTAGCCTGGTTCCAGCAGAAACCTGGCCAGGCTCCCAGGCTCCTCATCTATGGTG CATCCAGCAGGGCCGCTGGCTTCCCAGACAGGTTCAGTGGCAGTGGGTCTGGGACAGACTTCACTCTCACCATCAAG AGACTGGAGCCTGAAGATTCTGCAGTGTATTATTGTCAGCACTATGGTAGCTCACCGTGGCAGTTTTGGCCAGGGAC CAACCTGGAGATCAAA
2330	YANG-2303	VL domain amino acid sequence	EIVLTQSPGILSLSPGESATLSCRASQSIASNYLAWFQQKPGQAPRLLIYGASSRAAGFPDRFSGSGSGTDFTLTIK RLEPEDSAVYYCQHYGSSPCSFGQGTNLEIK

SEQ ID NO	Clone ID	Description	Sequence
2331	YANG-2303	LCDR1	QSIASNY
2332	YANG-2303	LCDR2	GAS
2333	YANG-2303	LCDR3	QHYGSSPCS
2334	YANG-2304	VH domain nucleic acid sequence	CAGGTCCAGCTGGTACAGTCTGGGACTGAAGTGAAGAAGCCTGGGGCCTCAGTGAAGGTCTCCTGCAAGGTTTCCGG ATACACCCTCCCTGAATTGGCCATTCACTGGGTGCGACAGGCTCCTGGAAAAGGGCTTGAGTGGATGGGAACTTTG ATCCTGAAGATGGTGAAACAATCTGCGCACAGAAGTTCCAGGGCAGAGTCACCATGACCGAGGACACATCTACAGAC ACAGCCTACATGGACCTGAGCAGCCTCAGATCTGAGGACACGGCCGTTTATTACTGTGCAACAACGTCGATTATAGC AGCTCGGTGGTGGTTCGACCCCTGGGGCCAGGGAACCCTGGTCACCGTCTCCTCA
2335	YANG-2304	VH domain amino acid sequence	QVQLVQSGTEVKKPGASVKVSCKVSGYTLPELAIHWVRQAPGKGLEWMGTFDPEDGETICAQKFQGRVTMTEDTSTD TAYMDLSSLRSEDTAVYYCATTSIIAARWWFDPWGQGTLVTVSS
2336	YANG-2304	HCDR1	GYTLPELA
2337	YANG-2304	HCDR2	FDPEDGET
2338	YANG-2304	HCDR3	ATTSIIAARWWFDP
2339	YANG-2304	VL domain nucleic acid sequence	CAATCTGCCCTGACTCAGCCTCCCTCCGCGTCCGGGTCTCCTGGACAGTCAGTCACCATCTCCTGCACTGGAACCAG CAGTGACGTTGGTGGTTATGACTATGTCTCCTGGTACCAACACCCAGGCAAAGCCCCCAAACTCATGATTTATG AGGTCAGTAAGCGGCCCTCAGGGTCCCTGATCGCTTCTCTGGCTCCAAGTCTGGCAACACGGCCTCCCTGACCGTC TCTGGGCTCCAGGCTGAGGATGAGGCTGATTATTACTGCAGTTCATTTGCAGGCAGCAACAATGTGGTTTTCGGCGG AGGGGCCAAGCTGACCGTCCTG
2340	YANG-2304	VL domain amino acid sequence	QSALTQPPSASGSPGQSVTISCTGTSSDVGGYDYVSWYQQHPGKAPKLMIYEVSKRPSGVPDRFSGSKSGNTASLTV SGLQAEDEADYYCSSFAGSNNVVFGGGAKLTVL
2341	YANG-2304	LCDR1	SSDVGGYDY
2342	YANG-2304	LCDR2	EVS

SEQ ID NO	Clone ID	Description	Sequence
2343	YANG-2304	LCDR3	SSFAGSNNVV
2344	YANG-2305	VH domain nucleic acid sequence	CAGGTGCAGCTGGTGGAGTCTGGGGGAGGCGTGGTCCAGCCTGGGAGGTCCCTGAGACTCTCCTGTGCAGCGTCTGG ATTCACCTTCAGTAGTTATGGCATGCACTGGGTCCGCCAGGCTCCAGGCAAGGGGCTGGAGTGGGTGGCAATTATTT GGTATGATGGAAGTAAGAAATACTATGCAGACTCCGTGAAGGGCCGATTCACCATCTCCAGAGACAATTCCAAGAAC ACGCTGAATCTGCAAATGAACAGCCTGAGAGCCGAGGACACGGCTGTGTATTACTGTGCGAGAGAAGAGGATATAGT GGCTTCGGGGGGGGCTCTATTACAACTTCAACGGTATGGACGTCTGGGGCCAAGGGACCACGGTCACCGTTTCCTCA
2345	YANG-2305	VH domain amino acid sequence	QVQLVESGGGVVQPGRSLRLSCAASGFTFSSYGMHWVRQAPGKGLEWVAIWYDGSKKYYADSVKGRFTISRDNSKN TLNLQMNSLRAEDTAVYYCAREEDIVASGGLYYNFNGMDVWGQGTTVTVSS
2346	YANG-2305	HCDR1	GFTFSSYG
2347	YANG-2305	HCDR2	IWYDGSKK
2348	YANG-2305	HCDR3	AREEDIVASGGLYYNFNGMDV
2349	YANG-2305	VL domain nucleic acid sequence	TCCTATGAGCTGACTCAGCCACCCTCAGTGTCCGTGTCCCCAGGACAGACAGCCAGCATCACCTGCTCTGGAGATAA ATTGGGGGATATAAATATGCTTGCTGGTATCAGCAGAAGCCAGGCCAGTCCCCTGTGCTGGTCATCTATCAAGATAGCA AGCGGCCCTCAGGGATCCCTGAGCGATTCTCTGGCTCCAACTCTGGGAACACAGCCACTCTGACCATCAACGGGACC CAGGCTATGGATGAGGCTGACTATTTCTGTCAGGCGTGGGACAGCACCACTGTGGTATTCGGCGGAGGGACCAAGCT GACCGTCCTA
2350	YANG-2305	VL domain amino acid sequence	SYELTQPPSVSVSPGQTASITCSGDKLGDKYACWYQQKPGQSPVLVIYQDSKRPSGIPERFSGSNSGNTATLTINGT QAMDEADYFCQAWDSTTVVFGGGTKLTVL
2351	YANG-2305	LCDR1	KLGDKY
2352	YANG-2305	LCDR2	QDS
2353	YANG-2305	LCDR3	QAWDSTTVV

SEQ ID NO	Clone ID	Description	Sequence
2354	YANG-2306	VH domain nucleic acid sequence	CAGGTCCAGCTGGTACAATCTGGGGCTGAGGTGAAGAAGCCTGGGGCCTCAGTGAAGGTCTCCTGCAAGGTTTCCGG ATACACCCTCCCTGAAATATCCATACACTGGGTGCGACAGGCTCCTGGAAAAGGGCTTGAGTGGATGGGAGGTTTTG ATCCTGAAGATGGTGAAACAATCTACGCACAGAAGTTCCAGGGCAGAGTGATCATGACCGAGGACACATCTACAGAC ACAGCCTATATGGACCTGAGCAGCCTGAGATCTGAGGACACGGCCGTGTATTTCTGTGCAGCTGCCCCGGCTATAGC TTCAGCTTCAACCTTCTGGCTCGACCCCTGGGGCCAGGGAACCCTGGTCACCGTCTCCACA
2355	YANG-2306	VH domain amino acid sequence	QVQLVQSGAEVKKPGASVKVSCKVSGYTLPEISIHWVRQAPGKGLEWMGGFDPEDGETIYAQKFQGRVIMTEDTSTD TAYMDLSSLRSEDTAVYFCAAAPAIASASTFWLDPWGQGTLVTVST
2356	YANG-2306	HCDR1	GYTLPEIS
2357	YANG-2306	HCDR2	FDPEDGET
2358	YANG-2306	HCDR3	AAAPAIASASTFWLDP
2359	YANG-2306	VL domain nucleic acid sequence	CAGTCTGCCCTGACTCAGCCTCCCTCCGCGTCCGGGTCTCCTGGACAGTCAGTCACCATCTCCTGCACTGGAACCAG CAGTGACGTTGGTGGTTATAACTATGTCTCCTGGTACCAACAGCACCCAGGCAAAGCCCCCAAACTCATGATTTATG AGGTCACTAAGCGGCCCTCAGGGGTCCCTGATCGCTTCTCTGGCTCCAAGTCTGACAACACGGCCTCCCTGACCGTC TCTGGGCTCCAGGCTGAGGATGAGGCTGATTATTACTGCAGTTCATATGCAGGCAGCAACAATTTGGTATTCGGCGG AGGGACCAAGCTGACCGTCCTA
2360	YANG-2306	VL domain amino acid sequence	QSALTQPPSASGSPGQSVTISCTGTSSDVGGYNYVSWYQQHPGKAPKLMIYEVTKRPSGVPDRFSGSKSDNTASLTV SGLQAEDEADYYCSSYAGSNNLVFGGGTKLTVL
2361	YANG-2306	LCDR1	SSDVGGYNY
2362	YANG-2306	LCDR2	EVT
2363	YANG-2306	LCDR3	SSYAGSNNLV

Table 2 – constant region sequences:

417	Human IgG1 constant region	IGHG1*01	Human Heavy Chain Constant Region (IGHG1*01) Nucleotide Sequence
			gcctccaccaagggcccatcggtcttccccctggcaccctcctccaagagcacctctggg ggcacagcggccctgggctgcctggtcaaggactacttccccgaaccggtgacggtgtcg tggaactcaggcgccctgaccagcggcgtgcacaccttcccggctgtcctacagtcctca ggactctactccctcagcagcgtggtgaccgtgccctccagcagcttgggcacccagacc tacatctgcaacgtgaatcacaagcccagcaacaccaaggtggacaagaaagttgagccc aaatcttgtgacaaaactcacacatgcccaccgtgcccagcacctgaactcctggggga ccgtcagtcttcctcttccccccaaaacccaaggacaccctcatgatctcccggacccct gaggtcacatgcgtggtggtggacgtgagccacgaagaccctgaggtcaagttcaactgg tacgtggacggcgtggaggtgcataatgccaagacaaagccgcgggaggagcagtacaac agcacgtaccgggtggtcagcgtcctcaccgtcctgcaccaggactggctgaatggcaag gagtacaagtgcaaggtctccaacaaagccctcccagcccccatcgagaaaaccatctcc aaagccaaagggcagccccgagaaccacaggtgtacaccctgcccccatcccgggatgag ctgaccaagaaccaggtcagcctgacctgcctggtcaaaggcttctatcccagcgacatc gccgtggagtgggagagcaatgggcagccggagaacaactacaagaccacgcctcccgtg ctggactccgacggctccttctacagcaagctcaccgtggacaagagcaggtgg cagcaggggaacgtcttctcatgctccgtgatgcatgaggctctgcacaaccactacacg cagaagagcctctccctgtctccgggtaaa
418			Human Heavy Chain Constant Region (IGHG1*01) Protein Sequence (P01857)
			ASTKGPSVFPLAPSSKSTSGGTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSS GLYSLSSVVTVPSSSLGTQTYICNVNHKPSNTKVDKKVEPKSCDKTHTCPPCPAPELLGG PSVFLFPPKPKDTLMISRTPEVTCVVVDVSHEDPEVKFNWYVDGVEVHNAKTKPREEQYN STYRVVSVLTVLHQDWLNGKEYKCKVSNKALPAPIEKTISKAKGQPREPQVYTLPPSRDE LTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSKLTVDKSRW QQGNVFSCSVMHEALHNHYTQKSLSLSPGK
419	Human IgG1 constant region	IGHG1*02 or IGHG1*05	Human Heavy Chain Constant Region (IGHG1*02 or IGHG1*05) Nucleotide Sequence
			gcctccaccaagggcccatcggtcttccccctggcaccctcctccaagagcacctctggg ggcacagcggccctgggctgcctggtcaaggactacttccccgaaccggtgacggtgtcg tggaactcaggcgccctgaccagcggcgtgcacaccttcccggctgtcctacagtcctca ggactctactccctcagcagcgtggtgaccgtgccctccagcagcttgggcacccagacc tacatctgcaacgtgaatcacaagcccagcaacaccaaggtggacaagaaagttgagccc aaatcttgtgacaaaactcacacatgcccaccgtgcccagcacctgaactcctggggga ccgtcagtcttcctcttccccccaaaacccaaggacaccctcatgatctcccggacccct gaggtcacatgcgtggtggtggacgtgagccacgaagaccctgaggtcaagttcaactgg tacgtggacggcgtggaggtgcataatgccaagacaaagccgcgggaggagcagtacaac agcacgtaccgtgtggtcagcgtcctcaccgtcctgcaccaggactggctgaatggcaag gagtacaagtgcaaggtctccaacaaagccctcccagcccccatcgagaaaaccatctcc aaagccaaagggcagccccgagaaccacaggtgtacaccctgcccccatcccgggatgag ctgaccaagaaccaggtcagcctgacctgcctggtcaaaggcttctatcccagcgacatc gccgtggagtgggagagcaatgggcagccggagaacaactacaagaccacgcctcccgtg ctggactccgacggctccttctacagcaagctcaccgtggacaagagcaggtgg

			cagcaggggaacgtcttctcatgctccgtgatgcatgagggtctgcacaaccactacacg cagaagagcctctccctgtctccgggtaaa
420		Human Heavy Chain Constant Region (IGHG1*02) Protein Sequence	A S T K G P S V F P L A P S S K S T S G G T A A L G C L V K D Y F P E P V T V S W N S G A L T S G V H T F P A V L Q S S G L Y S L S S V V T V P S S S L G T Q T Y I C N V N H K P S N T K V D K K V E P K S C D K T H T C P P C P A P E L L G G P S V F L F P P K P K D T L M I S R T P E V T C V V V D V S H E D P E V K F N W Y V D G V E V H N A K T K P R E E Q Y N S T Y R V V S V L T V L H Q D W L N G K E Y K C K V S N K A L P A P I E K T I S K A K G Q P R E P Q V Y T L P P S R D E L T K N Q V S L T C L V K G F Y P S D I A V E W E S N G Q P E N N Y K T T P P V L D S D G S F F L Y S K L T V D K S R W Q Q G N V F S C S V M H E A L H N H Y T Q K S L S L S P G K
421	Human IgG1 constant region	Human Heavy Chain Constant Region (IGHG1*03) Nucleotide Sequence (Y14737)	gcctccaccaagggcccatcggtcttccccctggcaccctcctccaagagcacctctggg ggcacagcggccctgggctgcctggtcaaggactacttccccgaaccggtgacggtgtcg tggaactcaggcgccctgaccagcggcgtgcacaccttcccggctgtcctacagtcctca ggactctactccctcagcagcgtggtgaccgtgccctccagcagcttgggcacccagacc tacatctgcaacgtgaatcacaagcccagcaacaccaaggtggacaagagagttgagccc aaatcttgtgacaaaactcacacatgcccaccgtgcccagcacctgaactcctggggga ccgtcagtcttcctcttccccccaaaacccaaggacaccctcatgatctcccggaccct gaggtcacatgcgtggtggacgtgagccacgaagaccctgaggtcaagttcaactgg tacgtggacggcgtggaggtgcataatgccaagacaaagccgcgggaggagcagtacaac agcacgtaccgtgtggtcagcgtcctcaccgtcctgcaccaggactggctgaatggcaag gagtacaagtgcaaggtctccaacaaagccctcccagcccccatcgagaaaaccatctcc aaagccaaagggcagccccgagaaccacaggtgtacaccctgcccccatcccgggaggag atgaccaagaaccaggtcagcctgacctgcctggtcaaaggcttctatcccagcgacatc gccgtggagtgggagagcaatgggcagccggagaacaactacaagaccacgcctcccgtg ctggactccgacggctccttcttcctctatagcaagctcaccgtggacaagagcaggtgg cagcaggggaacgtcttctcatgctccgtgatgcatgaggctctgcacaaccactacacg cagaagagcctctccctgtctccgggtaaa
422		Human Heavy Chain Constant Region (IGHG1*03) Protein Sequence	A S T K G P S V F P L A P S S K S T S G G T A A L G C L V K D Y F P E P V T V S W N S G A L T S G V H T F P A V L Q S S G L Y S L S S V V T V P S S S L G T Q T Y I C N V N H K P S N T K V D K R V E P K S C D K T H T C P P C P A P E L L G G P S V F L F P P K P K D T L M I S R T P E V T C V V V D V S H E D P E V K F N W Y V D G V E V H N A K T K P R E E Q Y N S T Y R V V S V L T V L H Q D W L N G K E Y K C K V S N K A L P A P I E K T I S K A K G Q P R E P Q V Y T L P P S R E E M T K N Q V S L T C L V K G F Y P S D I A V E W E S N G Q P E N N Y K T T P P V L D S D G S F F L Y S K L T V D K S R W Q Q G N V F S C S V M H E A L H N H Y T Q K S L S L S P G K

423	Human IgG1 constant region	IGHG1*04	Human Heavy Chain Constant Region (IGHG1*04) Nucleotide Sequence	gcctccaccaagggcccatcggtcttccccctggcaccctcctccaagagcacctctggg ggcacagcggccctgggctgcctggtcaaggactacttccccgaaccggtgacggtgtcg tggaactcaggcgccctgaccagcggcgtgcacaccttcccggctgtcctacagtcctca ggactctactccctcagcagcgtggtgaccgtgccctccagcagcttgggcacccagacc tacatctgcaacgtgaatcacaagcccagcaacaccaaggtggacaagaaagttgagccc aaatcttgtgacaaaactcacacatgcccaccgtgcccagcacctgaactcctgggggga ccgtcagtcttcctcttccccccaaaacccaaggacaccctcatgatctcccggacccct gaggtcacatgcgtggtggtggacgtgagccacgaagaccctgaggtcaagttcaactgg tacgtggacggcgtggaggtgcataatgccaagacaaagccgcgggaggagcagtacaac agcacgtaccgtgtggtcagcgtcctcaccgtcctgcaccaggactggctgaatggcaag gagtacaagtgcaaggtctccaacaaagccctcccagcccccatcgagaaaaccatctcc aaagccaaagggcagccccgagaaccacaggtgtacaccctgcccccatcccgggatgag ctgaccaagaaccaggtcagcctgacctgcctggtcaaaggcttctatcccagcgacatc gccgtggagtgggagagcaatgggcagccggagaacaactacaagaccacgcctcccgtg ctggactccgacggctccttcttcctctacagcaagctcaccgtggacaagagcaggtgg cagcaggggaacgtcttctcatgctccgtgatgcatgaggctctgcacaaccactacacg cagaagagcctctccctgtctccgggtaaa
424			Human Heavy Chain Constant Region (IGHG1*04) Protein Sequence	ASTKGPSVFPLAPSSKSTSGGTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSS GLYSLSSVVTVPSSSLGTQTYICNVNHKPSNTKVDKKVEPKSCDKTHTCPPCPAPELLGG PSVFLFPPKPKDTLMISRTPEVTCVVVDVSHEDPEVKFNWYVDGVEVHNAKTKPREEQYN STYRVVSVLTVLHQDWLNGKEYKCKVSNKALPAPIEKTISKAKGQPREPQVYTLPPSRDE LTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSKLTVDKSRW QQGNIFSCSVMHEALHNHYTQKSLSLSPGK
425	Disabled Human IgG1 heavy chain constant region	Disabled human IGHG1*01	Disabled Human IGHG1*01 Heavy Chain Constant Region Nucleotide Sequence.	gcctccaccaagggcccatcggtcttccccctggcaccctcctccaagagcacctctggg ggcacagcggccctgggctgcctggtcaaggactacttccccgaaccggtgacggtgtcg tggaactcaggcgccctgaccagcggcgtgcacaccttcccggctgtcctacagtcctca ggactctactccctcagcagcgtggtgaccgtgccctccagcagcttgggcacccagacc tacatctgcaacgtgaatcacaagcccagcaacaccaaggtggacaagaaagttgagccc aaatcttgtgacaaaactcacacatgcccaccgtgcccagcacctgaactcctgggggca ccgtcagtcttcctcttccccccaaaacccaaggacaccctcatgatctcccggacccct gaggtcacatgcgtggtggtggacgtgagccacgaagaccctgaggtcaagttcaactgg tacgtggacggcgtggaggtgcataatgccaagacaaagccgcgggaggagcagtacaac agcacgtaccgtgtggtcagcgtcctcaccgtcctgcaccaggactggctgaatggcaag gagtacaagtgcaaggtctccaacaaagccctcccagcccccatcgagaaaaccatctcc aaagccaaagggcagccccgagaaccacaggtgtacaccctgcccccatcccgggatgag ctgaccaagaaccaggtcagcctgacctgcctggtcaaaggcttctatcccagcgacatc gccgtggagtgggagagcaatgggcagccggagaacaactacaagaccacgcctcccgtg ctggactccgacggctccttcttcctctacagcaagctcaccgtggacaagagcaggtgg cagcaggggaacgtcttctcatgctccgtgatgcatgaggctctgcacaaccactacacg cagaagagcctctccctgtctccgggtaaa

426		Disabled Human IGHG1*01 Heavy Chain Constant Region Amino Acid Sequence. Two residues that differ from the wild-type sequence are identified in **bold.**	ASTKGPSVFPLAPSSKSTSGGTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSS GLYSLSSVVTVPSSSLGTQTYICNVNHKPSNTKVDKKVEPKSCDKTHTCPPCPAPELL**G**A PSVFLFPPKPKDTLMISRTPEVTCVVVDVSHEDPEVKFNWYVDGVEVHNAKTKPREEQYN STYRVVSVLTVLHQDWLNGKEYKCKVSNKALPAPIEKTISKAKGQPREPQVYTLPPSRDE LTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSKLTVDKSRW QQGNVFSCSVMHEALHNHYTQKSLSLSPGK
427	Human IgG2 constant region	IGHG2*01 or IGHG2*04 or IGHG2*05	Human Heavy Chain Constant Region (IGHG2*01 or IGHG2*03 or IGHG2*05) Nucleotide Sequence	gcctccaccaagggcccatcggtcttccccctggcgccctgctccaggagcacctccgag agcacagccgccctgggctgcctggtcaaggactacttccccgaaccggtgacggtgtcg tggaactcaggcgctctgaccagcggcgtgcacaccttcccagctgtcctacagtcctca ggactctactccctcagcagcgtggtgaccgtgccctccagcaacttcggcacccagacc tacacctgcaacgtagatcacaagcccagcaacaccaaggtggacaagacagttgagcgc aaatgttgtgtcgagtgcccaccgtgcccagcaccacctgtggcaggaccgtcagtcttc ctcttccccccaaaacccaaggacaccctcatgatctcccggacccctgaggtcacgtgc gtggtggtggacgtgagccacgaagaccccgaggttcagttcaactggtacgtggacggc gtggaggtgcataatgccaagacaaagccacgcgggaggagcagttcaacagcacgttccgt gtggtcagcgtcctcaccgtcgtgcaccaggactggctgaacggcaaggagtacaagtgc aaggtctccaacaaaggcctcccagcccccatcgagaaaaccatctccaaaaccaaaggg cagccccgagaaccacaggtgtacaccctgcccccatcccgggaggagatgaccaagaac caggtcagcctgacctgcctggtcaaaggcttctaccccagcgacatcgccgtggagtgg gagagcaatgggcagccggagaacaactacaagaccacacctcccatgctggactccgac ggctccttctttctcctacagcaagctcaccgtggacaagagcaggtggcagcaggggaac gtcttctcatgctccgtgatgcatgaggctctgcacaaccactacacgcagaagagcctc tccctgtctccgggtaaa
428			Human Heavy Chain Constant Region (IGHG2*01) Protein Sequence	ASTKGPSVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSS GLYSLSSVVTVPSSNFGTQTYTCNVDHKPSNTKVDKTVERKCCVECPPCPAPPVAGPSVF LFPPKPKDTLMISRTPEVTCVVVDVSHEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTFR VVSVLTVVHQDWLNGKEYKCKVSNKGLPAPIEKTISKTKGQPREPQVYTLPPSREEMTKN QVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPMLDSDGSFFLYSKLTVDKSRWQQGN VFSCSVMHEALHNHYTQKSLSLSPGK
429	Human IgG2 constant region	IGHG2*02	Human Heavy Chain Constant Region (IGHG2*02) Nucleotide Sequence	GCCTCCACCAAGGGCCCATCGGTCTTCCCCCTGGCGCCCTGCTCCAGGAGCACCTCCGAG AGCACAGCGGCCCTGGGCTGCCTGGTCAAGGACTACTTCCCCGAACCGGTGACGGTGTCG TGGAACTCAGGCGCTCTGACCAGCGGCGTGCACACCTTCCCGGCTGTCCTACAGTCCTCA GGACTCTACTCCCTCAGCAGCGTGGTGACCGTGACCTCCAGCAACTTCGGCACCCAGACC TACACCTGCAACGTAGATCACAAGCCCAGCAACACCAAGGTGGACAAGACAGTTGAGCGC AAATGTTGTGTCGAGTGCCCACCGTGCCCAGCACCACCTGTGGCAGGACCGTCAGTCTTC CTCTTCCCCCCAAAACCCAAGGACACCCTCATGATCTCCCGGACCCCTGAGGTCACGTGC GTGGTGGTGGACGTGAGCCACGAAGACCCCGAGGTCCAGTTCAACTGGTACGTGGACGGC ATGGAGGTGCATAATGCCAAGACAAAGCCACGGGAGGAGCAGTTCAACAGCACGTTCCGT GTGGTCAGCGTCCTCACCGTCGTGCACCAGGACTGGCTGAACGGCAAGGAGTACAAGTGC AAGGTCTCCAACAAAGGCCTCCCAGCCCCCATCGAGAAAACCATCTCCAAAACCAAAGGG

			CAGCCCCGAGAACCACAGGTGTACACCCTGCCCCCATCCCGGGAGGAGATGACCAAGAAC
			CAGGTCAGCCTGACCTGCCTGGTCAAAGGCTTCTACCCCAGCGACATCGCCGTGGAGTGG
			GAGAGCAATGGGCAGCCGGAGAACAACTACAAGACCACACCTCCCATGCTGGACTCCGAC
			GGCTCCTTCTTCCTCTACAGCAAGCTCACCGTGGACAAGAGCAGGTGGCAGCAGGGGAAC
			GTCTTCTCATGCTCCGTGATGCATGAGGCTCTGCACAACCACTACACACAGAAGAGCCTC
430			TCCCTGTCTCCGGGTAAA
	Human Heavy Chain Constant Region (IGHG2*02) Protein Sequence		ASTKGPSVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSS
			GLYSLSSVVTVTSSNFGTQTYTCNVDHKPSNTKVDKTVERKCCVECPPCPAPPVAGPSVF
			LFPPKPKDTLMISRTPEVTCVVVDVSHEDPEVQFNWYVDGMEVHNAKTKPREEQFNSTFR
			VVSVLTVVHQDWLNGKEYKCKVSNKGLPAPIEKTISKTKGQPREPQVYTLPPSREEMTKN
			QVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPMLDSDGSFFLYSKLTVDKSRWQQGN
			VFSCSVMHEALHNHYTQKSLSLSPGK
431	Human IgG2 constant region	IGHG2*04	gcctcccaccaagggcccatcggtcttccccctggcgccctgctccaggagcacctccgag
			agcacagcggccctgggctgcctggtcaaggactacttccccgaaccggtgacggtgtcg
			tggaactcaggcgctctgaccagcggcgtgcacaccttcccagctgtcctacagtcctca
	Human Heavy Chain Constant Region (IGHG2*04) Nucleotide Sequence		ggactctactccctcagcagcgtggtgaccgtgccctccagcagcttgggcacccagacc
			tacacctgcaacgtagatcacaagcccagcaacaccaaggtggacaagacagttgagcgc
			aaatgttgtgtcgagtgcccaccgtgcccagcaccacctgtggcaggaccgtcagtcttc
			ctcttccccccaaaacccaaggacaccctcatgatctcccggacccctgaggtcacgtgc
			gtggtggtggacgtgagccacgaagaccccgaggtccagttcaactggtacgtggacggc
			gtggaggtgcataatgccaagacaaagccacgcgggaggagcagttcaacagcacgttccgt
			gtggtcagcgtcctcaccgttgtgcaccaggactggctgaacggcaaggagtacaagtgc
			aaggtctccaacaaaggcctcccagccccatcgagaaaaccatctccaaaaccaaaggg
			cagccccgagaaccacaggtgtacaccctgcccccatcccgggaggagatgaccaagaac
			caggtcagcctgacctgcctggtcaaaggcttctacccccagcgacatcgccgtggagtgg
			gagagcaatgggcagccggagaacaactacaagaccacacctcccatgctggactccgac
			ggctccttcttcctctacagcaagctcaccgtggacaagagcaggtggcagcaggggaac
			gtcttctcatgctccgtgatgcatgaggctctgcacaaccactacacgcagaagagcctc
432			tccctgtctccgggtaaa
	Human Heavy Chain Constant Region (IGHG2*04) Protein Sequence		ASTKGPSVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSS
			GLYSLSSVVTVPSSSLGTQTYTCNVDHKPSNTKVDKTVERKCCVECPPCPAPPVAGPSVF
			LFPPKPKDTLMISRTPEVTCVVVDVSHEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTFR
			VVSVLTVVHQDWLNGKEYKCKVSNKGLPAPIEKTISKTKGQPREPQVYTLPPSREEMTKN
			QVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPMLDSDGSFFLYSKLTVDKSRWQQGN
			VFSCSVMHEALHNHYTQKSLSLSPGK
433	Human IgG2 constant region	IGHG2*06	GCCTCCACCAAGGGCCCATCGGTCTTCCCCCTGGCGCCCTGCTCCAGGAGCACCTCCGAG
			AGCACAGCGGCCCTGGGCTGCCTGGTCAAGGACTACTTCCCCGAACCGGTGACGGTGTCG
			TGGAACTCAGGCGCTCTGACCAGCGGCGTGCACACCTTCCCGGCTGTCCTACAGTCCTCA
	Human Heavy Chain Constant Region (IGHG2*06) Nucleotide Sequence		GGACTCTACTCCCTCAGCAGCGTGGTGACCGTGCCCTCCAGCAACTTCGGCACCCAGACC
			TACACCTGCAACGTAGATCACAAGCCCAGCAACACCAAGGTGGACAAGACAGTTGAGCGC
			AAATGTTGTGTCGAGTGCCCACCGTGCCCAGCACCACCTGTGGCAGGACCGTCAGTCTTC

			CTCTTCCCCCCAAAACCCAAGGACACCCTCATGATCTCCCGGACCCCTGAGGTCACGTGC GTGGTGGTGGACGTGAGCCACGAAGACCCCGAGGTCCAGTTCAACTGGTACGTGGACGGC GTGGAGGTGCATAATGCCAAGACAAAGCCACGGGAGGAGCAGTTCAACAGCACGTTCCGT GTGGTCAGCGTCCTCACCGTCGTGCACCAGGACTGGCTGAACGGCAAGGAGTACAAGTGC AAGGTCTCCAACAAAGGCCTCCCAGCCCCCATCGAGAAAACCATCTCCAAAACCAAAGGG CAGCCCCGAGAACCACAGGTGTACACCCTGCCCCCATCCCGGGAGGAGATGACCAAGAAC CAGGTCAGCCTGACCTGCCTGGTCAAAGGCTTCTACCCCAGCGACATCTCCGTGGAGTGG GAGAGCAATGGGCAGCCGGAGAACAACTACAAGACCACACCTCCCATGCTGGACTCCGAC GGCTCCTTCTTCCTCTACAGCAAGCTCACCGTGGACAAGAGCAGGTGGCAGCAGGGGAAC GTCTTCTCATGCTCCGTGATGCATGAGGCTCTGCACAACCACTACACACAGAAGAGCCTC
434		Human Heavy Chain Constant Region (IGHG2*06) Protein Sequence	ASTKGPSVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSS GLYSLSSVVTVPSSNFGTQTYTCNVDHKPSNTKVDKTVERKCCVECPPCPAPPVAGPSVF LFPPKPKDTLMISRTPEVTCVVVDVSHEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTFR VVSVLTVVHQDWLNGKEYKCKVSNKGLPAPIEKTISKTKGQPREPQVYTLPPSREEMTKN QVSLTCLVKGFYPSDISVEWESNGQPENNYKTTPPMLDSDGSFFLYSKLTVDKSRWQQGN VFSCSVMHEALHNHYTQKSLSLSPGK
435	Human IgG4 constant region	IGHG4*01 or IGHG4*04	Human Heavy Chain Constant Region (IGHG4*01 or IGHG4*04) Nucleotide Sequence	gcttccaccaagggcccatccgtcttccccctggcgccctgctccaggagcacctccgag agcacagccgccctgggctgcctggtcaaggactacttccccgaaccggtgacggtgtcg tggaactcaggcgccctgaccagcggcgtgcacaccttcccggctgtcctacagtcctca ggactctactccctcagcagcgtggtgaccgtgccctccagcagcttgggcacgaagacc tacacctgcaacgtagatcacaagcccagcaacaccaaggtggacaagagagttgagtcc aaatatggtcccccatgcccatcatgcccagcacctgagttcctggggggaccatcagtc ttcctgttccccccaaaacccaaggacactctcatgatctcccggacccctgaggtcacg tgcgtggtggtggacgtgagccaggaagaccccgaggtccagttcaactggtacgtggat ggcgtggaggtgcataatgccaagacaaagccgcgggaggagcagttcaacagcacgtac cgtgtggtcagcgtcctcaccgtcctgcaccaggactggctgaacggcaaggagtacaag tgcaaggtctccaacaaaggcctcccgtcctccatcgagaaaaccatctccaaagccaaa gggcagccccgagagccacaggtgtacaccctgcccccatcccaggaggagatgaccaag aaccaggtcagcctgacctgcctggtcaaaggcttctaccccagcgacatcgccgtggag tgggagagcaatgggcagccggagaacaactacaagaccacgcctcccgtgctggactcc gacggctccttcttcctctacagcaggctaaccgtggacaagagcaggtggcaggaggggg aatgtcttctcatgctccgtgatgcatgaggctctgcacaaccactacacgcagaagagc ctctccctgtctctgggtaaa	ASTKGPSVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSS GLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRVESKYGPPCPSCPAPEFLGGPSV FLFPPKPKDTLMISRTPEVTCVVVDVSQEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTY RVVSVLTVLHQDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPSQEEMTK NQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSRLTVDKSRWQEG NVFSCSVMHEALHNHYTQKSLSLSLGK
436				

437	Human IgG4 constant region	IGHG4*02	Human Heavy Chain Constant Region (IGHG4*02) Nucleotide Sequence	gcttccaccaagggcccatccgtcttccccctggcgccctgctccaggagcacctccgag agcacagccgccctgggctgcctggtcaaggactacttccccgaaccggtgacggtgtcg tggaactcaggcgccctgaccagcggcgtgcacaccttcccggctgtcctacagtcctca ggactctactccctcagcagcgtggtgaccgtgccctccagcagcttgggcacgaagacc tacacctgcaacgtagatcacaagcccagcaacaccaaggtggacaagagagttgagtcc aaatatggtcccccgtgcccatcatgcccagcacctgagttcctgggggaccatcagtc ttcctgttccccccaaaacccaaggacactctcatgatctcccggacccctgaggtcacg tgcgtggtggtggacgtgagccaggaagaccccgaggtccagttcaactggtacgtggat ggcgtggaggtgcataatgccaagacaaagccgcgggaggagcagttcaacagcacgtac cgtgtggtcagcgtcctcaccgtcctgcaccaggactggctgaacggcaaggagtacaag tgcaaggtctccaacaaaggcctcccgtcctccatcgagaaaaccatctccaaagccaaa gggcagccccgagagccacaggtgtacaccctgcccccatcccaggaggagatgaccaag aaccaggtcagcctgacctgcctggtcaaaggcttctaccccagcgacatcgccgtggag tgggagagcaatgggcagccggagaacaactacaagaccacgcctcccgtgctggactcc gacggctccttcttcctctacagcaggctaaccgtggacaagagcaggtggcaggaggggg aatgtcttctcatgctccgtgatgcatgaggctctgcacaaccactacacgcagaagagc ctctccctgtctctgggtaaa	ASTKGPSVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSS GLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRVESKYGPPCPSCPAPEFLGGPSV FLFPPKPKDTLMISRTPEVTCVVVDVSQEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTY RVVSVLTVVHQDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPSQEEMTK NQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSRLTVDKSRWQEG NVFSCSVMHEALHNHYTQKSLSLSLGK	gcttccaccaagggcccatccgtcttccccctggcgccctgctccaggagcacctccgag agcacagccgccctgggctgcctggtcaaggactacttccccgaaccggtgacggtgtcg tggaactcaggcgccctgaccagcggcgtgcacaccttcccggctgtcctacagtcctca ggactctactccctcagcagcgtggtgaccgtgccctccagcagcttgggcacgaagacc tacacctgcaacgtagatcacaagcccagcaacaccaaggtggacaagagagttgagtcc aaatatggtcccccgtgcccatcatgcccagcacctgagttcctgggggaccatcagtc ttcctgttccccccaaaacccaaggacactctcatgatctcccggacccctgaggtcacg tgcgtggtggtggacgtgagccaggaagaccccgaggtccagttcaactggtacgtggat ggcgtggaggtgcataatgccaagacaaagccgcgggaggagcagttcaacagcacgtac cgtgtggtcagcgtcctcaccgtcctgcaccaggactggctgaacggcaaggagtacaag tgcaaggtctccaacaaaggcctcccgtcctccatcgagaaaaccatctccaaagccaaa gggcagccccgagagccacaggtgtacaccctgcccccatcccaggaggagatgaccaag aaccaggtcagcctgacctgcctggtcaaaggcttctaccccagcgacatcgccgtggag tgggagagcaatgggcagccggagaacaactacaagaccacgcctcccgtgctggactcc gacggctccttcttcctctacagcaagctcaccgtggacaagagcaggtggcaggaggggg aacgtcttctcatgctccgtgatgcatgaggctctgcacaaccactacacgcagaagagc ctctccctgtctctgggtaaa
438				
439	Human IgG4 constant region	IGHG4*03	Human Heavy Chain Constant Region (IGHG4*03) Nucleotide Sequence	

440		Human Heavy Chain Constant Region (IGHG4*03) Protein Sequence	ASTKGPSVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSS GLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRVESKYGPPCPSCPAPEFLGGPSV FLFPPKPKDTLMISRTPEVTCVVVDVSQEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTY RVVSVLTVLHQDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPSQEEMTK NQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSKLTVDKSRWQEG NVFSCSVMHEALHNHYTQKSLSLSLGK
441	Human IgG4-PE constant region	IGHG4- PE	gcctccaccaagggcccatccgtcttccccctggcgccctgctccaggagcacctccgag agcacggccgccctgggctgcctggtcaaggactacttccccgaaccagtgacggtgtcg tggaactcaggcgccctgaccagcggcgtgcacaccttcccggctgtcctacagtcctca ggactctactccctcagcagcgtggtgaccgtgccctccagcagcttgggcacgaagacc tacacctgcaacgtagatcacaagcccagcaacaccaaggtggacaagagagttgagtcc aaatatggtcccccatgcccaccatgcccagcgcctgaatttgaggggggaccatcagtc ttcctgttccccccaaaacccaaggacactctcatgatctcccggacccctgaggtcacg tgcgtggtggtggacgtgagccaggaagaccccgaggtccagttcaactggtacgtggat ggcgtggaggtgcataatgccaagacaaagccgcgggaggagcagttcaacagcacgtac cgtgtggtcagcgtcctcaccgtcctgcaccaggactggctgaacggcaaggagtacaag tgcaaggtctccaacaaaggcctcccgtcatcgagaaaaccatctccaaagccaaa gggcagccccgagagccacaggtgtacaccctgcccccatcccaggaggagatgaccaag aaccaggtcagcctgacctgcctggtcaaaggcttctaccccagcgacatcgccgtggag tgggagagcaatgggcagccggagaacaactacaagaccacgcctcccgtgctggactcc gacggatccttcttcctctacagcaggctaaccgtggacaagagcaggtggcaggaggggg aatgtcttctcatgctccgtgatgcatgaggctctgcacaaccactacacacagaagagc ctctccctgtctctgggtaaa
442	Human Heavy Chain Constant Region (IGHG4-PE) Nucleotide Sequence Version B		gcctccaccaagggacctagcgtgtttcctctggccccctgttccaggtccacaagcgag tccaccgctgccctcggctgtctggtgaaagactacttttccgagccccgtgaccgtctcc tggaatagcggagccctgacctccggcgtgcacacatttcccgccgtgctgcagagcagc ggactgtatagcctgagcagcgtggtgaccgtgcccagctccagcctcggcaccaaaacc tacacctgcaacgtggaccacaagccctccaacaccaaggtggacaagcgggtggagagc aagtacggccccccttgccctcctttgtcctgccctgagttcgagggaggacccctccgtg ttcctgtttccccccaaacccaaggacaccctgatgatctcccggacacccgaggtgacc tgtgtggtcgtggacgtcagccaggaggaccccgaggtgcagttcaactggtatgtggac ggcgtggaggtgcacaatgccaaaaccaagcccagggaggagcagttcaattccacctac agggtggtgagcgtgctgaccgtcctgcatcaggattggctgaacggcaaggagtacaag tgcaaggtgtccaacaaggggctgcccagctccatcgagaaaaccatcagcaaggctaag ggccagccgagggagccccaggtgtataccctgcctccagccaggaagagatgaccaag aaccaagtgtccctgacctgcctggtgaagggattctaccccctccgacatcgccgtggag tgggagagcaatgggccagcccgagaacaactacaaaaccacccctcccgtgctcgatagc gacggcagcttctttctctacagccggctgacagtggacaagagcaggtggcaggaggagc aacgtgttctcctgttccgtgatgcacgaggccctgcacaatcactacacccagaagagc ctctccctgtccctgggcaag

443	IGHG4- PE Inactivated IGHG4	Human Heavy Chain Constant Region (IGHG4-PE) Nucleotide Sequence Version C	gccagcaccaagggcccttccgtgtttccccctggccccttgcagcaggagcacctccgaa tccacagctgccctgggctgtctggtgaaggactactttccccgagcccgtgaccgtgagc tggaacagcggcgctctgacatccggcgtccacacctttcctgccgtcctgcagtcctcc ggcctctactccctgtcctccgtggtgaccgtgcctagctcctccctcggcaccaagacc tacacctgtaacgtggaccacaaacccctccaacaccaaggtggacaaacgggtcgagagc aagtacggccctccctgcccctgtcctgcccccgagttcgaaggcggacccagcgtg ttcctgttccctccctaagcccaaggacaccctcatgatcagccggacacccgaggtgacc tgcgtggtggtggatgtgagccaggaggaccctgaggtccagttcaactggtatgtggat ggcgtggaggtgcacaacgccaagacaaagccccgggaagagcagttcaacctccacctac agggtggtcagcgtgctgaccgtgctgcatcaggactggctgaacggcaaggagtacaag tgcaaggtcagcaataaggggctgcccagcagcatcgagaaaaccatctccaaaggctaaa ggccagccccgggaacctcaggtgtacaccctgcctcccagccaggaggagatgaccaag aaccaggtgagcctgacctgcctggtgaaggggttctaccctccgacatcgccgtggag tgggagtccaacggccagcccgagaacaattataagaccacccctcccgtcctcgacagc gacggatccttctttctgtactccaggctgaccgtggataagtccaggtggcaggaagggc aacgtgttcagctgctccgtgatgcacgaggccctgcacaatcactacacccagaagtcc ctgagcctgtccctgggaaag
444	Human Heavy Chain Constant Region (IGHG4-PE) Protein Sequence (Amino acid substitution shown in **BOLD**)		ASTKGPSVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSS GLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRVESKYGPPCP**P**CPAPEF**E**GGPSV FLFPPKPKDTLMISRTPEVTCVVVDVSQEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTY RVVSVLTVLHQDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPSQEEMTK NQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSRLTVDKSRWQEG NVFSCSVMHEALHNHYTQKSLSLSLGK
445	Inactivated Human Heavy Chain Constant Region (IGHG4) Nucleotide Sequence		gcctcccaccaagggcccatccgtcttccccctggcgccctgctccaggagcacctccgag agcacggccgccctgggctgcctggtcaaggactacttccccgaaccagtgacggtgtcg tggaactcaggcgccctgaccagcggcgtgcacaccttcccggctgtcctacagtcctca ggactctactccctcagcagcgtggtgaccgtgccctccagcagcttgggcacgaagacc tacacctgcaacgtagatcacaagcccagcaacaccaaggtggacaagagagttgagtcc aaatatggtcccccatgcccaccatgcccagcgcctccagttgcgggggaccatcagtc ttcctgttccccccaaaacccaaggacactctcatgatctcccggaccctgaggtcacg tgcgtggtggtggacgtgagccaggaagaccccgaggtccagttcaactggtacgtggat ggcgtggaggtgcataatgccaagacaaagccgcgggaggagcagttcaacagcacgtac cgtgtggtcagcgtcctcaccgtcctgcaccaggactggctgaacggcaaggagtacaag tgcaaggtctccaacaaaggcctcccgtcatcgatccaaaaaccatctccaaagccaaa gggcagccccgagagccacaggtgtacaccctgcccccatcccaggaggagatgaccaag aaccaggtcagcctgacctgcctggtcaaaggcttctaccccagcgacatcgccgtggag tgggagagcaatgggcagccggagaacaactacaagaccacgcctcccgtgctggactcc gacggatccttctttctacagcaggctaaccgtggacaagagcaggtggcaggaggggg aatgtcttctcatgctccgtgatgcatgaggctctgcacaaccactacacacagaagagc ctctccctgtctctgggtaaa

446		Inactivated Human Heavy Chain Constant Region (IGHG4) Protein Sequence (inactivating mutations from human IgG4 shown in bold)	ASTKGPSVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSSGLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRVESKYGPPCP**P**CPAP**PVA**GGPSVFLFPPKPKDTLMISRTPEVTCVVVDVSQEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTYRVVSVLTVLHQDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPSQEEMTKNQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSRLTVDKSRWQEGNVFSCSVMHEALHNHYTQKSLSLSLGK
447	Human Ck constant region	IGKC*01	Human Ck Light Chain Constant Region (IGKC*01) Nucleotide Sequence	cgtacggtggccgctcccctccgtgttcatctttcccacctttccgacgagcagctgaaagtccggcaccgcttctgtcgtgtgcctgctgaacaacttctacccccgcgaggccaaggtgcagtggaaggtggacaacgccctgcagtccggcaactcccaggaatccgtgaccgagcaggactccaaggacagcacctactccctgtcctccaccctgaccctgtccaaggccgactacgagaagcacaaggtgtacgcctgcgaagtgacccaccagggcctgtctagcccctgtgaccaagtcttcaacccggggcgagtgt
448			Ck Light Chain Constant Region (IGKC*01) Amino Acid Sequence	RTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQWKVDNALQSGNSQESVTEQDSKDSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC
449	Human Ck constant region	IGKC*02	Ck Light Chain Constant Region (IGKC*02) Nucleotide Sequence	cgaactgtggctgcaccatctgtcttcatcttcccgccatctgatgagcagttgaaatctggaactgcctctgttgtgtgcctgctgaataacttctatcccagagaggccaaagtacagtggaaggtggataacgccctccaatcgggtaactcccaggagagtgtcacagagcaggacagcacctacagcctcagcagcaccctgacgctgagcaaagcagactacgagaaacacaaagtctacgcctgcgaagtcacccatcagggcctgagctcgcccgtcacaaagagcttcaacaggggagagtgt
450			Ck Light Chain Constant Region (IGKC*02) Amino Acid Sequence	RTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQWKVDNALQSGNSQESVTEQDSKDSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC
451	Human Ck constant region	IGKC*03	Ck Light Chain Constant Region (IGKC*03) Nucleotide Sequence	cgaactgtggctgcaccatctgtcttcatcttcccgccatctgatgagcagttgaaatctggaactgcctctgttgtgtgcctgctgaataacttctatcccagagaggccaaagtacagcggaaggtggataacgccctccaatcgggtaactcccaggagagtgtcacagagcaggagcaaggacagcacctacagcctcagcagcaccctgacgctgagcaaagcagactacgagaaacacaaagtctacgcctgcgaagtcacccatcagggcctgagctcgcccgtcacaaag
452			Ck Light Chain Constant Region (IGKC*03) Amino Acid Sequence	RTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQRKVDNALQSGNSQESVTEQESKDSTYSLSSTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC
453	Human Ck constant region	IGKC*04	Ck Light Chain Constant Region (IGKC*04) Nucleotide Sequence	cgaactgtggctgcaccatctgtcttcatcttcccgccatctgatgagcagttgaaatctggaactgcctctgttgtgtgcctgctgaataacttctatcccagagaggccaaagtacagtggaaggtggataacgccctccaatcgggtaactcccaggagagtgtcacagagcaggacagcacctacagcctcagcagcaccctgacgctgagcaaagcagactacgagaaacacaaactctacgcctgcgaagtcacccatcagggcctgagctcgcccgtcacaaag

454		Ck Light Chain Constant Region (IGKC*04) Amino Acid Sequence	RTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQWKVDNALQSGNSQESVTEQD SKDSTYSLSSTLTLSKADYEKHKLYACEVTHQGLSSPVTKSFNRGEC
455	Human Ck constant region	IGKC*05	Ck Light Chain Constant Region (IGKC*05) Nucleotide Sequence	cgaactgtggctgcaccatctgtcttcatcttcccgccatctgatgagcagttgaaatct ggaactgcctctgttgtgtgcctgctgaataacttctatcccagagaggccaaagtacag tggaaggtggataacgccctccaatcgggtaactcccaggagagtgtcacagagcaggac agcaaggacagcacctacagcctcagcaacaccctgacgctgagcaaagcagactacgag aaacacaaagtctacgcctgcgaagtcacccatcagggcctgagctcgcccgtcacaaag agcttcaacaggggagagtgc
456			Ck Light Chain Constant Region (IGKC*05) Amino Acid Sequence	RTVAAPSVFIFPPSDEQLKSGTASVVCLLNNFYPREAKVQWKVDNALQSGNSQESVTEQD SKDSTYSLSNTLTLSKADYEKHKVYACEVTHQGLSSPVTKSFNRGEC
457	Human Cλ constant region	IGLC1*01	Cλ Light Chain Constant Region (IGLC1*01) Nucleotide Sequence (ENST00000390321.2)	cccaaggccaaccccacggtcactctgttcccgccctcctctgaggagctccaagccaac aaggccacactagtgtgtctgatcagtgacttctacccgggagctgtgacagtggcttgg aaggcagatggcagccccgtcaaggcgggagtggagaccaaaccctccaaacagagc aacaacaagtacgcggccagcagctacctgagcctgacgcccgagcagtggaagtcccac agaagctacagctgccaggtcacgcatgaagggagcaccgtggagaagacagtggcccct acagaatgttca
458			Cλ Light Chain Constant Region (IGLC1*01) Amino Acid Sequence (A0A075B6K8)	PKANPTVTLFPPSSEELQANKATLVCLISDFYPGAVTVAWKADGSPVKAGVETTKPSKQS NNKYAASSYLSLTPEQWKSHRSYSCQVTHEGSTVEKTVAPTECS
459	Human Cλ constant region	IGLC1*02	Cλ Light Chain Constant Region (IGLC1*02) Nucleotide Sequence Version A	ggtcagcccaaggccaaccccactgtcactctgttcccgccctcctctgaggagctccaa gccaacaaggccacactagtgtgtctgatcagtgacttctacccgggagctgtgacagtg gcctggaaggcagatggcagccccgtcaaggcgggagtggagaccaccaaacccctccaaa cagagcaacaacaagtacgcggccagcagctacctgagcctgacgcccgagcagtggaag tcccacagaagctacagctgccaggtcacgcatgaagggagcaccgtggagaagacagtg gcccctacagaatgttca
460			Cλ Light Chain Constant Region (IGLC1*02) Nucleotide Sequence Version B	ggtcagcccaaggccaaccccactgtcactctgttcccgccctcctctgaggagctccaa gccaacaaggccacactagtgtgtctgatcagtgacttctacccgggagctgtgacagtg gcctggaaggcagatggcagccccgtcaaggcgggagtggagaccaccaaacccctccaaa cagagcaacaacaagtacgcggccagcagctacctgagcctgacgcccgagcagtggaag tcccacagaagctacagctgccaggtcacgcatgaagggagcaccgtggagaagacagtg gcccctacagaatgttca
461	Human Cλ constant region	IGLC1*02 IGLC2*01	Cλ Light Chain Constant Region (IGLC1*02) Amino Acid Sequence	GQPKANPTVTLFPPSSEELQANKATLVCLISDFYPGAVTVAWKADGSPVKAGVETTKPSK QSNNKYAASSYLSLTPEQWKSHRSYSCQVTHEGSTVEKTVAPTECS
462	Human Cλ constant region		Cλ Light Chain Constant Region (IGLC2*01)	ggccagcctaaggccgctccttctgtgaccctgttccccccatcctcccgaggaactgcag gctaacaagggcaccctcgtgtgcctgatcagcgacttctacccgggcgccgtgaccgtg gcctggaaggctgatagctcctcgtgaagggcggcgtggaaaccaccacccctccaag

463	Nucleotide Sequence Version A		cagtccaacaacaaatacgccgcctccctcctaacctgtccctgacccctgagcagtggaag tcccaccggtcctacagctgccaagtgacccacgagggctccaccgtggaaaagaccgtg gctcctaccgagtgctcc
	Cλ Light Chain Constant Region (IGLC2*01) Nucleotide Sequence Version B		ggccagccctaaagctgccccccagcgtcacccctgtttcctccctccagcgaggagctccag gccaacaaggccacactcgtgtgcctgatctccgacttctatcccggccgcctgtgaccgtg gcttggaaagccgactccagccctgtcaaagccggcgtggagaccaccacacccctccaag tcccaccggtcctactcctgtcaggtgacccacgagggctccaccgtggaaaagaccgtc gccccaccgagtgctcc
464	Human Cλ constant region	IGLC2*01 IGLC2*02 or IGLC2*03	Cλ Light Chain Constant Region (IGLC1*02) Amino Acid Sequence	GQPKAAPSVTLFPPSSEELQANKATLVCLISDFYPGAVTVAWKADSSPVKAGVETTTPSK QSNNKYAASSYLSLTPEQWKSHRSYSCQVTHEGSTVEKTVAPTECS
465	Human Cλ constant region		Cλ Light Chain Constant Region (IGLC2*02 or IGLC2*03) Nucleotide Sequence	ggtcagcccaaggctgccccctcggtcactctgttcccgccctcctctgaggagcttcaa gccaacaaggccacactggtgtgtctcataagtgacttctacccgggagccgtgacagtg gcctggaaggcagatagcagccccgtcaaggcgggagtggagaccaccacacccctccaaa caaagcaacaacaagtacgcggccagcagctatctgagcctgacgcctgagcagtggaag tcccacagaagctacagctgccaggtcacgcatgaagggagcaccgtggaagaagacagtg gccctacagaatgttca
467			Cλ Light Chain Constant Region (IGLC2*02) Amino Acid Sequence	GQPKAAPSVTLFPPSSEELQANKATLVCLISDFYPGAVTVAWKADSSPVKAGVETTTPSK QSNNKYAASSYLSLTPEQWKSHRSYSCQVTHEGSTVEKTVAPTECS
468	Human Cλ constant region	IGLC3*01	Cλ Light Chain Constant Region (IGLC3*01) Nucleotide Sequence	cccaaggctgccccctcggtcactctgttcccaccctcctctgaggagcttcaagccaac aaggccacactggtgtgtctcataagtgacttctacccgggagccgtgacagttggtgg aaggcagatagcagccccgtcaaggcgggggtggagaccaccacacccctccaaacaaagc aacaacaagtacgcggccagcagctacctgagcctgacgcctgagcagtggaagtcccac aaaagctacagctgccaggtcacgcatgaagggagcaccgtggagaagacagtttgcccct acggaatgttca
469			Cλ Light Chain Constant Region (IGLC3*01) Amino Acid Sequence	PKAAPSVTLFPPSSEELQANKATLVCLISDFYPGAVTVAWKADSSPVKAGVETTTPSKQS NNKYAASSYLSLTPEQWKSHKSYSCQVTHEGSTVEKTVAPTECS
470	Human Cλ constant region	IGLC3*02	Cλ Light Chain Constant Region (IGLC3*02) Nucleotide Sequence	ggtcagcccaaggctgccccctcggtcactctgttcccaccctcctctgaggagcttcaa gccaacaaggccacactggtgtgtctcataagtgacttctacccgggccagtgacagtt gcctggaaggcagatagcagccccgtcaaggcgggggtggagaccaccacacccctccaaa caaagcaacaacaagtacgcggccagcagctacctgagcctgacgcctgagcagtggaag tcccacaaaagctacagctgccaggtcacgcatgaagggagcaccgtggagaagacagtg gcccctacggaatgttca
471			Cλ Light Chain Constant Region (IGLC1*02) Amino Acid Sequence	GQPKAAPSVTLFPPSSEELQANKATLVCLISDFYPGPVTVAWKADSSPVKAGVETTTPSK QSNNKYAASSYLSLTPEQWKSHKSYSCQVTHEGSTVEKTVAPTECS

472	Human Cλ constant region	IGLC3*03	Cλ Light Chain Constant Region (IGLC3*03) Nucleotide Sequence	ggtcagcccaaggctgccccctcggtcactctgttcccaccctcctctgaggagcttcaa gccaacaaggccacactggtgtgtctcataagtgacttctacccgggagccgtgacagtg gcctggaaggcagatagcagccccgtcaaggcgggagtggagaccaccacacccctccaaa caaagcaacaacaagtacgcggccagcagctacctgagcctgacgcctgagcagtggaag tcccacaaaagctacagctgccaggtcacgcatgaagggagcaccgtggagaaagacagtg
				gccctacagaatgttca
473			Cλ Light Chain Constant Region (IGLC3*03) Amino Acid Sequence	GQPKAAPSVTLFPPSSEELQANKATLVCLISDFYPGAVTVAWKADSSPVKAGVETTTPSK QSNNKYAASSYLSLTPEQWKSHKSYSCQVTHEGSTVEKTVAPTECS
474	Human Cλ constant region	IGLC3*04	Cλ Light Chain Constant Region (IGLC3*04) Nucleotide Sequence	ggtcagcccaaggctgccccctcggtcactctgttcccgccctcctctgaggagcttcaa gccaacaaggccacactggtgtgtctcataagtgacttctacccgggagccgtgacagtg gcctggaaggcagatagcagccccgtcaaggcgggagtggagaccaccacacccctccaaa caaagcaacaacaagtacgcggccagcagctacctgagcctgacgcctgagcagtggaag tcccacagaagctacagctgccaggtcacgcatgaagggagcaccgtggagaaagacagtg
				gccctacagaatgttca
475			Cλ Light Chain Constant Region (IGLC3*04) Amino Acid Sequence	GQPKAAPSVTLFPPSSEELQANKATLVCLISDFYPGAVTVAWKADSSPVKAGVETTTPSK QSNNKYAASSYLSLTPEQWKSHRSYSCQVTHEGSTVEKTVAPTECS
476	Human Cλ constant region	IGLC6*01	Cλ Light Chain Constant Region (IGLC6*01) Nucleotide Sequence	ggtcagcccaaggctgccccatcggtcactctgttcccgccctcctctgaggagcttcaa gccaacaaggccacactggtgtgcctgatcagtgacttctacccgggagctgtgaaagtg gcctggaaggcagatggcagcccgtcaacacgggagtggagaccacacacctccaaaa cagagcaacaacaagtacgcggccagcagctacctgagcctgacgcctgagcagtggaag tcccacagaagctacagctgccaggtcacgcatgaagggagcaccgtggagaagacagtg
				gccctgcagaatgttca
477			Cλ Light Chain Constant Region (IGLC6*01) Amino Acid Sequence	GQPKAAPSVTLFPPSSEELQANKATLVCLISDFYPGAVKVAWKADGSPVNTGVETTTPSK QSNNKYAASSYLSLTPEQWKSHRSYSCQVTHEGSTVEKTVAPAECS
478	Human Cλ constant region	IGLC7*01 or IGLC7*02	Cλ Light Chain Constant Region (IGLC7*01 or IGLC7*02) Nucleotide Sequence	ggtcagcccaaggctgccccatcggtcactctgttcccaccctcctctgaggagcttcaa gccaacaaggccacactggtgtgtctccgtaagtgacttctacccgggagccgtgacagtg gcctggaaggcagatggcagccccgtcaaggtgggagtggagaccaccaaacccctccaaa caaagcaacaacaagtatgcggccagcagctacctgagcctgacgcccgagcagtggaag tcccacagaagctacagctgccggtcacgcatgaagggagcaccgtggagaagacagtg
				gccctgcagaatgctct
479			Cλ Light Chain Constant Region (IGLC7*01) Amino Acid Sequence	GQPKAAPSVTLFPPSSEELQANKATLVCLVSDFYPGAVTVAWKADGSPVKVGVETTKPSK QSNNKYAASSYLSLTPEQWKSHRSYSCRVTHEGSTVEKTVAPAECS
480	Human Cλ constant region	IGLC7*03	Cλ Light Chain Constant Region (IGLC7*03) Nucleotide Sequence	GGTCAGCCCCAAGGCTGCCCCCTCGGTCACTCTGTTCCCACCCTCCTCTGAGGAGCTTCAA GCCAACAAGGCCACACTGGTGTGTCTCGTAAGTGACTTCAACCCGGGAGCCGTGACAGTG GCCTGGAAGGCAGATGGCAGCCCCGTCAAGGTGGGAGTGGAGACCACCAAACCCTCCAAA CAAAGCAACAACAAGTATGCGGCCAGCAGCTACCTGAGCCTGACGCCCGAGCAGTGGAAG

481		Cλ Light Chain Constant Region (IGLC7*03) Amino Acid Sequence	TCCCACAGAAGCTACAGCTGCCGGGTCACGCATGAAGGGAGCACCGTGGAGAAGACAGTG GCCCCTGCAGAATGCTCT GQPKAAPSVTLFPPSSEELQANKATLVCLVSDFNPGAVTVAWKADGSPVKVGVETTKPSK QSNNKYAASSYLSLTPEQWKSHRSYSCRVTHEGSTVEKTVAPAECS
482	Human IgG4-PE constant region Human IgG4-PE constant region	IGHG4-PE IGHG4-PE	Human Heavy Chain Constant Region (IGHG4-PE) Nucleotide Sequence (lysine clipped)	GCTTCTACCAAGGGACCCAGCGTGTTCCCTCTGGCTCCTTGCTCCAGATCCACCTCCGAG TCTACAGCTGCTCTGGGCTGCCTGGTCAAGGACTACTTTCCTGAGCCTGTGACCGTGTCT TGGAACTCTGGCGCTCTGACATCTGGCGTGCACACATTCCCTGCTGTGCTGCAGTCCTCC GGCCTGTACTCTCTGTCCTCTGTCGTGACCGTGCCTTCCTCTAGCCTGGGCACCCAAGACC TACACCTGTAATGTGGACCACAAGCCTTCCAACACCAAGGTGGACAAGCGCGTGGAATCT AAGTACGGCCCTCCTTGTCCTCCATGTCCTGCTCCAGAGTTTGAAGGCGGCCCTTCCGTG TTTCTGTTCCCTCCAAAGCCTAAGGACACCCTGATGATCTCTCGGACCCCTGAAGTGACC TGCGTGGTGGTGGATGTGTCCCAAGAGGATCCCGAGGTGCAGTTCAATTGGTACGTGGAC GGCGTGGAAGTGCACAACGCCAAGACCAAGCCTAGAGAGGAACAGTTCAACTCCACCTAC AGAGTGGTGTCCGTGCTGACCGTGCTGCACCAGGATTGGCTGAACGGCAAAGAGTACAAG TGCAAGGTGTCCAACAAGGGCCTGCCTAGCTCCATCGAAAAGACCATCTCCAAGGCCAAG GGCCAGCCTCGAGAACCCCAGGTTTACACCCTGCCTCCAAGCCAAGAGGAAATGACCAAG AACCAGGTGTCCCTGACCTGCCTCGTGAAGGGATTCTACCCCTCCGATATCGCCGTGGAA TGGGAGTCTAATGGCCAGCCAGAGAACAACTACAAGACAACCCCTCCTGTGCTGGACTCC GACGGCTCCTTCTTCCTGTATTCCCGCCTGACCGTGGACAAGTCCAGATGGCAAGAGGGC AACGTGTTCTCCTGCAGCGTGATGCACGAGGCCCTGCACAATCACTACACCCAGAAGTCC CTGTCTCTGTCCCTGGGC ASTKGPSVFPLAPCSRSTSESTAALGCLVKDYFPEPVTVSWNSGALTSGVHTFPAVLQSS GLYSLSSVVTVPSSSLGTKTYTCNVDHKPSNTKVDKRVESKYGPPCPPCPAPEFEGGPSV FLFPPKPKDTLMISRTPEVTCVVVDVSQEDPEVQFNWYVDGVEVHNAKTKPREEQFNSTY RVVSVLTVLHQDWLNGKEYKCKVSNKGLPSSIEKTISKAKGQPREPQVYTLPPSQEEMTK NQVSLTCLVKGFYPSDIAVEWESNGQPENNYKTTPPVLDSDGSFFLYSRLTVDKSRWQEG NVFSCSVMHEALHNHYTQKSLSLSLG
483		Human Heavy Chain Constant Region (IGHG4-PE) Protein Sequence (lysine clipped)	
484	Human IGHA1 constant region		ASPTSPKVFPLSLCSTQPDGNVVIACLVQGFFPQEPLSVTWSESGQGVTARNFP PSQDASGDLYTTSSQLTLPATQCLAGKSVTCHVKHYTNPSQDVTVPCPVPSTPP TPSPSTPPTPSPSCCHPRLSLHRPALEDLLLGSEANLTCTLTGLRDASGVTFTW TPSSGKSAVQGPPERDLCGCYSVSSVLPGCAEPWNHGKTFTCTAAYPESKTPLT ATLSKSGNTFRPEVHLLPPPSEELALNELVTLTCLARGFSPKDVLVRWLQGSQE LPREKYLTWASRQEPSQGTTTFAVTSILRVAAEDWKKGDTFSCMVGHEALPLAF TQKTIDRLAGKPTHVNVSVVMAEVDGTCY
485	Human IGHA2		ASPTSPKVFPLSLDSTPQDGNVVVACLVQGFFPQEPLSVTWSESGQNVTARNFPPSQDAS GDLYTTSSQLTLPATQCPDGKSVTCHVKHYTNSSQDVTVPCRVPPPPPCCHPRLSLHRPA LEDLLLGSEANLTCTLTGLRDASGATFTWTPSSGKSAVQGPPERDLCGCYSVSSVLPGCA QPWNHGETFTCTAAHPELKTPLTANITKSGNTFRPEVHLLPPPSEELALNELVTLTCLAR

constant region			GFSPKDVLVRWLQGSQELPREKYLTWASRQEPSQGTTTYAVTSILRVAAEDWKKGETFSC MVGHEALPLAFTQKTIDRMAGKPTHINVSVVMAEADGTCY

Table 3 below shows the heavy and light chain v and j gene segments corresponding to each of the antibodies set out in Tables 1a and 1b above.

Ab name	heavy chain v gene segment	heavy chain j gene segment	light chain v gene segment	light chain j gene segment
IMPI-001	IGHV4-4*02	IGHJ4*02	IGKV2D-30*01	IGKJ4*01
IMPI-002	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ4*01
IMPI-003	IGHV3-9*01	IGHJ6*02	IGKV1-6*01	IGKJ1*01
IMPI-004	IGHV3-33*01	IGHJ6*02	IGKV3-20*01	IGKJ4*01
IMPI-005	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ5*01
IMPI-006	IGHV4-39*01	IGHJ6*02	IGKV1D-16*01	IGKJ4*01
IMPI-007	IGHV4-4*02	IGHJ4*02	IGKV2D-30*01	IGKJ4*01
IMPI-008	IGHV3-9*01	IGHJ6*02	IGKV1D-13*d01	IGKJ4*01
IMPI-009	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01
IMPI-010	IGHV3-9*01	IGHJ6*02	IGKV1D-13*d01	IGKJ4*01
IMPI-011	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01
IMPI-012	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ4*01
IMPI-013	IGHV3-9*01	IGHJ6*02	IGKV1-6*01	IGKJ1*01
IMPI-014	IGHV4-31*03	IGHJ4*02	IGKV1D-13*d01	IGKJ4*01
IMPI-015	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01

Ab name	heavy chain v gene segment	heavy chain j gene segment	light chain v gene segment	light chain j gene segment
IMPI-016	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01
IMPI-017	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ1*01
IMPI-018	IGHV4-31*03	IGHJ4*02	IGKV1D-13*d01	IGKJ4*01
IMPI-019	IGHV4-4*02	IGHJ4*02	IGKV2D-30*01	IGKJ4*01
IMPI-020	IGHV4-4*02	IGHJ4*02	IGKV2D-30*01	IGKJ4*01
IMPI-021	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ2*04
IMPI-022	IGHV3-9*01	IGHJ6*02	IGKV1D-13*d01	IGKJ4*01
IMPI-023	IGHV4-4*02	IGHJ4*02	IGKV2D-30*01	IGKJ4*01
IMPI-024	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01
IMPI-025	IGHV4-4*02	IGHJ4*02	IGKV2D-30*01	IGKJ4*01
IMPI-026	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01
IMPI-027	IGHV4-31*03	IGHJ4*02	IGKV1D-13*d01	IGKJ4*01
IMPI-028	IGHV3-53*01	IGHJ4*02	IGKV3-20*01	IGKJ1*01
IMPI-029	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ5*01
IMPI-030	IGHV4-4*02	IGHJ4*02	IGKV2D-30*01	IGKJ4*01
IMPI-031	IGHV3-9*01	IGHJ6*02	IGKV1D-13*d01	IGKJ4*01

Ab name	heavy chain v gene segment	heavy chain j gene segment	light chain v gene segment	light chain j gene segment
IMPI-032	IGHV4-4*02	IGHJ4*02	IGKV2D-30*01	IGKJ4*01
IMPI-033	IGHV4-31*03	IGHJ4*02	IGKV1D-13*d01	IGKJ4*01
IMPI-034	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01
IMPI-035	IGHV3-9*01	IGHJ6*02	IGKV1D-13*d01	IGKJ4*01
IMPI-036	IGHV1-8*01	IGHJ4*02	IGKV6-21*01	IGKJ3*01
IMPI-037	IGHV3-15*01	IGHJ4*02	IGKV1-9*d01	IGKJ1*01
IMPI-038	IGHV3-30*18	IGHJ6*02	IGKV1-12*01	IGKJ1*01
IMPI-039	IGHV4-4*02	IGHJ4*02	IGKV2D-30*01	IGKJ4*01
IMPI-040	IGHV4-4*02	IGHJ4*02	IGKV2D-30*01	IGKJ4*01
IMPI-041	IGHV1-8*01	IGHJ4*02	IGKV6-21*01	IGKJ3*01
IMPI-042	IGHV3-53*01	IGHJ6*02	IGKV1-33*01	IGKJ5*01
IMPI-043	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01
IMPI-044	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01
IMPI-045	IGHV4-31*03	IGHJ4*02	IGKV1D-13*d01	IGKJ4*01
IMPI-046	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01
IMPI-047	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ4*01

Ab name	heavy chain v gene segment	heavy chain j gene segment	light chain v gene segment	light chain j gene segment
IMPI-048	IGHV4-31*03	IGHJ4*02	IGKV1D-13*d01	IGKJ4*01
IMPI-049	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01
IMPI-050	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01
IMPI-051	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01
IMPI-052	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ4*01
IMPI-053	IGHV4-4*02	IGHJ4*02	IGKV2D-30*01	IGKJ4*01
IMPI-054	IGHV3-53*01	IGHJ6*02	IGKV1-33*01	IGKJ5*01
IMPI-055	IGHV1-8*01	IGHJ4*02	IGKV6-21*01	IGKJ3*01
IMPI-056	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ5*01
IMPI-057	IGHV3-9*01	IGHJ6*02	IGKV1D-13*d01	IGKJ4*01
IMPI-058	IGHV5-51*01	IGHJ4*02	IGKV1D-13*d01	IGKJ1*01
IMPI-059	IGHV3-53*01	IGHJ3*02	IGKV1-33*01	IGKJ2*04
IMPI-060	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ2*04
IMPI-061	IGHV3-20*d01	IGHJ4*02	IGKV3-20*01	IGKJ2*04
IMPI-062	IGHV3-20*d01	IGHJ4*02	IGKV3-20*01	IGKJ2*04
IMPI-063	IGHV3-20*d01	IGHJ4*02	IGKV3-20*01	IGKJ2*04

Ab name	**heavy chain v gene segment**	**heavy chain j gene segment**	**light chain v gene segment**	**light chain j gene segment**
IMPI-064	IGHV3-20*d01	IGHJ4*02	IGKV3-20*01	IGKJ2*04
IMPI-065	IGHV3-20*d01	IGHJ4*02	IGKV3-20*01	IGKJ2*04
IMPI-066	IGHV3-20*d01	IGHJ4*02	IGKV3-20*01	IGKJ2*04
IMPI-067	IGHV3-30*18	IGHJ6*02	IGKV3-20*01	IGKJ4*01
IMPI-068	IGHV3-30*18	IGHJ6*02	IGKV1D-13*d01	IGKJ3*01
IMPI-069	IGHV3-20*d01	IGHJ4*02	IGKV3-20*01	IGKJ2*04
IMPI-070	IGHV3-20*d01	IGHJ4*02	IGKV3-20*01	IGKJ2*04
IMPI-071	IGHV3-20*d01	IGHJ4*02	IGKV3-20*01	IGKJ2*04
IMPI-072	IGHV3-30*18	IGHJ6*02	IGKV3-20*01	IGKJ4*01

Ab name	Heavy chain v gene segment	Heavy chain j gene segment	Light chain v gene segment	Light chain j gene segment
YANG-1101	IGHV4-39*01	IGHJ3*02	IGLV2-23*d02	IGLJ2*01
YANG-1102	IGHV4-4*02	IGHJ4*02	IGLV1-40*01	IGLJ3*02
YANG-1103	IGHV3-53*01	IGHJ4*02	IGKV1-9*d01	IGKJ5*01
YANG-1105	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ2*04
YANG-1106	IGHV3-53*01	IGHJ4*02	IGKV3-15*01	IGKJ1*01

Ab name	Heavy chain v gene segment	Heavy chain j gene segment	Light chain v gene segment	Light chain j gene segment
YANG-1107	IGHV3-53*01	IGHJ4*02	IGKV1-9*d01	IGKJ5*01
YANG-1108	IGHV3-30*18	IGHJ6*02	IGKV1D-13*d01	IGKJ4*01
YANG-1109	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ2*04
YANG-1110	IGHV3-30*18	IGHJ6*02	IGLV4-60*d03	IGLJ1*01
YANG-1111	IGHV3-48*02	IGHJ4*02	IGLV3-21*d01	IGLJ2*01
YANG-1112	IGHV2-5*10	IGHJ3*02	IGLV3-10*01	IGLJ2*01
YANG-1113	IGHV3-21*03	IGHJ4*02	IGLV2-14*01	IGLJ2*01
YANG-1114	IGHV3-21*03	IGHJ4*02	IGLV2-14*01	IGLJ2*01
YANG-1115	IGHV3-21*03	IGHJ4*02	IGLV2-14*01	IGLJ2*01
YANG-1116	IGHV3-21*03	IGHJ4*02	IGLV2-14*01	IGLJ2*01
YANG-1117	IGHV3-21*03	IGHJ4*02	IGLV2-14*01	IGLJ2*01
YANG-1118	IGHV3-21*03	IGHJ4*02	IGLV2-14*01	IGLJ3*02
YANG-1119	IGHV3-21*03	IGHJ4*02	IGLV2-14*01	IGLJ2*01
YANG-1201	IGHV4-4*02	IGHJ6*02	IGKV3-20*01	IGKJ1*01
YANG-1202	IGHV3-7*01	IGHJ6*02	IGKV1-16*02	IGKJ1*01
YANG-1203	IGHV3-9*01	IGHJ6*02	IGKV1-33*01	IGKJ3*01
YANG-1204	IGHV3-30*18	IGHJ3*02	IGKV2-30*01	IGKJ4*01
YANG-1205	IGHV1-46*03	IGHJ4*02	IGKV2D-29*01	IGKJ1*01
YANG-1206	IGHV3-30*18	IGHJ4*02	IGLV1-40*01	IGLJ3*02
YANG-1207	IGHV3-33*01	IGHJ4*02	IGLV3-1*01	IGLJ2*01
YANG-1301	IGHV3-33*01	IGHJ5*02	IGLV3-1*01	IGLJ2*01
YANG-1302	IGHV3-33*01	IGHJ5*02	IGLV3-1*01	IGLJ2*01

Ab name	Heavy chain v gene segment	Heavy chain j gene segment	Light chain v gene segment	Light chain j gene segment
YANG-1303	IGHV1-18*01	IGHJ4*02	IGLV3-10*01	IGLJ3*02
YANG-1304	IGHV4-34*01	IGHJ4*02	IGLV3-10*01	IGLJ3*02
YANG-1305	IGHV3-30*18	IGHJ6*02	IGKV1-27*01	IGKJ3*01
YANG-1401	IGHV4-4*02	IGHJ5*02	IGKV1D-16*01	IGKJ4*01
YANG-1402	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ4*01
YANG-1403	IGHV3-33*01	IGHJ6*02	IGKV1D-17*01	IGKJ1*01
YANG-2101	IGHV3-13*01	IGHJ4*02	IGKV1-16*02	IGKJ4*01
YANG-2102	IGHV3-13*01	IGHJ6*02	IGKV1-16*02	IGKJ1*01
YANG-2103	IGHV3-53*01	IGHJ6*02	IGLV3-21*d01	IGLJ1*01
YANG-2104	IGHV3-13*01	IGHJ6*02	IGKV1-16*02	IGKJ1*01
YANG-2105	IGHV3-53*01	IGHJ6*02	IGKV1-9*d01	IGKJ4*01
YANG-2106	IGHV3-33*01	IGHJ6*02	IGKV1D-17*01	IGKJ1*01
YANG-2107	IGHV4-4*02	IGHJ3*02	IGLV2-23*d02	IGLJ2*01
YANG-2108	IGHV4-4*02	IGHJ3*02	IGLV2-23*d02	IGLJ2*01
YANG-2109	IGHV1-69*05	IGHJ6*02	IGKV1-17*01	IGKJ4*01
YANG-2110	IGHV3-53*01	IGHJ4*02	IGKV3D-7*01	IGKJ4*01
YANG-2111	IGHV3-9*01	IGHJ4*02	IGKV2-28*01	IGKJ5*01
YANG-2112	IGHV1-24*d01	IGHJ6*02	IGLV1-47*01	IGLJ2*01
YANG-2201	IGHV3-30*18	IGHJ4*02	IGKV2D-28*d01	IGKJ5*01
YANG-2202	IGHV3-23*04	IGHJ4*02	IGKV1-12*01	IGKJ5*01
YANG-2203	IGHV1-46*03	IGHJ3*02	IGLV1-51*01	IGLJ2*01
YANG-2204	IGHV1-46*03	IGHJ3*02	IGLV1-51*01	IGLJ3*02

Ab name	Heavy chain v gene segment	Heavy chain j gene segment	Light chain v gene segment	Light chain j gene segment
YANG-2205	IGHV1-46*03	IGHJ3*02	IGLV1-51*01	IGLJ3*02
YANG-2206	IGHV1-46*03	IGHJ3*02	IGLV1-51*01	IGLJ3*02
YANG-2207	IGHV1-46*03	IGHJ3*02	IGLV1-51*01	IGLJ3*02
YANG-2208	IGHV1-46*03	IGHJ3*02	IGLV1-51*01	IGLJ3*02
YANG-2301	IGHV1-24*d01	IGHJ6*02	IGKV3-15*01	IGKJ4*01
YANG-2302	IGHV1-24*d01	IGHJ6*02	IGKV3-20*01	IGKJ2*04
YANG-2303	IGHV1-24*d01	IGHJ6*02	IGKV3-20*01	IGKJ2*04
YANG-2304	IGHV1-24*d01	IGHJ5*02	IGLV2-8*01	IGLJ2*01
YANG-2305	IGHV3-33*01	IGHJ6*02	IGLV3-1*01	IGLJ2*01
YANG-2306	IGHV1-24*d01	IGHJ5*02	IGLV2-8*01	IGLJ2*01

CLAIMS

1. A neutralising antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor.

2. An antibody according to claim 1, wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, and wherein HCDR3 is the HCDR3 of antibody IMPI-037 as shown in Table 1a (SEQ ID NO: 182).

3. An antibody according to claim 2, wherein the 6 CDRs are those of antibody IMPI-037 as shown in Table 1a (SEQ ID NOs: 180 to 182, 185, 18, and 186) .

4. An antibody according to claim 3, wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody IMPI-037 as shown in Table 1a (SEQ ID NOs: 179 and 184), optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

5. An antibody according to claim 3, wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-037 as shown in Table 1a, provided that the antibody has the 6 CDRs of antibody IMPI-037 as shown in Table 1a.

6. An antibody according to any preceding claim, wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody IMPI-037 as shown in Table 1a.

7. An antibody according to claim 1, wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity

determining regions LCDR1, LCDR2 and LCDR3, wherein HCDR3 is the HCDR3 of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111 as shown in Table 1b.

	YANG-1112	**YANG-2107**	**YANG-2108**	**YANG-2111**
HCDR3	SEQ ID No: 574	SEQ ID No: 901	SEQ ID No: 910	SEQ ID No: 1048

8. An antibody according to claim 7, wherein the 6 CDRs are those of one of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111 as shown in Table 1b.

	YANG-1112	**YANG-2107**	**YANG-2108**	**YANG-2111**
HCDR1	SEQ ID No: 572	SEQ ID No: 899	SEQ ID No: 908	SEQ ID No: 1046
HCDR2	SEQ ID No: 573	SEQ ID No: 900	SEQ ID No: 909	SEQ ID No: 1047
HCDR3	SEQ ID No: 574	SEQ ID No: 901	SEQ ID No: 910	SEQ ID No: 1048
LCDR1	SEQ ID No: 577	SEQ ID No: 904	SEQ ID No: 913	SEQ ID No: 1051
LCDR2	SEQ ID No: 578	SEQ ID No: 203	SEQ ID No: 203	SEQ ID No: 1052
LCDR3	SEQ ID No: 579	SEQ ID No: 905	SEQ ID No: 914	SEQ ID No: 1053

9. An antibody according to claim 8, wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111 as shown in Table 1b optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

	YANG-1112	**YANG-2107**	**YANG-2108**	**YANG-2111**
VH	SEQ ID No: 571	SEQ ID No: 898	SEQ ID No: 907	SEQ ID No: 1045
VL	SEQ ID No: 576	SEQ ID No: 903	SEQ ID No: 912	SEQ ID No: 1050

10. An antibody according to claim 8, wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111 as shown in Table 1b, provided that the antibody has the CDRs of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111 as shown in Table 1b, respectively.

11. An antibody according to any of claims 7 to 10, wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1112, YANG-2107, YANG-2108, or YANG-2111 as shown in Table 1b.

12. A neutralising antibody that specifically binds to the S2 subunit of the SARS-CoV-2 spike protein.

13. An antibody according to claim 12, wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, wherein HCDR3 is the HCDR3 of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208 as shown in Table 1b.

	YANG-2203	**YANG-2204**	**YANG-2205**	**YANG-2206**	**YANG-2207**	**YANG-2208**
HCDR3	SEQ ID No: 1108	SEQ ID No: 1228	SEQ ID No: 1238	SEQ ID No: 1248	SEQ ID No: 1258	SEQ ID No: 1268

14. An antibody according to claim 13, wherein the 6 CDRs are those of one of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208 as shown in Table 1b.

	YANG-2203	**YANG-2204**	**YANG-2205**	**YANG-2206**	**YANG-2207**	**YANG-2208**
HCDR1	SEQ ID No: 1106	SEQ ID No: 1226	SEQ ID No: 1236	SEQ ID No: 1246	SEQ ID No: 1256	SEQ ID No: 1266
HCDR2	SEQ ID No: 1107	SEQ ID No: 1227	SEQ ID No: 1237	SEQ ID No: 1247	SEQ ID No: 1257	SEQ ID No: 1267
HCDR3	SEQ ID No: 1108	SEQ ID No: 1228	SEQ ID No: 1238	SEQ ID No: 1248	SEQ ID No: 1258	SEQ ID No: 1268
LCDR1	SEQ ID No: 1111	SEQ ID No: 1231	SEQ ID No: 1241	SEQ ID No: 1251	SEQ ID No: 1261	SEQ ID No: 1271
LCDR2	SEQ ID No: 1112	SEQ ID No: 1232	SEQ ID No: 1242	SEQ ID No: 1252	SEQ ID No: 1262	SEQ ID No: 1272
LCDR3	SEQ ID No: 1113	SEQ ID No: 1233	SEQ ID No: 1243	SEQ ID No: 1253	SEQ ID No: 1263	SEQ ID No: 1273

15. An antibody according to claim 14, wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-2203, YANG-2204, YANG-2205, YANG-

2206, YANG-2207, or YANG-2208 as shown in Table 1b optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

	YANG-2203	**YANG-2204**	**YANG-2205**	**YANG-2206**	**YANG-2207**	**YANG-2208**
VH	SEQ ID No: 1105	SEQ ID No: 1225	SEQ ID No: 1235	SEQ ID No: 1245	SEQ ID No: 1255	SEQ ID No: 1265,
VL	SEQ ID No: 1110	SEQ ID No: 1230	SEQ ID No: 1240	SEQ ID No: 1250	SEQ ID No: 1260	SEQ ID No: 1270

16. An antibody according to claim 14, wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208 as shown in Table 1b, provided that the antibody has the CDRs of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208 as shown in Table 1b, respectively.

17. An antibody according to any of claims 12 to 16, wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-2203, YANG-2204, YANG-2205, YANG-2206, YANG-2207, or YANG-2208 as shown in Table 1b.

18. A neutralising antibody that specifically binds to the receptor binding domain (RBD) of the SARS-CoV-2 spike protein, wherein the antibody does not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor.

19. An antibody according to claim 1, wherein the antibody comprises a variable heavy (VH) domain sequence comprising complementarity determining regions (CDRs) HCDR1, HCDR2 and HCDR3, and a variable light (VL) domain sequence comprising complementarity determining regions LCDR1, LCDR2 and LCDR3, and wherein HCDR3 is the HCDR3 of antibody YANG-1401 as shown in Table 1b (SEQ ID NO: 780).

20. An antibody according to claim 2, wherein the 6 CDRs are those of antibody YANG-1401 as shown in Table 1b (SEQ ID NOs: 778-780, 783, 18, and 784).

21. An antibody according to claim 3, wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) domain and variable light (VL) domain sequences of antibody YANG-1401 as shown in Table 1b (SEQ ID Nos:777 and 782) , optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable heavy (VH) domain sequence and optionally with 1, 2, 3, 4 or 5 amino acid alterations outside the complementarity determining regions (CDRs) in the variable light (VL) domain sequence.

22. An antibody according to claim 3, wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise a sequence having at least 90% identity to the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1401 as shown in Table 1b, provided that the antibody has the 6 CDRs of antibody YANG-1401 as shown in Table 1b.

23. An antibody according to any preceding claim, wherein the variable heavy (VH) domain and variable light (VL) domain sequences respectively comprise the variable heavy (VH) and variable light (VL) domain sequences of antibody YANG-1401 as shown in Table 1b.

24. An antibody which competes for binding to the SARS-CoV-2 spike protein with an antibody according to any one of claims 1 to 23.

25. An antibody which binds to the same epitope on the SARS-CoV-2 spike protein as an antibody according to any one of claims 1 to 23.

26. An antibody according to any one of claims 1 to 25, wherein the antibody is a human IgG1 antibody.

27. An antibody according to claim 26, wherein the antibody is a human IgG1 antibody comprising a constant region sequence of SEQ ID NO: 418.

28. An antibody according to any one of claims 1 to 25, wherein the antibody is a human IgG4 antibody.

29. An antibody according to claim 28, wherein the antibody is a human IgG4 antibody comprising a constant region sequence of SEQ ID NO: SEQ ID NO: 436.

30. An antibody according to any one of claims 1 to 25, wherein the antibody comprises kappa (κ) light chain constant regions, preferably wherein the kappa (κ) light chain constant regions sequence is SEQ ID NO: 448.

31. A nucleic acid comprising a sequence that encodes a VH domain and/or an VL domain of an antibody as defined in any preceding claim.

32. A vector comprising the nucleic acid of claim 31; optionally wherein the vector is a CHO vector.

33. A host cell comprising the nucleic acid of claim 31 or the vector of claim 32.

34. A pharmaceutical composition comprising an antibody according to any one of claims 1 to 30 and a pharmaceutically acceptable excipient.

35. A pharmaceutical composition comprising an isolated nucleic acid encoding an antibody according to any one of claims 1 to 30, or the isolated nucleic acid of claim 31 and a pharmaceutically acceptable excipient.

36. A pharmaceutical composition according to claim 34 or 35 formulated for intravenous, intramuscular or subcutaneous administration.

37. A pharmaceutical composition according to any of claims 34 to 36, further comprising at least one further therapeutic agent.

38. A pharmaceutical composition according to claim 37, wherein the further therapeutic agent is at least one, preferably one or two, further antibodies.

39. A pharmaceutical composition according to claim 38, wherein the at least one further antibody is selected from:

    a. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;

b. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and does not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;
c. an antibody that specifically binds to the N-terminal domain (NTD) of the S1 subunit of the of SARS-CoV-2 spike protein;
d. an antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein; and
e. an antibody preferentially binds to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, S1 subunit and S2 subunit of the SARS-CoV-2 spike protein.

40. A kit comprising the pharmaceutical composition of any one of claims 34 to 39.

41. A kit according to claim 40 further comprising at least one further therapeutic agent.

42. A kit according to claim 41, wherein the further therapeutic agent is a further pharmaceutical composition comprising at least one, preferably one or two, further antibodies.

43. A kit according to claim 42, wherein the at least one further antibody is selected from:
a. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;
b. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and does not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;
c. an antibody that specifically binds to the N-terminal domain (NTD) of the S1 subunit of the of SARS-CoV-2 spike protein;
d. an antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein; and
e. an antibody preferentially binds to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, S1 subunit and S2 subunit of the SARS-CoV-2 spike protein.

44. A kit according to any of claims 40 to 43, further comprising a label or instructions for use to treat and/or prevent a SARS-CoV-2-related disease or condition, such as COVID-19, in a human; optionally wherein the label or instructions comprise a marketing authorisation number (e.g., an FDA or EMA authorisation number); optionally wherein the kit comprises an IV or injection device that comprises the antibody or fragment.

45. An antibody according to any one of claims 1 to 30, or the composition according to any one of claims 34 to 39, for use as a medicament.

46. The antibody according to any one of claims 1 to 30, or the composition according to any one of claims 34 to 39, for use in a method of treating a SARS-CoV-2-related disease or condition, said method comprising administering the antibody or composition to a patient.

47. The antibody according to any one of claims 1 to 30, or the composition according to any one of claims 34 to 39, for use in a method of preventing a SARS-CoV-2-related disease or condition, said method comprising administering the antibody or composition to a patient.

48. Use of an antibody according to any one of claims 1 to 30, or the composition according to any one of claims 34 to 39, in the manufacture of a medicament for use in a method of treating a SARS-CoV-2-related disease or condition.

49. Use of an antibody according to any one of claims 1 to 30, or the composition according to any one of claims 34 to 39, in the manufacture of a medicament for use in a method of preventing a SARS-CoV-2-related disease or condition.

50. A method of treating a SARS-CoV-2-related disease or condition in a human, comprising administering to said human a therapeutically effective amount of an antibody according to any one of claims 1 to 30, or the composition according to any one of claims 34 to 39.

51. A method of preventing a SARS-CoV-2-related disease or condition in a human, comprising administering to said human a therapeutically effective amount of an antibody according to any one of claims 1 to 30, or the composition according to any one of claims 34 to 39.

52. An antibody for use according to claim 46 or 47, or
the composition for use according to claim 46 or 47, or
the use of an antibody according to claim 48 or 49, or
the method according to claim 50 or 51,
wherein the SARS-CoV-2-related disease or condition is COVID-19.

53. An antibody for use according to claim 46, 47 or 52, or
the composition for use according to claim 46, 47 or 52, or
the use of an antibody according to claim 48, 49 or 52, or

the method according to claim 50, 51 or 52,
said method further comprising administering at least one further therapeutic agent.

54. An antibody for use according to claim 46, 47, 52, or 53, or
the composition for use according to claim 46, 47, 52 or 53, or
the use of an antibody according to claim 48, 49, 52 or 53, or
the method according to claim 50, 51, 52 or 53,
wherein administration of the further therapeutic agent is simultaneous, separate or sequential.

55. An antibody for use according to claim 46, 47, 52, 53 or 54, or
the composition for use according to claim 46, 47, 52, 53 or 54, or
the use of an antibody according to claim 48, 49, 52, 53 or 54, or
the method according to claim 50, 51, 52, 53 or 54,
wherein the further therapeutic agent is at least one, preferably one or two, further antibodies.

56. An antibody for use according to claim 46, 47, 52, 53, 54 or 55, or
the composition for use according to claim 46, 47, 52, 53, 54 or 55, or
the use of an antibody according to claim 48, 49, 52, 53, 54 or 55, or
the method according to claim 50, 51, 52, 53, 54 or 55,
wherein the at least one further antibody is selected from:
    a. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;
    b. an antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and does not compete for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor;
    c. an antibody that specifically binds to the N-terminal domain (NTD) of the S1 subunit of the of SARS-CoV-2 spike protein;
    d. an antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein; and
    e. an antibody preferentially binds to the trimer form of the SARS-CoV-2 spike protein over the isolated RBD domain, S1 subunit and S2 subunit of the SARS-CoV-2 spike protein.

57. Use of an antibody according to any of claims 1 to 30, for determining the presence or absence of SARS-CoV-2 in a sample.

58. A method of determining the presence or absence of SARS-CoV-2, in a sample, the method comprising
contacting the sample with an antibody according to any of 1 to 30; and
testing for binding between the antibody and SARS-CoV-2 in the sample;
wherein detection of binding indicates the presence of SARS-CoV-2 in the sample and
wherein absence of binding indicates the absence of SARS-CoV-2 in the sample.

59. Use according to claim 57 or a method according to claim 58, wherein the antibody comprises or is conjugated to a detectable label.

60. Use according to claim 57 or claim 59, or a method according to claim 58 or claim 59, wherein the sample has been obtained from a human who has been or is suspected of having been infected with SARS-CoV-2 and/or who exhibits one or more symptoms of a SARS-CoV-2-related disease or condition, such as COVID-19.

61. Use according to claim 57, 59, or 60, or a method according to claim 58, 59, or 60, wherein the sample is a serum, plasma, or whole blood sample, or an oral or nasal swab, urine, faeces, or cerebrospinal fluid (CFS), or wherein the sample is from any suspected SARS-CoV-2 infected organ or tissue.

62. A diagnostic kit for the use as set out in any of claims 57, 59, 60 or 61, or the method as set out in any of claims 58, 59, 60 or 61, comprising an antibody according to any of claims 1 to 30, and optionally one or more buffering solutions.

63. A diagnostic kit according to claim 62, wherein the antibody comprises or is conjugated to a detectable label.

64. A diagnostic kit according to claim 62, comprising
a first reagent comprising the antibody according to any of claims 1 to 30, and
a second reagent comprising a detector molecule that binds to the first reagent.

65. A diagnostic kit according to claim 64, wherein the detector molecule is an antibody that comprises or is conjugated to a detectable label.

66. A kit or a pharmaceutical composition comprising:

a first antibody that specifically binds to the receptor binding domain (RBD) of the S1 subunit of the SARS-CoV-2 spike protein and competes for binding to the SARS-CoV-2 spike protein with the human ACE2 receptor; and

a second antibody that specifically binds to the S2 subunit of the of SARS-CoV-2 spike protein.

67. A kit or a pharmaceutical composition according to claim 66, wherein the kit or pharmaceutical composition is capable of syncytia formation inhibition of 45% or greater, or 50% or greater.

68. A kit or a pharmaceutical composition according to claim 66 or claim 67, wherein the first antibody is an antibody according to any one of claims 1 to 11.

69. A kit or a pharmaceutical composition according to claim 66 or claim 67, wherein the first antibody is IMPI-059 or an antibody having HCDR3, the 6 CDRs, or the VH and/or VL domain sequences of IMPI-059 as shown in Table 1a.

	IMPI-059
VH	SEQ ID No: 53
VL	SEQ ID No: 58
HCDR1	SEQ ID No: 54
HCDR2	SEQ ID No: 55
HCDR3	SEQ ID No: 56
LCDR1	SEQ ID No: 59
LCDR2	SEQ ID No: 28
LCDR3	SEQ ID No: 60

70. A kit or a pharmaceutical composition according to any one of claims 66 to 69, wherein the second antibody is an antibody according to any one of claims 12 to 17.

71. A kit or a pharmaceutical composition according to claim 70, wherein the second antibody is YANG-2204, YANG-2206, or YANG-2207 or an antibody having HCDR3, the 6 CDRs, or the VH and/or VL domain sequences of YANG-2204, YANG-2206, or YANG-2207 as shown in Table 1b.

72. A kit or a pharmaceutical composition according to any one of claims 66 to 71 for use in a method of treating a SARS-CoV-2-related disease or condition, said method comprising administering the first and second antibody or the composition comprising the first and second antibody to a patient, optionally wherein the SARS-CoV-2-related disease or condition is COVID-19.