

DESCRIPTION

Malaria vaccine

TECHNICAL FIELD

5 [0001] The present invention relates to a particle comprising a polypeptide and at least one malaria antigen, and a composition or vaccine comprising thereof, its use in medicine, particularly in the prevention or treatment of malaria.

10

BACKGROUND

[0002] Malaria is one of the world's most prevalent serious infectious diseases, with approximately 250 million cases and 1 million deaths per year (WHO, 2009). Mortality is primarily in children under the age of five and in
15 pregnant women. Every 45 seconds, an African child dies of malaria. The disease is transmitted from person to person by infected mosquitoes, so past eradication efforts involved massive insecticide campaigns. These were successful in the Southeast U.S. for example, but failed in
20 most poorly developed tropical countries. Current efforts involve distribution of bednets, particularly bednets impregnated with insecticide, to prevent mosquito bites at night. However, resistance to insecticides and to anti-malarial drugs for both prevention and treatment is rapidly

rising. Thus, the need for a malaria vaccine is imperative for protection of millions of people from disease (<http://www.globalvaccines.org/content/malaria+vaccine+program/19614>).

5 [0003] Malaria caused by *Plasmodium falciparum* remains a major public health threat, especially among children and pregnant women in Africa. An effective malaria vaccine would be a valuable tool to reduce the disease burden and could contribute to elimination of malaria in some regions
10 of the world. Current malaria vaccine candidates are directed against human and mosquito stages of the parasite life cycle, but thus far, relatively few proteins have been studied for potential vaccine development.

[0004] The most advanced vaccine candidate, RTS,S,
15 conferred partial protection against malaria in phase II clinical trials and is currently being evaluated in a phase III trial in Africa. (The Journal of Clinical Investigation 120(12) 4168-4178, 2010).

[0005] The CSP is the predominant surface antigen on
20 sporozoites. CSP is composed of an N-terminal region that binds heparin sulfate proteoglycans (RI), a central region containing a four-amino-acid (NPNA) repeat, and a GPI-anchored C-terminal region containing a thrombospondin-like

domain (RII). The region of the CSP included in the RTS,S vaccine includes the last 16 NPNA repeats and the entire flanking C-terminus. HBsAg particles serve as the matrix carrier for RTS,S, 25% of which is fused to the CSP segment
5 (The Journal of Clinical Investigation 120(12) 4168-4178, 2010).

[0006] In a series of phase II clinical trials for RTS,S, 30%-50% of malaria-naïve adults immunized with RTS,S were protected against challenge by mosquitoes infected with the
10 homologous *P. falciparum* clone. In phase II field trials in the Gambia and Kenya, RTS,S conferred short-lived protection against malaria infection in approximately 35% of adults, although results from the Kenya trial did not reach statistical significance. Approximately 30%-50% of
15 children and infants immunized with RTS,S in phase II trials conducted in Mozambique, Tanzania, and Kenya were protected from clinical malaria, however, protection was generally short-lived (The Journal of Clinical
Investigation 120(12) 4168-4178, 2010). Results from a
20 pivotal, large-scale Phase III trial, published November 9, 2012, online in the *New England Journal of Medicine (NEJM)*, show that the RTS,S malaria vaccine candidate can help protect African infants against malaria. When compared to immunization with a control vaccine, infants (aged 6-12

weeks at first vaccination) vaccinated with RTS,S had one-third fewer episodes of both clinical and severe malaria and had similar reactions to the injection.

[0007] There are currently no licensed vaccines against malaria. Highly effective malaria vaccine is strongly desired.

[0008] Virus-like particles (VLPs) are multiprotein structures that mimic the organization and conformation of authentic native viruses but lack the viral genome, potentially yielding safer and cheaper vaccine candidates. A handful of prophylactic VLP-based vaccines is currently commercialized worldwide: GlaxoSmithKline's Engerix® (hepatitis B virus) and Cervarix® (human papillomavirus), and Merck and Co., Inc.'s Recombivax HB® (hepatitis B virus) and Gardasil® (human papillomavirus) are some examples. Other VLP-based vaccine candidates are in clinical trials or undergoing preclinical evaluation, such as, influenza virus, parvovirus, Norwalk and various chimeric VLPs. Many others are still restricted to small-scale fundamental research, despite their success in preclinical tests. The implications of large-scale VLP production are discussed in the context of process control, monitorization and optimization. The main up- and downstream technical challenges are identified and discussed

accordingly. Successful VLP-based vaccine blockbusters are briefly presented concomitantly with the latest results from clinical trials and the recent developments in chimeric VLP-based technology for either therapeutic or prophylactic vaccination (Expert Rev. Vaccines 9(10), 1149-1176, 2010).

[0009] Chikungunya virus (CHIKV) has infected millions of people in Africa, Europe and Asia since this alphavirus reemerged from Kenya in 2004. The severity of the disease and the spread of this epidemic virus present a serious public health threat in the absence of vaccines or antiviral therapies. It is reported that a VLP vaccine for epidemic Chikungunya virus protects non-human primates against infection (Nat Med. 2010 March; 16(3): 334-338).

US patent publication No. 2012/0003266 discloses a virus-like particle (VLP) comprising one or more Chikungunya virus structural polypeptides which is useful for formulating a vaccine or antigenic composition for Chikungunya that induces immunity to an infection or at least one symptom thereof. WO2012/106356 discloses modified alphavirus or flavivirus virus-like particles (VLPs) and methods for enhancing production of modified VLPs for use in the prevention or treatment of alphavirus and

flavivirus-mediated diseases. (these cited references are herein incorporated by reference).

SUMMARY OF THE INVENTION

[0010] In the first aspect, the present invention provides
5 a particle which is capable of being self-assembled,
comprising a polypeptide and at least one malaria antigen,
wherein said polypeptide comprises at least one first
attachment site and said at least one malaria antigen
comprises at least one second attachment site, and wherein
10 said polypeptide and said malaria antigen are linked
through said at least one first and said at least one
second attachment site.

[0011] In the second aspect, the present invention
provides a nucleic acid molecule which is designed for
15 expression of a particle provided in the first aspect of
the present invention.

[0012] In the third aspect, the present invention provides
a composition or vaccine comprising the particle provided
in the first aspect of the present invention and/or the
20 nucleic acid molecule provided in the second aspect of the
present invention.

[0013] In the fourth aspect, the present invention provides a method of producing an antibody, comprising contacting the particle provided in the first aspect of the present invention and/or the nucleic acid molecule provided in the second aspect of the present invention to a mammal.

[0014] In the fifth aspect, the present invention provides a method of immunomodulation, a method of treating malaria , a method of inducing and/or enhancing immune response against a malaria antigen in a mammal, comprising administering the composition provided in the third aspect of the present invention to a mammal.

[0015] In sixth aspect, the present invention provides a method of passive immunization against a malaria-causing pathogen, comprising administering the antibody provided in the fourth aspect of the present invention to a mammal.

[0016] In seventh aspect, the present invention provides a method of presenting an antigen on macrophage, comprising contacting the particle provided in the first aspect of the present invention and/or the nucleic acid molecule provided in the second aspect of the present invention to a mammal.

[0017] In eighth aspect, the present invention provides a method for producing the particle provided in the first aspect of the present invention, comprising preparing a

vector which is designed for expression of said particle;
culturing a cell which is transfected with said vector to
express said particle; and recovering said particle.

BRIEF DESCRIPTION OF THE INVENTION

5 [0018]

Fig 1 shows pVLP74_15 (VLP_CHI 532 NPNAx6) vector.

Fig 2 shows pVLP78_15 (VLP_CHI 532 NPNAx25) vector.

Fig 3 shows pVLP74_25 (VLP_VEEV 519 NPNAx6) vector.

Fig 4 shows that the serum from individual monkeys
10 immunized with Malaria VLPs after 2 weeks induced high
titer of antibodies against CSP.

Fig 5 shows mean value and SD of the data shown in Fig 4.

Fig 6 shows effects of combined immunization of CHIKV VLP
and VEEV VLP on induction of antibodies against CSP. In
15 the figure, Adj indicates adjuvant.

Fig 7 shows effects of administered VLP fused with no
malaria antigen on induction of antibodies against CSP. In
the figure, 4w, 6w, 10w and 14w indicate 4 weeks after
immunization, 6 weeks after immunization, 10 weeks after
20 immunization and 14 weeks after immunization, respectively.

Fig 8 shows effects of administered VLP fused with malaria
antigen on induction of antibodies against CSP. In the
figure, 4w, 6w, 10w and 14w indicate 4 weeks after
immunization, 6 weeks after immunization, 10 weeks after

immunization and 14 weeks after immunization, respectively.
Fig 9 shows effects of administered VLP fused with malaria
antigen together with adjuvant on induction of antibodies
against CSP. In the figure, 4w, 6w, 10w and 14w indicate 4
5 weeks after immunization, 6 weeks after immunization, 10
weeks after immunization and 14 weeks after immunization,
respectively.

Fig 10 shows schedule of the experiment.

Fig 11 shows detection of 18S malaria DNA by means of PCR.

10

DETAILED DESCRIPTION OF THE INVENTION

[0019]

(1) A particle comprising a polypeptide and at least one
15 malaria antigen

In the first aspect, the present invention provides
a particle which is capable of being self-assembled,
comprising a polypeptide and at least one malaria antigen,
wherein said polypeptide comprises at least one first
20 attachment site and said at least one antigen comprises at
least one second attachment site, and wherein said
polypeptide and said malaria antigen are linked through
said at least one first and said at least one second
attachment site.

25 [0020]As used herein, "a particle which is capable of being

self-assembled" refers to a particle formed by at least one constituent which is spontaneously assembled. The constituent may be a polypeptide or non-peptide chemical compound. In one embodiment, "a particle which is capable
5 of being self-assembled" may be a particle comprising or consisting of at least one polypeptide. The at least one polypeptide consists of one or more kinds of peptide. In one embodiment, said particle has a diameter of at least 10nm, for example, at least 20nm, preferably at least 50nm.

10 In one embodiment, molecular weight of said particle is from 100 kDa to 100,000 kDa, preferably from 400kDa to 30,000kDa.

[0021] A polypeptide used for the present invention may be spontaneously assembled. The polypeptide may be a virus
15 structural polypeptide. Thus, the particle provided by the present invention may be a virus like particle.

[0022] A virus structural polypeptide may be a naturally occurring viral polypeptide or modified polypeptide thereof. In one embodiment, the modified polypeptide has at least
20 70%, 75%, 80%, 85%, 90%, 95% or 98% amino acid sequence identity to a naturally occurring viral structural polypeptide including capsid and envelope protein. In one embodiment, the modified polypeptide is a mutant where at most 10% of the amino acids are deleted, substituted,
25 and/or added to a naturally occurring viral structural

polypeptide including capsid and envelope protein.

[0023] In one embodiment, virus structural polypeptide used for the present invention consists of or comprises capsid and/or envelope protein or fragment thereof. For example, virus structural polypeptide used for the present invention consists of or comprises capsid and E2 and E1.

An antigen may be inserted into E2. In one embodiment, a particle provided by the first aspect of the present invention can be formed by assembling 240 capsids, 240 E1 proteins and 240 E2 proteins where a malaria antigen is inserted into each of E2 proteins.

[0024] Virus structural polypeptide used for the present invention may be derived from Alphavirus or Flavivirus. Thus, the particle provided by the present invention may be a virus like particle derived from Alphavirus or Flavivirus. Examples of Alphavirus and Flavivirus include, but not limited to, Aura virus, Babanki virus, Barmah Forest virus (BFV), Bebaru virus, Cabassou virus, Chikungunya virus (CHIKV), Eastern equine encephalitis virus (EEEV), Eilat virus, Everglades virus, Fort Morgan virus, Getah virus, Highlands J virus, Kyzylagach virus, Mayaro virus, Me Tri virus, Middelburg virus, Mosso das Pedras virus, Mucambo virus, Ndumu virus, O'nyong-nyong virus, Pixuna virus, Rio Negro virus, Ross River virus (RRV), Salmon pancreas disease virus, Semliki Forest virus, Sindbis virus,

Southern elephant seal virus, Tonate virus, Trocara virus, Una virus, Venezuelan equine encephalitis virus (VEEV), Western equine encephalitis virus (WEEV), Whataroa virus, West Nile virus, dengue virus, tick-borne encephalitis virus and yellow fever virus.

[0025] Malaria is a disease which human or other animal (e.g. mouse) suffers from. Example of malaria include, but are not limited to, a disease caused by Plasmodium (P.) species including P. falciparum, P. malariae, P. ovale, P. vivax, P. knowlesi, P. berghei, P. chabaudi and P. yoelii

[0026] As used herein, the term "malaria antigen" refers to any antigen or fragment thereof. The term antigen or fragment thereof, means any peptide-based sequence that can be recognized by the immune system and/or that stimulates a cell-mediated immune response and/or stimulates the generation of antibodies.

[0027] According to Scand. J. Immunol. 56, 327-343, 2002, considering the whole parasite life cycle, there are essentially six targets for a malaria vaccine: (1) sporozoites; (2) liver stages; (3) merozoites; (4) infected RBC; (5) parasite toxins; (6) sexual stages.

[0028] Table summarizes the main candidate antigens of each stage identified.

Table 1. Main vaccine candidates from the different phases of *Plasmodium* life cycle

Targets	Candidate antigens
Sporozoite	Circumsporozoite protein (CSP)
	Thrombospondin-related adhesive protein (TRAP)
	Sporozoite and liver-stage antigen (SALSA)
	Sporozoite threonine- and asparagine-rich protein (STARP)
Liver stage	CSP
	Liver-stage antigen (LSA)-1 and -3
	SALSA
	STARP
Merozoite	Merozoite surface protein (MSP)-1, -2, -3, -4 and -5
	Erythrocyte-binding antigen (EBA)-175
	Apical membrane antigen (AMA)-1
	Rhoptry-associated protein (RAP)-1 and -2
Blood stage	Acidic-basic repeat antigen (ABRA)
	Duffy-binding protein (DBP) (<i>Plasmodium vivax</i>)
	Ring erythrocyte surface antigen (RESA)
	Serine-rich protein (SERP)
Toxins	Erythrocyte membrane protein (EMP)-1, -2 and -3
	Glutamate-rich protein (GLURP)
	Glycosilphosphatidylinositol (GPI)

Table 1. Main vaccine candidates from the different phases of *Plasmodium* life cycle

Targets	Candidate antigens
Sexual stages	Ps25, Ps28, Ps48/45 and Ps230

(Scand. J. Immunol. 56, 327-343, 2002)

[0029] According to the present invention, one or more antigens listed above can be used as long as it is formed to a particle. For example, a circumsporozoite protein and a fragment thereof can be used as an antigen. Examples of circumsporozoite protein include, but are not limited to, *Plasmodium falciparum* circumsporozoite protein consisting of amino acid sequence described below (SEQ ID No.:56):

Mmrklailsvssflfvealfqeyqcygsssntrvlnelnydnagtnlynelemnyygkq
 enwyslkksrslgenddgnnnngdngregkdcdkrdgnnedneklrkpkhkkklkqpgd
 gnpdpnanpnvdnpnanpnvdnpnanpnvdnpnanpnnpnanpnnpnanpnnpna
 npnanpnnpnanpnnpnanpnnpnanpnnpvdnpnanpnnpnanpnnpnanpnnpn
 anpnnpnanpnnpnanpnnpnanpnnpnanpnnpnanpnnpnanpnnpnknnqgng
 qghnmpndpnrvdenanannavknnnnneepsdkhieqylkkiknsistewspcsvtcg
 ngiqvrikpgsankpkdeldyendiekkickmekcssvfnvnssiglimvlsflflnt
 r.

[0030] In one embodiment, malaria antigen is a *Plasmodium falciparum* circumsporozoite protein B cell epitope. Example of *Plasmodium falciparum* circumsporozoite protein B cell epitope may be a repeat sequence of NPNA, including

(NPNA)₄₋₃₀ (i.e. 4xNPNA, 5xNPNA, 6xNPNA, 7xNPNA, 8xNPNA, 9xNPNA, 10xNPNA, 11xNPNA, 12xNPNA, 13xNPNA, 14xNPNA, 15xNPNA, 16xNPNA, 17xNPNA, 18xNPNA, 19xNPNA, 20xNPNA, 21xNPNA, 22xNPNA, 23xNPNA, 24xNPNA, 25xNPNA, 26xNPNA, 27xNPNA, 28xNPNA, 29xNPNA or 30xNPNA).

[0031] In one embodiment, malaria antigen is a Plasmodium yoelii circumsporozoite protein B cell epitope including (QGPGAP)₃₋₁₂.

[0032] In one embodiment, malaria antigen is a Plasmodium vivax circumsporozoite protein B cell epitope including (ANGAGNQPG)₁₋₁₂.

[0033] In one embodiment, malaria antigen is a Plasmodium malariae circumsporozoite protein B cell epitope including (NAAG)₄₋₃₀.

[0034] In one embodiment, malaria antigen is a Plasmodium falciparum circumsporozoite protein T cell epitope. Example of Plasmodium falciparum circumsporozoite protein T cell epitope may be EYLNKIQNSLSTEWSPCSVT (SEQ ID No.:44). (EYLNKIQNSLSTEWSPCSVT)₁₋₆ may be also used as a malaria antigen.

[0035] In one embodiment, malaria antigen is a Plasmodium yoelii circumsporozoite protein T cell epitope which is YNRNIVNRL LGDALNGPEEK (SEQ ID No.45). (YNRNIVNRL LGDALNGPEEK)₁₋₆ may be also used as a malaria antigen.

[0036] The present invention addresses one or more of the above needs by providing antigens, vectors encoding the antigens, and antibodies (and antibody-like molecules including aptamers and peptides) that specifically bind to the antigen, together with the uses thereof (either alone or in combination) in the prevention or treatment of malaria infections. As used herein, the term "antibody" refers to molecules which are capable of binding an epitope or antigenic determinant. The term is meant to include whole antibodies and antigen-binding fragments thereof, including single-chain antibodies. Such antibodies include human antigen binding antibody fragments and include, but are not limited to, Fab, Fab' and F(ab')₂, Fd, single-chain Fvs (scFv), single-chain antibodies, disulfide-linked Fvs (sdFv) and fragments comprising either a VL or VH domain. The antibodies can be from any animal origin including birds and mammals. Preferably, the antibodies are mammalian e.g. human, murine, rabbit, goat, guinea pig, camel, horse and the like, or other suitable animals e.g. chicken. As used herein, "human" antibodies include antibodies having the amino acid sequence of a human immunoglobulin and include antibodies isolated from human immunoglobulin libraries or from animals transgenic for one or more human immunoglobulins and that do not express endogenous immunoglobulins, as described, for example, in U.S. Patent

No. 5,939,598, the disclosure of which is incorporated herein by reference in its entirety.

[0037] The antigen used for the present invention can be modified polypeptide derived from a naturally occurring protein. The modified polypeptide may be a fragment of the naturally occurring protein. In one embodiment, the modified polypeptide has at least 70%, 75%, 80%, 85%, 90%, 95% or 98% amino acid sequence identity to a polypeptide derived from a naturally occurring protein. In one embodiment, the modified polypeptide derived is a mutant where at most 10% of the amino acids are deleted, substituted, and/or added based on a polypeptide derived from naturally occurring protein.

[0038] In the particle as provided by the present invention, a polypeptide and an antigen may be linked through at least one first attachment site which is present in the polypeptide and at least one second attachment site which is present in the antigen.

[0039] As used herein, each of "a first attachment site" and "a second attachment site" refers to a site where more than one substance is linked each other.

[0040] In one embodiment, the polypeptide and the antigen are directly fused. Alternatively, one or two linkers may intervene between N-terminal residue of the antigen and the polypeptide and/or between C-terminal residue of the

antigen and the polypeptide.

[0041] The antigen or the polypeptide can be truncated and replaced by short linkers. In some embodiments, the antigen or the polypeptide include one or more peptide
5 linkers. Typically, a linker consists of from 2 to 25 amino acids. Usually, it is from 2 to 15 amino acids in length, although in certain circumstances, it can be only one, such as a single glycine residue.

[0042] In one embodiment, a nucleic acid molecule, in
10 which polynucleotide encoding the polypeptide is genetically fused with polynucleotide encoding the antigen, is expressed in a host cell so that the first attachment site and the second attachment site are linked through a peptide bond. In this case, the polypeptide and the
15 antigen are linked through a peptide bond. Relating to this embodiment, the first attachment site and/or the second attachment site may be genetically modified from the original polypeptide or antigen. For example, the first attachment site is modified from the polypeptide so that
20 through a linker peptide including SG, GS, SGG, GGS and SGSG, the polypeptide is conjugated with the antigen.

[0043] When the polypeptide are chemically conjugated with the antigen, the first attachment site and the second attachment site may be linked through a chemical cross-
25 linker which is a chemical compound.

[0044] Examples of the cross-linker include, but are not limited to, SMPH, Sulfo-MBS, Sulfo-EMCS, Sulfo-GMBS, Sulfo-SIAB, Sulfo-SMPB, Sulfo-SMCC, SVSB, SIA and other cross-linkers available from the Pierce Chemical Company.

5 [0045] In one embodiment, the particle provided by the present invention comprises a polypeptide linked to an antigen, wherein spatial distance between the N-terminal residue and C-terminal residue of the antigen is 30Å or less when the distance is determined in a crystal of the
10 antigen or a naturally occurring protein containing the antigen or modified protein therefrom.

[0046] The antigen used for the present invention can be designed by a person skilled in the art. For example, the antigen used for the present invention may be a naturally
15 occurring protein or a fragment thereof. Alternatively, the antigen used for the present invention may be a protein modified from a naturally occurring protein or a fragment thereof. A person skilled in the art can design the antigen so that spatial distance between the N-terminal
20 residue and C-terminal residue of the antigen is 30Å or less when the distance is determined in a crystal of the antigen or a naturally occurring protein containing the antigen or modified protein therefrom. For example, the antigen used for the particle provided by the present
25 invention can be designed using a free software including

PyMOL (e.g. PyMOL v0.99: <http://www.pymol.org>). In one embodiment, the spatial distance between the N-terminal residue and C-terminal residue of the antigen is 30Å (angstrom) or less, 20Å or less, or 10Å or less (e.g. from 5 Å to 15 Å, from 5 Å to 12 Å, from 5 Å to 11 Å, from 5 Å to 10 Å, from 5 Å to 8 Å, from 8 Å to 15 Å, from 8 Å to 13 Å, from 8 Å to 12 Å, from 8 Å to 11 Å, from 9 Å to 12 Å, from 9 Å to 11 Å, from 9 Å to 10 Å or from 10 Å to 11 Å).

10 [0047]

Chikungunya virus like particle or a Venezuelan equine encephalitis virus like particle

In one embodiment, the present invention provides a Chikungunya virus like particle or a Venezuelan equine encephalitis virus like particle comprising a Chikungunya or Venezuelan equine encephalitis virus structural polypeptide and at least one malaria antigen, wherein said Chikungunya virus structural polypeptide or said Venezuelan equine encephalitis virus structural polypeptide comprises at least one first attachment site and said at least one malaria antigen comprises at least one second attachment site, and wherein said Chikungunya or Venezuelan equine encephalitis virus structural polypeptide and said at least one antigen are linked through said at least one first and said at least one second attachment site.

[0048] In one embodiment, a spatial distance between the N-terminal residue and C-terminal residue of the malaria antigen may be 30 Å or less; 25 Å or less; 20 Å or less; 15 Å or less; 14 Å or less; 13 Å or less; 12 Å or less; 11 Å or less; 10 Å or less; 9 Å or less; or 8 Å or less (e.g. from 5 Å to 15 Å, from 5 Å to 12 Å, from 5 Å to 11 Å, from 5 Å to 10 Å, from 5 Å to 8 Å, from 8 Å to 15 Å, from 8 Å to 13 Å, from 8 Å to 12 Å, from 8 Å to 11 Å, from 9 Å to 12 Å, from 9 Å to 11 Å, from 9 Å to 11 Å or from 10 Å to 11 Å) when the distance is determined in a crystal of the malaria antigen or a naturally occurring protein containing the malaria antigen or modified protein therefrom.

[0049] In one embodiment, the malaria antigen is linked to the Chikungunya or Venezuelan equine encephalitis virus structural polypeptide by way of chemical cross-linking or as a fusion protein produced by way of genetic engineering.

[0050] A Chikungunya or Venezuelan equine encephalitis virus structural polypeptide used in the present invention may comprise a Chikungunya or Venezuelan equine encephalitis virus envelope protein and/or a capsid.

[0051] Examples of Chikungunya virus include, but are not limited to, strains of 37997 and LR2006 OPY-1.

Examples of Venezuelan equine encephalitis virus include, but are not limited to, TC-83.

[0052] Chikungunya or Venezuelan equine encephalitis virus structural polypeptide used in the present invention may naturally occurring virus structural polypeptide or modified polypeptide thereof. The modified polypeptide may
5 be a fragment of the naturally occurring virus structural polypeptide. In one embodiment, the modified polypeptide has at least 70%, 75%, 80%, 85%, 90%, 95% or 98% amino acid sequence identity to a naturally occurring viral capsid and/or envelope protein. In one embodiment, the modified
10 polypeptide is a mutant where at most 10% of the amino acids are deleted, substituted, and/or added based on a naturally occurring viral capsid and/or envelope protein. For example, K64A or K64N mutataion may be introduced into a capsid of Venezuelan equine encephalitis virus structural
15 polypeptide used in the present invention.

[0053] Chikungunya or Venezuelan equine encephalitis virus structural polypeptide may consist of or comprise a capsid, E2 and E1.

[0054] Examples of Chikungunya virus structural
20 polypeptide include, but are not limited to, Capsid- E2-E1 of Chikungunya virus Strain 37997, and Capsid- E2-E1 of Chikungunya virus LR2006 OPY-1.

[0055] Examples of Venezuelan equine encephalitis virus structural polypeptide include, but are not limited to,
25 Capsid- E2-E1 of Venezuelan equine encephalitis virus

Strain TC-83.

[0056] An exemplary Chikungunya virus structural polypeptide sequence is provided at Genbank Accession No. ABX40006.1, which is described below (SEQ ID No.:1):

mefiptqtfnrryqprpwtprptiqvirprprpqrqagqlaqlisavnkltmravpqq
kprnrknkkqkqkqgqapqnnntngkkqppkkkpaqkkkkpgrrrermcmkiendcifevk
hegkvtgyaclvgdkvmkpahvkgtidnadlaklafkrsskydlecaqipvhmksdask
fthekpeggyynwhhgavqysggrftiptgagkpgdsgrpifdnkgrvvaivlgganega
rtalsvvtwnkdivtkitpegaeewslaipvmcllanttfpcsqppctpcyekepeet
lrmlednmrpgyyqllqasltcsphrqrstkdnfnykatrpylahcpdcgeghsch
spvalerirneatdgtlkiqvsllqigiktdsdshdwtklrymdnhmpadaeraglfvrt
apctitgtmghfilarcpkgetltvgftdsrkishscsthpfhhdppvigrekfhsrpqh
gkelpcstyvgstaatteeievhmppdtpdrtlmsqqsgnkvkitvngqtvrykcncggs
neglttttdkvinnckvdqchaavtnhkkwqynsplvprnaelgdrkgkihipfplanvt
crvpkarnptvtgknqvimllypdhptllsyrmgeepnyqeewvmhkkevltvpte
glevtwgnnepkywpqlstngtahghpheiiillyyelyptmtvvvsvatfillsmvg
maagmcmcarrrcitpyeltpgatvpfllsliccirtakaatygeaaiylwneqqplfw
lqaliplaalivlcnclrlppcccktlaflavmsvgahtvsayehvtvipntvgvpykt
lvnrpgyspmvlemellsvtleptlslidyitceyktvipspyvkccgtaeckdknlpy
sckvftgvypfmwggaycfdaentqlseahveksescktefasayrahtasasaklr
lyqgnnitvtayangdhavtvkdakfivgpmssawtpfdnkivvykgdvynmdyppfga
grpqgfgdiqsrtpeskdvyanqlvlqrpavgtvhvpysqapsgfkywlkergaslqh
tapfgcqiatnpvrvancavgnmpisidipeaaftrvvdapsltdmscevpacthssdf
ggvalikyaaskkgkcavhsmtnavtireaeievegnsqqlqisfstalasaefrvqvc
tqvhcaaechppkdhivnypashttlgvqdisatamswvqkitggvgllvavaaliliv
vlcvsfsrh

5

[0057] Another exemplary Chikungunya virus structural polypeptide sequence is provided at Genbank Accession No. ABX40011.1, which is described below (SEQ ID No.:2):

mefiptqtfynrryqprpwaprptiqvirprprpqrqagqlaqlisavnkltnravpqq
 kprnrknkkqrqkkqapqndpkqkkqppqkkpaqkkkkpgrrrermcmkiende
 ifevkhegkvmgyaclvgdkvmkpahvkgtidnadlaklafkrsskydlecaqipvh
 mksdaskfthekegyynwhhgavqysggrftiptgagkpgdsgrpifdnkgrvvai
 vlgganegartalsvvtwnkdivtkitpegaeewslalpvllcllanttfpcsqppctpccye
 kepestlrmllednvmrpgyyqllkasltcsphrrstkdnfnykatrpylahcpdcg
 eghschspialerirneatdgtlkiqvsqigiktdsdhwtklrymdshtpadaeragll
 vrtsapctitgtmghfilarcpkgetltvgftdsrkishtcthpfhheppvigrerfhsrpq
 hgkelpestyvqstaataeeievhmppdtpdrtlmtqqsgnvkitvngqtvrykencg
 gsnegltttdkvinnckidqchaavtnhknwqynsplvprnaelgdrkgkihipfplan
 vtervpkarnptvtygknqvtmllypdhptllsyrnmgqepnyheewvthkkevtltv
 pteglevtwgnnepyykywpqmstngtahghpheillyyyelyptmtvvivsvasfvlls
 mvgtavgmecvcarrrcitpyeltpgatvpfllsllccvrttkaatyeeaaaylwneqqplf
 wlqaliplaalivlcnclklpcccktlaflavmsigahtvsayehvtvipntvgvpyktlvn
 rpgyspmvlemelqsvtleptlslidyitceyktvipspyvkcgcgtaeckdkslpdysckvf
 tgvypfmwggaycfdaentqlseahveksescktefasayrahtasasaklrlyqgn
 nitvaayangdhavtvkdakfvvgpmssawtpfdnkivvykgdvynmdyppfgagr
 pgqfgdiqsrtpeskdvyantqlvlqrpaagtvhvpysqapsgfkywlkergaslqhta
 pfgcqiatnpvravncavgnipisidipdaaftvvvdapsvtdmscevpackthssdfggv
 aiikytasckgkcavhsmtnavtireadvevegnsqqlqisfstalasaefrvqvstqvhc
 aaachppkdhivnypashttlgvqdisttamswvqkitggvglivavaalilivvlcvfsf
 rh

[0058] An exemplary Venezuelan equine encephalitis virus structural polypeptide is provided at Genbank Accession No. L01443.1 (<http://www.ncbi.nlm.nih.gov/nuccore/L01443.1>), which is described below (SEQ ID No.:3):

mfpfqpmypmqmpyrnpfaaprrpwpfprtdpflamqvqeltrsmantlfkqrrdappe
gpsaakpkkeasqkqkggggkknqgkkaaktgppnpkaqngnkkktnkkpgkrqrm
vmklesdktfpimlegkingyacvvvggklfrpmhvegkidndvlaalktkkaskydley
advpqnmradtfkkythekpggyyswhhgavqyengrftvpkgvgakgdsgrpildnqgr
vvaivlggvnegsrtalsvmmwnekgtvkytpenceqwsllvtmcllanvtfpcagpp
icydrkpaetlamlsvnvdpngydelleaavkcpgrkrsteelfneykltrpymarci
rcavgschspiaieavksdghdgyvrlqtssqygldssgnlkgtrmrydmhgtikeipl
hqvslytsrpchivdghgyfllarcpagdsitmeffkdsvrhscsvpyevkfnpvgrel
ythppehgveqacqvyahdaqnrgayvemhlpgevdsslvslsgssvtvtpdgtal
vececggtkisetinktkqfsqctkkeqcrayrlqndkwvynsdklpkaagatlkgklh
vpflladgkctvplapepmitfgfrsvslklhpkntylitrqladephythelisepa
vrnftvtekfwefvwnhppkrfwaqetapgnphglphevithyyhrypmstilglsic
aaiatvsvaastwlfcrsrvacltpyrlltpnaripfclavlc cartaraettwesldhl
wnnnqgmfiwqlliplaalivtrllrcvccvvpflvmagaagagayehattmpsqagi
syntivnragyaplpisitptkikliptvnleyvtchyktgmdspaikccgsqectpty
rpdeqckvftgvypfmwggaycfcdtentqvskayvmksddcladhaeaykahtasvqa
flnitvgehsivttvyvngetpvnfngvkitagplstawtpfdrkivqyageiynydfp
eygagqpqafgdiqsrvtsssdlyantnlvlqrpkagaihvpytqapsqfegwkdkkap
slkftapfgceiytnpiracavgsiplafdipldalftrvsetptlsaaectlnecvy
ssdfggiatvkysaskgkavhvpsgtatlkeaavelteqgsatihfstanihpfevrl
qictsyvtckgdchppkdhivthpqyhaqtftaavsktawtwltsllggsaviiiiglv
lativamyvltngkhn.

5

[0059] In one embodiment, a first attachment site comprises an amino group, preferably an amino group of a lysine residue. In one embodiment, the second attachment site comprises a sulfhydryl group, preferably, a sulfhydryl group of a cysteine.

10

[0060] In one embodiment, a conjugation of more than two substances (e.g. antigen and Chikungunya or Venezuelan equine encephalitis virus structural polypeptide) through a first attachment site or a second attachment site is achieved using chemical cross linker. Examples of the cross-linker include, but are not limited to, SMPH, Sulfo-

15

MBS, Sulfo-EMCS, Sulfo-GMBS, Sulfo-SIAB, Sulfo-SMPB, Sulfo-SMCC, SVSB, SIA and other cross-linkers available from the Pierce Chemical Company.

[0061] According to the present invention, a Chikungunya
5 or Venezuelan equine encephalitis virus like particle
comprising a Chikungunya or Venezuelan equine encephalitis
virus structural polypeptide and an antigen, wherein said
Chikungunya or Venezuelan equine encephalitis virus
structural polypeptide and said antigen are expressed as a
10 fusion protein can be provided.

[0062] In one embodiment, the antigen can be fused with
any site of the Chikungunya or Venezuelan equine
encephalitis virus structural polypeptide. For example,
the antigen may be directly or indirectly linked to N- or
15 C- terminal of the Chikungunya or Venezuelan equine
encephalitis virus structural polypeptide, or the antigen
may be inserted into Chikungunya or Venezuelan equine
encephalitis virus structural protein.

[0063] In one embodiment, at least one antigen is
20 inserted into E2 of Chikungunya or Venezuelan equine
encephalitis virus structural protein. For example,
regarding Chikungunya virus structural protein, at least
one antigen is inserted between residues 519 and 520 of SEQ
ID Nos.1 or 2 (i.e. between G at 519-position and Q at 520-
25 position of SEQ ID Nos.1 or 2); between residues 530 and

531 of SEQ ID Nos.1 or 2 (i.e. between G at 530-position and S at 531-position of SEQ ID Nos.1 or 2); between residues 531 and 532 of SEQ ID Nos.1 or 2 (i.e. between S at 531-position and N at 532-position of SEQ ID Nos.1 or 2); between residues 529 and 530 of SEQ ID Nos.1 or 2 (i.e. between G at 529-position and G at 530-position of SEQ ID Nos.1 or 2); or between residues 510 and 511 of SEQ ID Nos.1 or 2 (i.e. between S at 510-position and G at 511-position of SEQ ID Nos.1 or 2); or between residues 511 and 512 of SEQ ID Nos.1 or 2 (i.e. between G at 511-position and N at 512-position of SEQ ID Nos.1 or 2); or between residues 509 and 510 of SEQ ID Nos.1 or 2 (i.e. between Q at 509-position and S at 510-position of SEQ ID Nos.1 or 2).

[0064] For example, regarding Venezuelan equine encephalitis virus structural protein, at least one antigen is inserted between residues 517 and 518 of SEQ ID No.3 (i.e. between G at 517-position and S at 518-position of SEQ ID No.3); between residues 518 and 519 of SEQ ID No.3 (i.e. between S at 518-position and S at 519-position of SEQ ID No.3); between residues 519 and 520 of SEQ ID No.3 (i.e. between S at 519-position and V at 520-position of SEQ ID No.3); between residues 515 and 516 of SEQ ID No.3 (i.e. between L at 515-position and S at 516-position of SEQ ID No.3); between residues 516 and 517 of SEQ ID No.3 (i.e. between S at 516-position and G at 517-position

of SEQ ID No.3); between residues 536 and 537 of SEQ ID No.3(i.e. between C at 536-position and G at 537-position of SEQ ID No.3) ; between residues 537 and 538 of SEQ ID No.3(i.e. between G at 537-position and G at 538-position of SEQ ID No.3) ; between residues 538 and 539 of SEQ ID No.3(i.e. between G at 538-position and T at 539-position of SEQ ID No.3).

[0065] The fusion protein may be expressed using a conventional technique in the art. A variety of expression systems can be used for the expression of the fusion protein. For example, the fusion protein can be expressed in 293 cells, Sf9 cells or E.coli.

[0066] A polypeptide derived from Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV) may be a naturally occurring viral polypeptide or modified polypeptide thereof. In addition, a polypeptide derived from malaria antigen may be a naturally occurring polypeptide or modified polypeptide of the naturally occurring polypeptide or a fragment of the naturally occurring polypeptide or the modified peptide. The modified polypeptide may be a fragment of the naturally occurring virus structural polypeptide.

[0067] In one embodiment, the modified polypeptide derived from malaria antigen has at least 70%, 75%, 80%, 85%, 90%, 95% or 98% amino acid sequence identity to a

naturally occurring polypeptide. In one embodiment, the modified peptide derived from malaria antigen is a mutant where at most 10% of the amino acids are deleted, substituted, and/or added based on a naturally occurring polypeptide derived from malaria antigen.

[0068] When a polypeptide derived from a virus is conjugated with a polypeptide derived from an antigen, a linker peptide including SG, GS, SGG, GGS SGSG and TRGGS may be used. Examples of conjugation of the polypeptide derived from a virus (referred to as "PFV" below) with the polypeptide derived from the antigen (referred to as "PFA" below) include, but not limited to: PFV-SG-PFA-GS-PFV; PFV-SG-PFA-GGS-PFV; PFV-SSG-PFA-GS-PFV; PFV-SGG-PFA-GGS-PFV; PFV-SGSG-PFA-GS-PFV; and PFA-SGG-PFA-TRGGS-PFV.

[0069] In one embodiment, the present invention provides a virus like particle comprising a fusion protein of a polypeptide derived from Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV) and a polypeptide derived from malaria antigen, wherein the virus like particle is prepared by transfecting an expression vector comprising a nucleic acid molecule corresponding to the amino acid sequence represented by SEQ ID NO. 28, 31, 34, 37, 39, 41 or 43 into a mammalian cell (e.g. 293F cell). Regarding this embodiment, modified fusion protein can be also used for a virus like particle provided by the present

invention, which can be prepared by transfecting an expression vector comprising a nucleic acid molecule corresponding to the amino acid sequence having at least 70%, 75%, 80%, 85%, 90%, 95% or 98% amino acid sequence identity to SEQ ID NO. 28, 31, 34, 37, 39, 41 or 43 into a mammalian cell (e.g. 293F cell).

[0070] In one embodiment, the present invention provides a virus like particle comprising or consisting of:

one or more capsid of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV);

one or more E1 of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV); and

one or more E2 of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV), wherein malaria antigen is inserted into E2 of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV). For example, present invention provides a virus like particle comprising or consisting of:

240 capsids of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV);

240 E1s of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV); and

240 E2s of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV), wherein malaria antigen is inserted into each of E2s of Chikungunya virus (CHIKV) or

Venezuelan equine encephalitis virus (VEEV).

[0071] In this embodiment, the E2 into which the antigen is inserted may consist of an amino acid sequence represented by SEQ ID No.50; the E1 may consist of an amino acid sequence represented by SEQ ID No.51; and the capsid may consist of an amino acid sequence represented by SEQ ID NO.: 52; or

the E2 into which the antigen is inserted may consist of an amino acid sequence represented by SEQ ID NO.53; the E1 may consist of an amino acid sequence represented by SEQ ID NO.54; and the capsid may consist of an amino acid sequence represented by SEQ ID NO.: 55.

[0072] Further, regarding this embodiment, modified capsid of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV), modified E1 of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV) and modified E2 of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV) may be used for the virus like particle. For example, the modified capsid of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV) may have at least 70%, 75%, 80%, 85%, 90%, 95% or 98% amino acid sequence identity to the amino acid sequence represented by SEQ ID NO.: 52 or SEQ ID No.:55; the modified E1 of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV) may have at least 70%, 75%,

80%, 85%, 90%, 95% or 98% amino acid sequence identity to the amino acid sequence represented by SEQ ID NO.: 51 or SEQ ID No.:54; and/or the modified E2 of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV) may
5 have at least 70%, 75%, 80%, 85%, 90%, 95% or 98% amino acid sequence identity to the amino acid sequence represented by SEQ ID NO.: 50 or SEQ ID No.:53.

Also, the modified capsid, E1 or E2 may be a mutant where at most 10% of the amino acids are deleted, substituted,
10 and/or added based on the capsid consisting of an amino acid sequence represented by SEQ ID NO.: 52 or SEQ ID No.:55; E1 consisting of an amino acid sequence represented by SEQ ID NO.: 51 or SEQ ID No.:54; and/or E2 consisting of consisting of an amino acid sequence represented by SEQ ID
15 NO.: 50 or SEQ ID No.:53.

[0073]

(2) Nucleotide, Vector, Host cell

In the second aspect, the present invention provides
20 a nucleic acid molecule which is designed for expression of a particle as provided in the first aspect of the present invention.

[0074] In one embodiment, the present invention provides a nucleic acid molecule comprising a nucleotide sequence
25 that encodes the Chikungunya or Venezuelan equine

encephalitis virus like particle as described above.

[0075] Examples of the nucleotide sequence that encodes the Chikungunya or Venezuelan equine encephalitis virus like particle include, but are not limited to, a nucleotide sequence encoding envelope of Chikungunya virus Strain 37997, a nucleotide sequence encoding Capsid-envelope of Chikungunya virus Strain 37997, a nucleotide sequence encoding envelope of Chikungunya virus Strain LR2006 OPY-1, a nucleotide sequence encoding Capsid-envelope of Chikungunya virus LR2006 OPY-1, a nucleotide sequence encoding envelope of Venezuelan equine encephalitis virus Strain TC-83 and a nucleotide sequence encoding Capsid-envelope of Venezuelan equine encephalitis virus TC-83.

[0076] Regarding Chikungunya virus, an exemplary nucleotide sequence that encodes envelope is described below (SEQ ID No.:4):

Atgagcctcgccctccgggtcttgtgctgttggcaaacactacattccctgctctcagccgcttgcacacctgtgtctacga
 aaaggaaacgggaaagcaccttgccgatgcttgaggacaacgtgatgagaccggatactaccagctactaaaagcatcgct
 gacttgcctccccaccgccaaagacgcagtaactaaggacaattttaatgtctataaaagccacaagaccatatctagctcattg
 tctgactgcgggagaaggccattcgtgccacagccctatcgattggagcgcatcagaaatgaagcaacggacggaacgctg
 aaaatccagggtctcttgcagatcgggataaagacagatgacagccacgattggaccaagctgcgctatatggatagccata
 cggcagcgggacggagcgagcgggattgcttgaaggacttcagcaccgtgcacgatcaccgggaccatgggacacatttatt
 ctgcccgatgcccgaaggagagacgctgacagtgaggatttacggacagcagaaagatcaccacacatgcacacacccg
 ttccatcatgaaccacctgtgataggtaggagaggttccactctcgaccacaacatggtaaaagattaccttgacgacgta
 cgtgcagagcacccgtgccactgtgagggagatagaggtgcataatgccccagataactctgacccgacgctgatgacgcag
 cagtctggcaacgtgaagatcacagttaattgggcagacgggtcggtacaagtgcactcggttgctcaaacgaggggactg
 acaaccacagacaaagtgtcaataactgcaaaattgatcagtgccatgctgcagtcactaatcacaagaattggcaatac
 aactcccccttagtcccgccgaacgctgaactcggggaccgtaaaggaaagatccacatcccattcccattggcaaacgtgac
 ttgcagagtgcccaaaagcaagaaccctacagtaacttacggaaaaaaccaagtcaccatgctgctgtatcctgacccatccg
 aactcttgcctaccgtaacatgggacagggaaccaaattaccacgaggagtggtgacacacaagaaggaggttaccttg
 accgtgcctactgagggtctggaggtcacttggggcaacaacgaaccatacaagtagtggcgagatgctacgaacggta
 ctgctcatggtcaccacatgagataatctgtactattatgagctgtacccactatgactgtagtcttctgctcggtggtcgtg
 ttgctgcttctgtgatggtgggcacagcagtggaatgtgtgtgtgcgcacggcgagatgcattacaccatagtaattaac
 accaggagccactgttcccttctgctcagcctgctatgtctgctcagaacgaccaaggcgccacatattacgaggtcgccgc
 atatctatggaaacgaacagcagccctgttctggttgacgctcttateccgctggcgcccttgatcgtcctgtgcaactgtctg
 aaactcttgccatgctgctgtaagacctggcttttttagccgtaatgagcatcggtgcccacactgtgagcgcgtagcaaac
 gtaacagtgatcccgaacacgggtgggagtagcgtataagactcttgtcaacagacgggttacagccccatggtgttgagag
 tggagctacaatcagtcacettggaaccaacactgtcactgactacatcagtcgcagtagcaaaactgtcatccccctccccgt
 acgtgaagtgtgtggtacagcagagtgcaaggacaagagcctaccagactacagctgcaagggtcttactggaggtctaccc
 atttatgtggggcgccgctactgcttttgacgcgcgaaaaatagcaattgagcgaggcacatgtagagaaatctgaatctt
 gcaaaacagagtttgcattcgccctacagagccacaccgcacgctggcgctggcggaagctccgctcctttaccaaggaaacaa
 cattaccgtagctgctacgctaacgggtgacctgcccgtcacagtaaaaggacgccaagtttgctgtgggcccacatgtctccgc
 ctggacaccttttgacaacaaaatcgtggtgtacaaaggcgacgtctacaacatggactaccaccttttggcgaggaagac
 caggacaatttgggtgacattcaaaagtcgtacacgggaaagttaaagacgtttatgccaacactcagttggtactacagagggc
 agcagcaggcagcgtacatgtaccatactctcaggcaccatctggttcaagtattggctgaagggaacgaggagcagcgtac
 cagcacacggcaccgttcggttgcagattgacgacaaacccgtaagagctgtaaattgcgctgtggggaacataccaatttc
 catcgacataccggatggggccttactagggttgcgatgcacctctgtaacggacatgtcatgcgaagtaccagcctgcac
 tcactcctccgactttggggggctgcccacatcaataacacagctagcaagaaaggtaaatgtgcagtacattcgatgacca
 acggcgttaccattcgagaagccgacgtagaagtagaggggaaactcccagctgcaaaatcccttctcaacagccctggcaag
 cgccgagtttgcgtgcaagtgtgctccacacaagtacactgcgcagccgcatgccacctccaaaggaccacatagtcaatt
 acccagcatcacacaccaccttgggggtccaggatataccacaacggcaatgtcttgggtgcagaagattacgggaggaggt
 aggattaattgtgtgtgtgctgccttaatttaattgtggtgctatgcgtgtcgtttagcaggcac

[0077] Regarding Chikungunya virus, another exemplary
 nucleotide sequence that encodes envelope is described
 5 below (SEQ ID No.:5):

Atgagctcttgccatcccagttatgtgctgttggcaaacaccacgttcccctgctccagccccttgccagcccctgctgctacga
aaaggaaccggaggaaacccatgcatgcttgaggacaacgtcatgagacctgggtactatcagctgctacaagcatcctta
acatgttctccccaccgacgacgcagcaccaggaacacttcaatgtctataaagccacaagaccatacttagctcactgt
cccagctgtggagaagggcactcgtgccatagtcctgtagcactagaacgcatcagaaatgaagcgacagacgggacgctg
aaaatccaggtctccttgcaaatcggaataaagacggatgacagccacgattggaccaagctgcgttatatggacaaccaca
tgccagcagacgcagagaggggggggctatttgaagaacatcagcaccgtgtacgattactggacaacatgggacacttcat
cctggcccgatgtccaaaaggggaaactctgacgggtgggattcactgacagtaggaagattagtcactcatgtacgcaccat
ttaccacgacccctcctgtgataggctgggaaaaattccattcccagaccgcagcaggtaaagagctaccttgccagcagctacg
tgccagcagcaccgccaactaccgaggagatagaggtacacatgccccagacacccctgatccacattaatgtcacaca
gtccggcaacgtaaaagatcagctcaatggccagacgggtgcggtacaagtgtattgcggtgggtcaaatgaaggactaaca
actacagacaaaagtgattaataactgcaagggtgatcaatgtcatgcccgggtaccaatcacaanaagtggcagtataact
cccctctgtcccgcgtaatgtgaacttggggaccgaaaaggaaaaattcacatcccgtttccgctggcaaatgtacatgca
gggtgcttaagcaaggaaacccacccgtgacgtacgggaaaaaccaagtcatcatgctactgtatcctgaccaccaacactc
ctgtcctacgggaatattgggagaaacacaaactatcaagaagagtggtgatgcataagaaggaaagctgtgctaacctg
ccgactgaagggtcgcaggtcagctgggggcaacacgagccgtataagattggccgcagttatctacaacgggtacagccc
atggccacccgcgtagataattctgtattattatgagctgacccactatgactgtagtagttgtgcagtggccacgttcat
actcctgtcgtatgggtatggcagcggggatgtgcatgtgtgcacgacgcagatgcacacacccgtatgaactgacaccag
gagctacgctcccttctcgttagcctaataatgctgcatcagaacagctaaagcgccacataccaagaggtgctgataacc
tgtggaacgagcagcaacctttgtttggctacaagccctattccgctggcagccctgattgttctatgcaactgtctgagactc
ttaccatgctgctgtaaaacgttggctttttagccgtaatgagcgtcggtgccacactgtgagcgcgtacgaacacgttaaca
gtgatcccgaaacacgggtgggagtaccgtataagactctagtcataagacctgggtacagccccatggtattggagatggaact
actgtcagctactttggagccaacactatcgcttgattacatcagctgcgagtacaaaacccgtcatcccgtctccgtacgtgaag
tgctgcggtacagcagatgcaaggacaaaaacctacctgactacagctgtaaggcttccacggcgtctacccatttatgtgg
tgccggcgcctactccttctgcgacgtgaaaacacgcagctgaaagcagacacgtggagaagtcggaatcagcaaaaacag
aatgttcacacagcatacaggggtcctacccgcatctgcacagctaaagctccgcgtcctttaccaaggaaataacatcactgtaa
ctgctatgcaaacggcgaccatgccgtcacagttaaaggacgcgaattcattgtggggccaatgtcttcagcctggacacctt
cgacaacaaaattgtggtgtacaagggtgacgtctataacatggactacccgccccttggcgaggaagaccaggacaattt
ggcgatatccaaagtgcacacctgagagtaaaagacgtctatgctaatacacaactgggtactgcagagacggcgtgtgggta
cggtacacgtgccatactctcaggcaccatctggttttaagtattggctaaaagaacgggggctgcgtgcagcacacagca
ccatttgctgccaaaatagcaaaaacccggtaagagcgggtgaactgcgcgttagggaaacatgccatccatcgacataacc
ggaagcggcctcactagggtcgtgcagcgcctcttttaacggacatgtcgtgcgaggtaccagcctgcaccattctcagac
tttggggcgcctcgcattattaaatagcagccagcaagaaggcaagtgctgcgtgcattcgatgactaacgcgcgtcactatt
cgggaagctgagatagaagttgaagggaattctcagctgcaaatctcttctgcagcgccttagccagcgcgaattccgcgta
caagctgttctacacaagctacactgtgcagccgagtgccacccccgaaggaccacatagtcactacccggcgtcacatacc
accctgggggtccaggacatctccgtacggcgatgcatgggtgcagaagatcacgggaggtgtgggactggttgtgtgtgt
ccgcactgatttcaatcgtggtgctatgcgtgtcgttcagcaggcac

[0078] Regarding Chikungunya virus, an exemplary
nucleotide sequence that encodes a Capsid-envelope is
described below (SEQ ID No.:6):

atggagttcatcccagcgcgaactttctataacagaaggtaccaacccccgaccctgggc
cccacgcccctacaattcaagtaattagacctagaccacgtccacagaggcaggctgggc
aactcgcccagctgatctccgcagtcacaaaattgaccatgcgcgcggtacctcaacag
aagcctcgagaaatcggaaaaaacaagaagcaaaaggcagaagaagcaggcgccgcaaaa
cgacccaaagcaaaaagaagcaaccaccacaaaagaagccggctcaaaagaagaagaac
caggccgtagggagagaatgtgcatgaaaattgaaaatgattgcatcttcgaagtcaag
catgaaggcaaaagtgatgggtacgcagctgcttgggtgggggataaagtaatgaaaccagc
acatgtgaagggaactatcgacaatgccgatctggctaaactggcctttaagccggtcgt
ctaaatcacgatcttgaatgtgcacagataccggtgcacatgaagtctgactgcctcgaag
tttaccacagagaaacccgaggggtactataactggcatcacggagcagtgagttatc
aggaggccggttactatcccagcgggtgcaggcaagccgggagacagcggcagaccga
tcttcgacaacaaaggacgggtggtggccatcgtcctaggagggggccaacgaagggtgcc
cgcacggccctctccgtgggtgacgtggaacaaagacatcgtcacaaaaattaccctga
gggagccgaagagtggagcctcgccctcccggtcttgtgctgttggcaaacactacat
tcccctgctctcagccgccttgccacaccctgctgctacgaaaaggaaaccggaaagcacc

ttgcgcatgcttgaggacaacgtgatgagacccggatactaccagctactaaaagcatc
 gctgacttgctctccccaccgccaagacgcagtaactaaggacaattttaatgtctata
 aagccacaagaccatatctagctcattgtcctgactgcgagagaagggcatttcgtgccac
 agccctatcgcattggagcgcatcagaaatgaagcaacggacggaacgctgaaaatcca
 ggtctctttgcagatcgggataaagacagatgacagccacgattggaccaagctgcgt
 atatggatagccatacggcagcgagcgaggagcgagccggattgcttgtaaggacttca
 gcaccgtgcacgatcaccggggaccatgggacactttattctcgcccgatgcccgaaggg
 agagacgctgacagtgaggatttacggacagcagaaagatcagccacacatgcacacacc
 cgttccatcatgaaccacctgtgataggtagggagaggttccactctcgaccacaacat
 ggtaaagagttaccttgcagcacgtacgtgcagagcaccgctgccactgctgaggagat
 agaggtgcatatgccccagataactcctgaccgcagctgatgacgcagcagctctggca
 acgtgaagatcacagttaatgggcagacgggtgcggtacaagtgcgaactgcggtgggtca
 aacgaggggactgacaaccacagacaaagtgatcaataactgcaaaattgatcagtgcca
 tgctgcagtcactaatcacaagaattggcaatacaactcccccttagtcccgcgcaacg
 ctgaactcggggaccgtaaaaggaaagatccacatcccattcccattggcaaacgtgact
 tgcagagtgcacaaaagcaagaaccctacagtaacttacggaaaaaaccaagtcacat
 gctgctgtatcctgaccatccgacactcttgtcttacgtaacatgggacaggaaccaa
 attaccacgaggagtgggtgacacacaagaaggaggttaccttgaccgtgcctactgag
 ggtctggaggtcacttggggcaacaacgaaccatacaagtaactggccgcagatgtctac
 gaacggtactgctcatgggtcaccacatgagataatcttgtactattatgagctgtacc
 ccactatgactgtagtcattgtgtcggtggcctcgctcgcttctgtcgatgggtgggc
 acagcagtggggaatgtgtgtgtgcgcacggcgagatgcattacaccatatgaattaac
 accaggagccactgttcccttctgctcagcctgctatgctgcgtcagaacgaccaagg
 cggccacatattacgaggtgcggcatatctatggaacgaacagcagccctgttctgg
 ttgcaggtcttatcccgtggcgccttgatcgctcctgtgcaactgtctgaaactctt
 gccatgctgctgtaagacctggcttttttagccgtaatgagcatcgggtgccacactg
 tgagcgcgtagcaaacacgtaaacagtgatcccgaacacgggtgggagtagccgtataagact
 cttgtcaacagaccgggttacagccccatgggtgttgagatggagctacaatcagtcac
 cttggaaccaacactgtcacttgactacatcacgtgcgagtacaaaactgtcatccccct
 ccccgtagctgaagtgtgtgtgtacagcagagtgcaggacaagagcctaccagactac
 agctgcaaggtctttactggagtctacccatttatgtggggcggcgccactactgcttttg
 cgagcgcgaaaatacgcgaattgagcgagggcacatgtagagaaatctgaatcttgcaaaa
 cagagtttgcatcggcctacagagccccacacgcgcatcggcggtcggcgaagctccgcgtc
 ctttaccaaggaaacaacattaccgtagctgcctacgctaacgggtgacctgcccgtcac
 agtaaaggacgccaagtttgcgtgggcccgaatgtcctccgcctggacaccttttgaca
 acaaaatcgtggtgtacaaaggcgacgtctacaacatggactaccaccttttggcgca
 ggaagaccaggacaatttggtgacattcaaagtcgtacaccggaaagtaagacgttta
 tgccaacactcagttggtactacagagggccagcagcaggcacgggtacatgtaccatact
 ctacggcaccatctggcttcaagtattggctgaaggaaacgaggagcatcgctacagcac
 acggcacccgttcggttgccagattgcgacaaaacccggtgaagagctgtaaattgcgctgt
 ggggaacataccaatttccatcgacataccggatgcggcctttactaggggtgtcgatg
 caccctctgtaacggacatgtcatgcgaagtaccagcctgcactcactcctccgacttt
 gggggcgtcgccatcatcaaatcacagctagcaagaaaggtaaatgtgcagtaacattc
 gatgaccaacgcccgttaccattcgagaagccgacgtagaagtagaggggaactcccagc
 tgcaaatatccttctcaacagccctggcaagcgccgagtttcgcgtgcaagtgtgctcc
 acacaagtacactgcgcagccgcatgccaccctccaaaggaccacatagtaattatccc
 agcatcacacaccaccttgggggtccagatatatccacaacggcaatgtcttgggtgc
 agaagattacgggaggagtaggattaattgttgctgttgctgccttaatttttaattgtg
 gtgctatgcgtgtcgttttagcaggcactaa.

[0079] Regarding Chikungunya virus, another exemplary
 nucleotide sequence that encodes a Capsid-envelope is
 described below (SEQ ID No.:7):

atggagttcatcccaacccaaactttttacaataggaggtaccagcctcgaccctggac
 tccgcgccttactatccaagtcacagggccagaccgcgccttcagaggcaagctgggc
 aacttgcccagctgatctcagcagttataaaactgacaatgcgcgcggtaccacaacag
 aagccacgcaggaatcggaagaataagaagcaaaaagcaaaaacaacaggcgccacaaaa
 caacacaaatcaaaagaagcagccacctaataaagaacccggctcaaaagaaaaagaagc
 cgggcccgcagagagaggatgtgcatgaaaatcgaaaatgattgtattttcgaaagtcag
 cacgaaggttaaggtaacaggttacgcgtgcctgggtgggggacaaagtaatgaaaccagc
 acacgtaaaaggggaccatcgataacgcggacctggccaaactggcctttaagcgggtcat
 ctaagtatgaccttgaatgcgcgcgacatacccggtgcacatgaagtccgacgcttcgaag
 ttcacccatgagaaaacccggagggtactacaactggcaccacggagcagtagtactc
 aggaggccgggttaccatccctacaggtgctggcaaaccaggggacagcggcagaccga
 tcttcgacaacaagggaacgcgtgggtggccatagtcttaggaggagctaataaggaggcc
 cgtacagccctctcgggtgggtgacctggaataaagacattgtcactaaaatcacccccga
 gggggccgaagagtggagtcttggccatcccagttatgtgcctgttggcaaaccaccagct
 tccccgtctcccagcccccttgacgccttgcctgctacgaaaaggaaccggaggaaacc
 ctacgcatgcttgaggacaacgcatgagacctgggtactatcagctgctacaagcatc
 cttaacatgttctccccaccgcccagcgcagcagcaccaggacaacttcaatgtctata
 aagccacaagaccatacttagctcactgtcccgactgtggagaagggcactcgtgccat
 agtcccgtagcactagaacgcacagaaatgaagcgacagacgggacgctgaaaaatcca
 ggtctccttgcaaatcggaataaagacggatgacagccacgattggaccaagctgcgtt
 atatggacaaccacatgccagcagacgcagagaggcggggctatttgtaagaacatca
 gcaccgtgtacgattactggaacaatgggacacttcacctggcccgatgtccaaaagg
 ggaaactctgacgggtgggattcactgacagtaggaagattagtcactcatgtacgcacc
 catttcaccacgacctcctgtgataggtcgggaaaaaattccattcccagccgagcac
 ggtaaaagagctaccttgacgcacgtacgtgcagagcaccgcgcgaactaccgagagat
 agaggtaacacatgccccagacacccctgatcgacattaatgtcacaacagtcgggca
 acgtaaaagatcacagtcacatggccagacgggtgcggtacaagtgtaatgcggtgggtca
 aatgaaggactaacaactacagacaaagtattataaactgcaagggtgatcaatgtca
 tgccgcggtcaccaatcacaaaaagtggcagttataactccccctctgggtccgcgtaatg
 ctgaacttggggaccgaaaaaggaaaaattcacatcccgtttccgctggcaaatgtaaca
 tgcaggggtgcctaaagcaaggaacccaccgtgacgtacgggaaaaaccaaagtcacat
 gctactgtatcctgaccacccaacactcctgtcctaccggaatatggggagaagaaccaa
 actatcaagaagagtgggtgatgcataagaaggaagtgcgtgctaaccgtgccgactgaa
 gggctcgagggtcacgtggggcaacaacgagccgtataagattggccgcagttatctac
 aaacgggtacagcccattggccaccgcagatgagataattctgtattattatgagctgtacc
 ccactatgactgtagtagttgtgtcagtgggccacgttcatactcctgtcgatgggtgggt
 atggcagcggggatgtgcatgtgtgcacgacgcagatgcatcacaccgtatgaactgac
 accaggagctaccgtccctttcctgcttagcctaataatgctgcatcagaacagctaaag
 cggccacataccaagaggtgcgatataacctgtggaacgagcagcaaccttgttttg
 ctacaagcccttatccgctggcagccctgattgttctatgcaactgtctgagactctt
 accatgctgctgtataaacgttggcttttttagccgtaatgagcgtcgggtgccacactg
 tgagcgcgtacgaacacgtaaacagtgatcccgaacacgggtgggagtaccgtataagact
 ctagtcaatagacctggctacagccccatgggtattggagatggaactactgtcagtcac
 tttggagccaacactatcgcttgattacatcacgtgcgagtacaaaaccgtcatcccg
 ctccgtacgtgaagtgtgcggtacagcagagtgcaggacaaaaacctacctgactac
 agctgtaaggtcttcaccggcgtctacccatttatgtggggcggcgcctactgcttctg
 cgacgctgaaaacacgcagttgagcgaagcacacgtggagaagtccgaatcatgcaaaa
 cagaatttgcacagcatacaggggtcataccgcacatctgcatcagctaagctccgcgtc
 ctttaccaaggaaataacatcactgtaactgcctatgcaaacggcgaccatgccgtcac
 agttaaggacgccaatttcattgtggggccaatgtcttcagcctggacacctttcgaca
 acaaaattgtgggtgtacaaaggtgacgtctataacatggactaccgcacctttggcgca
 ggaagaccaggacaatttggcgatatccaaagtcgcacacctgagagtaaaagacgtcta

tgctaatacacaaactggtactgcagagaccggctgtgggtacgggtacacgtgccataact
 ctcaggcaccatctggctttaagtattggctaaaagaacgcggggcgctcgctgcagcac
 acagcaccatttggctgccaaatagcaacaaacccggtaagagcggtgaactgcgccgt
 agggaaacatgcccattctccatcgacataccggaagcggccttcactagggtcgtcgacg
 cgccctctttaacggacatgtcgtgaggtaccagcctgcacccattcctcagacttt
 gggggcgctcgccattattaaatatgcagccagcaagaaaggcaagtgtgcgggtgcattc
 gatgactaacgcggtcactattcggaagctgagatagaagttgaagggaattctcagc
 tgcaaatctctttctcgacggccttagccagcgccgaattccgcgtacaagtctgttct
 acacaagtacactgtgcagccgagtgccacccccgaaggaccacatagtcaactaccc
 ggcgtcacataccaccctcggggtccaggacatctccgctacggcgatgtcatgggtgc
 agaagatcacgggaggtgtgggactggttggtgctgttgccgactgattctaactcgtg
 gtgctatgcgtgtcgttcagcaggcactaa.

[0080] In one embodiment, the present invention provides
 a vector comprising the nucleic acid molecule as described
 above, wherein the vector optionally comprises an
 5 expression control sequence operably linked to the nucleic
 acid molecule.

[0081] Examples of an expression control sequence
 include, but are not limited to, promoter such as CMV
 promoter, phage lambda PL promoter, the E. coli lac, phoA
 10 and tac promoters, the SV40 early and late promoters, and
 promoters of retroviral LTRs.

[0082] In this embodiment, the vector comprising an
 expression control sequence operably linked to the nucleic
 acid molecule as described above can be used as an
 15 expression vector for preparing the particle provided by
 the first aspect of the present invention.

[0083] The expression vectors can be prepared by a
 person skilled in the art based on WO/2012/006180, the
 entire contents of which are incorporated by reference
 20 herein.

[0084] Examples of vectors which can be used for expressing a virus like particle comprising a fusion protein of a polypeptide derived from Chikungunya virus (CHIKV) and a polypeptide of antigen include a vector shown in VLP_CHI 512 vector (SEQ ID No.:8) containing CHIKV VLP polynucleotide (SEQ ID No. 13; corresponding amino acid sequence represented by SEQ ID No.:14); and VLP_CHI 532 vector (SEQ ID No.: 9) containing CHIKV VLP polynucleotide (SEQ ID No. 15; corresponding amino acid sequence represented by SEQ ID No.:16).

[0085] The expression vectors can be prepared by a person skilled in the art based on US2012/0003266, the entire contents of which are incorporated by reference herein.

[0086] Examples of vectors which can be used for expressing a virus like particle comprising a fusion protein of a polypeptide derived from Venezuelan equine encephalitis virus (VEEV) and a polypeptide of antigen include a vector shown in VLP_VEEV VLP 518 vector (SEQ ID No.:10) containing VEEV VLP polynucleotide (SEQ ID No. 17; corresponding amino acid sequence represented by SEQ ID No.:18); VLP_VEEV VLP 519 vector (SEQ ID No.11) containing VEEV VLP polynucleotide (SEQ ID No. 19; corresponding amino acid sequence represented by SEQ ID No.:20); and VLP_VEEV VLP 538 vector (SEQ ID No.: 12) containing VEEV VLP

polynucleotide (SEQ ID No. 21; corresponding amino acid sequence represented by SEQ ID No.:22).

[0087] In one embodiment, the present invention provides a nucleic acid molecule which is designed for expression of a virus like particle comprising a fusion protein of a polypeptide derived from Chikungunya virus (CHIKV) or Venezuela equine encephalitis virus (VEEV) and a polypeptide derived from malaria antigen, which consists of a nucleotide sequence represented by SEQ ID Nos.26-27, 29-30, 32-33, 35-36, 38, 40 or 42.

[0088] In one embodiment, the present invention provides a nucleic acid molecule which is modified from the nucleic acid molecule having a nucleotide sequence represented by any one of SEQ ID Nos.26-27, 29-30, 32-33 or 35-36, 38, 40 or 42. The modified nucleic acid molecule may have at least 70%, 75%, 80%, 85%, 90%, 95% or 98% nucleotide sequence identity to the nucleic acid molecule having a nucleotide sequence represented by any one of SEQ ID Nos.26-27, 29-30, 32-33, 35-36, 38, 40 or 42. Also, the modified nucleic acid molecule may be a mutant where at most 10% of the amino acids are deleted, substituted, and/or added based on the nucleic acid molecule having a nucleotide sequence represented by any one of SEQ ID Nos.26-27, 29-30, 32-33, 35-36, 38, 40 or 42.

[0089]

(3) Composition or vaccine

In the third aspect, the present invention provides a composition or vaccine comprising the particle provided in the first aspect of the present invention and/or the nucleic acid molecule provided in the second aspect of the present invention.

[0090] In one embodiment, the present invention provides a composition or vaccine comprising the Alphavirus or Flavivirus virus like particle (e.g. Chikungunya virus like particle or Venezuelan equine encephalitis virus like particle) as described above or the nucleic acid molecule as described above. The content of the Alphavirus or Flavivirus virus like particle and the content of the nucleic acid molecule may be 0.00001-1 w/w%.

[0091] Dosage amount of the particle provided in the first aspect of the present invention (e.g. CHIKV VLP or VEEV VLP) may be 1-500µg/day.

[0092] One or more malaria antigens may be used for one composition or one vaccine provided by the third aspect of the present invention.

[0093] The composition or vaccine may further comprise a pharmaceutical acceptable carrier and/or adjuvant. Examples of adjuvant include, but are not limited to, aluminium salts, sodium hydroxide, Freund's complete adjuva

nt, Freund's incomplete adjuvant and Ribi solution (Sigma Adjuvant system, Sigma-Aldrich). The composition or vaccine provided in the third aspect of the present invention may contain buffering agent such as dibasic sodium phosphate hydrate, sodium dihydrogen phosphate and sodium chloride; and preserving agent such as thimerosal. In one embodiment, the composition or vaccine is an aqueous solution containing 0.001-1 w/w% of the particle provided in the first aspect of the present invention (e.g. CHIKV VLP or VEEV VLP), 1-10w/w% of buffering agent, 0.01-1w/w% of adjuvant and 0.00001-0.001w/w% of preserving agent.

[0094] A skilled person can prepare the pharmaceutical composition and vaccine using conventional technique. For example, the particle provided in the first aspect of the present invention is mixed with buffer solution having physiological pH (e.g. pH 5-9, pH7) to prepare the pharmaceutical composition and vaccine provided in the third aspect of the present invention.

[0095] The pharmaceutical composition of the present invention may contain a single active ingredient or a combination of two or more active ingredients, as far as they are not contrary to the objects of the present invention. For example, cytokines including chemokines, anti-body of cytokines such as anti TNF antibody (e.g. infliximab, adalimumab), anti-VEGF antibody (e.g.

bevacizumab and ranibizumab), cytokine receptor antagonist such as anti HER2 antibody (e.g. Trastuzumab), anti EGF receptor antibody (e.g. Cetuximab), anti VEGF aptamer (e.g. Pegaptanib) and immunomodulator such as cyclosporine, tacrolimus, ubenimex may be used for the combination therapy.

[0096] In a combination of plural active ingredients, their respective contents may be suitably increased or decreased in consideration of their therapeutic effects and safety.

[0097] The term "combination" used herein means two or more active ingredient are administered to a patient simultaneously in the form of a single entity or dosage, or are both administered to a patient as separate entities either simultaneously or sequentially with no specific time limits, wherein such administration provides therapeutically effective levels of the two components in the body, preferably at the same time.

[0098] In one embodiment, the composition is a vaccine composition including a DNA vaccine. In one embodiment, the DNA vaccine provided by the present invention comprises CpG containing oligonucleotide.

[0099] The composition or vaccine provided in the third aspect of the present invention can be administered one or more times. When the composition or vaccine provided in

the third aspect of the present invention is administered more than one time, different particle provided in the first aspect of the present invention (e.g. CHIKV VLP or VEEV VLP) may be used for each of the administration. In

5 one embodiment, combination of immunization using CHIKV VLP provided in the first aspect of the invention and immunization using VEEV VLP provided in the first aspect of the invention is employed. For example, CHIKV VLP provided in the first aspect of the present invention may be used
10 for the 1st immunization and VEEV VLP provided in the first aspect of the present invention may be used for the 2nd immunization, or VEEV VLP provided in the first aspect of the present invention may be used for the 1st immunization and CHIKV VLP provided in the first aspect of the present
15 invention may be used for the 2nd immunization.

[0100] A skilled person can determine timing of immunization using the composition or vaccine provided in the third aspect of the present invention. For example, 2nd immunization is performed 1, 2, 3, 4, 5, 6, 7, 8, 9 or
20 10 weeks after 1st immunization.

[0101] In one embodiment, the present invention provides a kit comprising

(a) a vaccine composition comprising the particle provided in the first aspect of the present invention; and

25 (b) another vaccine composition comprising the particle

provided in the first aspect of the present invention,
wherein the particle contained in (a) is a virus like
particle which is different from the particle contained in
(b). In this embodiment, the particle contained in (a) may
5 be Chikungunya virus like particle and the particle
contained in (b) may be Venezuelan equine encephalitis
virus like particle.

[0102] In one embodiment, the present invention provides
a kit comprising

10 (a) a vaccine composition comprising the particle provided
in the first aspect of the present invention; and
(b) another vaccine composition comprising the particle
provided in the first aspect of the present invention,
(c) one or more vaccine composition, each of which
15 comprises the particle provided in the first aspect of the
present invention,

wherein (a) is used for priming immunization and (b) and
(c) are used for boosting immunization; and the particle
contained in (a) is a virus like particle which is
20 different from the particle contained in (b); and the
particle contained in (c) is different from the particle
contained in (a) and (b), or the same as the particle
contained in (a) or (b).

[0103] The respective vaccine compositions contained in
25 the above-described kit may be administered simultaneously,

separately or sequentially.

[0104] The Alphavirus or Flavivirus virus like particle (e.g. Chikungunya virus or Venezuelan equine encephalitis virus) provided in the first aspect of the present invention or the nucleic acid molecule provided by the second aspect of the invention can be used for the composition and vaccine provided in the third aspect of the present invention.

[0105] For example, Chikungunya or Venezuelan equine encephalitis virus like particle comprising or consisting of:

one or more (e.g. 240) capsid of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV);

one or more (e.g. 240) E1 of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV); and

one or more (e.g. 240) E2 of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV), wherein malaria antigen is inserted into E2 of Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV) may be used for preparing the composition or vaccine provided in the third aspect of the present invention. The E2 into which the antigen is inserted may consist of an amino acid sequence represented by SEQ ID No.50; the E1 may consist of an amino acid sequence represented by SEQ ID No.51; and the capsid may consist of an amino acid sequence represented by

SEQ ID NO.: 52; or

the E2 into which the antigen is inserted may consist of an amino acid sequence represented by SEQ ID NO.53; the E1 may consist of an amino acid sequence represented by SEQ ID
5 NO.54; and the capsid may consist of an amino acid sequence represented by SEQ ID NO.: 55.

[0106] The composition or vaccine provided in the third aspect of the present invention can be administered to a mammal (e.g. human) intramuscularly (i.m.),
10 intracutaneously (i.c.), subcutaneously (s.c.), intradermally (i.d.) or intraperitoneally (i.p.).

[0107] The composition or vaccine provided in the third aspect of the present invention may be used for treating or preventing malaria.

15 [0108] Thus, use of the Alphavirus or Flavivirus (e.g. Chikungunya virus or Venezuelan equine encephalitis virus) virus like particle provided in the first aspect of the present invention or the nucleic acid molecule provided by the second aspect of the invention for manufacturing a
20 pharmaceutical composition or vaccine for treating or preventing malaria is also provided by the present invention.

[0109]

(4) Method of producing an antibody, Method of immunomodulation, Method of treating malaria, Method of
25

inducing and/or enhancing immune response against a malaria antigen in a mammal, Method of passive immunization, Method of presenting an antigen on macrophage, and Method for producing a particle

5 In the fourth aspect, the present invention provides a method of producing an antibody, comprising contacting the particle provided in the first aspect of the present invention and/or the nucleic acid molecule provided in the second aspect of the present invention to a mammal.

10 [0110] The antibody produced in the fourth aspect of the present invention may be humanized using a conventional technique. Thus, in one embodiment, the method provided in the fourth aspect of the invention further comprises a step of humanizing non-human mammal produced antibody.

15 [0111] The particle provided in the first aspect of the present invention and/or the nucleic acid molecule provided in the second aspect of the present invention may be administered directly into the patient, into the affected organ or systemically, or applied ex vivo to cells derived
20 from the patient or a human cell line which are subsequently administered to the patient, or used in vitro to select a subpopulation from immune cells such as B-cell and T-cell derived from the patient, which are then re-administered to the patient.

[0112] According to the present invention, the virus like particle can be applied for the immune therapy.

[0113] In the fifth aspect, the present invention provides a method of immunomodulation, a method of treating malaria,
5 a method of inducing and/or enhancing immune response against a malaria antigen in a mammal comprising administering the composition provided in the third aspect of the present invention to a mammal.

[0114] In sixth aspect, the present invention provides a
10 method of passive immunization against a malaria-causing pathogen, comprising administering the antibody provided in the fourth aspect of the present invention to a mammal.

[0115] In seventh aspect, the present invention provides a method of presenting a malaria antigen on macrophage,
15 comprising contacting the particle provided in the first aspect of the present invention and/or the nucleic acid molecule provided in the second aspect of the present invention to a mammal.

[0116] In eighth aspect, the present invention provides a
20 method for producing the particle provided in the first aspect of the present invention, comprising preparing a vector designed for expression of said particle; culturing

a cell which is transfected with said vector to express said particle; and recovering said particle.

[0117] Examples of mammal include, but are not limited to, a human.

5 [0118] In one embodiment, the present invention provides a method of producing an antibody against malaria antigen, comprising contacting the Chikungunya or Venezuelan equine encephalitis virus like particle as described above and/or the nucleic acid molecule as described above to a mammal.

10 The produced antibody may be an antibody which can specifically bind to a malaria antigen comprised in the Chikungunya or Venezuelan equine encephalitis virus like particle or a malaria antigen encoded by the nucleic acid molecule. The method of producing an antibody provided by
15 the present invention may be a useful for producing a monoclonal or polyclonal antibody against a malaria antigen.

[0119] In one embodiment, an antibody against malaria antigen obtained by the method of producing an antibody according to the present invention is used for passive
20 immunization. The method of passive immunization may comprise administering the obtained antibody to a mammal.

[0120] In one preferred embodiment, the immunomodulation provided by the present invention is inducing and/or

enhancing immune response against malaria antigen in a mammal. Thus, in one embodiment, the present invention provides a method of inducing and/or enhancing immune response against malaria antigen in a mammal, comprising
5 administering an effective amount of the composition as described above to the mammal.

[0121] Given the symptom of patients infected with Chikungunya or Venezuelan equine encephalitis together with unusual big molecule of Chikungunya or Venezuelan equine
10 encephalitis, this VLP can act effectively and efficiently to target macrophage and its composition such as cytokines and immunomodulative compounds.

[0122] In one aspect, the present invention provides a method of presenting an antigen on macrophage, comprising
15 administering the Chikungunya or Venezuelan equine encephalitis virus like particle as described above and/or the nucleic acid molecule as described above to a mammal. The Chikungunya or Venezuelan equine encephalitis virus like particle provided by the present invention is good to
20 target macrophage. In one embodiment, the Chikungunya or Venezuelan equine encephalitis virus like particle provided by the present invention is a kind of delivery system of the at least one antigen, which is comprised in the

Chikungunya or Venezuelan equine encephalitis virus like particle, to macrophage.

[0123] In one embodiment, the present invention provides a method for producing Chikungunya or Venezuelan equine encephalitis virus like particle provided in the first aspect of the present invention, comprising preparing a vector designed for expression of said particle; culturing a cell which is transfected with said vector to express said particle; and recovering said particle. In this embodiment, transfection can be conducted using a conventional method. Cells using for the transfection may be 293 cells. Recovering VLP may include collecting a conditioned medium after cells are transfected with a vector, and may further include purify VLP from the conditioned medium using ultracentrifugation.

[0124] The present invention will be described in detail with reference to the following example, which, however, is not intended to limit the scope of the present invention.

[0125]

20 EXAMPLES

EXAMPLE 1: Preparation of Chikungunya virus (CHIKV) like particle comprising a virus structural polypeptide and a fragment of malaria antigen

5 Sggnpnanpnanpnanpnanpnanpnaggs (SEQ ID No.:46)

VLP78 (25 repeat of NPNA amino acid sequence)

10 npnanpnanpnanpnanpnanpnanpnanpnanpnanpnanpnanpnanaggs (SEQ ID
No. : 48)

15 caaccctaacgccaatcccaacggaatcctaacgctaatcccaacgcaaataccaatg
ctaataccgaacggaaccctaatacgaaaccccaacgccaacccgaacgctaaccggaac
gctaatacccaacgcccgtggatcc) (SEQ ID No.:49)

[0126] The respective polynucleotides was inserted between the codons encoding Ser at 531-position and Asn at 532-position of SEQ ID Nos.15 or 16 (SEQ ID Nos.1 or 2) to
20 construct a plasmid (hereinafter referred to as CHIKV-VLP74 or 78) for expressing Chikungunya virus like particle where the modified VLP74 or 78-derived peptide is inserted into E2 of Chikungunya virus structural polypeptide.

[0127] 293F cells (Lifetechnology) were transfected with the plasmid using PEI (GE Healthcare) or GeneX (ATCC). 4 days after the transfection, the conditioned medium was collected and centrifuged at 3000rpm for 15 minutes to
5 separate it from cells. The supernatant was filtrated using 0.45µm filter to obtain virus like particles. The virus like particles were concentrated using TFF column and purified using QXL column (GE Healthcare) to obtain
10 purified virus like particles. When animals were immunized with virus like particles, the purified virus like particles were further concentrated using spin column (Molecular Weight-cutoff: 100kDa) to prepare the virus like particles for the immunization.

[0128] The expression of VLP comprising VLP74 or 78
15 conjugated with Chikungunya virus structural polypeptide was confirmed by Western Blot using an antibody specific for CHIVK (ATCC: VR-1241AF) and an antibody specific for VLP74 or 78.

[0129]

20 EXAMPLE 2: Preparation of Venezuelan equine encephalitis virus (VEEV) like particle comprising a virus structural polypeptide and a fragment of malaria antigen

The same polynucleotides of malaria CSP1 proteins (VLP74 and VLP78) used in EXAMPLE 1 are used. N terminal linker is SGG and C terminal linker is GGS.

[0130] The respective polynucleotides was inserted
5 between the codons encoding Ser at 518-position and Ser at
519-position of SEQ ID Nos.19 or 20 (SEQ ID No.3) to
construct a plasmid (hereinafter referred to as VEEV-VLP74
or 78) for expressing Venezuelan equine encephalitis virus
like particle where the modified VLP74 or 78 -derived
10 peptide is inserted into E2 of Venezuelan equine
encephalitis virus structural polypeptide.

[0131] 293F cells (Lifetechnology) were transfected with
the plasmid using PEI (GE Healthcare) or GeneX (ATCC). 4
days after the transfection, the conditioned medium was
15 collected and centrifuged at 3000rpm for 15 minutes to
separate it from cells. The supernatant was filtrated
using 0.45µm filter to obtain virus like particles. The
virus like particles were concentrated using TFF column and
purified using QXL column (GE Healthcare) to obtain
20 purified virus like particles. When animals were immunized
with virus like particles, the purified virus like
particles were further concentrated using spin column
(Molecular Weight-cutoff: 100kDa) to prepare the virus like
particles for the immunization.

[0132] The expression of VLP comprising VLP 74 or 78 conjugated with Venezuelan equine encephalitis virus structural polypeptide was confirmed by Western Blot using an antibody specific for VEEV and an antibody specific for VLP74 or 78.

[0133]

EXAMPLE 3: Immunogenicity in Non-human Primate (Monkey)

The monkeys were immunized with x25-CHI (80ug) at 0 week and x6-VEE (80ug) at 3 week by intramuscular injection with or without adjuvant (Sigma Adjuvant System, Sigma, S6322). X25-CHI means 25 times malaria CSP repeat amino acid NPNA on CHIKV VLP particle (VLP78_15). X6-VEE means 6 times malaria CSP repeat amino acid NPNA on VEEV VLP particle (VLP74_25). The blood is taken at 2 and 5 weeks after the first immunization.

[0134] 96 well ELISA plate were coated with 50ng of Recombinant Circumsporozoite Protein (rCSP) (Reagent Proteins, ATG-422) in 100ul PBS buffer pre well. The Plates after 2 hours incubation were washed three times TBS buffer containing 0.05% Tween-20 and blocked with TBS buffer containing 0.05% Tween-20 and 5% dry milk. The heat inactivated diluted serum from monkeys were added in the blocking buffer and incubated for 1 h at room temperature.

After washing three times, peroxidase labeled goat anti-human IgG or anti-mouse IgG was added at 1:4000 dilution and incubated for 1h at room temperature. After washing three times, Peroxidase substrate was added for development and incubated for 10 mins and 2N H₂SO₄ was added to stop the development. The data were analyzed using Gen5 (BioTek) and GraphPad Prism6 (GraphPad software Inc).

[0135] The Immunogenicities are shown in Figures 4 to 6.

[0136] Induction of antibodies against CSP was found in the serum of all monkeys immunized with Malaria VLPs (see Figure 4). The mean OD values indicating titer of antibodies against CSP is shown in Figure 5. Figure 5 shows that the serum from immunized monkeys induced high titer of antibodies against CSP.

[0137] As seen in Figure 6, higher titer of antibodies against CSP was achieved when CHIKV VLP particle comprising NPNA and VEEV VLP particle comprising NPNA were used for the priming immunization and boosting immunization, respectively, compared to when only CHIKV VLP particle comprising NPNA was used for both of the priming immunization and the boosting immunization. In addition, Figure 6 shows that use of adjuvant further enhanced the titer of antibodies against CSP. Further, Figure 6 shows

that administration of 25-repeats of NPNA induces higher titer of antibodies against CSP compared to administration of 6-repeats of CSP.

[0138] The anti-Pf CSP antibody titer in the serum from the monkeys immunized with x25-CHI (80ug) at 0 week and x6-VEE (80ug) at 3 week without using adjuvant was measured by ELISA at Malaria Serology Lab Malaria Vaccine Branch, WRAIR. In the ELISA performed at Malaria Serology Lab Malaria Vaccine Branch, WRAIR, the plates were coated with CSPrp ((NPNA)6 Peptide) [0.2µg/µL] (Supplier: Eurogentec EP070034) and Goat α-Human IgG (KPL/074-1002 LOT# 120714) was used as 2nd antibody. The final titer was determined by the dilution factor that yields an OD of 1.0 (414nm).

[0139] As a result, the anti-Pf CSP antibody titer in the serum from the monkeys was enhanced after 2nd immunization compared to 1st immunization (see Table 2). Compared to the anti-Pf CSP antibody titer in the serum from the monkeys immunized with RTS,S (GlaxoSmithKline), the anti-Pf CSP antibody titer in the serum from the monkeys immunized with x25-CHI (80ug) and x6-VEE (80ug) in the absence of adjuvant was considered to be higher even though RTS,S (GlaxoSmithKline) contains adjuvant.

[Table 2]

Animal No.	After 1st immunization	After 2nd immunization
	Week 2	Week 5
1	8990	29420
2	48210	44100
3	80400	51230
4	16260	19640
Geometric mean	27359	33801

[0140]

Example 4: Immunogenicity in mouse

The mice immunized with 10ug of VLP78_15 at week 0,
 5 10ug of VLP74_25 at week3 and 10ug of VLP78_15 at week 6
 with or without adjuvant (Sigma Adjuvant System, Sigma,
 S6322) by intramuscular injection.

[0141] The anti-Pf CSP antibody titer in the serum from
 the immunized mice were measured by ELISA at Malaria
 10 Serology Lab Malaria Vaccine Branch, WRAIR, where plates
 were coated with CSPrp ((NPNA)6 Peptide) [0.2µg/µL]
 (Supplier: Eurogentec EP070034) and Goat α-Mouse IgG
 (KPL/074-1806 LOT# 100737) is used as 2nd antibody to
 detect the antibodies in the serum.

[0142] The final titer was determined by the dilution factor that yields an OD of 1.0 (414nm).

[0143] The Immunogenicity are shown in Tables 3 and 4.

[0144] Tables 3 and 4 show that higher titer of antibodies against CSP was achieved after immunizing virus like particle three times. In addition, Tables 3 and 4 show that use of adjuvant enhanced the titer of antibodies against CSP.

[Table 3]

Mouse Week 3 (after 1st immunization)

Mouse No.	VLP	VLP+Adjuvant
1	6070	QNS
2	5850	13680
3	9610	7610
4	5440	23370
5	16320	27390
Geometric Mean	7875	16066

QNS=Quantity not sufficient to test

10

[Table 4]

Mouse Week 9 (after 1st immunization)

Mouse No.	VLP	VLP+Adjuvant
1	35510	729000
2	15040	197800
3	41650	106700
4	37250	436000
5	48200	497600
Geometric Mean	33134	319666

[0145]

Example 5: Immunogenicity of P. yoelii CSP inserted VLP in mice

QGP GAP seen in the rodent malaria CSP (P.yoelii CSP) was used as an antigen. 6x QGP GAP was inserted into CHIKV VLP. The mice were immunized with the CHIKV VLP 2 times at 0 and 8 week (20ug VLP per mouse) by intramuscle injection with or without Adjuvant Ribi.

[0146] Immunogenicity was confirmed at 4, 6, 10 and 14 weeks after the first immunization. The anti- P. yoelii CSP antibody were measured by ELISA. The ELISA was performed in the same way as ELISA described in Example 3 except that the plates were coated with P. Yoelii CSP repeat sequence peptide at 0.1 ng/ μ l. The secondary antibody was anti-mouse IgG HRP (Cell signal, #7076S). The results are shown in Figures 7-9.

[0147] Figures 7-9 show that higher titer of antibodies against CSP was achieved by intramuscler administration of CHIKV VLP comprising 6X QGP GAP. In addition, Figures 7-9 show that use of adjuvant enhanced the titer of antibodies against CSP.

[0148]

Example 6: Protection of mice against malaria by intramuscle injection of CHIKV VLP comprising P. yoelii CSP epitope: 6x QGPGAP

6x QGPGAP was inserted into CHIKV VLP. The mice (n=5) were immunized with the CHIKV VLP 2 times at 0 and 8 week (20ug VLP per mouse) by intramuscle injection with or without Adjuvant Ribi (see Figure 10). Rodent malaria: P. yoelii-challenge (i.v.) was conducted at 17 weeks (see Figure 10).

[0149] Malaria infection was confirmed by PCR. Genomic DNA was purified from the mice blood day 6 after challenge. 18S malaria DNA was amplified by PCR. Figure 11 shows results of the PCR, indicating that all of 5 control mice (PBS injection) were infected with malaria; all of 5 mice immunized with Control VLP were infected with malaria; among 5 mice immunized with CHIKV VLP comprising 6x QGPGAP, 2 mice were infected with malaria and 3 mice were not infected with malaria; and among 5 mice immunized with CHIKV VLP comprising 6x QGPGAP with adjuvant: Ribi, 1 mouse was infected with malaria and 4 mice were not infected with malaria.

[0150]

Example 7: Preparation of vaccine composition comprising Chikungunya virus (CHIKV) like particle comprising NPNA

repeat or Venezuelan equine encephalitis virus (VEEV) like particle comprising NPNA repeat

- Chikungunya virus (CHIKV) like particle comprising 6x or 25x NPNA was prepared according to Example 1, and
- 5 Venezuelan equine encephalitis virus (VEEV) like particle comprising 6x NPNA was prepared according to Example 2.
- To prepare a vaccine composition, 80 μ g of each of the prepared particles was mixed with 1ml of Sucrose Phosphate Solution, pH 7.2, Endotoxin Free (Teknova, SP buffer).

SEQUENCE LISTING

<110> VLP THERAPEUTICS, LLC

<120> MALARIA VACCINE

<130> SG5972A

<160> 56

<170> PatentIn version 3.5

<210> 1

<211> 1248

<212> PRT

<213> Chikungunya virus

<400> 1

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
 1 5 10 15

Arg Pro Trp Thr Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro
 20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
 35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
 50 55 60

Arg Lys Asn Lys Lys Gln Lys Gln Lys Gln Gln Ala Pro Gln Asn Asn
 65 70 75 80

Thr Asn Gln Lys Lys Gln Pro Pro Lys Lys Lys Pro Ala Gln Lys Lys
 85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
 100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Thr Gly Tyr Ala Cys
 115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
 130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
 145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
 165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
 180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
 195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
 210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
 225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
 245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Ile Pro Val Met Cys Leu Leu Ala
 260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
 275 280 285

Glu Lys Glu Pro Glu Glu Thr Leu Arg Met Leu Glu Asp Asn Val Met
 290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Gln Ala Ser Leu Thr Cys Ser Pro
 305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
 325 330 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
 340 345 350

Cys His Ser Pro Val Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
 355 360 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp
 370 375 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Asn His Met Pro
 385 390 395 400

Ala Asp Ala Glu Arg Ala Gly Leu Phe Val Arg Thr Ser Ala Pro Cys
 405 410 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
 420 425 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His
 435 440 445

Ser Cys Thr His Pro Phe His His Asp Pro Pro Val Ile Gly Arg Glu
 450 455 460

Lys Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr
 465 470 475 480

Tyr Val Gln Ser Thr Ala Ala Thr Thr Glu Glu Ile Glu Val His Met
 485 490 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Ser Gln Gln Ser Gly Asn
 500 505 510

Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys
 515 520 525

Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn
 530 535 540

Cys Lys Val Asp Gln Cys His Ala Ala Val Thr Asn His Lys Lys Trp
 545 550 555 560

Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg
 565 570 575

Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn Val Thr Cys Arg
 580 585 590

Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val
 595 600 605

Ile Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn
 610 615 620

Met Gly Glu Glu Pro Asn Tyr Gln Glu Glu Trp Val Met His Lys Lys
 625 630 635 640

Glu Val Val Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly
 645 650 655

Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Leu Ser Thr Asn Gly Thr
 660 665 670

Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr

675	680	685
Pro Thr Met Thr Val Val Val Val Ser Val Ala Thr Phe Ile Leu Leu		
690	695	700
Ser Met Val Gly Met Ala Ala Gly Met Cys Met Cys Ala Arg Arg Arg		
705	710	715 720
Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu		
725	730	735
Leu Ser Leu Ile Cys Cys Ile Arg Thr Ala Lys Ala Ala Thr Tyr Gln		
740	745	750
Glu Ala Ala Ile Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu		
755	760	765
Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu		
770	775	780
Arg Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met		
785	790	795 800
Ser Val Gly Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile		
805	810	815
Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly		
820	825	830
Tyr Ser Pro Met Val Leu Glu Met Glu Leu Leu Ser Val Thr Leu Glu		
835	840	845
Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile		
850	855	860
Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys		
865	870	875 880
Asn Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe		
885	890	895
Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu		
900	905	910
Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala		
915	920	925
Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val		
930	935	940

Leu Tyr Gln Gly Asn Asn Ile Thr Val Thr Ala Tyr Ala Asn Gly Asp
 945 950 955 960

His Ala Val Thr Val Lys Asp Ala Lys Phe Ile Val Gly Pro Met Ser
 965 970 975

Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp
 980 985 990

Val Tyr Asn Met Asp Tyr Pro Pro Phe Gly Ala Gly Arg Pro Gly Gln
 995 1000 1005

Phe Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser Lys Asp Val Tyr
 1010 1015 1020

Ala Asn Thr Gln Leu Val Leu Gln Arg Pro Ala Val Gly Thr Val
 1025 1030 1035

His Val Pro Tyr Ser Gln Ala Pro Ser Gly Phe Lys Tyr Trp Leu
 1040 1045 1050

Lys Glu Arg Gly Ala Ser Leu Gln His Thr Ala Pro Phe Gly Cys
 1055 1060 1065

Gln Ile Ala Thr Asn Pro Val Arg Ala Val Asn Cys Ala Val Gly
 1070 1075 1080

Asn Met Pro Ile Ser Ile Asp Ile Pro Glu Ala Ala Phe Thr Arg
 1085 1090 1095

Val Val Asp Ala Pro Ser Leu Thr Asp Met Ser Cys Glu Val Pro
 1100 1105 1110

Ala Cys Thr His Ser Ser Asp Phe Gly Gly Val Ala Ile Ile Lys
 1115 1120 1125

Tyr Ala Ala Ser Lys Lys Gly Lys Cys Ala Val His Ser Met Thr
 1130 1135 1140

Asn Ala Val Thr Ile Arg Glu Ala Glu Ile Glu Val Glu Gly Asn
 1145 1150 1155

Ser Gln Leu Gln Ile Ser Phe Ser Thr Ala Leu Ala Ser Ala Glu
 1160 1165 1170

Phe Arg Val Gln Val Cys Ser Thr Gln Val His Cys Ala Ala Glu
 1175 1180 1185

Cys His Pro Pro Lys Asp His Ile Val Asn Tyr Pro Ala Ser His
 1190 1195 1200

Thr Thr Leu Gly Val Gln Asp Ile Ser Ala Thr Ala Met Ser Trp
 1205 1210 1215

Val Gln Lys Ile Thr Gly Gly Val Gly Leu Val Val Ala Val Ala
 1220 1225 1230

Ala Leu Ile Leu Ile Val Val Leu Cys Val Ser Phe Ser Arg His
 1235 1240 1245

<210> 2

<211> 1248

<212> PRT

<213> Chikungunya virus

<400> 2

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
 1 5 10 15

Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro
 20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
 35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
 50 55 60

Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp
 65 70 75 80

Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys
 85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
 100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys
 115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
 130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
 145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
 165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
 180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
 195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
 210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
 225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
 245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala
 260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
 275 280 285

Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met
 290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro
 305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
 325 330 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
 340 345 350

Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
 355 360 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp
 370 375 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro
 385 390 395 400

Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys
 405 410 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
420 425 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His
435 440 445

Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu
450 455 460

Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr
465 470 475 480

Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met
485 490 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn
500 505 510

Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys
515 520 525

Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn
530 535 540

Cys Lys Ile Asp Gln Cys His Ala Ala Val Thr Asn His Lys Asn Trp
545 550 555 560

Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg
565 570 575

Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn Val Thr Cys Arg
580 585 590

Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val
595 600 605

Thr Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn
610 615 620

Met Gly Gln Glu Pro Asn Tyr His Glu Glu Trp Val Thr His Lys Lys
625 630 635 640

Glu Val Thr Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly
645 650 655

Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Met Ser Thr Asn Gly Thr
660 665 670

Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr

675	680	685
Pro Thr Met Thr Val Val Ile Val Ser Val Ala Ser Phe Val Leu Leu		
690	695	700
Ser Met Val Gly Thr Ala Val Gly Met Cys Val Cys Ala Arg Arg Arg		
705	710	715 720
Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu		
725	730	735
Leu Ser Leu Leu Cys Cys Val Arg Thr Thr Lys Ala Ala Thr Tyr Tyr		
740	745	750
Glu Ala Ala Ala Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu		
755	760	765
Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu		
770	775	780
Lys Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met		
785	790	795 800
Ser Ile Gly Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile		
805	810	815
Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly		
820	825	830
Tyr Ser Pro Met Val Leu Glu Met Glu Leu Gln Ser Val Thr Leu Glu		
835	840	845
Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile		
850	855	860
Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys		
865	870	875 880
Ser Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe		
885	890	895
Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu		
900	905	910
Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala		
915	920	925
Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val		
930	935	940

Leu Tyr Gln Gly Asn Asn Ile Thr Val Ala Ala Tyr Ala Asn Gly Asp
 945 950 955 960

His Ala Val Thr Val Lys Asp Ala Lys Phe Val Val Gly Pro Met Ser
 965 970 975

Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp
 980 985 990

Val Tyr Asn Met Asp Tyr Pro Pro Phe Gly Ala Gly Arg Pro Gly Gln
 995 1000 1005

Phe Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser Lys Asp Val Tyr
 1010 1015 1020

Ala Asn Thr Gln Leu Val Leu Gln Arg Pro Ala Ala Gly Thr Val
 1025 1030 1035

His Val Pro Tyr Ser Gln Ala Pro Ser Gly Phe Lys Tyr Trp Leu
 1040 1045 1050

Lys Glu Arg Gly Ala Ser Leu Gln His Thr Ala Pro Phe Gly Cys
 1055 1060 1065

Gln Ile Ala Thr Asn Pro Val Arg Ala Val Asn Cys Ala Val Gly
 1070 1075 1080

Asn Ile Pro Ile Ser Ile Asp Ile Pro Asp Ala Ala Phe Thr Arg
 1085 1090 1095

Val Val Asp Ala Pro Ser Val Thr Asp Met Ser Cys Glu Val Pro
 1100 1105 1110

Ala Cys Thr His Ser Ser Asp Phe Gly Gly Val Ala Ile Ile Lys
 1115 1120 1125

Tyr Thr Ala Ser Lys Lys Gly Lys Cys Ala Val His Ser Met Thr
 1130 1135 1140

Asn Ala Val Thr Ile Arg Glu Ala Asp Val Glu Val Glu Gly Asn
 1145 1150 1155

Ser Gln Leu Gln Ile Ser Phe Ser Thr Ala Leu Ala Ser Ala Glu
 1160 1165 1170

Phe Arg Val Gln Val Cys Ser Thr Gln Val His Cys Ala Ala Ala
 1175 1180 1185

Cys His Pro Pro Lys Asp His Ile Val Asn Tyr Pro Ala Ser His
 1190 1195 1200

Thr Thr Leu Gly Val Gln Asp Ile Ser Thr Thr Ala Met Ser Trp
 1205 1210 1215

Val Gln Lys Ile Thr Gly Gly Val Gly Leu Ile Val Ala Val Ala
 1220 1225 1230

Ala Leu Ile Leu Ile Val Val Leu Cys Val Ser Phe Ser Arg His
 1235 1240 1245

<210> 3

<211> 1255

<212> PRT

<213> Venezuelan equine encephalitis virus

<400> 3

Met Phe Pro Phe Gln Pro Met Tyr Pro Met Gln Pro Met Pro Tyr Arg
 1 5 10 15

Asn Pro Phe Ala Ala Pro Arg Arg Pro Trp Phe Pro Arg Thr Asp Pro
 20 25 30

Phe Leu Ala Met Gln Val Gln Glu Leu Thr Arg Ser Met Ala Asn Leu
 35 40 45

Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Ala
 50 55 60

Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly
 65 70 75 80

Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro
 85 90 95

Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro
 100 105 110

Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe
 115 120 125

Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly
 130 135 140

Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp
 145 150 155 160

Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu
 165 170 175

Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr
 180 185 190

His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln
 195 200 205

Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly
 210 215 220

Asp Ser Gly Arg Pro Ile Leu Asp Asn Gln Gly Arg Val Val Ala Ile
 225 230 235 240

Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val
 245 250 255

Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys
 260 265 270

Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr
 275 280 285

Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu
 290 295 300

Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu
 305 310 315 320

Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr
 325 330 335

Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg
 340 345 350

Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu
 355 360 365

Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser
 370 375 380

Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met
 385 390 395 400

Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val
 405 410 415

Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr
420 425 430

Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe
435 440 445

Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys
450 455 460

Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly
465 470 475 480

Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly
485 490 495

Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu
500 505 510

Val Ser Leu Ser Gly Ser Ser Val Thr Val Thr Pro Pro Asp Gly Thr
515 520 525

Ser Ala Leu Val Glu Cys Glu Cys Gly Gly Thr Lys Ile Ser Glu Thr
530 535 540

Ile Asn Lys Thr Lys Gln Phe Ser Gln Cys Thr Lys Lys Glu Gln Cys
545 550 555 560

Arg Ala Tyr Arg Leu Gln Asn Asp Lys Trp Val Tyr Asn Ser Asp Lys
565 570 575

Leu Pro Lys Ala Ala Gly Ala Thr Leu Lys Gly Lys Leu His Val Pro
580 585 590

Phe Leu Leu Ala Asp Gly Lys Cys Thr Val Pro Leu Ala Pro Glu Pro
595 600 605

Met Ile Thr Phe Gly Phe Arg Ser Val Ser Leu Lys Leu His Pro Lys
610 615 620

Asn Pro Thr Tyr Leu Ile Thr Arg Gln Leu Ala Asp Glu Pro His Tyr
625 630 635 640

Thr His Glu Leu Ile Ser Glu Pro Ala Val Arg Asn Phe Thr Val Thr
645 650 655

Glu Lys Gly Trp Glu Phe Val Trp Gly Asn His Pro Pro Lys Arg Phe
660 665 670

Trp Ala Gln Glu Thr Ala Pro Gly Asn Pro His Gly Leu Pro His Glu

675

680

685

Val Ile Thr His Tyr Tyr His Arg Tyr Pro Met Ser Thr Ile Leu Gly
 690 695 700

Leu Ser Ile Cys Ala Ala Ile Ala Thr Val Ser Val Ala Ala Ser Thr
 705 710 715 720

Trp Leu Phe Cys Arg Ser Arg Val Ala Cys Leu Thr Pro Tyr Arg Leu
 725 730 735

Thr Pro Asn Ala Arg Ile Pro Phe Cys Leu Ala Val Leu Cys Cys Ala
 740 745 750

Arg Thr Ala Arg Ala Glu Thr Thr Trp Glu Ser Leu Asp His Leu Trp
 755 760 765

Asn Asn Asn Gln Gln Met Phe Trp Ile Gln Leu Leu Ile Pro Leu Ala
 770 775 780

Ala Leu Ile Val Val Thr Arg Leu Leu Arg Cys Val Cys Cys Val Val
 785 790 795 800

Pro Phe Leu Val Met Ala Gly Ala Ala Gly Ala Gly Ala Tyr Glu His
 805 810 815

Ala Thr Thr Met Pro Ser Gln Ala Gly Ile Ser Tyr Asn Thr Ile Val
 820 825 830

Asn Arg Ala Gly Tyr Ala Pro Leu Pro Ile Ser Ile Thr Pro Thr Lys
 835 840 845

Ile Lys Leu Ile Pro Thr Val Asn Leu Glu Tyr Val Thr Cys His Tyr
 850 855 860

Lys Thr Gly Met Asp Ser Pro Ala Ile Lys Cys Cys Gly Ser Gln Glu
 865 870 875 880

Cys Thr Pro Thr Tyr Arg Pro Asp Glu Gln Cys Lys Val Phe Thr Gly
 885 890 895

Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Thr Glu
 900 905 910

Asn Thr Gln Val Ser Lys Ala Tyr Val Met Lys Ser Asp Asp Cys Leu
 915 920 925

Ala Asp His Ala Glu Ala Tyr Lys Ala His Thr Ala Ser Val Gln Ala
 930 935 940

Phe Leu Asn Ile Thr Val Gly Glu His Ser Ile Val Thr Thr Val Tyr
 945 950 955 960

Val Asn Gly Glu Thr Pro Val Asn Phe Asn Gly Val Lys Ile Thr Ala
 965 970 975

Gly Pro Leu Ser Thr Ala Trp Thr Pro Phe Asp Arg Lys Ile Val Gln
 980 985 990

Tyr Ala Gly Glu Ile Tyr Asn Tyr Asp Phe Pro Glu Tyr Gly Ala Gly
 995 1000 1005

Gln Pro Gly Ala Phe Gly Asp Ile Gln Ser Arg Thr Val Ser Ser
 1010 1015 1020

Ser Asp Leu Tyr Ala Asn Thr Asn Leu Val Leu Gln Arg Pro Lys
 1025 1030 1035

Ala Gly Ala Ile His Val Pro Tyr Thr Gln Ala Pro Ser Gly Phe
 1040 1045 1050

Glu Gln Trp Lys Lys Asp Lys Ala Pro Ser Leu Lys Phe Thr Ala
 1055 1060 1065

Pro Phe Gly Cys Glu Ile Tyr Thr Asn Pro Ile Arg Ala Glu Asn
 1070 1075 1080

Cys Ala Val Gly Ser Ile Pro Leu Ala Phe Asp Ile Pro Asp Ala
 1085 1090 1095

Leu Phe Thr Arg Val Ser Glu Thr Pro Thr Leu Ser Ala Ala Glu
 1100 1105 1110

Cys Thr Leu Asn Glu Cys Val Tyr Ser Ser Asp Phe Gly Gly Ile
 1115 1120 1125

Ala Thr Val Lys Tyr Ser Ala Ser Lys Ser Gly Lys Cys Ala Val
 1130 1135 1140

His Val Pro Ser Gly Thr Ala Thr Leu Lys Glu Ala Ala Val Glu
 1145 1150 1155

Leu Thr Glu Gln Gly Ser Ala Thr Ile His Phe Ser Thr Ala Asn
 1160 1165 1170

Ile His Pro Glu Phe Arg Leu Gln Ile Cys Thr Ser Tyr Val Thr
 1175 1180 1185

Cys Lys Gly Asp Cys His Pro Pro Lys Asp His Ile Val Thr His
 1190 1195 1200

Pro Gln Tyr His Ala Gln Thr Phe Thr Ala Ala Val Ser Lys Thr
 1205 1210 1215

Ala Trp Thr Trp Leu Thr Ser Leu Leu Gly Gly Ser Ala Val Ile
 1220 1225 1230

Ile Ile Ile Gly Leu Val Leu Ala Thr Ile Val Ala Met Tyr Val
 1235 1240 1245

Leu Thr Asn Gln Lys His Asn
 1250 1255

<210> 4

<211> 2964

<212> DNA

<213> Chikungunya virus

<400> 4

atgagcctcg ccctcccggt ctgtgcctg ttggcaaaca ctacattccc ctgctctcag	60
ccgccittgca caccctgctg ctacgaaaag gaaccggaaa gcaccttgcg catgcttgag	120
gacaacgtga tgagaccggg atactaccag ctactaaaag catcgctgac ttgctctccc	180
caccgccaaa gacgcagtac taaggacaat tttaatgtct ataaagccac aagaccatat	240
ctagctcatt gtctgactg cggagaaggg cattcgtgcc acagccctat cgcattggag	300
cgcatcagaa atgaagcaac ggacggaacg ctgaaaatcc aggtctcttt gcagatcggg	360
ataaagacag atgacagcca cgattggacc aagctgcgct atatggatag ccatacgcca	420
gceggacceg agcgagccgg attgcttgta aggacttcag caccgtgcac gatcaccggg	480
accatgggac actttattct cgcccgatgc ccgaaaggag agacgctgac agtgggattt	540
acggacagca gaaagatcag ccacacatgc acacaccgt tccatcatga accacctgtg	600
ataggtaggg agaggttcca ctctcgacca caacatggta aagagttacc ttgcagcacg	660
tacgtgcaga gcaccgctgc cactgctgag gagatagagg tgcatatgcc cccagatact	720
cctgaccgca cgctgatgac gcagcagtct ggcaacgtga agatcacagt taatgggcag	780
acggtgcggt acaagtgcaa ctgcggtggc tcaaacgagg gactgacaac cacagacaaa	840

gtgatcaata actgcaaaat tgatcagtg cagctgcag tcactaatca caagaattgg	900
caatacaact cccctttagt cccgcgcaac gctgaactcg gggaccgtaa aggaaagatc	960
cacatcccat tcccatggc aaacgtgact tgcagagtg caaaagcaag aaaccctaca	1020
gtaacttacg gaaaaaacca agtcaccatg ctgctgtatc ctgaccatcc gacactcttg	1080
tcttacgta acatgggaca ggaaccaa ataccagagg agtgggtgac acacaagaag	1140
gaggttacct tgaccgtgcc tactgagggt ctggaggta ctggggcaa caacgaacca	1200
tacaagtact ggccgcagat gtctacgaac ggtactgctc atggtcaccc acatgagata	1260
atcttgtact attatgagct gtacccact atgactgtag tcattgtgtc ggtggcctcg	1320
ttcgtgcttc tgtcgatgtt gggcacagca gtgggaatgt gtgtgtgctc acggcgaga	1380
tgattacac catatgaatt aacaccagga gccactgttc ctttcctgct cagcctgcta	1440
tgtgctgta gaacgaccaa ggcggccaca tattacgagg ctgcggcata tctatggaac	1500
gaacagcagc cctgttctg gtgcaggct cttatccgc tggccgctt gatgtcctg	1560
tgcaactgtc tgaactctt gccatgtctc tgaagacc tggcttttt agccgtaatg	1620
agcatcgggt cccacactgt gagcgctac gaacacgtaa cagtgtccc gaacacgggt	1680
ggagtaccgt ataagactct tgtcaacaga ccgggttaca gcccattgt gtggagatg	1740
gagctacaat cagtcacctt ggaaccaaca ctgtcactg actacatcac gtgcgagtac	1800
aaaactgtca tccctcccc gtacgtgaag tctgttgta cagcagagt caaggacaag	1860
agcctaccag actacagctg caaggcttt actggagtct accatttat gtgggcggc	1920
gcctactgct ttgcgacgc cgaataacg caattgagc aggcacatgt agagaaatct	1980
gaatcttgca aaacagagtt tgcacggcc tacagagccc acaccgcatc ggcgtcggc	2040
aagctccgc tcctttacca aggaacaac attaccgtag ctgcctacg taacggtgac	2100
catgccgtca cagtaaagga cgcaagttt gtcgtggcc caatgtctc gcctggaca	2160
ccttttgaca acaaatcgt ggtgtacaaa ggcgacgtct acaacatgga ctaccacct	2220
ttggcgag gaagaccagg acaatttgtt gacattcaaa gtcgtacac ggaaagtaaa	2280

gacgtttatg ccaacactca gttggtacta cagaggccag cagcaggcac ggtacatgia 2340
 ccatactctc aggcaccatc tggcttcaag tattggctga aggaacgagg agcatcgcta 2400
 cagcacacgg caccgttcgg ttgccagatt gcgacaaacc cggtaagagc tgtaaatgic 2460
 gctgtgggga acataccaat ttccatcgac ataccggatg cggccittac tagggttgic 2520
 gatgcaccct ctgtaacgga catgtcatgc gaagtaccag cctgcactca ctctccgac 2580
 tttggggcgc tcgccatcat caaatacaca gctagcaaga aaggtaaagc tgcagtacat 2640
 tcgatgacca acgccgttac caticgagaa gccgacgtag aagtagaggg gaactcccag 2700
 ctgcaaatat ccttctcaac agccctggca agcggcgagt ttgcgtgca agtgtgctcc 2760
 acacaagtac actgcgcagc cgcattgccac cctccaaagg accacatagt caattacca 2820
 gcatcacaca ccaccctigg ggtccaggat atatccacaa cggcaatgic ttgggtgcag 2880
 aagattacgg gaggagtagg attaatgtt gctgttgctg ccttaatttt aattgtggtg 2940
 ctatgcgtgt cgtttagcag gcac 2964

<210> 5

<211> 2964

<212> DNA

<213> Chikungunya virus

<400> 5

atgagtcttg ccatcccagt tatgtgcctg ttggcaaaca ccacgttccc ctgctcccag 60
 ccccttgca cggcctgctg ctacgaaaag gaaccggagg aaaccctacg catgcttgag 120
 gacaacgtca tgagacctgg gtactatcag ctgctacaag catcctaac atgttctccc 180
 caccgccagc gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac 240
 ttagctcact gtcccgactg tggagaaggg cactcgtgcc atagtccgt agcactagaa 300
 cgcacagaa atgaagcgac agacgggacg ctgaaaatcc aggtctcctt gcaaactcga 360
 ataaagacgg atgacagcca cgattggacc aagctgcgtt atatggacaa ccacatgcca 420
 gcagacgcag agaggcgagg gctatttgta agaacatcag caccgtgtac gattactgga 480
 acaatgggac acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc 540

actgacagta ggaagattag tcactcatgt acgcacccat ttcaccacga ccctcctgtg	600
ataggtcggg aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcacg	660
tacgtgcaga gcaccgccgc aactaccgag gagatagagg tacacatgcc ccagacacc	720
cctgatcgca cattaatgtc acaacagtcc ggcaacgtaa agatcacagt caatggccag	780
acggtgcggt acaagtgtaa ttgcggtggc tcaaataag gactaacaac tacagacaaa	840
gtgattaata actgcaaggt tgatcaatgt catgcccgcg tcaccaatca caaaaagtgg	900
cagtataact ccctcctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt	960
cacatcccg tttccgctggc aaatgtaca tgcagggcgc ctaaagcaag gaacccacc	1020
gtgacgtacg gaaaaacca agtcatcatg ctactgtatc ctgaccaccc aacactcctg	1080
tcctaccgga atatgggaga agaaccaaac tatcaagaag agtgggtgat gcataagaag	1140
gaagtcgtgc taaccgtgcc gactgaaggc ctcgaggcca cgtggggcaa caacgagccg	1200
tataagtatt ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata	1260
attctgtatt attatgagct gtacccact atgactgtag tagttgtgtc agtggccacg	1320
ttcatactcc tgtcgtggt gggatatggc gcggggatgt gcatgtgtgc acgacgcaga	1380
tgcatcacac cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata	1440
tgctgcatca gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac	1500
gagcagcaac cttgtttttg gctacaagcc cttatccgc tggcagccct gattgttcta	1560
tgcaactgtc tgagactctt accatgtgtc tgtaaacgt tggctttttt agccgtaatg	1620
agcgtcgggtg ccacactgt gagcgcgtac gaacacgtaa cagtgatccc gaacacggtg	1680
ggagtaccgt ataagactct agtcaataga cctggctaca gcccattggt attggagatg	1740
gaactactgt cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac	1800
aaaaccgtca tccgtctcc gtacgtgaag tgctgcggta cagcagagtg caaggacaaa	1860
aacctacctg actacagctg taaggctttc accggcgtct acccatttat gtggggcggc	1920
gcctactgct tctgcgacgc tgaaaacacg cagttgagcg aagcacacgt ggagaagtcc	1980
gaatcatgca aaacagaatt tgcatcagca tacagggtc ataccgcac tgcatcagct	2040

aagctccgcg tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac 2100
catgccgta cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca 2160
cctttcgaca acaaaattgt gggtiacaac ggtgacgtct ataacatgga ctacccgccc 2220
tttggcgag gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtaaa 2280
gacgtctatg ctaatacaca actggtactg cagagaccgg ctgtgggtac ggtacacgtg 2340
ccatactctc aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcgtg 2400
cagcacacag caccatttgg ctgccaata gcaacaaacc cggttaagagc ggtgaactgc 2460
gccgtagga acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc 2520
gacgcgcct ctttaacgga catgtcgtg gaggtaccag cctgcaccca ttctcagac 2580
tttggggcg tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat 2640
tcgatgacta acgccgtcac tattcgggaa gctgagatag aagtigaagg gaattctcag 2700
ctgcaaactt ctttctcgac ggccttagcc agcgcgaat tccgcgtaca agtctgttct 2760
acacaagtac actgtgcagc cgagtgccac ccccggaagg accacatagt caactaccg 2820
gcgtcacata ccacctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag 2880
aagatcacgg gaggtgtgg actggttgtt gctgttgcc cactgattct aatcgtggtg 2940
ctatgcgtgt cgttcagcag gcac 2964

<210> 6

<211> 3747

<212> DNA

<213> Chikungunya virus

<400> 6

atggagttca tcccgacgca aactttctat aacagaaggt accaaccg accctgggcc 60
ccacgcccta caattcaagt aattagacct agaccacgtc cacagaggca gcttgggcaa 120
ctgcccagc tgatctccg agtcaacaaa tigaccatgc gcgcgtacc tcaacagaag 180
cctcgagaa atcggaacaa caagaagcaa aggcagaaga agcaggcgcc gcaaacgac 240
ccaagcaaa agaagcaacc accacaaaag aagccggctc aaaagaaga gaaaccaggc 300

cgtagggaga gaatgtgcat gaaaattgaa aatgattgca tcttcgaagt caagcatgaa	360
ggcaaagtga tgggctacgc atgcctgggtg ggggataaag taatgaaacc agcacatgtg	420
aagggaacta tcgacaatgc cgatctggct aaactggcct ttaagcggtc gtctaaatac	480
gatcttgaat gtgcacagat accggtgcac atgaagtctg atgcctcgaa gtttaccac	540
gagaaacccg aggggtacta taactggcat cacggagcag tgcagtattc aggaggccgg	600
ttcactatcc cgacgggtgc aggcaagccg ggagacagcg gcagaccgat cttcgacaac	660
aaaggacggg tggtgccat cgtcctagga ggggccaacg aagggtgccc caccggccctc	720
tccgtggtga cgtggaacaa agacatcgtc acaaaaatta cccctgaggg agccgaagag	780
tggagcctcg ccctccgggt ctgtgcccgt ttggcaaaca ctacattccc ctgctctcag	840
ccgccttgca caccctgctg ctacgaaaag gaaccggaaa gcaccttgcg catgcttgag	900
gacaacgtga tgagaccggg atactaccag ctactaaaag catcgctgac ttgctctccc	960
caccgccaaa gacgcagtac taaggacaat tttaatgtct ataaagccac aagaccatat	1020
ctagctcatt gtctgactg cggagaaggg cattcgctgc acagccctat cgcattggag	1080
cgcattcagaa atgaagcaac ggacggaacg ctgaaaatcc aggtctcttt gcagatcggg	1140
ataaagacag atgacagcca cgattggacc aagctgcgct atatggatag ccatacgcca	1200
gcggacgcgg agcgagccgg attgcttgta aggacttcag caccgtgcac gatcaccggg	1260
accatgggac actttattct cgccgatgc ccgaaaggag agacgctgac agtgggattt	1320
acggacagca gaaagatcag ccacacatgc acacaccgt tccatcatga accacctgtg	1380
ataggtaggg agaggttcca ctctcgacca caacatggta aagagttacc ttgcagcacg	1440
tacgtgcaga gcaccgctgc cactgctgag gagatagagg tgcataatgcc ccagatact	1500
cctgaccgca cgctgatgac gcagcagctt ggcaacgtga agatcacagt taatgggcag	1560
acgggtgcgg acaagtgcaa ctgcggtggc tcaaacgagg gactgacaac cacagacaaa	1620
gtgatcaata actgcaaat tgatcagtc catgctgcag tcactaatca caagaattgg	1680
caatacaact cccctttagt cccgcgcaac gctgaactcg gggaccgtaa aggaaagatc	1740

cacatcccat tcccatiggc aaacgtgact tgcagagtgc caaaagcaag aaaccctaca	1800
gtaacttacg gaaaaaacca agtcaccatg ctgctgtatc ctgaccatcc gacactcttg	1860
tcttaccgta acatgggaca ggaaccaa at taccacgagg agtgggtgac acacaagaag	1920
gaggttacct tgaccgtgcc tactgagggt ctggagggtca cttggggcaa caacgaacca	1980
tacaagtact ggccgcagat gtctacgaac ggtactgctc atggtcacc acatgagata	2040
atcttgtact attatgagct gtacccact atgactgtag tcattgtgtc gctggcctcg	2100
ttcgtgcttc tgcgatggt gggcacagca gtgggaatgt gtgtgtgcgc acggcgaga	2160
tgcattacac catatgaatt aacaccagga gccactgttc ccttctgct cagcctgcta	2220
tgctgcgtca gaacgaccaa ggccggccaca tattacgagg ctgcggcata tctatggaac	2280
gaacagcagc cctgttctg gttgcaggct cttatccgc tggccgcctt gatcgtcctg	2340
tgcaactgtc tgaacctctt gccatgctgc tgaagaccc tggcttttt agccgtaatg	2400
agcatcggcg cccacactgt gagcgctac gaacacgtaa cagtgatccc gaacacggcg	2460
ggagtaccgt ataagactct tgtcaacaga ccgggttaca gcccattggt gttggagatg	2520
gagctacaat cagtcacctt ggaaccaaca ctgtcacttg actacatcac gtgcgagtac	2580
aaaactgtca tcccctcccc gtacgtgaag tgctgtggtc cagcagagtg caaggacaag	2640
agcctaccag actacagctg caaggtcttt actggagtct acccatttat gtggggcggc	2700
gcctactgct tttgcgacgc cgaaaatacg caattgagcg aggcacatgt agagaaatct	2760
gaatcttgca aaacagagtt tgcacggcc tacagagccc acaccgcac ggctcggcg	2820
aagctccgcg tctttacca aggaacaac attaccgtag ctgcctacgc taacggtgac	2880
catgccgtca cagtaaagga cgccaagttt gtcgtgggcc caatgtcctc cgcctggaca	2940
ccttttgaca aaaaaatcgt ggtgtacaaa ggcgacgtct acaacatgga ctaccacct	3000
tttggcgag gaagaccagg acaatttggg gacattcaaa gtcgtacacc ggaaagtaaa	3060
gacgtttatg ccaacactca gtgtgtacta cagaggccag cagcaggcac ggtacatgta	3120
ccatactctc aggcaccatc tggcttcaag tattggctga aggaacgagg agcatcgcta	3180
cagcacacgg caccgttcgg ttgccagatt gcgacaaacc cggtaaagagc tgtaaattgc	3240

gctgtgggga acataccaat ttccatcgac ataccggatg cggcctttac tagggttgtc 3300
 gatgcaccct ctgtaacgga catgtcatgc gaagtaccag cctgcactca ctccctcgac 3360
 tttgggggcg tcgccatcat caaatacaca gctagcaaga aaggtaaagtg tgcagtacat 3420
 tcgatgacca acgccgttac cattcgagaa gccgacgtag aagtagaggg gaactcccag 3480
 ctgcaaatat ccittctaac agccctggca agcgcggagt ttgcggtgca agtgtgtctc 3540
 acacaagtac actgcgcagc cgcattgccac cctccaaagg accacatagt caattaccca 3600
 gcatcacaca ccaccttgg ggtccaggat atatccacaa cggcaatgtc ttgggtgcag 3660
 aagattacgg gaggagtagg attaattgtt gctgttgctg ccttaatttt aattgtggtg 3720
 ctatgcgtgt cgtttagcag gcactaa 3747

<210> 7

<211> 3747

<212> DNA

<213> Chikungunya virus

<400> 7

atggagttca tccaaccca aactttttac aataggaggt accagcctcg accctggact 60
 ccgcgcccta ctatccaagt catcaggccc agaccgcgcc ctgagaggca agctgggcaa 120
 ctggcccagc tgatctcagc agttaataaa ctgacaatgc gcgcggtacc acaacagaag 180
 ccacgcagga atcgggaagaa taagaagcaa aagcaaaaac aacaggcgcc acaaaacaac 240
 acaaatcaaa agaagcagcc acctaaaaag aaaccggctc aaaagaaaaa gaagccgggc 300
 cgcagagaga ggatgtgcat gaaaatcgaa aatgattgta ttttcgaagt caagcacgaa 360
 ggtaagtaa caggttacgc gtgcctgggt ggggacaaag taatgaaacc agcacacgta 420
 aaggggacca tcgataacgc ggacctggcc aaactggcct ttaagcggtc atctaagtat 480
 gaccttgaat gcgcgcagat acccgtgcac atgaagtccg acgcttcgaa gttcacccat 540
 gagaaaccgg aggggtacta caactggcac cacggagcag tacagtactc aggaggccgg 600
 ttcacccatc ctacaggtgc tggcaaacca ggggacagcg gcagaccgat cttcgacaac 660
 aagggacgcg tgggtggccat agtcttagga ggagctaag aaggagcccc tacagccctc 720

tcggtgggga cctggaataa agacattgtc actaaaatca ccccgaggg ggccgaagag	780
tggagtcttg ccatcccagt tatgtgcctg ttggcaaaca ccacgttccc ctgctcccag	840
cccccttgca cgccctgtcg ctacgaaaag gaaccggagg aaacctacg catgcttgag	900
gacaacgtca tgagacctgg gtactatcag ctgctacaag catcctaac atgttctccc	960
caccgccagc gacgcagcac caaggacaac ttcaatgtct ataaagccac aagaccatac	1020
ttagctcact gtcccgactg tggagaaggg cactcgtgcc atagtcctgt agcactagaa	1080
cgcatcagaa atgaagcgac agacgggacg ctgaaaatcc aggtctcctt gcaaatcgga	1140
ataaagacgg atgacagcca cgattggacc aagctgcgtt atatggacaa ccacatgcc	1200
gcagacgcag agaggcgagg gctatttgta agaacatcag caccgtgtac gattactgga	1260
acaatgggac acttcatcct ggcccgatgt ccaaaagggg aaactctgac ggtgggattc	1320
actgacagta ggaagattag tcactcatgt acgcacccat ttcaccacga cctcctgtg	1380
ataggtcggg aaaaattcca ttcccgaccg cagcacggta aagagctacc ttgcagcagc	1440
tacgtgcaga gcaccgccgc aactaccgag gagatagagg tacacatgcc ccagacacc	1500
cctgatcgca cattaatgtc acaacagtcg ggcaacgtaa agatcacagt caatggccag	1560
acggtgcggt acaagtgtaa ttgcggtggc tcaaatgaag gactaacaac tacagacaaa	1620
gtgattaata actgcaaggt tgatcaatgt catgccgagg tcaccaatca caaaaagtgg	1680
cagtataact cccctctggt cccgcgtaat gctgaacttg gggaccgaaa aggaaaaatt	1740
cacatccctg ttccgtggc aaatgtaaca tgcagggtgc ctaaagcaag gaacccacc	1800
gtgacgtacg ggaaaaacca agtcatcatg ctactgtatc ctgaccaccc aacactcctg	1860
tcctaccgga atatgggaga agaaccacaa tatcaagaag agtgggtgat gcataagaag	1920
gaagtctgac taaccgtgcc gactgaaggg ctcgagggtc cgtggggcaa caacgagccg	1980
tataagtatt ggccgcagtt atctacaaac ggtacagccc atggccaccc gcatgagata	2040
attctgtatt attatgagct gtacccact atgactgtag tagttgtgtc agtggccacg	2100
ttcatactcc tgtcgtggt gggtatggca gcggggatgt gcatgtgtgc acgacgcaga	2160

tgcatcacac cgtatgaact gacaccagga gctaccgtcc ctttcctgct tagcctaata	2220
tgctgcatca gaacagctaa agcggccaca taccaagagg ctgcgatata cctgtggaac	2280
gagcagcaac ctttgttttg gctacaagcc ctatttcgcg tggcagccct gattgttcta	2340
tgcaactgtc tgagactcct accatgtctg tgtaaaacgt tggctttttt agccgtaatg	2400
agcgtcggtg cccacactgt gagcgctac gaacacgtaa cagtcatccc gaacacggtg	2460
ggagtaccgt ataagactct agtcaataga cctggctaca gccccatggg attggagatg	2520
gaactactgt cagtcacttt ggagccaaca ctatcgcttg attacatcac gtgcgagtac	2580
aaaaccgtca tcccgctctc gtacgtgaag tgctgcggta cagcagagtg caaggacaaa	2640
aacctaccgt actacagctg taaggctctc accggcgtct acccatitat gtggggcggc	2700
gcctactgct tctgcgacgc tgaaaacacg cagttgagcg aagcacacgt ggagaagtc	2760
gaatcatgca aaacagaatt tgcatcagca tacagggctc ataccgcctc tgcatcagct	2820
aagctccgcg tcctttacca aggaaataac atcactgtaa ctgcctatgc aaacggcgac	2880
catgccgtca cagttaagga cgccaaattc attgtggggc caatgtcttc agcctggaca	2940
cctttcgaca acaaaattgt ggtgtacaaa ggtgacgtct ataacatgga ctaccgccc	3000
tttggcgag gaagaccagg acaatttggc gatatccaaa gtcgcacacc tgagagtaaa	3060
gacgtctatg ctaatacaca actggtactg cagagaccgg ctgtgggtac ggtacacgtg	3120
ccatactctc aggcaccatc tggctttaag tattggctaa aagaacgcgg ggcgtcgtg	3180
cagcacacag caccatttgg ctgccaaata gcaacaaacc cgtaagagc ggtgaactgc	3240
gccgtaggga acatgcccat ctccatcgac ataccggaag cggccttcac tagggtcgtc	3300
gacgcgccct cttaacgga catgtcgtgc gaggtaccag cctgcaccca ttcctcagac	3360
tttggggcg tcgccattat taaatatgca gccagcaaga aaggcaagtg tgcggtgcat	3420
tcgatgacta acgccgtcac tattcgggaa gctgagatag aagtgaagg gaattctcag	3480
ctgcaaactc ctttctcgac ggcccttagc agcgccgaat tccgcgtaca agtctgttct	3540
acacaagtac actgtgcagc cgagtccac cccccgaagg accacatagt caactacccg	3600
gcgtcacata ccaccctcgg ggtccaggac atctccgcta cggcgatgtc atgggtgcag	3660

aagatcacgg gaggtgtggg actggttggt gctgttgccg cactgattct aatcgtggg 3720
ctatgcgtgt cgttcagcag gcactaa 3747

<210> 8
<211> 8404
<212> DNA
<213> Artificial

<220>
<223> VLP_CHI512 vector

<400> 8
gaattcccat tgcatacgtt gtatccatat cataatatgt acatttatat tggctcatgt 60
ccaacattac cgccatgttg acattgatta ttgactagtt attaatagta atcaattacg 120
gggtcattag ttcatagccc atatatggag ttccgcgtta cataacttac ggtaaatggc 180
ccgcctggct gaccgcccac cgacccccgc ccattgacgt caataatgac gtatgttccc 240
atagtaacgc caataggagc ttccattga cgtcaatggg tggagtattt acggtaaact 300
gcccacttgg cagtacatca agtgtatcat atgccaagta cggcccctat tgacgtcaat 360
gacggtaaatt ggcccgcctg gcattatgcc cagtacatga ctttatggga ctttcctact 420
tggcagtaca tctacgtatt agtcatcgct attaccaatg tgatgcggtt ttggcagtac 480
atcaatgggc gtggatagcg gtttgactca cggggatttc caagtctcca cccattgac 540
gtcaatggga gtttgttttg gcacaaaaat caacgggact ttccaaaatg tcgtaacaac 600
tccgccccat tgacgcaaatt ggccggtagg cgtgtacggt gggagggtcta tataagcaga 660
gctcgttttag tgaaccgtca gatcgccctg agacgccatc cacgctgttt tgacctccat 720
agaagacacc gggaccgatc cagcctccgt taacgggtga gggcagtga gtctgagcag 780
tactcgttgc tgccgcgcgc gccaccagac ataatagctg acagactaac agactgttcc 840
tttccatggg tcttttctgc agtcaccgtc gtcgacacgt gtgatcagat atcgcggccg 900
ccaccatgga gtcatcccg acgcaaactt tctataacag aaggtaacaa ccccgaccct 960
gggccccacg ccctacaatt caagtaatta gacctagacc acgtccacag aggcaggctg 1020

ggcaactcgc ccagctgac tccgcagtca acaaattgac catgcgcgcg gtacctcaac	1080
agaagcctcg cagaaatcgg aaaaacaaga agcaaaggca gaagaagcag gcgccgcaaa	1140
acgacccaaa gcaaaagaag caaccaccac aaaagaagcc ggctcaaaag aagaagaaac	1200
caggccgtag ggagagaatg tgcatgaaaa ttgaaaatga ttgcatcttc gaagtcaagc	1260
atgaaggcaa agtgatgggc tacgcatgcc tggggggga taaagtaatg aaaccagcac	1320
atgtgaaggg aactatcgac aatgccgac tggctaaact ggcctttaag cggctgtcta	1380
aatacgatct tgaatgtgca cagataccgg tgcacatgaa gtctgatgcc tcgaagtta	1440
cccacgagaa acccgagggg tactataact ggcatcacgg agcagtcag tattcaggag	1500
gccggttcac tatcccgacg ggtgcaggca agccgggaga cagcggcaga ccgatcttcg	1560
acaacaaagg acgggtggtg gccatcgtcc taggggggc caacgaaggc gcccgcacgg	1620
ccctctccgt ggtgacgtgg aacaagaca tcgtcacaaa aattaccctt gagggagccg	1680
aagagtggag cctcgccctc ccggtcttgt gcctgttggc aaacactaca ttcccctgct	1740
ctcagccgcc ttgcacacc tgctgtctacg aaaaggaacc ggaaagcacc ttgcgcatgc	1800
ttgaggacaa cgtgatgaga cccggatact accagctact aaaagcatcg ctgacttgct	1860
ctccccaccg ccaaagacgc agtactaagg acaattttaa tgtctataaa gccacaagac	1920
catacttagc tcattgtcct gactgcggag aagggcattc gtgccacagc cctatcgcat	1980
tggagcgcac cagaaatgaa gcaacggacg gaacgctgaa aatccaggtc tctttgcaga	2040
tcgggataaa gacagatgac agccacgatt ggaccaagct gcgctatatg gatagccata	2100
cgccagcggg cgcggagcga gccggattgc ttgtaaggac ttcagcaccg tgcacgatca	2160
ccgggaccat gggacacttt attctcgccc gatgcccgaa aggagagacg ctgacagtgg	2220
gatttacgga cagcagaaaag atcagccaca catgcacaca ccggttccat catgaaccac	2280
ctgtgatagg tagggagagg ttccactctc gaccacaaca tggtaaagag ttaccttgca	2340
gcacgtacgt gcagagcacc gctgccactg ctgaggagat agagggtgcat atgccccag	2400
atactcctga ccgcacgctg atgacgcagc agtccggagg atccaacgtg aagatcacag	2460
ttaatgggca gacgggtcgg tacaagtgc aatgcgggtg ctcaaacgag ggactgacaa	2520

ccacagacaa agtgaatcaat aactgcaaaa ttgatcagtg ccatgctgca gtcactaatc	2580
acaagaattg gcaatacaac tccccttttag tcccgcgcaa cgctgaactc ggggaccgta	2640
aaggaaagat ccacatccca ttcccatigc caaacgtgac ttgcagagtg ccaaaagcaa	2700
gaaaccctac agtaacttac gaaaaaacc aagtcacat gctgctgtat cctgaccatc	2760
cgacactcct gtcctaccgt aacatgggac aggaaccaa ttaccacgag gagtgggtga	2820
cacacaagaa ggaggttacc ttgaccgtgc ctactgaggg tctggaggtc acttggggca	2880
acaacgaacc atacaagtac tggccgcaga tgtctacgaa cggctactgt catggtcacc	2940
cacatgagat aatcttgtac tattatgagc tgtacccac tatgactgta gtcatttgt	3000
cggctggcctc gtctgtctt ctgtcgatgg tgggcacagc agtgggaatg tgtgtgtgcg	3060
cacggcgag atgcattaca ccatatgaat taacaccagg agccactgtt ccttcctgc	3120
tcagcctgct atgctgcgtc agaacgacca aggcggccac atattacgag gctcggcat	3180
atctatggaa cgaacagcag cccctgttct ggttcagggc tcttatcccg ctggccgcct	3240
tgatcgtcct gtgcaactgt ctgaaactct tgccatgctg ctgtaagacc ctggctttt	3300
tagccgtaat gagcatcggg gccacactg tgagcgcgta cgaacacgta acagtgatcc	3360
cgaacacggg gggagtaccg tataagactc ttgtcaacag accgggttac agcccatgg	3420
tgttgagat ggagctacaa tcagtcacct tggaaccaac actgtcactt gactacatca	3480
cgtgcgagta caaaactgtc atcccctccc cgtacgtgaa gtgctgtggt acagcagagt	3540
gcaaggacaa gagcctacca gactacagct gcaaggctt tactggagtc taccattta	3600
tgtggggcgg cgcctactgc ttttgcgacg ccgaaaatac gcaattgagc gaggcacatg	3660
tagagaaatc tgaatcttgc aaaacagagt ttgcatcggc ctacagagcc cacaccgcat	3720
cggcgtcggc gaagctccgc gtcctttacc aaggaaacaa cattaccgta gctgcctacg	3780
ctaacggtga ccatgccgtc acagtaaagg acgccaagtt tgtcgtgggc ccaatgtcct	3840
ccgcctggac accttttgac acaaaaatcg tegtgtacaa aggcgacgtc tacaacatgg	3900
actaccacc ttttggcgca ggaagaccag gacaatttgg tgacattcaa agtcgtacac	3960

cggaagtaa agacgtttat gccaacactc agttggtact acagaggcca gcagcaggca	4020
cggatcatgt accatactct caggcaccat ctggcttcaa gtattggctg aaggaacgag	4080
gagcatcgct acagcacacg gcaccgttcg gttgccagat tgcgacaaac ccggtaaagag	4140
ctgtaaattg cgctgtgggg aacataccaa ttccatcga cataccggat gcggccttta	4200
ctagggttgt cgatgcaccc tctgtaacgg acatgtcatg cgaagtacca gcctgcactc	4260
actcctccga ctttgggggc gtcgccatca tcaaatacac agctagcaag aaaggtaa	4320
gtgcagtaca ttcatgacc aacgccgtta ccattcgaga agccgacgta gaagtagagg	4380
ggaactccca gcigcaaata tccttctcaa cagccctggc aagcgccgag ttctgcgtgc	4440
aagtgtgctc cacacaagta cactgcgcag ccgcatgcc aacctcaaag gaccacatag	4500
tcaattacc agcatcacac accacccttg gggccagga tataaccaca acggcaatgt	4560
cttgggtgca gaagattacg ggaggagtag gattaattgt tgctgttgct gccttaattt	4620
taattgtggt gctatgcgtg tcgttttagca ggcactaagg atctagatct gctgtgcctt	4680
ctagttgcca gccatctgtt gtttggccct ccccggtgcc ttcttgacc ctggaaggta	4740
ccactccac tgtcctttcc taataaaatg aggaaattgc atcgattgt ctgagtaggt	4800
gtcattctat tctggggggt ggggtggggc aggacagcaa gggggaggat tgggaagaca	4860
atagcaggca tgctgggat gcggtgggct ctatgggtac ccagtgctg aagaattgac	4920
ccggttcctc ctgggccaga aagaagcagg cacatccct tctctgtgac acaccctgtc	4980
cagccccctg gttcttagtt ccagccccac tcataggaca ctcatagctc aggagggtc	5040
cgcttcaat ccacccgct aaagtacttg gagcggtctc tccctccctc atcagcccac	5100
caaaccaaac ctagcctcca agagtggga gaaattaaag caagataggc tattaagtgc	5160
agaggagag aaaatgcctc caacatgtga ggaagtaatg agagaaatca tagaatttta	5220
aggccatgat ttaaggccat catggcctaa gcttgaaagg agataggatc aaagcttggc	5280
gtaatcatgg tcatagctgt ttctgtgtg aaattgttat ccgctcaca ttccacacaa	5340
catacgagcc ggaagcataa agtgtaaagc ctggggtgcc taatgagtga gctaactcac	5400
attaattgcg ttgcgtcac tgcccgcttt ccagtcggga aacctgtcgt gccagctgca	5460

ttaatgaatc ggccaacgcg cggggagagg cggtttgcgt attgggcgct cticcgcctc	5520
ctcgctcact gactcgctgc gctcggctcg tccgctgcgg cgagcggtat cagctcactc	5580
aaaggcggta atacggttat ccacagaatc aggggataac gcaggaaaga acatgtgagc	5640
aaaaggccag caaaaggcca ggaaccgtaa aaaggccgcg ttgctggcgt ttttccatag	5700
gctccgcccc cctgacgagc atcacaaaaa tcgacgctca agtcagaggt ggcgaaaccc	5760
gacaggacta taaagatacc aggcgtttcc ccttggaagc tccctcgtgc gctctcctgt	5820
tccgacctg ccgcttaccg gataacctgc cgcttttctc ccttcgggaa gcgtggcgct	5880
ttctcatagc tcacgctgia ggtatctcag ttcgggtgtag gtcgttcgct ccaagctggg	5940
ctgtgtgcac gaaccccccg ttcagcccgga ccgctgcgcc ttatccggta actatcgtct	6000
tgagtccaac ccgtaagac acgacttatt gccactggca gcagccactg gtaacaggat	6060
tagcagagcg aggtatgtag gcggtgctac agagtctctg aagtgggtgc ctaactacgg	6120
ctacactaga agaacagtat ttggtatctg cgctctgctg aagccagtta ccttcggaaa	6180
aagagttggt agctcttgat ccggcaaaca aaccaccgct ggtagcggtg gttttttgt	6240
ttgcaagcag cagattacgc gcagaaaaaa aggatctcaa gaagatcctt tgatcttttc	6300
tacggggctc gacgctcagt ggaacgaaaa ctacagttaa gggattttgg tcatgagatt	6360
atcaaaaagg atcttcacct agatcctttt aaattaaaaa tgaagtttta aatcaatcta	6420
aagtatatat gagtaaacct ggtctgacag ttaccaatgc ttaatcagtg aggcacctat	6480
ctcagcgatc tgtctatttc gtcatccat agttgcctga ctccccgtcg tgtagataac	6540
tacgatacgg gagggcttac catctggccc cagtctgca atgataccgc gagaaccacg	6600
ctcaccggct ccagatttat cagcaataaa ccagccagcc ggaagggccg agcgcagaag	6660
tggtcctgca actttatccg cctccatcca gtctattaat tgttgccggg aagctagagt	6720
aagtagttcg ccagttaata gtttgcgcaa cgttggtgcc attgctacag gcatcgtggt	6780
gtcacgctcg tcgtttggta tggcttcatt cagctccggt tcccaacgat caaggcgagt	6840
tacatgatcc cccatgttgt gcaaaaaagc ggttagctcc ttcggtcctc cgatcgttgt	6900

cagaagtaag tiggccgcag tgtatcact catggtatg gcagcactgc ataattctct	6960
tactgtcatg ccatccgtaa gatgcttttc tgtgactggt gagtactcaa ccaagtcatt	7020
ctgagaatag tgtatgcggc gaccgagttg ctcttgcccg gcgtcaatac gggataatac	7080
cgcgccacat agcagaactt taaaagtgt catcattgga aaacgttctt cggggcgaaa	7140
actctcaagg atcttaccgc tgttgagatc cagttcgatg taaccactc gtgcacccaa	7200
ctgatcttca gcatctttta ctttcaccag cgtttctggg tgagcaaaaa caggaaggca	7260
aaatgccgca aaaaaggga taaggcgac acggaaatgt tgaatactca tactcttct	7320
ttttcaatat tattgaagca ttatcaggg ttattgtctc atgagcggat acatatttga	7380
atgtatttag aaaaataaac aaataggggt tccgcgcaca ttccccgaa aagtgccacc	7440
tgacgtctaa gaaaccatta ttatcatgac attaacctat aaaaataggc gtatcacgag	7500
gccctttcgg gtgcgcggt tccgtgatga cggtgaaaac ctctgacaca tgcagctccc	7560
gttgacggtc acagcttgtc tgtaagcga tgcgggagc agacaagccc gtcaggcgcc	7620
gtcagcgggt gttggcgggt gtcggggctg gcttaactat gcggcatcag agcagattgt	7680
actgagagtg caccataaaa ttgtaaacgt taatatattg ttaaaattcg cgttaaattt	7740
ttgttaaadc agctcatitt ttaaccaata ggccgaaatc ggcaaaatcc cttataaatc	7800
aaaagaatag cccgagatag ggttgagtgt tgttccagtt tggaacaaga gtccactatt	7860
aaagaacgtg gactccaacg tcaaaggcg aaaaaccgtc tatcaggcg atggccact	7920
acgtgaacca tcacccaaat caagttttt ggggtcgagg tgccgtaaag cactaaatcg	7980
gaaccctaaa gggagcccc gatttagagc ttgacggga aagccggcga acgtggcgag	8040
aaaggaagg aagaaagcga aaggagcgg cgctaggcg ctggcaagt tagcgtcac	8100
gctgcgcta accaccacac cgcgcgct taatgcgcc ctacaggcg cgtactatgg	8160
tgtcttgac gtatgcggtg tgaataacc cacagatgcg taaggagaaa ataccgcatc	8220
aggcgcatt cgcattcag gctgcgaac tgttgggaag ggcgatcgt gcgggcctct	8280
tcgctattac gccagctggc gaaagggga tctgtgcaa ggcgattaag ttgggtaacg	8340
ccagggttt cccagtcag acgttgtaa acgacggcca gtgaattcca tggctcaac	8400

tttc

8404

<210> 9

<211> 8410

<212> DNA

<213> Artificial

<220>

<223> VLP_CHI 532 vector

<400> 9

gaattcccat tgcatacgtt gtatccatat cataatatgt acatttatat tggctcatgt	60
ccaacattac cgccatgttg acattgatta ttgactagtt attaatagta atcaattacg	120
gggtcattag ttcatagccc atatatggag ttccgcgtta cataacttac ggtaaattggc	180
ccgcctggct gaccgcccac cgacccccgc ccattgacgt caataatgac gtatgttccc	240
atagtaacgc caataggac ttccattga cgtcaatggg tggagtattt acggtaaact	300
gccacttgg cagtacatca agtgtatcat atgccaagta cgccccctat tgacgtcaat	360
gacggtaaat ggccgcctg gcattatgcc cagtacatga ccttatggga ctttcctact	420
tggcagtaca tctacgtatt agtcacgct attaccatgg tgatgcggtt ttggcagtac	480
atcaatgggc gtggatagcg gtttgactca cggggatttc caagtctcca cccattgac	540
gtcaatggga gtttgitttg gcacaaaat caacgggact ttccaaaatg tcgtaacaac	600
tccgccccat tgacgcaaat gggcggtagg cgtgtacggt gggaggctta tataagcaga	660
gctcgittag tgaaccgtca gatcgcttg agacgccatc cagctgttt tgacctccat	720
agaagacacc gggaccgatc cagcctccgt taacgggtga gggcagtgtg gtctgagcag	780
tactcgttgc tgccgcgcgc gccaccagac ataatagctg acagactaac agactgttcc	840
tttccatggg tcttttctgc agtcaccgtc gtcgacacgt gtgatcagat atcgcgcccg	900
ccaccatgga gttcatcccg acgcaaactt tctataacag aaggtaacaa ccccgaccct	960
gggccccacg ccctacaatt caagtaatta gacctagacc acgtccacag aggcaggctg	1020
ggcaactcgc ccagctgatc tccgcagtca acaaattgac catgcgcgcg gtacctcaac	1080

agaagcctcg cagaaatcgg aaaaacaaga agcaaaggca gaagaagcag gcgccgcaaa	1140
acgacccaaa gcaaaagaag caaccaccac aaaagaagcc ggctcaaaag aagaagaaac	1200
caggccgtag ggagagaatg tgcataaaaa ttgaaaatga ttgcatcttc gaagtaagc	1260
atgaaggcaa agtgatgggc tacgcatgcc tgggtgggga taaagtaatg aaaccagcac	1320
atgtgaaggg aactatcgac aatgccgac tggctaaact ggccittaaag cggtcgtcta	1380
aatacgatct tgaatgtgca cagataccgg tgcacatgaa gtctgatgcc tcgaagtta	1440
cccacgagaa acccgagggg tactataact ggcatcacgg agcagtgacg tattcaggag	1500
gccggttcac tatcccgacg ggtgcaggca agccgggaga cagcggcaga ccgatcttcg	1560
acaacaaagg acgggtggg gccatcgtcc taggaggggc caacgaaggt gcccgcacgg	1620
ccctctccgt ggtgacgtgg aacaaagaca tcgtcacaaa aattaccctt gagggagccg	1680
aagagtggag cctcgccctc ccggtcttgt gcctgttggc aaacactaca ttcccctgct	1740
ctcagccgcc ttgcacaccc tgcgtctacg aaaaggaacc ggaaagcacc ttgcgcatgc	1800
ttgaggacaa cgtgatgaga cccggatact accagctact aaaagcatcg ctgacttgct	1860
ctccccaccg ccaaagacgc agtactaagg acaattttta tgtctataaa gccacaagac	1920
catatctagc tcattgtcct gactgcggag aagggcattc gtgccacagc cctatcgcat	1980
tggagcgcat cagaaatgaa gcaacggacg gaacgctgaa aatccaggtc tctttgcaga	2040
tcgggataaa gacagatgac agccacgatt ggaccaagct gcgctatatg gatagccata	2100
cgccagcggg cgcggagcga gccggattgc ttgtaaggac ttcagcaccg tgcacgatca	2160
ccgggaccat gggacacttt attctcgccc gatgcccgaaggagagacg ctgacagtgg	2220
gatttacgga cagcagaaag atcagccaca catgcacaca cccgttccat catgaaccac	2280
ctgtgatagg tagggagagg ttccactctc gaccacaaca tggtaaagag ttaccttgca	2340
gcacgtacgt gcagagcacc gctgccactg ctgaggagat agaggatgat atgccccag	2400
atactcctga ccgcacgctg atgacgcagc agtctggcaa cgtgaagatc acagttaatg	2460
ggcagacggt gcggtacaag tgcaactgcg gtggctccgg aagtgatcc aacgaggac	2520
tgacaaccac agacaaagt atcaataact gcaaaattga tcagtgccat gctgcagtca	2580

ctaatacaca gaattggcaa tacaactccc ctttagtccc gcgcaacgct gaactcgggg	2640
accgtaaagg aaagatccac atcccattcc cattggcaaa cgtgacttgc agagtgccaa	2700
aagcaagaaa ccctacagta acttacggaa aaaaccaagt caccatgctg ctgtatcctg	2760
accatccgac actcttgtct taccgtaaca tgggacagga accaaattac cagcaggagt	2820
gggtgacaca caagaaggag gttaccttga ccgtgcctac tgagggtctg gaggtcactt	2880
ggggcaacaa cgaaccatac aagtactggc gcgagatgtc tacgaacggt actgctcatg	2940
gtcaccacaca tgagataatc ttgtactatt atgagctgta cccactatg actgtagtca	3000
ttgtgtcggg gccctcgttc gtgcttctgt cgatggggg cacagcagtg ggaatgtgtg	3060
tgtgcgcacg gcgcagatgc attacaccat atgaattaac accaggagcc actgttcctt	3120
tcctgctcag cctgctatgc tgcgtcagaa cgaccaaggc ggccacatat tacgaggctg	3180
cggcatactt atggaacgaa cagcagcccc tgttctgggt gcaggctctt atcccgtgg	3240
ccgccitgat cgtcctgtgc aactgtctga aactcttggc atgctgctgt aagaccctgg	3300
cttttttagc cgtaatgagc atcgggtccc acactgtgag cgcgtacgaa cacgtaacag	3360
tgatcccgaa cacggtggga gtaccgtata agactcttgt caacagaccg ggttacagcc	3420
ccatggtgtt ggagatggag ctacaatcag tcaccttga accaactctg tcaactgact	3480
acatcacgtg cgagtacaaa actgtcatcc cctccccgta cgtgaagtgc tgggtacag	3540
cagagtgcga ggacaagagc ctaccagact acagctgcaa ggtctttact ggagtctacc	3600
catttatgtg gggcggcgcc tactgctttt gcgacgccga aaatacgcaa ttgagcgagg	3660
cacatgtaga gaaatctgaa tcttgcaaaa cagagtttgc atcggcctac agagcccaca	3720
ccgcatcggc gtcggcgaag ctccgcgtcc ttaccaagg aaacaacatt accgtagctg	3780
cctacgctaa cggtgaccat gccgtcacag taaaggacgc caagtttgc gtgggcccc	3840
gtcctccgc ctggacacct ttgacaaca aaatcgtggg gtacaaaggc gacgtctaca	3900
acatggacta cccacctttt ggcgaggaa gaccaggaca atttggtag attcaaagtc	3960
gtacaccgga aagtaaagac gtttatgcca acactcagtt ggtactacag aggccagcag	4020

caggcacggt acatgtacca tactctcagg caccatctgg cttcaagtat tggctgaagg	4080
aacgaggagc atcgctacag cacacggcac cgttcggttg ccagattgcg acaaaccggg	4140
taagagctgt aaattgcgct gtggggaaca taccaatttc catcgacata ccggatgcgg	4200
cctttactag ggttgtcgat gcacctctg taacggacat gtcatgcgaa gtaccagcct	4260
gcactcactc ctccgacttt gggggcgctg ccatcatcaa atacacagct agcaagaaag	4320
gtaaatgtgc agtacattcg atgaccaacg ccgttaccat tcgagaagcc gacgtagaag	4380
tagaggggaa ctcccagctg caaatatcct tctcaacagc cctggcaagc gccgagtttc	4440
gcgtgcaagt gtgctccaca caagtacact gcgcagccgc atgccaccct ccaaaggacc	4500
acatagtcaa ttaccagca tcacacacca cccttgggt ccaggatata tccacaacgg	4560
caatgtcttg ggtgcagaag attacgggag gagtaggatt aattgttgct gttgctgcct	4620
taattttaat tgttggtcta tgcgtgtcgt ttagcaggca ctaaggatct agatctgctg	4680
tgccttctag ttgccagcca tctgttggtt gccccicccc cgtgccttcc ttgaccctgg	4740
aaggigccac tcccactgtc ctttctaata aaaatgagga aattgcatcg cattgtctga	4800
gtaggtgtca ttctattctg gggggtgggg tggggcagga cagcaagggg gaggattggg	4860
aagacaatag caggcatgct ggggatgcgg tgggtcttat gggtagccag gtgctgaaga	4920
attgaccggg ttcttcttgg gccagaaaga agcaggcaca tccccttctc tgtgacacac	4980
cctgtccacg cccctggttc ttagttccag ccccatcat aggacactca tagctcagga	5040
gggtccgcc ttcaatccca cccgctaaag tacttggagc ggtctctccc tccctcatca	5100
gcccaccaaa ccaaacctag cctccaagag tgggaagaaa ttaaagcaag ataggctatt	5160
aagtgcagag ggagagaaaa tgcctccaac atgtgaggaa gtaatgagag aaatcataga	5220
attttaaggc catgatttta ggccatcatg gcctaagctt gaaaggagat aggatccaag	5280
cttggcgtaa tcatggtcac agctgtttcc tgttgaaat tgttatccgc tcacaattcc	5340
acacaacata cgagccggaa gcataaagtg taaagcctgg ggtgcctaata gagtgagcta	5400
actcacatta attgcgttgc gctcactgcc cgctttccag tcgggaaacc tgtcgtgcca	5460
gctgcattaa tgaatcggcc aacgcgcggg gagaggcggg ttgcgtattg ggcgctcttc	5520

cgcttcctcg ctactgact cgctgcgctc ggtcgttcgg ctgcggcgag cggatcagc	5580
tcactcaaag gcgtaatac ggttatccac agaatcaggg gataacgcag gaaagaacat	5640
gtgagcaaaa ggccagcaaa aggccaggaa ccgtaaaaag gccgcgttgc tggcgtttt	5700
ccataggctc cgccccctg acgagcatca caaaaatcga cgctcaagtc agaggtggcg	5760
aaacccgaca ggactataaa gataccaggc gtttccccct ggaagctccc tcgtgcgctc	5820
tcctgttccg accctgccgc ttaccggata cctgtccgcc tttctccctt cgggaagcgt	5880
ggcgctttct catagctcac gctgtaggta tctcagttcg gtgtaggctg ttcgctccaa	5940
gctgggctgt gtgcacgaac cccccgttca gcccgaccgc tgcgccttat ccggttaacta	6000
tcgtcttgag tccaacccgg taagacacga cttatcgcca ctggcagcag ccactggtaa	6060
caggattagc agagcgaggt atgtaggcgg tgctacagag ttcttgaagt ggtggcctaa	6120
ctacggctac actagaagaa cagtatttgg tatctgcgct ctgctgaagc cagttacctt	6180
cggaaaaaga gttggtagct cttgatccgg caaacaacc accgctggta gcggtggttt	6240
ttttgtttgc aagcagcaga ttacgcgcag aaaaaaagga tctcaagaag atcctttgat	6300
cttttctacg ggtctgacg ctcagtggaa cgaaaactca cgtaaggga ttttggtcac	6360
gagattatca aaaaggatct tcacctagat ctttttaa ataaaaatgaa gttttaaatc	6420
aatctaaagt atatatgagt aaacttggtc tgacagttac caatgcctaa tcagtgaggc	6480
acctatctca gcgatctgtc tatttcgttc atccatagtt gcctgactcc ccgtcgtgta	6540
gataactacg atacgggagg gcttaccatc tggccccagt gctgcaatga taccgcgaga	6600
accacgcica ccggctccag atttatcagc aataaaccag ccagccggaa gggccgagcg	6660
cagaagtggc cctgcaactt tatccgcctc catccagctt attaattgtt gccgggaagc	6720
tagagtaagt agttcgccag ttaatagttt gcgcaacgtt gttgccattg ctacaggcat	6780
cgtgggtgtc cgctcgtcgt ttggatggc ttcatcagc tccggttccc aacgatcaag	6840
gcgagttaca tgatcccca tgttgtgcaa aaaagcgggt agctccttcg gtcctccgat	6900
cgttgtcaga agtaagtgg ccgcagtgtt atcactcatg gttatggcag cactgcataa	6960

ttctcttact gtcatgccat ccgtaagatg cttttctgtg actggtgagt actcaaccaa	7020
gtcattctga gaatagtgtg tgcggcgacc gagttgctct tgcggcgct caatacggga	7080
taataccgcg ccacatagca gaactttaaa agtgctcatc attggaaaac gttcttcggg	7140
gcgaaaactc tcaaggatct taccgctgtt gagatccagt tcgatgtaac ccaactcgtc	7200
acccaactga tcttcagcat cttttacttt caccagcgtt tctgggtgag caaaaacagg	7260
aaggcaaaat gccgcaaaaa agggaataag ggcgacacgg aaatgttgaa tactcatact	7320
cttccttttt caatattatt gaagcattta tcagggttat tgtctcatga gcggatacat	7380
atttgaatgt atttagaaaa ataaacaaat aggggttccg cgcacatttc cccgaaaagt	7440
gccacctgac gtctaagaaa ccattattat catgacatta acctataaaa ataggcgtat	7500
cacgaggccc tttcgggtcg cgcgtttcgg tgatgacggt gaaaacctct gacacatgca	7560
gctcccgttg acggtcacag cttgtctgta agcggatgcc gggagcagac aagcccgtca	7620
gggcgcgtca gcgggtgttg gcgggtgtcg gggctggctt aactatgcgg catcagagca	7680
gattgtactg agagtgcacc ataaaattgt aaacgttaat atttgttaa aattcgcgtt	7740
aaattttgt taaatcagct ctttttttaa ccaataggcc gaaatcggca aaatccctta	7800
taaatcaaaa gaatagccc agatagggtt gagtgttgtt ccagtttga acaagagtc	7860
actattaaag aacgtggact ccaacgtcaa agggcgaaaa accgtctatc agggcgatgg	7920
cccactacgt gaaccatcac ccaaatcaag ttttttgggg tcgagggtgcc gtaaagcact	7980
aaatcggaac cctaaaggga gccccgatt tagagcttga cggggaagc cggcgaacgt	8040
ggcgagaaaag gaagggaaga aagcgaaagg agcggcgctt agggcgctgg caagtgtagc	8100
ggtcacgctg cgcgtaacca ccacaccgc cgcgttaat gcgccgtac agggcgctga	8160
ctatggttgc ttgacgtat gcggtgtgaa ataccgcaca gatgcgtaag gagaaaatac	8220
cgcatcaggc gccattcgcc attcaggctg cgcaactgtt ggaaggcg atcgggtcgg	8280
gcctcttcgc tattacgcca gctggcgaaa ggggatgtg ctgcaaggcg attaagtgg	8340
gtaacgccag ggttttcca gtcacgacgt tgtaaaacga cggccagtga attccatggt	8400
ctcaactttc	8410

<210> 10
 <211> 8431
 <212> DNA
 <213> Artificial

<220>
 <223> VLP_VEEV VLP 518 vector

<400> 10
 gaattcccat tgcatacggt gtatccatat cataatatgt acatttatat tggctcatgt 60
 ccaacattac cgccatgttg acattgatta ttgactagtt attaatagta atcaattacg 120
 gggtcattag ttcatagccc atatatggag ttccgcgtta cataacttac ggtaaatggc 180
 ccgcctggct gaccgccccaa cgacccccgc ccattgacgt caataatgac gtatgttccc 240
 atagtaacgc caataggagc ttccattga cgtcaatggg tggagtattt acggtaaaact 300
 gcccaattgg cagtacatca agtgtatcat atgccaagta cgccccctat tgacgtcaat 360
 gacggtaaat ggcccgcttg gcattatgcc caglacatga ccttatggga ctttcctact 420
 tggcagtaca tctacgtatt agtcatcgct attaccatgg tgatgcggtt ttggcagtac 480
 atcaatgggc gtggatagcg gtttgactca cggggatttc caagtctcca cccattgac 540
 gtcaatggga gtttgttttg gcacaaaaat caacgggact ttccaaaatg tcgtaacaac 600
 tccgccccat tgacgcaaat gggcggtagg cgtgtacggg gggaggtctt tataagcaga 660
 gctcgtttag tgaaccgtca gatcgcttgg agacgccatc cacgctgttt tgacctccat 720
 agaagacacc gggaccgatc cagcctccgt taacggtgga gggcagtgtg gtctgagcag 780
 tactcgttgc tgccgcgcgc gccaccagac ataatagctg acagactaac agactgttcc 840
 ttccatggg tcttttctgc agtcaccgtc gtcgacacgt gtgatcagat atcgcgcccg 900
 ccaccatgtt ccggttccag ccaatgtatc cgatgcagcc aatgccctat cgcaaccgt 960
 tcgcgccccc gcgcaggccc tggttcccca gaaccgaccc ttttctggcg atgcaggctc 1020
 aggaattaac ccgtcgtatg gctaacctga cgttcaagca acgccgggac gcgccacctg 1080
 aggggccatc cgctaataaa ccgaagaagg aggcctcgca aaaacagaaa gggggaggcc 1140
 aagggaagaa gaagaagaac caagggaaga agaaggctaa gacagggccg cctaattccga 1200

aggcacagaa tggaaacaag aagaagacca acaagaaacc aggcaagaga cagcgcattg	1260
tcatgaaatt ggaatctgac aagacgttcc caatcatgtt ggaagggaag ataaacggct	1320
acgcttgtgt ggtcggaggg aagttattca ggccgatgca tgtggaaggc aagatcgaca	1380
acgacgttct ggccgcgctt aagacgaaga aagcatccaa atacgatctt gagtatgcag	1440
atgtgccaca gaacatgcgg gccgatacat tcaaatacac ccatgagaaa cccaaggct	1500
attacagctg gcatcatgga gcagttcaat atgaaaatgg gcgtttcacg gtgccgaaag	1560
gagttggggc caaggagac agcggacgac ccattctgga taaccaggga cgggtggtcg	1620
ctattgtgct gggagggtgt aatgaaggat ctaggacagc cttttcagtc gtcattgtga	1680
acgagaaggg agttaccgtg aagtatactc cagagaactg cgagcaatgg tcactagtga	1740
ccaccatgtg tctgctcgcc aatgtgacgt tcccatgtgc tcaaccacca atttgctacg	1800
acagaaaacc agcagagact ttggccatgc tcagcgtaa cgttgacaac ccgggctacg	1860
atgagctgct ggaagcagct gttaagtgc ccggaaggaa aaggagatcc accgaggagc	1920
tgtttaatga gtataagcta acgcgccctt acatggccag atgcatcaga tgtgcagttg	1980
ggagctgcca tagtccaata gcaatcgagg cagtaaagag cgacgggcac gacggttatg	2040
ttagacttca gacttcctcg cagtatggcc tggattcctc cggcaactta aagggcagga	2100
ccatgcggta tgacatgcac gggaccatta aagagatacc actacatcaa gtgtcactct	2160
atacatctcg cccgtgtcac attgtggatg ggcacggtta tttcctgctt gccaggcgcc	2220
cggcagggga ctccatcacc atggaattta agaaagattc cgtcagacac tcctgctcgg	2280
tgccgtatga agtgaaattt aatcctgtag gcagagaact ctatactcat ccccagaaac	2340
acggagtaga gcaagcgtgc caagtctacg cacatgatgc acagaacaga ggagcttatg	2400
tcgagatgca cctcccgggc tcagaagtgg acagcagttt ggtttccttg agcggctccg	2460
gaggatccag ttcagtcacc gtgacacctc ctgatgggac tagcggcctg gtggaatgcg	2520
agtgtggcgg cacaagatc tccgagacca tcaacaagac aaaacagttc agccagtgca	2580
caaagaagga gcagtgcaga gcatacggc tgcagaacga taagtgggtg tataattctg	2640

acaaactgcc caaagcagcg ggagccacct taaaaggaaa actgcatgtc ccattcttgc	2700
tggcagacgg caaatgcacc gtgcctctag caccagaacc tatgataacc ttcggtttca	2760
gatcagtgtc actgaaactg caccctaaga atccacata tctaatacacc cgccaacttg	2820
ctgatgagcc tcactacacg cagcagctca tatctgaacc agctgttagg aattttaccg	2880
tcaccgaaaa aggggtggag ttgtatggg gaaaccaccc gccgaaaagg ttttgggcac	2940
aggaaacagc acccggaat ccacatgggc taccgcacga ggtgataact cattattacc	3000
acagataccc tatgtccacc atcctgggtt tgtcaatttg tgccgccatt gcaaccgttt	3060
ccgttgacg gtctacctgg ctgttttgca gatcaagagt tgctgccta actccttacc	3120
ggctaacacc taacgctagg ataccatitt gtctggctgt gccttgctgc gcccgactg	3180
cccgggccga gaccacctgg gaticcttgg atcacctatg gaacaataac caacagatgt	3240
tctggattca attgctgac cctctggccg ccttgatcgt agtgactcgc ctgctcaggt	3300
gcgtgtgctg tgtcgtgcct tttttagtca tggccggcgc cgcaggcgcc ggccgctacg	3360
agcacgcgac cagatgccg agccaagcgg gaatctcgta taacactata gtcaacagag	3420
caggctacgc accactccct atcagcataa caccaacaaa gatcaagctg atacctacag	3480
tgaacttga gtacgtcacc tgcactaca aaacaggaat ggattacca gccatcaaat	3540
gtcgcggatc tcaggaatgc actccaactt acaggcctga tgaacagtgc aaagtcttca	3600
caggggttta cccgttcacg tgggttggtg catattgctt ttgcgacact gagaacaccc	3660
aagtcagcaa ggcctacgta atgaaatctg acgactgcct tgcggatcat gctgaagcat	3720
ataaagcgca cacagcctca gtgcaggcgt tcctcaacat cacagtggga gaacactcta	3780
ttgtgactac cgtgtatgtg aatggagaaa ctctgtgaa ttccaatggg gtcaaaaata	3840
ctgcaggicc gctttccaca gcttggacac cctttgatcg caaaatcgtg cagtatgccg	3900
gggagatcta taattatgat tttctgagt atggggcagg acaaccagga gcatttggag	3960
atatacaatc cagaacagtc tcaagctctg atctgtatgc caataccaac ctagtctgc	4020
agagacccaa agcaggagcg atccacgtgc catacactca ggcaccttcg ggttttgagc	4080
aatggaagaa agataaagct ccatcattga aatttaccgc ccctttcgga tgcgaaatat	4140

atacaaacc caticgcgcc gaaaactgtg ctgtagggtc aattccatta gcctttgaca	4200
ttcccagcgc ctgttcacc aggtgtcag aaacaccgac actttcagcg gccgaatgca	4260
ctcttaacga gtgcgtgtat tcttcgact ttgttggat cgccacggtc aagtactcg	4320
ccagcaagtc aggcaagtc gcagtcctg tgccatcagg gactgctacc ctaaaagaag	4380
cagcagtcga gctaaccgag caagggtcgg cgactatcca ttctcagacc gcaaatatcc	4440
acccggagt caggctcaa atatgcacat catatgttac gtgcaaagg gattgtcacc	4500
ccccgaaaga ccatattgtg acacaccctc agtatcacgc ccaaacattt acagccgcgg	4560
tgcaaaaac cgcgtggacg tggtaacat cctgtctggg aggatcagcc gtaattatta	4620
taattggctt ggtgctggct actattgtg ccatgtacgt gctgaccaac cagaaacata	4680
attaaggatc tagatctgct gtgccttcta gttgccagcc atctgttgtt tgcccctccc	4740
ccgtgccttc cttgaccctg gaagggtcca ctcccactgt cctttcctaa taaaatgagg	4800
aaattgcac gcattgtctg agtaggtgtc attctattct ggggggtggg gtggggcagg	4860
acagcaaggg ggaggattgg gaagacaata gcaggcatgc tggggatgcg gtgggctcta	4920
tgggtaccca ggtgctgaag aattgacccg gttcctcctg ggccagaaag aagcaggcac	4980
atccccctct ctgtgacaca ccctgtccac gcccctgggt cttagttcca gcccactca	5040
taggacactc atagctcagg agggctccgc cttaatccc acccgctaaa gtacttgag	5100
cgtctctcc ctccctcacc agcccaccaa accaaacctc gcctccaaga gtgggaagaa	5160
attaaagcaa gataggctat taagtgcaga gggagagaaa atgcctcaa catgtgagga	5220
agtaatgaga gaaatcatag aattttaagg ccatgattta aggccatcat ggcctaagct	5280
tgaaaggaga taggatcaaa gcttggcgta atcatggta tagctgtttc ctgtgtgaaa	5340
ttgttatccg ctcaaatc cacacaacat acgagccgga agcataaagt gtaaagcctg	5400
gggtgcctaa tgagtgagct aactcacatt aattgcgttg cgctcactgc ccgctttcca	5460
gtcgggaaac ctgtcgtgcc agctgcatta atgaatcggc caacgcgcgg ggagaggcgg	5520
tttgcgtatt gggcgctctt ccgttcctc gctcactgac tcgtgcgtc cggtcgttcg	5580

gcigcggcga gcggtatcag ctcactcaaa ggcggtaata cggttatcca cagaatcagg	5640
ggataacgca ggaaagaaca tgtgagcaaa aggccagcaa aaggccagga accgtaaaaa	5700
ggccgcgttg ctggcgtttt tccataggct ccgccccct gacgagcatc acaaaaatcg	5760
acgctcaagt cagagggtgc gaaacccgac aggactataa agataccagg cgtttcccc	5820
tggaagctcc ctctgctgct ctctgttcc gacctgccc cttaccgat acctgtccgc	5880
ctttctcct tcgggaagcg tggcgcttc tcatagctca cgctgtaggt atctcagttc	5940
ggigttagtc gttcgtcca agctgggctg tgtgcacgaa cccccgttc agcccgaccg	6000
ctgcgcctta tccgtaact atcgicttga gtccaacccg gtaagacacg acttatcgcc	6060
actggcagca gccactggta acaggattag cagagcgagg tatgtaggcg gtgctacaga	6120
gttcttgaag tggtagccta actacggcta cactagaaga acagtatttg gtatctgcgc	6180
tcigtgaag ccagttacct tcggaaaaag agtggtagc tcttgatccg gcaaacaac	6240
caccgctggt agcgggtggt tttttgttg caagcagcag attacgcgca gaaaaaagg	6300
atctcaagaa gatcctttga tctttctac ggggtctgac gctcagtga acgaaaactc	6360
acgttaaggg attttggtca tgagattatc aaaaaggatc ttcacctaga tccitttaaa	6420
ttaaaaatga agttttaaat caatctaaag tatatatgag taaacttggc ctgacagtta	6480
ccaatgctta atcagtggg cacctatctc agcgatctgt ctatttcgtt catccatagt	6540
tgcttgactc ccctcgtgt agataactac gatacgggag ggcttaccat ctggccccag	6600
tgctgcaatg ataccgcgag aaccacgctc accggctcca gatttatcag caataaacca	6660
gccagccgga agggccgagc gcagaagtgg tcttgcaact ttatccgcct ccatccagtc	6720
tattaatgtg tgcggggaag ctagagtaag tagttcgcca gttaatagtt tgcgcaacgt	6780
tgttgccatt gctacaggca tcgtgggtc acgctcgtcg tttggtatgg cttcattcag	6840
ctccggttcc caacgatcaa ggcgagttac atgatcccc atgttgtgca aaaaagcggc	6900
tagctccttc ggtcctccga tcgttgtcag aagtaagtgc gccgcagtgt tatcactcat	6960
ggttatggca gcactgcata attctcttac tgicagtcca tccgtaagat gcttttctgt	7020
gactggtgag tactcaacca agtcattctg agaatagtgt atgcggcgac cgagttgctc	7080

ttgcccggcg tcaatacggg ataataccgc gccacatagc agaactttaa aagtgtcat	7140
cattggaaaa cgttcttcgg ggcgaaaact ctcaaggatc ttaccgctgt tgagatccag	7200
ttcgaatgtaa ccactcgtg caccctaactg atcttcagca tcitttactt tcaccagcgt	7260
ttctgggtga gcaaaaacag gaaggcaaaa tgccgcaaaa aagggaataa gggcgacacg	7320
gaaatgttga atactcatac tcttcctttt tcaatattat tgaagcattt atcagggtta	7380
ttgtctcatg agcggataca tatttgaatg tatttagaaa aataaacaaa taggggttcc	7440
gcgcacattt ccccgaaaag tgccacctga cgtctaagaa accattatta tcatgacatt	7500
aacctataaa aataggcgta tcacgaggcc ctttcgggtc gcgcgtttcg gtgatgacgg	7560
tgaaaacctc tgacacatgc agctcccggt gacggtcaca gcitgtctgt aagcggatgc	7620
cgggagcaga caagcccgtc agggcgctc agcgggtgtt ggccgggtgc ggggctggct	7680
taactatgcg gcatcagagc agattgtact gagagtgcac cataaaattg taaacgttaa	7740
tattttgtta aaattcgcgt taaatttttg ttaaatcagc tcatttttta accaataggc	7800
cgaaatcggc aaaatccctt ataaatcaaa agaatagccc gagatagggt tgagtgttgt	7860
tccagtttgg aacaagagtc cactattaaa gaacgtggac tccaacgtca aaggcgcaaa	7920
aaccgtctat cagggcgatg gccactacg tgaacatca cccaaatcaa gttttttggg	7980
gtcgagggtc cgtaaagcac taaatcgga cctaaaggg agccccgat ttagagcttg	8040
acggggaaaag ccggcgaacg tggcgagaaa ggaagggaag aaagcgaaag gagcgggcgc	8100
tagggcgctg gcaagtgtag cggtcacgct gcgcgtaacc accacacccg ccgcgcitaa	8160
tgcgccgcta cagggcgcgt actatggttg ctttgacgta tgcgggtgtga aataccgcac	8220
agatgcgtaa ggagaaaata ccgcatcagg gccattcgc cattcaggct gcgcaactgt	8280
tgggaagggc gatcgggtcg ggctcttcg ctattacgcc agctggcgaa agggggatgt	8340
gctgcaaggc gattaagttg ggtaacgcca gggttttccc agtcacgacg ttgtaaaacg	8400
acggccagtg aattccatgg tctcaacttt c	8431

<211> 8431
 <212> DNA
 <213> Artificial

<220>

<223> VLP_VEEV VLP 519 vector

<400> 11

gaattcccat tgcatacgtt gtatccatat cataatatgt acatttatat tggctcatgt	60
ccaacattac cgccatgttg acattgatta ttgactagtt attaatagta atcaattacg	120
gggtcattag ttcatagccc atatatggag ttccgcgtta cataacttac ggtaaattggc	180
ccgcttggct gaccgcccac cgacccccgc ccattgacgt caataatgac gtatgttccc	240
atagtaacgc caataggagc ttccattga cgtcaatggg tggagtattt acggtaaact	300
gccacttgg cagtacatca agtgtatcat atgccaagta cgccccctat tgacgtcaat	360
gacggtaaat ggccccctg gcattatgcc cagtacatga cttatggga ctttctact	420
tggcagtaca tctacgtatt agtcatcgt attaccatgg tgatgcggtt ttggcagtac	480
atcaatgggc gtggatagcg gtttgactca cggggatttc caagtctcca cccattgac	540
gtcaatggga gtttgtttg gcacccaaat caacgggact ttccaaaatg tcgtaacaac	600
tccgccccat tgacgcaaat gggcggtagg cgtgtacgtt gggaggctta tataagcaga	660
gtcgttttag tgaaccgtca gatgcctgg agacgccatc cagctgttt tgacctccat	720
agaagacacc gggaccgatc cagcctcgt taacgggtga gggcagtgta gtctgagcag	780
tactcgttgc tgccgcgcgc gccaccagac ataatagctg acagactaac agactgttcc	840
tttccatggg tcttttctgc agtcaccgtc gtgcacacgt gtgatcagat atcgcggccg	900
ccaccatgtt ccggttccag ccaatgtatc cgatgcagcc aatgccctat cgcaaccgt	960
tcgcggcccc gcgcaggccc tggttcccca gaaccgaccc tttctggcg atgcaggtgc	1020
aggaattaac ccgtcgtatg gctaacctga cgttcaagca acgccgggac gcgccacctg	1080
aggggccatc cgctaataaa ccgaagaagg aggcctcgca aaaacagaaa gggggaggcc	1140
aagggaagaa gaagaagaac caagggaaga agaaggctaa gacagggccg cctaattcga	1200
aggcacagaa tggaaacaag aagaagacca acaagaaacc aggcaagaga cagcgcatgg	1260

tcatgaaatt ggaatctgac aagacgttcc caatcatgtt ggaagggaag ataaacggct	1320
acgcttgtgt ggtcggaggg aagttattca ggccgatgca tgtggaaggc aagatcgaca	1380
acgacgttct ggccgcgctt aagacgaaga aagcatccaa atacgatctt gagtatgcag	1440
atgtgccaca gaacatgcgg gccgatacat tcaaatacac ccatgagaaa cccaaggct	1500
attacagctg gcatcatgga gcagtcgaat atgaaaatgg gcgtttcacg gtgccgaaag	1560
gagttggggc caaggagagac agcggacgac ccattctgga taaccagggc cgggtggtcg	1620
ctatttgtct gggaggtgtg aatgaaggat ctaggacagc cttttcagtc gtcatgtgga	1680
acgagaaggg agttaccgtg aagtatactc cagagaactg cgagcaatgg tcactagtga	1740
ccaccatgtg tctgctcgcc aatgtgacgt tcccatgtgc tcaaccacca atttgctacg	1800
acagaaaacc agcagagact ttggccatgc tcagcgtaa cgttgacaac ccgggctacg	1860
atgagctgct ggaagcagct gttaagtgcc ccggaaggaa aaggagatcc accgaggagc	1920
tgtttaatga gtataagcta acgcgccctt acatggccag atgcatcaga tgtgcagttg	1980
ggagctgcc a tagtccaata gcaatcgagg cagtaaagag cgacgggcac gacggttatg	2040
ttagacttca gacttcctcg cagtatggcc tggattcctc cggcaactta aagggcagga	2100
ccatgcggta tgacatgcac gggaccatta aagagatacc actacatcaa gtgtcactct	2160
atacatctcg cccgtgtcac atttgtgatg ggcacggtta tttcctgctt gccaggtgcc	2220
cggcagggga ctccatcacc atggaattta agaaagattc cgtcagacac tctgctcgg	2280
tgccgtatga agtgaattt aatcctgtag gcagagaact ctatactcat ccccagaac	2340
acggagtaga gcaagcgtgc caagtctacg cacatgatgc acagaacaga ggagcttatg	2400
tcgagatgca cctcccgggc tcagaagtgg acagcagttt ggtttccttg agcggcagtt	2460
ccggaggatc ctcagtcacc gtgacacctc ctgatgggac tagcgccctg gtggaatgcg	2520
agtgtggcgg cacaagatc tccgagacca tcaacaagac aaaacagttc agccagtgc	2580
caaagaagga gcagtgcaga gcatatcggc tgcagaacga taagtgggtg tataattctg	2640
acaaactgcc caaagcagcg ggagccacct taaaaggaaa actgcatgtc ccattcttgc	2700

tggcagacgg caaatgcacc gtgcctctag caccagaacc tatgataacc ttcggtttca	2760
gatcagtgct.actgaaactg caccctaaga atcccacata tctaatacacc cgccaacttg	2820
ctgatgagcc tcactacacg cagcagctca tatctgaacc agctgttagg aattttaccg	2880
tcaccgaaaa aggggtgggag tttgtatggg gaaaccaccc gccgaaaagg ttttgggcac	2940
aggaaacagc acccggaat ccacatgggc taccgcacga ggtgataact cattattacc	3000
acagataccc tatgtccacc atcctgggtt tgtcaatttg tgccgccatt gcaaccgttt	3060
ccgttgacg gtctacctgg ctgttttgca gatcaagagt tgcgtgccta actccttacc	3120
ggctaacacc taacgctagg ataccatttt gtctggctgt gctttgctgc gccgcactg	3180
cccgggccga gaccacctgg gagtccttgg atcacctatg gaacaataac caacagatgt	3240
tctggattca attgctgac cctciggccg ccttgatcgt agtgactcgc ctgctcaggt	3300
gcgtgtgctg tgtcgtgcct tttttagtca tggccggcgc cgcaggcgcc ggcgctacg	3360
agcacgcgac cagcatgccg agccaagcgg gaatctcgta taacactata gtcaacagag	3420
caggctacgc accactccct atcagcataa caccaacaaa gatcaagctg atacctacag	3480
tgaacttggg gtacgtcacc tgccactaca aaacaggaat ggattcacca gccatcaaat	3540
gctgcggatc tcaggaatgc actccaactt acaggcctga tgaacagtgc aaagtcttca	3600
caggggttta cccgttcattg tgggttggtg cataatgctt ttgcgacact gagaacaccc	3660
aagtcagcaa ggcctacgta atgaaatctg acgactgcct tgcggatcat gctgaagcat	3720
ataaagcgca cacagcctca gtgcaggcgt tcctcaacat cacagtggga gaacactcta	3780
ttgtgactac cgtgtatgtg aatggagaaa ctccgttgaa tttcaatggg gtcaaaataa	3840
ctgcaggtcc gctttccaca gcttggacac cctttgatcg caaaatcgtg cagtatgccg	3900
gggagatcta taattatgat tttcctgagt atggggcagg acaaccagga gcatttggag	3960
atatacaatc cagaacagtc tcaagctctg atcigtatgc caataccaac ctagtgtgc	4020
agagacccaa agcaggagcg atccacgtgc catacactca ggcaccttcg ggttttgagc	4080
aatggaagaa agataaagct ccatcattga aatttaccgc ccctttcgga tgcgaaatat	4140
atacaaaccc cattcgcgcc gaaaactgtg ctgtagggtc aattccatta gcctttgaca	4200

ttcccgacgc ctgtttcacc aggggtgtcag aaacaccgac actttcagcg gccgaatgca	4260
ctcttaacga gtgcgtgtat tcttccgact ttgggtggat cgccacggtc aagtactcgg	4320
ccagcaagtc aggcaagtgc gcagtcctatg tgccatcagg gactgctacc ctaaaagaag	4380
cagcagtcga gctaaccgag caagggtcgg cgactatcca ttctctgacc gcaaatatcc	4440
acccggagtt caggctccaa atatgcacat catatgttac gtgcaaaggt gattgtcacc	4500
ccccgaaaga ccatattgtg acacaccctc agtatcacgc ccaaacattt acagccgcgg	4560
tgtcaaaaac cgcgtggacg tggttaacat ccctgctggg aggatcagcc gtaattatta	4620
taattggctt ggtgctggct actattgtgg ccatgtacgt gctgaccaac cagaaacata	4680
attaaggatc tagatctgct gtgccttcta gtggccagcc atctgtgtt tggccctccc	4740
ccgtgccttc ctgaccctg gaagggtcca ctcccactgt cctttcctaa taaaatgagg	4800
aaattgcacg gcattgtctg agtaggtgtc attctattct ggggggtggg gtggggcagg	4860
acagcaaggg ggaggattgg gaagacaata gcaggcatgc tggggatgcg gtgggctcta	4920
tgggtaccca ggtgctgaag aattgacccg gttcttctg ggccagaaag aagcaggcac	4980
atcccccttc ctgtgacaca ccctgtccac gccccgtgtt cttagtcca gccccactca	5040
taggacactc atagctcagg agggctccgc cttcaatccc acccgctaaa gtacttgag	5100
cgtctctcc ctccctcatc agcccaccaa accaaaccta gcctccaaga gtgggaagaa	5160
attaaagcaa gataggctat taagtgcaga gggagagaaa atgcctccaa catgtgagga	5220
agtaatgaga gaaatcatag aattttaagg ccatgattta aggccatcat ggcctaagct	5280
tgaaggaga taggatcaaa gcttggcgta atcatggtca tagctgtttc ctgtgtgaaa	5340
ttgttatccg ctcaaatc cacacaacat acgagccgga agcataaagt gtaaagcctg	5400
gggtgcctaa tgagtgagct aactcacatt aatigcgttg cgctcactgc ccgctttcca	5460
gtcgggaaac ctgtcgtgcc agctgcatta atgaatcggc caacgcgcgg ggagaggcgg	5520
tttgcttatt gggcgctctt ccgcttcctc gctcactgac tcgctgcgct cggctgttcg	5580
gctgcggcga gcggtatcag ctcaactcaa ggcggtaata cggttatcca cagaatcagg	5640

ggataacgca ggaaagaaca tgtgagcaaa aggccagcaa aaggccagga accgtaaaaa	5700
ggccgcgttg ctggcgtttt tccataggct cggccccct gacgagcatc acaaaaatcg	5760
acgctcaagt cagaggctggc gaaacccgac aggactataa agataccagg cgtttcccc	5820
tggaagctcc ctctgtcgct ctctgttcc gacctgccc cttaccgat acctgtccg	5880
ctttctccct tcgggaagcg tggcgcttc tcatagctca cgctgtaggt atctcagttc	5940
gggtaggtc gttcgctcca agctgggctg tgtgcacgaa cccccgttc agcccgaccg	6000
ctggcgctta tccggttaact atcgtcttga gtccaacccg gtaagacacg acttatcgcc	6060
actggcagca gccactggta acaggattag cagagcgagg tatgtaggcg gtgctacaga	6120
gttcttgaag tggtagccta actacggcta cactagaaga acagtatttg gtatctgcgc	6180
tctgtgaag ccagttacct tcggaaaaag agtiggtagc tcttgatccg gcaaacaac	6240
caccgctggt agcgggtggt tttttgttg caagcagcag attacgcgca gaaaaaagg	6300
atctcaagaa gatcctttga tcttttctac ggggtctgac gctcagtga acgaaaactc	6360
acgttaaggg attttggtca tgagattatc aaaaaggatc ttcacctaga tccitttaaa	6420
ttaaaaatga agttttaaat caatctaaag tatatatgag taaacttggt ctgacagtta	6480
ccaatgccta atcagtggg cacctatctc agcgatctgt ctatttcgtt catccatagt	6540
tgcctgactc cccgtcgtgt agataactac gatacgggag ggcttaccat ctggccccag	6600
tgttgcaatg ataccgcgag aaccacgctc accggctcca gatttatcag caataaacca	6660
gccagccgga agggccgagc gcagaagtgg tcctgcaact ttatccgcct ccatccagtc	6720
tattaattgt tggcggaag ctagagtaag tagttcgcca gtaaatagtt tgcgcaacgt	6780
tgttgccatt gctacaggca tcgtgggtgc acgctcgtcg ttgggtatgg cttcattcag	6840
ctccggttcc caacgatcaa ggcgagttac atgatcccc atgttgtgca aaaaagcgtt	6900
tagctccttc ggtcctccga tcgtgtcag aagtaagttg gccgcagtgt tatcactcat	6960
ggttatggca gcactgcata attctcttac tgtcatgcca tccgtaagat gcttttctgt	7020
gactgggtgag tactcaacca agtcattctg agaatagttg atgcggcgac cgagttgctc	7080
ttgccccgcg tcaatacggg ataataccgc gccacatagc agaactttaa aagtgtcat	7140

cattggaaaa cgttcttcgg ggcgaaaact ctcaaggatc ttaccgctgt tgagatccag	7200
ttcgatgtaa cccactcgtg cacccaactg atcttcagca tcttttactt tcaccagcgt	7260
ttctgggtga gcaaaaacag gaaggcaaaa tgccgcaaaa aagggaataa gggcgacacg	7320
gaaatgttga atactcatac tcttcctttt tcaatattat tgaagcattt atcagggtta	7380
ttgtctcatg agcggataca tatttgaatg tatitagaaa aataaacaaa taggggttcc	7440
gcgcacattt ccccgaaaag tgccacctga cgtctaagaa accattatta tcatgacatt	7500
aacctataaa aataggcgta tcacgaggcc ctttcgggtc gcgcgtttcg gtgatgacgg	7560
tgaaaacctc tgacacatgc agctcccggt gacggtcaca gcttgtctgt aagcggatgc	7620
cgggagcaga caagcccgtc agggcgctc agcgggtgtt ggccgggtgc gggcctggct	7680
taactatgcg gcatcagagc agattgtact gagagtgcac cataaaattg taaacgttaa	7740
tattttgtta aaattcgcgt taaatttttg ttaaatacagc tcatitttta accaataggc	7800
cgaaatcggc aaaatccctt ataaatcaaa agaatagccg gagatagggt tgagtgttgt	7860
tccagtttgg aacaagagtc cactattaaa gaacgtggac tccaacgtca aaggcgaaaa	7920
aaccgtctat caggcgcatg gccactacg tgaacatca cccaaatcaa gttttttggg	7980
gtcgagggtc cgtaaagcac taaatcggaa ccctaaaggg agccccgat ttagagcttg	8040
acggggaaa g cggcgaaacg tggcgagaaa ggaagggaag aaagcgaaag gagcgggcgc	8100
tagggcgctg gcaagtgtag cggtcacgtc gcgcgtaacc accacaccg ccgcgcttaa	8160
tgcgccgcta caggcgctg actatggtt ctttgacgta tgcgggttga aataccgcac	8220
agatgcgtaa ggagaaaata ccgcatcagg cgccattcgc cattcaggct gcgcaactgt	8280
tgggaagggc gatcgggtcg ggcctcttcg ctattacgcc agctggcgaa agggggatgt	8340
gctgcaaggc gattaagttg ggtaacgcca gggttttccc agtcacgacg ttgtaaaacg	8400
acggccagtg aattccatgg tctcaacttt c	8431

<210> 12
 <211> 8431
 <212> DNA

<213> Artificial

<220>

<223> VLP_VEEV VLP 538 vector

<400> 12

gaattcccat tgcatacgtt gtatccatat cataataigt acatttatat tggctcatgt	60
ccaacattac cgccatgttg acattgatta ttgactagtt attaatagta atcaattacg	120
gggtcattag ttcatagccc atatatggag ttccgcgtta cataacttac ggtaaatggc	180
ccgcctggct gaccgcccac cgacccccgc ccattgacgt caataatgac gtatgttccc	240
atagtaacgc caataggagc ttccattga cgtcaatggg tggagtattt acggtaaact	300
gcccacttgg cagtacatca agtgtatcat atgccaagta cgccccctat tgacgtcaat	360
gacggtaaat ggccgcctg gcattatgcc cagtacatga ccctatggga ctttctact	420
tggcagtaca tctacgtatt agtcatcgct attaccatgg tgatgcggtt ttggcagtac	480
atcaatgggc gtggatagcg gtttgactca cggggatttc caagtctcca cccattgac	540
gtcaatggga gtttgtttg gcacaaaaat caacgggact ttcaaaaatg tcgtaacaac	600
tccgccccat tgacgcaaat gggcggtagg cgtgtacggt gggaggtcta tataagcaga	660
gtcgttttag tgaaccgtca gatcgctgg agacgccatc cacgctgttt tgacctccat	720
agaagacacc gggaccgatc cagcctccgt taacggtgga gggcagtgtg gtctgagcag	780
tactcgttgc tgcgcgcgc gccaccagac ataatagctg acagactaac agactgttcc	840
tttccatggg tcttttctgc agtcaccgtc gtcgacacgt gtgatcagat atcgcgcccg	900
ccaccatgtt ccgttccag ccaatgtatc cgaigcagcc aatgccctat cgcaaccggt	960
tcgcggcccc gcgcaggccc tggttcccca gaaccgaccc tttctggcg atgcaggtgc	1020
aggaattaac ccgtcgtatg gctaacctga cgttcaagca acgccgggac gcgccacctg	1080
aggggccatc cgctaataaa ccgaagaagg aggcctcgca aaaacagaaa gggggaggcc	1140
aagggaagaa gaagaagaac caagggaaga agaaggctaa gacagggccg cctaattccg	1200
aggcacagaa tggaaacaag aagaagacca acaagaaacc aggcaagaga cagcgcatgg	1260
tcatgaaatt ggaatctgac aagacgttcc caatcatgtt ggaagggaag ataaacggct	1320

acgcttgtgt ggtcggaggg aagttattca ggccgatgca tgtggaaggc aagatcgaca	1380
acgacgttct ggccgcgctt aagacgaaga aagcatccaa atacgatctt gagtatgcag	1440
atgtgccaca gaacatgcgg gccgatacat tcaaatacac ccatgagaaa cccaaggct	1500
attacagctg gcatcatgga gcagtccaat atgaaaatgg gcgtttcacg gtgccgaaag	1560
gagttggggc caagggagac agcggacgac ccattctgga taaccaggga cgggtggtcg	1620
ctattgtgct gggagggtgtg aatgaaggat ctaggacagc cctttcagtc gtcattgtga	1680
acgagaaggg agttaccgtg aagtatactc cagagaactg cgagcaatgg tcactagtga	1740
ccaccatgtg tctgctcgcc aatgtgacgt tcccatgtgc tcaaccacca atttgctacg	1800
acagaaaacc agcagagact ttggccatgc tcagcgtaa cgttgacaac ccgggctacg	1860
atgagctgct ggaagcagct gttaagtgcc ccggaaggaa aaggagatcc accgaggagc	1920
tgtttaatga gtataagcta acgcgccctt acatggccag atgcatcaga tgtgcagttg	1980
ggagctgcca tagtccaata gcaatcgagg cagtaaagag cgacgggcac gacggttatg	2040
ttagacttca gacttcctcg cagtatggcc tggattcctc cggcaactta aagggcagga	2100
ccatgcggta tgacatgcac gggaccatta aagagatacc actacatcaa gtgtcactct	2160
atacatctcg cccgtgtcac attgtggatg ggcacggtta tticctgctt gccaggtgcc	2220
cggcagggga ctccatcacc atggaattta agaaagattc cgtcagacac tcctgctcgg	2280
tgccgtatga agtgaaattt aatcctgtag gcagagaact ctatactcat ccccagaac	2340
acggagtaga gcaagcgtgc caagtctacg cacatgatgc acagaacaga ggagcttatg	2400
tcgagatgca cctcccgggc tcagaagtgg acagcagttt ggtttccttg agcggcagtt	2460
cagtcaccgt gacacctcct gatgggacta gcgccctggt ggaatgcgag tgtggctccg	2520
gaggatccgg cacaaagatc tccgagacca tcaacaagac aaaacagttc agccagtgc	2580
caaagaagga gcagtgcaga gcatatcggc tgcagaacga taagtgggtg tataattctg	2640
acaaactgcc caaagcagcg ggagccacct taaaaggaaa actgcatgtc ccattcttgc	2700
tggcagacgg caaatgcacc gtgcctctag caccagaacc tatgataacc ttcggtttca	2760

gatcagtgtc actgaaactg caccctaaga atccacata tctaatacc cgccaacttg	2820
ctgatgagcc tcactacag cagagctca tatctgaacc agctgttagg aattttaccg	2880
tcaccgaaaa aggggtggag ttgtatggg gaaaccaccc gccgaaaagg ttttgggcac	2940
aggaaacagc acccggaat ccacatgggc taccgcacga ggtgataact cattattacc	3000
acagataccc tatgtccacc atcctgggtt tgtcaatttg tgccgccatt gcaaccgttt	3060
ccgttgacgc gtctacctgg ctgttttgca gatcaagagt tgcgtgccta actccttacc	3120
ggctaacacc taacgctagg ataccatttt gtctggctgt gctttgctgc gccgcactg	3180
ccggggccga gaccacctgg gagtccctgg atcacctatg gaacaataac caacagaigt	3240
tctggattca attgctgac cctctggccg ccttgatcgt agtgactcgc ctgctcaggt	3300
gcgtgtgctg tgtcgtgcct tttttagtc tggccggcgc cgcaggcgc gccgcctacg	3360
agcacgcgac cacgatgccg agccaagcgg gaatctcgta taacactata gtcaacagag	3420
caggctacgc accactccct atcagcataa caccaacaaa gatcaagctg atacctacag	3480
tgaacttggg gtacgtcacc tgccactaca aaacaggaat ggattcacca gccatcaaat	3540
gctgcggatc tcaggaatgc actccaactt acaggcctga tgaacagtgc aaagtcttca	3600
caggggttta cccgttcacg tgggggtgtg catattgctt ttgcgacact gagaacaccc	3660
aagtcagcaa ggcctacgta atgaaatctg acgactgcct tgcggatcat gctgaagcat	3720
ataaagcgca cacagcctca gtgcaggcgt tctcaacat cacagtggga gaacactcta	3780
ttgtgactac cgtgtatgtg aatggagaaa ctctgtgaa tttcaatggg gtcaaaataa	3840
ctgcaggatc gctttccaca gcttggacac cctttgatcg caaaatcgtg cagtatgccg	3900
gggagatcta taattatgat tttcctgagt atggggcagg acaaccagga gcatttggag	3960
atatacaatc cagaacagtc tcaagctctg atctgtatgc caataccaac ctagtgtcgc	4020
agagacccaa agcaggagcg atccacgtgc catacactca ggcaccttcg ggttttgagc	4080
aatggaagaa agataaagct ccatcattga aattttaccg ccctttcgga tgcgaaatat	4140
atacaaacc cattcgcgcc gaaaactgtg ctgtagggtc aattccatta gcctttgaca	4200
ttcccgcgc cttgttcacc aggtgtcag aaacaccgac actttcagcg gccgaatgca	4260

ctcttaacga gtgcgtgtat tcttccgact ttgggtggat cgccacggtc aagtactcgg	4320
ccagcaagtc aggcaagtc gcagtcctatg tgccatcagg gactgctacc ctaaaagaag	4380
cagcagtcga gctaaccgag caagggtcgg cgactatcca ttctcgcacc gcaaatatcc	4440
acccggagtt caggctccaa atatgcacat catatgttac gtgcaaaggt gattgtcacc	4500
ccccgaaaga ccatattgtg acacacccctc agtatcacgc ccaaacaatt acagccgcgg	4560
tgcaaaaac cgcgtggacg tggttaacat cctgtctggg aggatcagcc gtaattatta	4620
taattggctt ggtgctggct actattgtgg ccatgtacgt gctgaccaac cagaaacata	4680
attaaggatc tagatctgct gtgccttcta gtgccagcc atctgttgtt tgccctccc	4740
ccgtgccttc ctgaccctg gaagggtcca ctcccactgt cctttcctaa taaaatgagg	4800
aaattgcacg gcattgtctg agtaggtgtc attctattct ggggggtggg gtggggcagg	4860
acagcaaggg ggaggattgg gaagacaata gcaggcatgc tggggatgcg gtgggtcta	4920
tgggtaccca ggtgctgaag aattgaccgg gtctctcctg ggccagaaaag aagcaggcac	4980
atcccttct ctgtgacaca cctgtccac gcccctggtt cttagtcca gcccactca	5040
taggacacgc atagctcagg agggctccgc ctcaatccc acccgctaaa gtacttggag	5100
cgtctctcc ctccctcgc agcccaccaa accaaaccta gcctccaaga gtgggaagaa	5160
attaaagcaa gataggctat taagtgcaga gggagagaaa atgcctcaa catgtgagga	5220
agtaatgaga gaaatcatag aattttaagg ccatgattta aggccatcat ggcctaagct	5280
tgaaaggaga taggatcaaa gcttggcgta atcatggtca tagctgtttc ctgtgtgaaa	5340
ttgttatccg ctcaaatc cacacaacat acgagccgga agcataaagt gtaaagcctg	5400
gggtgcctaa tgagtgagct aactcacatt aattgcgttg cgctcactgc ccgctttcca	5460
gtcgggaaac ctgtcgtgcc agctgcatta atgaatcggc caacgcgcgg ggagagcgg	5520
tttgcgtatt gggcgctctt ccgcttcctc gctcactgac tcgtcgcgt cggtcgttcg	5580
gctgcggcga gcggtatcag ctactcaaa ggcggttaata cggttatcca cagaatcagg	5640
ggataacgca ggaaagaaca tgtgagcaaa aggccagcaa aaggccagga accgtaaaaa	5700

ggccgcgttg ctggcgtttt tccataggct cgcggccctt gacgagcatc acaaaaatcg	5760
acgctcaagt cagaggiggc gaaacccgac aggactataa agataccagg cgtttcccc	5820
tggaaagctcc ctcgtgcgct ctccgtttcc gaccctgccg ctaccggat acctgtccgc	5880
ctttctccct tcgggaagcg tggcgctttc tcatagctca cgctgtaggt atctcagttc	5940
ggtgtaggtc gttcgctcca agctgggctg tgtgcacgaa cccccgttc agcccgaccg	6000
ctgcgcctta tccggttaact atcgctttga gtccaacccg gtaagacacg acttatcgcc	6060
actggcagca gccactggta acaggattag cagagcgagg tatgtaggcg gtgctacaga	6120
gttcttgaag tggtagccta actacggcta cactagaaga acagtatttg gtatctgcgc	6180
tctgtgaag ccagttacct tcggaaaaag agttggtagc tcttgatccg gcaaacaac	6240
caccgctggt agcgggtggt tttttgttg caagcagcag attacgcgca gaaaaaagg	6300
atctcaagaa gatcctttga tcttttctac ggggtctgac gctcagtga acgaaaactc	6360
acgttaaggg attttggta tgagattatc aaaaaggatc ttcacctaga tctttttaa	6420
ttaaaaatga agttttaaat caatctaaag tatatatgag taaacttggc ctgacagta	6480
ccaatgctta atcagtggag cacctatctc agcgatctgt ctatttcgtt catccatagt	6540
tgcctgactc cccgtcgtgt agataactac gatacgggag ggcttaccat ctggccccag	6600
tgttgcaatg ataccgcgag aaccacgctc accggctcca gatttatcag caataaacca	6660
gccagccgga agggccgagc gcagaagtgg tcttgcaact ttatccgcct ccatccagtc	6720
tattaattgt tgcggggaag ctagagtaag tagttcgcca gttaatagtt tgcgcaacgt	6780
tgttgccatt gctacaggca tcgtgggtgc acgctcgtcg tttggtaagg cttcattcag	6840
ctccggttcc caacgatcaa ggcgagttac atgatcccc atgttgtgca aaaaagcgg	6900
tagctccttc ggtcctccga tcgttgtcag aagtaagtig gccgcagtgt tatcactcat	6960
ggttatggca gcacigcata attctcttac tgtcatgcca tccgtaagat gcttttctgt	7020
gactggtag tactcaacca agtcattctg agaatagtgt atgcggcgac cgagttgctc	7080
ttgccggcg tcaatacggg ataataccgc gccacatagc agaactttaa aagtgtcat	7140
cattggaaaa cgttcttcgg ggcgaaaact ctcaaggatc ttaccgctgt tgagatccag	7200

ttcgaatgtaa cccactcgtg caccacaactg atcttcagca tcttttactt tcaccagcgt	7260
ttctgggtga gcaaaaacag gaaggcaaaa tgccgcaaaa aagggaataa gggcgacacg	7320
gaaatgttga atactcatac tcttcctttt tcaatattat tgaagcattt atcagggtta	7380
ttgtctcatg agcggataga tatttgaatg tatitagaaa aataaacaaa taggggttcc	7440
gcgacacattt ccccgaaaag tgccacctga cgtctaagaa accattatta tcatgacatt	7500
aacctataaa aataggcgta tcacgaggcc ctttcgggtc gcgcgtttcg gtgatgacgg	7560
tgaaaacctc tgacacatgc agctcccggt gacggtcaca gcttgtctgt aagcggatgc	7620
cgggagcaga caagcccgtc agggcgctgc agcgggtgtt ggcgggtgtc ggggctggct	7680
taactatgcg gcatcagagc agattgtact gagagtgcac cataaaattg taaacgttaa	7740
tattttgtta aaattcgcgt taaatttttg ttaaatcagc tcatttttta accaataggc	7800
cgaaatcggc aaaatccctt ataatcaaa agaatagcc gagatagggt tgagtgttgt	7860
tccagtttgg aacaagagtc cactattaaa gaacgtggac tccaacgtca aaggcgcaaa	7920
aaccgtctat caggcgcatg gccactacg tgaacatca cccaaatcaa gttttttggg	7980
gtcgaggtgc cgtaaagcac taaatcgaa ccctaaagg agccccgat ttagagcttg	8040
acggggaaa g ccggcgaacg tggcgagaaa ggaagggaag aaagcgaaag gagcgggcgc	8100
tagggcgctg gcaagtgtag cggtcacgct gcgcgttaacc accacacccg ccgcgcttaa	8160
tgcgccgcta caggcgcgct actatggttg ctttgacgta tgcgggtgta aataccgcac	8220
agatgcgtaa ggagaaaata ccgcatcagg cgccattcgc cattcaggct gcgcaactgt	8280
tgggaagggc gatcgggtgc ggcctcttcg ctattacgcc agctggcgaa agggggatgt	8340
gctgcaaggc gattaagtgt ggtaacgcca gggttttccc agtcacgacg ttgtaaaacg	8400
acggccagtg aattccatgg tctcaacttt c	8431

<210> 13
 <211> 3750
 <212> DNA
 <213> Artificial

<220>

<223> VLP_CHI 512 vector-CHIKV VLP

<400> 13

atggagttca tcccgacgca aactttctat aacagaaggt accaaccg accctgggcc	60
ccacgcccta caattcaagt aattagacct agaccacgtc cacagaggca ggctgggcaa	120
ctcgcccagc tgatctccgc agtcaacaaa ttgacatgc gcgcggtacc tcaacagaag	180
cctcgagaa atcggaaaaa caagaagcaa aggcagaaga agcaggcgcc gcaaaacgac	240
ccaaagcaaa agaagcaacc accacaaaag aagccggctc aaaagaagaa gaaaccaggc	300
cgtagggaga gaatgtgcat gaaaattgaa aatgattgca tcttcgaagt caagcatgaa	360
ggcaaagtga tgggtacgc atgcctggtg ggggataaag taatgaaacc agcacatgtg	420
aagggaacta tcgacaatgc cgatctggct aaactggcct ttaagcggtc gtctaaatac	480
gatcttgaat gtgcacagat accggtgcac atgaagtctg atgcctcgaa gtttaccac	540
gagaaacccg aggggtacta taactggcat caccgagcag tgcagtattc aggaggccgg	600
ttcactatcc cgacgggtgc aggcaagccg ggagacagcg gcagaccgat cttcgacaac	660
aaaggacggg tgggtggccat cgtcctagga ggggccaacg aagggtcccg cacggccctc	720
tccgtgtgta cgtggaacaa agacatcgtc acaaaaatta cccctgaggg agccgaagag	780
tggagcctcg cctcccggt cttgtgcctg ttggcaaaca ctacattccc ctgctctcag	840
ccgccttgca caccctgctg ctacgaaaag gaaccggaaa gcaccttgcg catgcttgag	900
gacaacgtga tgagaccggg atactaccag ctactaaaag catcgctgac ttgctctccc	960
caccgcaaaa gacgcagtac taaggacaat tttaatgtct ataaagccac aagaccatat	1020
ctagctcatt gtctgactg cggagaaggg cattcgtgcc acagccctat cgcattggag	1080
cgcatcagaa atgaagcaac ggacggaacg ctgaaaatcc aggtctcttt gcagatcggg	1140
ataaagacag atgacagcca cgattggacc aagctgcgct atatggatag ccatacgcca	1200
gcggaacggg agcgagccgg attgcttgta aggacttcag caccgtgcac gatcaccggg	1260
accatgggac actttattct cgccgatgc ccgaaaggag agacgctgac agtgggattt	1320
acggacagca gaaagatcag ccacacatgc acacaccggt tccatcatga accacctgtg	1380

ataggtaggg agaggttcca ctctcgacca caacatggta aagagttacc ttgcagcacg	1440
tacgtgcaga gcaccgctgc cactgctgag gagatagagg tgcataatgcc cccagatact	1500
cctgaccgca cgctgatgac gcagcagtcg ggaggatcca acgtgaagat cacagitaat	1560
gggcagacgg tgcggtacaa gtgcaactgc ggtggctcaa acgaggagct gacaaccaca	1620
gacaaagtga tcaataactg caaaattgat cagtgccatg ctgcagtcac taatcacaag	1680
aattggcaat acaactcccc tttagtcccc cgcaacgctg aactcgggga ccgtaaagga	1740
aagatccaca tccatttccc attggcaaac gtgacttgca gagtgcctaaa agcaagaaac	1800
cctacagtaa cttacggaaa aaaccaagtc accatgctgc tgtatcctga ccatccgaca	1860
ctcttgtctt accgtaacat gggacaggaa ccaaattacc acgaggagtg ggtgacacac	1920
aagaaggagg ttaccttgac cgtgcctact gagggctcgg aggtcacttg eggcaacaac	1980
gaaccataca agtactggcc gcagatgtct acgaacggta ctgctcatgg tcaccacat	2040
gagataatct tgtactatta tgagctgtac cccactatga ctgtagtcat tgtgtcggtg	2100
gcctcgttcg tgcttctgtc gatgggtggc acagcagtcg gaatgtgtgt gtgcgcacgg	2160
cgcagatgca ttacaccata tgaattaaca ccaggagcca ctgttcctt cctgctcagc	2220
ctgctatgct gcgtcagaac gaccaaggcg gccacatatt acgaggctgc ggcatatcta	2280
tggaacgaac agcagcccc tttcttggtg caggctctta tcccgtggc cgccttgatc	2340
gtcctgtgca actgtctgaa actcttgcca tgcctgtgta agaccctggc ttttttagcc	2400
gtaatgagca tcggtgcca cactgtgagc gcgtacgaac acgtaacagt gatcccgaac	2460
acggtgggag taccgtataa gactcttgct aacagaccgg gttacagccc catggtgttg	2520
gagatggagc tacaatcagt caccttggaa ccaacactgt cacttgacta catcacgtgc	2580
gagtacaaaa ctgtcatccc ctccccgtac gtgaagtgtc gtggtacagc agagtgaag	2640
gacaagagcc taccagacta cagctgcaag gtctttactg gagtctaccc atttatgttg	2700
ggcggcgctt actgcttttg cgacgccgaa aatacgcaat tgagcgaggc acatgtagag	2760
aaatctgaat ctgcaaaaac agagtttgca tcggcctaca gagcccacac cgcatcggcg	2820

tcggcgaagc tccgcgtcct ttaccaagga aacaacatta ccgtagctgc ctacgctaac 2880
 ggtgaccatg ccgtcacagt aaaggacgcc aagtttgtcg tgggcccaat gtcctccgcc 2940
 tggacacctt ttgacaacaa aatcgttggtg tacaaaggcg acgtctacaa catggactac 3000
 ccaccttttg gcgcaggaag accaggacaa ttfggtgaca ttcaaagtcg tacaccggaa 3060
 agtaaagacg tttatgccaa cactcagttg gtactacaga ggccagcagc aggcacggta 3120
 catgtaccat acitctaggc accatctggc ttcaagtatt ggctgaagga acgaggagca 3180
 tcgctacagc acacggcacc gttcggttgc cagattgcga caaaccgggt aagagctgta 3240
 aattgcgctg tggggaacat accaatttcc atcgacatac cggatgcggc ctttactagg 3300
 gttgtcgatg caccctctgt aacggacatg tcatgcgaag taccagcctg cactcactcc 3360
 tccgactttg ggggcgtcgc catcatcaaa tacacagcta gcaagaaagg taaatgtgca 3420
 gtacattcga tgaccaacgc cgttaccatt cgagaagccg acgtagaagt agaggggaac 3480
 tcccagctgc aaatatcctt ctcaacagcc ctggcaagcg ccgagtttcg cgtgcaagtg 3540
 tgcctccacac aagtacactg cgcagccgca tgccaccctc caaaggacca catagtcaat 3600
 taccagcat cacacaccac ccttggggtc caggatatat ccacaacggc aatgtcttgg 3660
 gtgcagaaga ttacgggagg agtaggatta attgttgctg ttgctgcctt aattttaatt 3720
 gtggtgctat gcgtgtcgtt tagcaggcac 3750

<210> 14
 <211> 1250
 <212> PRT
 <213> Artificial

<220>
 <223> VLP_CHI 512 vector-CHIKV VLP

<400> 14

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
 1 5 10 15

Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro
 20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
50 55 60

Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp
65 70 75 80

Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys
85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys
115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala
260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
275 280 285

Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met

290	295	300
Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro		
305	310	315 320
His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala		
	325	330 335
Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser		
	340	345 350
Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp		
	355	360 365
Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp		
	370	375 380
Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro		
385	390	395 400
Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys		
	405	410 415
Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys		
	420	425 430
Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His		
	435	440 445
Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu		
	450	455 460
Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr		
465	470	475 480
Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met		
	485	490 495
Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Gly		
	500	505 510
Ser Asn Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys		
	515	520 525
Asn Cys Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile		
	530	535 540
Asn Asn Cys Lys Ile Asp Gln Cys His Ala Ala Val Thr Asn His Lys		
545	550	555 560

Asn Trp Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly
 565 570 575

Asp Arg Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn Val Thr
 580 585 590

Cys Arg Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn
 595 600 605

Gln Val Thr Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr
 610 615 620

Arg Asn Met Gly Gln Glu Pro Asn Tyr His Glu Glu Trp Val Thr His
 625 630 635 640

Lys Lys Glu Val Thr Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr
 645 650 655

Trp Gly Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Met Ser Thr Asn
 660 665 670

Gly Thr Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu
 675 680 685

Leu Tyr Pro Thr Met Thr Val Val Ile Val Ser Val Ala Ser Phe Val
 690 695 700

Leu Leu Ser Met Val Gly Thr Ala Val Gly Met Cys Val Cys Ala Arg
 705 710 715 720

Arg Arg Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro
 725 730 735

Phe Leu Leu Ser Leu Leu Cys Cys Val Arg Thr Thr Lys Ala Ala Thr
 740 745 750

Tyr Tyr Glu Ala Ala Ala Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe
 755 760 765

Trp Leu Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn
 770 775 780

Cys Leu Lys Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala
 785 790 795 800

Val Met Ser Ile Gly Ala His Thr Val Ser Ala Tyr Glu His Val Thr
 805 810 815

Val Ile Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg
820 825 830

Pro Gly Tyr Ser Pro Met Val Leu Glu Met Glu Leu Gln Ser Val Thr
835 840 845

Leu Glu Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr
850 855 860

Val Ile Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys
865 870 875 880

Asp Lys Ser Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr
885 890 895

Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr
900 905 910

Gln Leu Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu
915 920 925

Phe Ala Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu
930 935 940

Arg Val Leu Tyr Gln Gly Asn Asn Ile Thr Val Ala Ala Tyr Ala Asn
945 950 955 960

Gly Asp His Ala Val Thr Val Lys Asp Ala Lys Phe Val Val Gly Pro
965 970 975

Met Ser Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys
980 985 990

Gly Asp Val Tyr Asn Met Asp Tyr Pro Pro Phe Gly Ala Gly Arg Pro
995 1000 1005

Gly Gln Phe Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser Lys Asp
1010 1015 1020

Val Tyr Ala Asn Thr Gln Leu Val Leu Gln Arg Pro Ala Ala Gly
1025 1030 1035

Thr Val His Val Pro Tyr Ser Gln Ala Pro Ser Gly Phe Lys Tyr
1040 1045 1050

Trp Leu Lys Glu Arg Gly Ala Ser Leu Gln His Thr Ala Pro Phe
1055 1060 1065

Gly Cys Gln Ile Ala Thr Asn Pro Val Arg Ala Val Asn Cys Ala

1070	1075	1080
Val Gly Asn Ile Pro Ile Ser Ile Asp Ile Pro Asp Ala Ala Phe		
1085	1090	1095
Thr Arg Val Val Asp Ala Pro Ser Val Thr Asp Met Ser Cys Glu		
1100	1105	1110
Val Pro Ala Cys Thr His Ser Ser Asp Phe Gly Gly Val Ala Ile		
1115	1120	1125
Ile Lys Tyr Thr Ala Ser Lys Lys Gly Lys Cys Ala Val His Ser		
1130	1135	1140
Met Thr Asn Ala Val Thr Ile Arg Glu Ala Asp Val Glu Val Glu		
1145	1150	1155
Gly Asn Ser Gln Leu Gln Ile Ser Phe Ser Thr Ala Leu Ala Ser		
1160	1165	1170
Ala Glu Phe Arg Val Gln Val Cys Ser Thr Gln Val His Cys Ala		
1175	1180	1185
Ala Ala Cys His Pro Pro Lys Asp His Ile Val Asn Tyr Pro Ala		
1190	1195	1200
Ser His Thr Thr Leu Gly Val Gln Asp Ile Ser Thr Thr Ala Met		
1205	1210	1215
Ser Trp Val Gln Lys Ile Thr Gly Gly Val Gly Leu Ile Val Ala		
1220	1225	1230
Val Ala Ala Leu Ile Leu Ile Val Val Leu Cys Val Ser Phe Ser		
1235	1240	1245
Arg His		
1250		

<210> 15
 <211> 3756
 <212> DNA
 <213> Artificial

<220>
 <223> VLP_CHI 532 vector-CHIKV VLP

<400> 15
 atggagtcca tcccgacgca aactttctat aacagaaggt accaaccgac accctgggcc

ccacgcccta caattcaagt aattagacct agaccacgtc cacagaggca ggctgggcaa	120
ctcggccagc tgatctccgc agtcaacaaa ttgacatgc gcgcggtacc tcaacagaag	180
cctcgagaa atcggaaaaa caagaagcaa aggcagaaga agcaggcgcc gcaaaacgac	240
ccaaagcaaa agaagcaacc accacaaaag aagccggctc aaaagaagaa gaaaccaggc	300
cgtagggaga gaatgtgcat gaaaattgaa aatgattgca tcttcgaagt caagcatgaa	360
ggcaaagtga tgggtacgc atgcctggcg ggggataaag taatgaaacc agcacatgtg	420
aagggaacta tcgacaatgc cgatctggct aaactggcct ttaagcggc gtctaaatac	480
gatcttgaat gtgcacagat accggcgac atgaagtctg atgcctcgaa gtttaccac	540
gagaaacccg aggggtacta taactggcat caccgagcag tgcagtattc aggaggccgg	600
ttcactatcc cgacgggtgc aggcgaagccg ggagacagcg gcagaccgat cttcgacaac	660
aaaggacggg tggtagccat cgtcctagga ggggccaacg aaggtagccg caccggcctc	720
tccgtggtag cgtggaacaa agacatcgtc acaaaaatta cccctgagg agccgaagag	780
tggagcctcg cctcccggc cttgtgcctg ttggcaaaca ctacattccc ctgctctcag	840
ccgccttgca caccctgctg ctacgaaaag gaaccggaaa gcaccttgcg catgcttgag	900
gacaacgtga tgagaccgg atactaccag ctactaaaag catcgctgac ttgctctccc	960
caccgcaaaa gacgcagtac taaggacaat tttaatgtct ataaagccac aagaccatat	1020
ctagctcatt gtctgactg cggagaaggc cattcgtgcc acagccctat cgcattggag	1080
cgcacagaa atgaagcaac ggacggaacg ctgaaaatcc aggtctcttt gcagatcggg	1140
ataaagacag atgacagcca cgattggacc aagctgcgct atatggatag ccatacgcca	1200
gcggacggg agcgagccgg attgcttgta aggacttcag caccgtgcac gatcaccggg	1260
accatgggac actttattct cggccgatgc ccgaaaggag agacgctgac agtgggattt	1320
acggacagca gaaagatcag ccacacatgc acacaccggt tccatcatga accacctgtg	1380
ataggtaggg agaggttcca ctctcgacca caacatggta aagagttacc ttgcagcacg	1440
tacgtgcaga gcaccgtgc cactgctgag gagatagagg tgcatatgcc cccagatact	1500

cctgaccgca cgctgatgac gcagcagtct ggcaacgtga agatcacagt taatgggcag	1560
acgggtgcggt acaagtgcaa ctgcggtggc tccggaagtg gatccaacga gggactgaca	1620
accacagaca aagtgatcaa taactgcaaa attgatcagt gccatgctgc agtcactaat	1680
cacaagaatt ggcaatacaa ctccccitta gtcccgcgca acgtgaact cggggaccgt	1740
aaaggaaaga tccacatccc attcccattg gcaaacgtga ctgtcagagt gccaaaagca	1800
agaaacccta cagtaactta cggaaaaaac caagtcacca tgctgctgta tcctgacct	1860
ccgacactct tgtcttaccg taacatggga caggaaccaa attaccacga ggagtgggtg	1920
acacacaaga aggaggttac ctgaccgtg cctactgagg gtctggaggt cacttggggc	1980
aacaacgaac catacaagta ctggccgcag atgtctacga acggtactgc tcatggtcac	2040
ccacatgaga taatcttgta ctattatgag ctgtacccca ctatgactgt agtcattgtg	2100
tccgtggcct cgttcgtgct tctgtcgatg gtgggcacag cagtgggaat gtgtgtgtgc	2160
gcacggcgca gatgcattac accatatgaa ttaacaccag gagccactgt tcccttcctg	2220
ctcagcctgc tatgtctgct cagaacgacc aaggcggcca catattacga ggctgcggca	2280
tatctatgga acgaacagca gcccctgttc tggttgcagg ctcttatccc gctggccgcc	2340
ttgatcgccc tgtgcaactg tctgaaactc ttgccatgct gctgtaagac cctggctttt	2400
ttagccgtaa tgagcatcgg tgcccacact gtgagcgcgt acgaacacgt aacagtgatc	2460
ccgaacacgg tgggagtacc gtataagact ctgtgcaaca gaccgggta cagcccatg	2520
gtgttgagga tggagctaca atcagtcacc ttggaaccaa cactgtcact tgactacatc	2580
acgtgcgagt acaaaactgt catccctcc ccgtacgtga agtgcgtgg tacagcagag	2640
tgcaaggaca agagcctacc agactacagc tgcaaggctt ttactggagt ctacccattt	2700
atgtggggcg gcgcctactg cttttgcgac gccgaaaata cgcaattgag cgaggcacat	2760
gtagagaaat ctgaatcttg caaacagag ttgcatcgg cctacagagc ccacaccgca	2820
tccgctcgg cgaagctccg cgtcccttac caaggaaaca acattaccgt agctgcctac	2880
gctaaccgtg accatgccgt cacagtaaag gacgccaagt ttgtcgtggg cccaatgtcc	2940
tccgcctgga caccttttga caacaaaatc gtgggtgtaca aaggcgacgt ctacaacatg	3000

gactaccac cttttggcgc aggaagacca ggacaatttg gtgacattca aagtcgtaca 3060
 ccggaaagta aagacgttta tgccaacact cagttggtac tacagaggcc agcagcaggc 3120
 acggtacatg taccatactc tcaggcacca tctggcttca agtattggct gaaggaacga 3180
 ggagcatcgc tacagcacac ggcaccgttc ggttgccaga ttgcgacaaa cccggtaaga 3240
 gctgtaaatt gcgctgtggg gaacatacca atttccatcg acataccgga tgcggccttt 3300
 actagggttg tcgatgcacc ctctgtaacg gacatgtcat gcgaagtacc agcctgcact 3360
 cactcctccg actttggggg cgtcgccatc atcaaataca cagctagcaa gaaaggtaaa 3420
 tgtgcagtac attcgatgac caacgccgtt accattcgag aagccgacgt agaagtagag 3480
 gggaactccc agctgcaaatt atcctttctca acagccctgg caagcgccga gtttcgcgtg 3540
 caagtgtgct ccacacaagt aactgcgca gccgcatgcc accctccaaa ggaccacata 3600
 gtcaattacc cagcatcaca caccaccctt ggggtccagg atatatccac aacggcaatg 3660
 tcttgggtgc agaagattac gggaggagta ggattaattg ttgctgttgc tgccttaatt 3720
 ttaattgtgg tgctatgcgt gtcgtttagc aggcac 3756

<210> 16
 <211> 1252
 <212> PRT
 <213> Artificial

<220>
 <223> VLP_CHI 532 vector-CHIKV VLP

<400> 16

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
 1 5 10 15

Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro
 20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
 35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
 50 55 60

Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp
65 70 75 80

Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys
85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys
115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala
260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
275 280 285

Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met
290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro
305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
 325 330 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
 340 345 350

Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
 355 360 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp
 370 375 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro
 385 390 395 400

Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys
 405 410 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
 420 425 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His
 435 440 445

Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu
 450 455 460

Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr
 465 470 475 480

Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met
 485 490 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn
 500 505 510

Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys
 515 520 525

Gly Gly Ser Gly Ser Gly Ser Asn Glu Gly Leu Thr Thr Thr Asp Lys
 530 535 540

Val Ile Asn Asn Cys Lys Ile Asp Gln Cys His Ala Ala Val Thr Asn
 545 550 555 560

His Lys Asn Trp Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn Ala Glu
 565 570 575

Leu Gly Asp Arg Lys Gly Lys Ile His Ile Pro Phe Pro Leu Ala Asn

580	585	590
Val Thr Cys Arg Val Pro Lys Ala Arg Asn Pro Thr Val Thr Tyr Gly		
595	600	605
Lys Asn Gln Val Thr Met Leu Leu Tyr Pro Asp His Pro Thr Leu Leu		
610	615	620
Ser Tyr Arg Asn Met Gly Gln Glu Pro Asn Tyr His Glu Glu Trp Val		
625	630	635
Thr His Lys Lys Glu Val Thr Leu Thr Val Pro Thr Glu Gly Leu Glu		
	645	650
		655
Val Thr Trp Gly Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln Met Ser		
	660	665
		670
Thr Asn Gly Thr Ala His Gly His Pro His Glu Ile Ile Leu Tyr Tyr		
	675	680
		685
Tyr Glu Leu Tyr Pro Thr Met Thr Val Val Ile Val Ser Val Ala Ser		
	690	695
		700
Phe Val Leu Leu Ser Met Val Gly Thr Ala Val Gly Met Cys Val Cys		
705	710	715
		720
Ala Arg Arg Arg Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly Ala Thr		
	725	730
		735
Val Pro Phe Leu Leu Ser Leu Leu Cys Cys Val Arg Thr Thr Lys Ala		
	740	745
		750
Ala Thr Tyr Tyr Glu Ala Ala Ala Tyr Leu Trp Asn Glu Gln Gln Pro		
	755	760
		765
Leu Phe Trp Leu Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile Val Leu		
	770	775
		780
Cys Asn Cys Leu Lys Leu Leu Pro Cys Cys Cys Lys Thr Leu Ala Phe		
785	790	795
		800
Leu Ala Val Met Ser Ile Gly Ala His Thr Val Ser Ala Tyr Glu His		
	805	810
		815
Val Thr Val Ile Pro Asn Thr Val Gly Val Pro Tyr Lys Thr Leu Val		
	820	825
		830
Asn Arg Pro Gly Tyr Ser Pro Met Val Leu Glu Met Glu Leu Gln Ser		
	835	840
		845

Val Thr Leu Glu Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys Glu Tyr
850 855 860

Lys Thr Val Ile Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr Ala Glu
865 870 875 880

Cys Lys Asp Lys Ser Leu Pro Asp Tyr Ser Cys Lys Val Phe Thr Gly
885 890 895

Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Ala Glu
900 905 910

Asn Thr Gln Leu Ser Glu Ala His Val Glu Lys Ser Glu Ser Cys Lys
915 920 925

Thr Glu Phe Ala Ser Ala Tyr Arg Ala His Thr Ala Ser Ala Ser Ala
930 935 940

Lys Leu Arg Val Leu Tyr Gln Gly Asn Asn Ile Thr Val Ala Ala Tyr
945 950 955 960

Ala Asn Gly Asp His Ala Val Thr Val Lys Asp Ala Lys Phe Val Val
965 970 975

Gly Pro Met Ser Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile Val Val
980 985 990

Tyr Lys Gly Asp Val Tyr Asn Met Asp Tyr Pro Pro Phe Gly Ala Gly
995 1000 1005

Arg Pro Gly Gln Phe Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser
1010 1015 1020

Lys Asp Val Tyr Ala Asn Thr Gln Leu Val Leu Gln Arg Pro Ala
1025 1030 1035

Ala Gly Thr Val His Val Pro Tyr Ser Gln Ala Pro Ser Gly Phe
1040 1045 1050

Lys Tyr Trp Leu Lys Glu Arg Gly Ala Ser Leu Gln His Thr Ala
1055 1060 1065

Pro Phe Gly Cys Gln Ile Ala Thr Asn Pro Val Arg Ala Val Asn
1070 1075 1080

Cys Ala Val Gly Asn Ile Pro Ile Ser Ile Asp Ile Pro Asp Ala
1085 1090 1095

Ala Phe Thr Arg Val Val Asp Ala Pro Ser Val Thr Asp Met Ser
 1100 1105 1110

Cys Glu Val Pro Ala Cys Thr His Ser Ser Asp Phe Gly Gly Val
 1115 1120 1125

Ala Ile Ile Lys Tyr Thr Ala Ser Lys Lys Gly Lys Cys Ala Val
 1130 1135 1140

His Ser Met Thr Asn Ala Val Thr Ile Arg Glu Ala Asp Val Glu
 1145 1150 1155

Val Glu Gly Asn Ser Gln Leu Gln Ile Ser Phe Ser Thr Ala Leu
 1160 1165 1170

Ala Ser Ala Glu Phe Arg Val Gln Val Cys Ser Thr Gln Val His
 1175 1180 1185

Cys Ala Ala Ala Cys His Pro Pro Lys Asp His Ile Val Asn Tyr
 1190 1195 1200

Pro Ala Ser His Thr Thr Leu Gly Val Gln Asp Ile Ser Thr Thr
 1205 1210 1215

Ala Met Ser Trp Val Gln Lys Ile Thr Gly Gly Val Gly Leu Ile
 1220 1225 1230

Val Ala Val Ala Ala Leu Ile Leu Ile Val Val Leu Cys Val Ser
 1235 1240 1245

Phe Ser Arg His
 1250

<210> 17
 <211> 3777
 <212> DNA
 <213> Artificial

<220>
 <223> VLP_VEEV VLP 518 vector-VEEV VLP

<400> 17
 atgttcccg tccagccaat gtatccgatg cagccaatgc cctatcgcaa cccgttcgcg 60
 gccccgcgca ggccctggtt cccagaacc gacccttttc tggcgatgca ggtgcaggaa 120
 ttaaccgcct cgatggctaa cctgacgttc aagcaacgcc gggacgcgcc acctgagggg 180

ccatccgcta ataaaccgaa gaaggaggcc tcgcaaaaac agaaaggggg aggccaaggg	240
aagaagaaga agaaccaagg gaagaagaag gctaagacag ggccgcctaa tccgaaggca	300
cagaatggaa acaagaagaa gaccaacaag aaaccaggca agagacagcg catggtcatg	360
aaatiggaa ctgacaagac gttcccaatc atgttggaag ggaagataaa cggctacgct	420
tgtgtggtcg gaggaagtt attcaggccg atgcatgtgg aaggcaagat cgacaacgac	480
gttctggccg cgcttaagac gaagaaagca tccaaatagc atcttgagta tgcagatgtg	540
ccacagaaca tgcgggccga tacattcaaa tacacccatg agaaaccca aggctattac	600
agctggcatc atggagcagt ccaatatgaa aatgggcgtt tcacggtgcc gaaaggagtt	660
ggggccaagg gagacagcgg acgaccatt ctggataacc agggacgggt ggtcgtatt	720
gtgctgggag gtgtgaatga aggatctagg acagcccttt cagtcgtcat gtgaacgag	780
aaggagtta ccgtgaagta tactccagag aactgcgagc aatggtcact agtgaccacc	840
atgtgtctgc tcgccaatgt gacgttccca tgtgtcaac caccaatttg ctacgacaga	900
aaaccagcag agactttggc catgctcagc gttacgttg acaaccggg ctacgatgag	960
ctgctggaag cagctgttaa gtgccccga aggaaaagga gatccaccga ggagctgtt	1020
aatgagtata agctaacgcg cccttacatg gccagatgca tcagatgtgc agttgggagc	1080
tgccatagtc caatagcaat cgaggcagta aagagcgacg ggcacgacgg ttatgttaga	1140
cttcagactt cctcgcagta tggcctggat tcctccggca acttaaaggg caggaccatg	1200
cggtatgaca tgcacgggac cattaaagag ataccactac atcaagtgtc actctataca	1260
tctcgcccggt gtcacattgt ggatgggcac ggttatttcc tgcttgccag gtgccccga	1320
ggggactcca tcacatgga atttaagaaa gattccgtca gacactcctg ctcggtgccg	1380
tatgaagtga aatttaatcc tgtaggcaga gaactctata ctcatcccc agaacacgga	1440
gtagagcaag cgtgccaaagt ctacgcacat gatgcacaga acagaggagc ttatgtcgag	1500
atgcacctcc cgggctcaga agtgacagc agtttggtt ccttgagcgg ctccggagga	1560
tccagttcag tcaccgtgac acctcctgat gggactagcg ccctggtgga atgcgagtgt	1620
ggcggcacia agatctccga gaccatcaac aagacaaaac agttcagcca gtgcacaaag	1680

aaggagcagt gcagagcata tcggctgcag aacgataagt ggggtgtataa ttctgacaaa	1740
ctgccccaaag cagcgggagc caccttaaaa ggaaaactgc atgtcccatt ctgtctggca	1800
gacggcaaat gcaccgtgcc tctagcacca gaacctatga taaccttcgg tticagatca	1860
gtgtcactga aactgcaccc taagaatccc acatatctaa tcacccgccca acttgctgat	1920
gagcctcact acacgcacga gctcatatct gaaccagctg ttaggaattt taccgtcacc	1980
gaaaaagggt gggagtittgt atggggaaac caccgccga aaaggttttg ggcacaggaa	2040
acagcaccgg gaaatccaca tgggctaccg cagcaggatga taactcatta ttaccacaga	2100
taccctatgt ccaccatcct gggtttgtca atttgtgccg ccattgcaac cgtttcctt	2160
gcagcgtcta cctggctgtt ttgcagatca agagttgcgt gcctaactcc ttaccggcta	2220
acacctaacg ctaggatacc atttgtctg gctgtgcttt gctgcgcccg cactgcccg	2280
gccgagacca cctgggagtc ctggatcac ctatggaaca ataaccaaca gatgttctgg	2340
attcaattgc tgatccctct ggccgccttg atcgtagtga ctgccttgct cagggtcgtg	2400
tgctgtgtcg tgcctttttt agtcatggcc ggccgccgag gcgccggcgc ctacgagcac	2460
gcgaccacga tgccgagcca agcgggaatc tcgtataaca ctatagtcaa cagagcaggc	2520
tacgcaccac tccctatcag cataacacca acaaagatca agctgatacc tacagtgaac	2580
ttggagtacg tcacctgcca ctacaaaaca ggaatggatt caccagccat caaatgctgc	2640
ggatctcagg aatgcactcc aacttacagg cctgatgaac agtgcaaagt cttcacagg	2700
gtttaccctg tcatgtgggg tggtgcatat tgcttttgcg aacttgagaa cacccaagtc	2760
agcaaggcct acgtaatgaa atctgacgac tgccttgcgg atcatgctga agcatataaa	2820
gcgcacacag cctcagtga ggcgttcctc aacatcacag tgggagaaca ctctattgtg	2880
actaccgtgt atgtgaatgg agaaactcct gtgaatttca atggggtcaa aataactgca	2940
ggtcgccttt ccacagcttg gacacccttt gatcgcaaaa tcgtgcagta tgccggggag	3000
atctataatt atgattttcc tgagtatggg gcaggacaac caggagcatt tggagatata	3060
caatccagaa cagtctcaag ctctgatctg tatgccaaata ccaacctagt gctgcagaga	3120

cccaaagcag gagcgatcca cgtgccatac actcaggcac cttcgggttt tgagcaatgg 3180
 aagaaagata aagctccatc attgaaattt accgccccctt tcggatgcga aatatataca 3240
 aacccccattc gcgccgaaaa ctgtgctgta gggtaatttc cattagcctt tgacattccc 3300
 gacgccttgt tcaccagggt gtcagaaaca ccgacacttt cagcggccga atgcactctt 3360
 aacgagtgcg tgtattcttc cgactttggt gggatcgcca cggtaagta ctcgccagc 3420
 aagtcaggca agtgcgcagt ccatgtgcc a tcagggactg ctaccctaaa agaagcagca 3480
 gtcgagctaa ccgagcaagg gtcggcgact atccatttct cgaccgcaa tatccaccgc 3540
 gatttcaggc tccaaatatg cacatcatat gttacgtgca aagtgattg tcaccccccg 3600
 aaagaccata ttgtgacaca ccctcagtat cagcccaaa catitacagc cgcggtgtca 3660
 aaaaccgcgt ggacgtggtt aacatccctg ctgggaggat cagccgtaat tattataatt 3720
 ggcttgggtc tggctactat tgtggccatg tacgtgctga ccaaccagaa acataat 3777

<210> 18
 <211> 1259
 <212> PRT
 <213> Artificial

<220>
 <223> VLP_VEEV VLP 518 vector-VEEV VLP

<400> 18

Met Phe Pro Phe Gln Pro Met Tyr Pro Met Gln Pro Met Pro Tyr Arg
1 5 10 15

Asn Pro Phe Ala Ala Pro Arg Arg Pro Trp Phe Pro Arg Thr Asp Pro
20 25 30

Phe Leu Ala Met Gln Val Gln Glu Leu Thr Arg Ser Met Ala Asn Leu
35 40 45

Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Asn
50 55 60

Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly
65 70 75 80

Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro

85	90	95
Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro		
100	105	110
Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe		
115	120	125
Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly		
130	135	140
Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp		
145	150	155
Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu		
165	170	175
Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr		
180	185	190
His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln		
195	200	205
Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly		
210	215	220
Asp Ser Gly Arg Pro Ile Leu Asp Asn Gln Gly Arg Val Val Ala Ile		
225	230	235
Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val		
245	250	255
Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys		
260	265	270
Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr		
275	280	285
Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu		
290	295	300
Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu		
305	310	315
Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr		
325	330	335
Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg		
340	345	350

Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu
 355 360 365

Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser
 370 375 380

Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met
 385 390 395 400

Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val
 405 410 415

Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr
 420 425 430

Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe
 435 440 445

Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys
 450 455 460

Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly
 465 470 475 480

Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly
 485 490 495

Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu
 500 505 510

Val Ser Leu Ser Gly Ser Gly Gly Ser Ser Ser Val Thr Val Thr Pro
 515 520 525

Pro Asp Gly Thr Ser Ala Leu Val Glu Cys Glu Cys Gly Gly Thr Lys
 530 535 540

Ile Ser Glu Thr Ile Asn Lys Thr Lys Gln Phe Ser Gln Cys Thr Lys
 545 550 555 560

Lys Glu Gln Cys Arg Ala Tyr Arg Leu Gln Asn Asp Lys Trp Val Tyr
 565 570 575

Asn Ser Asp Lys Leu Pro Lys Ala Ala Gly Ala Thr Leu Lys Gly Lys
 580 585 590

Leu His Val Pro Phe Leu Leu Ala Asp Gly Lys Cys Thr Val Pro Leu
 595 600 605

Ala Pro Glu Pro Met Ile Thr Phe Gly Phe Arg Ser Val Ser Leu Lys
610 615 620

Leu His Pro Lys Asn Pro Thr Tyr Leu Ile Thr Arg Gln Leu Ala Asp
625 630 635 640

Glu Pro His Tyr Thr His Glu Leu Ile Ser Glu Pro Ala Val Arg Asn
645 650 655

Phe Thr Val Thr Glu Lys Gly Trp Glu Phe Val Trp Gly Asn His Pro
660 665 670

Pro Lys Arg Phe Trp Ala Gln Glu Thr Ala Pro Gly Asn Pro His Gly
675 680 685

Leu Pro His Glu Val Ile Thr His Tyr Tyr His Arg Tyr Pro Met Ser
690 695 700

Thr Ile Leu Gly Leu Ser Ile Cys Ala Ala Ile Ala Thr Val Ser Val
705 710 715 720

Ala Ala Ser Thr Trp Leu Phe Cys Arg Ser Arg Val Ala Cys Leu Thr
725 730 735

Pro Tyr Arg Leu Thr Pro Asn Ala Arg Ile Pro Phe Cys Leu Ala Val
740 745 750

Leu Cys Cys Ala Arg Thr Ala Arg Ala Glu Thr Thr Trp Glu Ser Leu
755 760 765

Asp His Leu Trp Asn Asn Asn Gln Gln Met Phe Trp Ile Gln Leu Leu
770 775 780

Ile Pro Leu Ala Ala Leu Ile Val Val Thr Arg Leu Leu Arg Cys Val
785 790 795 800

Cys Cys Val Val Pro Phe Leu Val Met Ala Gly Ala Ala Gly Ala Gly
805 810 815

Ala Tyr Glu His Ala Thr Thr Met Pro Ser Gln Ala Gly Ile Ser Tyr
820 825 830

Asn Thr Ile Val Asn Arg Ala Gly Tyr Ala Pro Leu Pro Ile Ser Ile
835 840 845

Thr Pro Thr Lys Ile Lys Leu Ile Pro Thr Val Asn Leu Glu Tyr Val
850 855 860

Thr Cys His Tyr Lys Thr Gly Met Asp Ser Pro Ala Ile Lys Cys Cys

865	870	875	880
Gly Ser Gln Glu Cys Thr Pro Thr Tyr Arg Pro Asp Glu Gln Cys Lys			
	885	890	895
Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe			
	900	905	910
Cys Asp Thr Glu Asn Thr Gln Val Ser Lys Ala Tyr Val Met Lys Ser			
	915	920	925
Asp Asp Cys Leu Ala Asp His Ala Glu Ala Tyr Lys Ala His Thr Ala			
	930	935	940
Ser Val Gln Ala Phe Leu Asn Ile Thr Val Gly Glu His Ser Ile Val			
945	950	955	960
Thr Thr Val Tyr Val Asn Gly Glu Thr Pro Val Asn Phe Asn Gly Val			
	965	970	975
Lys Ile Thr Ala Gly Pro Leu Ser Thr Ala Trp Thr Pro Phe Asp Arg			
	980	985	990
Lys Ile Val Gln Tyr Ala Gly Glu Ile Tyr Asn Tyr Asp Phe Pro Glu			
	995	1000	1005
Tyr Gly Ala Gly Gln Pro Gly Ala Phe Gly Asp Ile Gln Ser Arg			
	1010	1015	1020
Thr Val Ser Ser Ser Asp Leu Tyr Ala Asn Thr Asn Leu Val Leu			
	1025	1030	1035
Gln Arg Pro Lys Ala Gly Ala Ile His Val Pro Tyr Thr Gln Ala			
	1040	1045	1050
Pro Ser Gly Phe Glu Gln Trp Lys Lys Asp Lys Ala Pro Ser Leu			
	1055	1060	1065
Lys Phe Thr Ala Pro Phe Gly Cys Glu Ile Tyr Thr Asn Pro Ile			
	1070	1075	1080
Arg Ala Glu Asn Cys Ala Val Gly Ser Ile Pro Leu Ala Phe Asp			
	1085	1090	1095
Ile Pro Asp Ala Leu Phe Thr Arg Val Ser Glu Thr Pro Thr Leu			
	1100	1105	1110
Ser Ala Ala Glu Cys Thr Leu Asn Glu Cys Val Tyr Ser Ser Asp			
	1115	1120	1125

Phe Gly Gly Ile Ala Thr Val Lys Tyr Ser Ala Ser Lys Ser Gly
1130 1135 1140

Lys Cys Ala Val His Val Pro Ser Gly Thr Ala Thr Leu Lys Glu
1145 1150 1155

Ala Ala Val Glu Leu Thr Glu Gln Gly Ser Ala Thr Ile His Phe
1160 1165 1170

Ser Thr Ala Asn Ile His Pro Glu Phe Arg Leu Gln Ile Cys Thr
1175 1180 1185

Ser Tyr Val Thr Cys Lys Gly Asp Cys His Pro Pro Lys Asp His
1190 1195 1200

Ile Val Thr His Pro Gln Tyr His Ala Gln Thr Phe Thr Ala Ala
1205 1210 1215

Val Ser Lys Thr Ala Trp Thr Trp Leu Thr Ser Leu Leu Gly Gly
1220 1225 1230

Ser Ala Val Ile Ile Ile Ile Gly Leu Val Leu Ala Thr Ile Val
1235 1240 1245

Ala Met Tyr Val Leu Thr Asn Gln Lys His Asn
1250 1255

<210> 19

<211> 3777

<212> DNA

<213> Artificial

<220>

<223> VLP_VEEV VLP 519 vector-VEEV VLP

<400> 19

atgttcccggt tccagccaat gtatccgatg cagccaatgc cctatcgcaa cccgttcgcg 60

gccccgcgca ggccttggtt cccagaacc gacccttttc tggcgatgca ggtgcaggaa 120

ttaaccgcct cgatggctaa cctgacgttc aagcaacgcc gggacgcgcc acctgagggg 180

ccatccgcta ataaaccgaa gaaggaggcc tcgcaaaaac agaaaggggg aggccaaggg 240

aagaagaaga agaaccaagg gaagaagaag gctaagacag ggccgcctaa tccgaaggca 300

cagaatggaa acaagaagaa gaccaacaag aaaccaggca agagacagcg catggtcatg 360

aaattggaat ctgacaagac gttcccaatc atgttggaag ggaagataaa cggctacgct	420
tgtgtggtcg gagggaagtt attcaggccg atgcatgttg aaggcaagat cgacaacgac	480
gttctggccg cgcttaagac gaagaaagca tccaaatacg atcttgagta tgcagatgtg	540
ccacagaaca tgcgggccga tacattcaaa tacacccatg agaaaccca aggctattac	600
agctggcatc atggagcagt ccaatatgaa aatgggcgtt tcacggtgcc gaaaggagtt	660
ggggccaagg gagacagcgg acgacccatt ctggataacc agggacgggt ggtcgtatt	720
gtgctgggag gtgtgaatga aggatctagg acagcccttt cagtcgtcat gtggaacgag	780
aaggagatta ccgtgaagta tactccagag aactgcgagc aatggtcact agtgaccacc	840
atgtgtctgc tcgccaatgt gacgttccca tgtgtctaac caccaatttg ctacgacaga	900
aaaccagcag agacttiggc catgctcagc gttaacgttg acaaccggg ctacgatgag	960
ctgctggaag cagctgttaa gtgccccga aggaaaagga gatccaccga ggagctgttt	1020
aatgagtata agctaacgcg cccttacatg gccagatgca tcagatgtgc agttgggagc	1080
tgccatagtc caatagcaat cgaggcagta aagagcgacg ggcacgacgg ttatgttaga	1140
cttcagactt cctcgagta tggcctggat tcctccggca acttaaaggg caggaccatg	1200
cggatgaca tgcacgggac cattaaagag ataccactac atcaagtgtc actctataca	1260
tcicgcccgt gtcacattgt ggatgggcac ggttatttcc tgcttgccag gtgcccggca	1320
ggggactcca tcaccatgga atttaagaaa gattccgtca gacactcctg ctcggtgccg	1380
tatgaagtga aatttaatcc tgtaggcaga gaactctata ctcatcccc agaacacgga	1440
gtagagcaag cgtgccaagt ctacgcacat gatgcacaga acagaggagc ttatgtcgag	1500
atgcacctcc cgggctcaga agtggacagc agtttggttt ccttgagcgg cagttccgga	1560
ggatcctcag tcaccgtgac acctcctgat gggactagcg ccctggtgga atgcgagtgt	1620
ggcggcacia agatctccga gaccatcaac aagacaaaac agttcagcca gtgcacaaag	1680
aaggagcagt gcagagcata tcggctgcag aacgataagt ggggtgtataa ttctgacaaa	1740
ctgcccgaag cagcgggagc caccttaaaa ggaaaactgc atgtccatt cttgctggca	1800

gacggcaaat gcaccgtgcc tctagcacca gaacctatga taaccttcgg tttcagatca	1860
gtgtcactga aactgcaccc taagaatccc acatatctaa tcacccgccca acttgctgat	1920
gagcctcact acacgcacga gctcatactt gaaccagctg ttaggaattt taccgtcacc	1980
gaaaaagggg gggagtttgt atggggaaac caccgcgcca aaaggttttg ggcacaggaa	2040
acagcaccgg gaaatccaca tgggctaccg cagcaggatga taactcatta ttaccacaga	2100
taccctatgt ccaccatcct gggtttgtca atttgtgccg ccattgcaac cgtttccgtt	2160
gcagcgtcta cctggctgtt ttgcagatca agagttgcgt gcctaactcc ttaccggcta	2220
acacctaaag ctaggatacc attttgtctg gctgtgcttt gctgcgccc cactgcccgg	2280
gccgagacca cctgggagtc cttggatcac ctatggaaca ataaccaaca gatgttctgg	2340
attcaattgc tgatccctct ggccgccttg atcgtagtga ctgcctgct caggtgcgtg	2400
tgctgtgtcg tgcctttttt agtcatggcc ggcgcgcag gcgcggcgc ctacgagcac	2460
gcgaccacga tgcgagcca agcgggaatc tcgtataaca ctatagtcaa cagagcaggc	2520
tacgcaccac tccctatcag cataacacca acaaagatca agctgatacc tacagtgaac	2580
tiggagtacg tcacctgcca ctacaaaaca ggaatggatt caccagccat caaatgctgc	2640
ggatctcagg aatgcactcc aacttacagg cctgatgaac agtgcaaagt cttcacagg	2700
gtttacccgt tcatgtgggg tggtgcatat tgcitttgcg aacttgagaa caccgaagtc	2760
agcaaggcct acgtaatgaa atctgacgac tgccttgccg atcatgctga agcatataaa	2820
gcgcacacag cctcagtga ggcgttcctc aacatcacag tgggagaaca ctctattgtg	2880
actaccgtgt atgtgaatgg agaaactcct gtgaatttca atggggctca aataactgca	2940
ggtccgcctt ccacagcttg gacacccttt gatcgcaaaa tcgtgcagta tgccggggag	3000
atctataatt atgattttcc tgagtatggg gcaggacaac caggagcatt tggagatata	3060
caatccagaa cagtctcaag ctctgatctg tatgccaata ccaacctagt gctgcagaga	3120
cccaaagcag gagcgatcca cgtgccatac actcaggcac cttcgggttt tgagcaatgg	3180
aagaaagata aagctccatc attgaaattt accgcccctt tcggatgcga aatatataca	3240
aaccccatc gcgcgaaaa ctgtgctgta gggtaattc cattagcctt tgacattccc	3300

gacgccttgt tcaccagggt gtcagaaaca ccgacacttt cagcgccga atgcactctt 3360
 aacgagtgcg tgtattcttc cgactttggt gggatcgcca cggtaagta ctggccagc 3420
 aagtcaggca agtgcgcagt ccatgtgcca tcagggactg ctaccctaaa agaagcagca 3480
 gtcgagctaa ccgagcaagg gtcggcgact atccatttct cgaccgaaa tatccaccgc 3540
 gagttcaggc tccaaatatg cacatcatat gttacgtgca aagtgattg tcacccccg 3600
 aaagaccata ttgtgacaca ccctcagtat cagcccaaa catttacagc cgcggtgtca 3660
 aaaaccgcgt ggacgtggtt aacatccctg ctgggaggat cagccgtaat tattataatt 3720
 ggcttgggtc tggctactat tgtggccatg tacgtgctga ccaaccagaa acataat 3777

<210> 20
 <211> 1259
 <212> PRT
 <213> Artificial

<220>
 <223> VLP_VEEV VLP 519 vector-VEEV VLP

<400> 20

Met Phe Pro Phe Gln Pro Met Tyr Pro Met Gln Pro Met Pro Tyr Arg
 1 5 10 15

Asn Pro Phe Ala Ala Pro Arg Arg Pro Trp Phe Pro Arg Thr Asp Pro
 20 25 30

Phe Leu Ala Met Gln Val Gln Glu Leu Thr Arg Ser Met Ala Asn Leu
 35 40 45

Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Asn
 50 55 60

Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly
 65 70 75 80

Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro
 85 90 95

Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro
 100 105 110

Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe
 115 120 125

Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly
 130 135 140

Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp
 145 150 155 160

Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu
 165 170 175

Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr
 180 185 190

His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln
 195 200 205

Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly
 210 215 220

Asp Ser Gly Arg Pro Ile Leu Asp Asn Gln Gly Arg Val Val Ala Ile
 225 230 235 240

Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val
 245 250 255

Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys
 260 265 270

Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr
 275 280 285

Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu
 290 295 300

Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu
 305 310 315 320

Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr
 325 330 335

Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg
 340 345 350

Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu
 355 360 365

Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser

370	375	380
Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met		
385	390	395 400
Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val		
	405	410 415
Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr		
	420	425 430
Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe		
	435	440 445
Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys		
	450	455 460
Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly		
465	470	475 480
Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly		
	485	490 495
Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu		
	500	505 510
Val Ser Leu Ser Gly Ser Ser Gly Gly Ser Ser Val Thr Val Thr Pro		
	515	520 525
Pro Asp Gly Thr Ser Ala Leu Val Glu Cys Glu Cys Gly Gly Thr Lys		
	530	535 540
Ile Ser Glu Thr Ile Asn Lys Thr Lys Gln Phe Ser Gln Cys Thr Lys		
545	550	555 560
Lys Glu Gln Cys Arg Ala Tyr Arg Leu Gln Asn Asp Lys Trp Val Tyr		
	565	570 575
Asn Ser Asp Lys Leu Pro Lys Ala Ala Gly Ala Thr Leu Lys Gly Lys		
	580	585 590
Leu His Val Pro Phe Leu Leu Ala Asp Gly Lys Cys Thr Val Pro Leu		
	595	600 605
Ala Pro Glu Pro Met Ile Thr Phe Gly Phe Arg Ser Val Ser Leu Lys		
	610	615 620
Leu His Pro Lys Asn Pro Thr Tyr Leu Ile Thr Arg Gln Leu Ala Asp		
625	630	635 640

Glu Pro His Tyr Thr His Glu Leu Ile Ser Glu Pro Ala Val Arg Asn
645 650 655

Phe Thr Val Thr Glu Lys Gly Trp Glu Phe Val Trp Gly Asn His Pro
660 665 670

Pro Lys Arg Phe Trp Ala Gln Glu Thr Ala Pro Gly Asn Pro His Gly
675 680 685

Leu Pro His Glu Val Ile Thr His Tyr Tyr His Arg Tyr Pro Met Ser
690 695 700

Thr Ile Leu Gly Leu Ser Ile Cys Ala Ala Ile Ala Thr Val Ser Val
705 710 715 720

Ala Ala Ser Thr Trp Leu Phe Cys Arg Ser Arg Val Ala Cys Leu Thr
725 730 735

Pro Tyr Arg Leu Thr Pro Asn Ala Arg Ile Pro Phe Cys Leu Ala Val
740 745 750

Leu Cys Cys Ala Arg Thr Ala Arg Ala Glu Thr Thr Trp Glu Ser Leu
755 760 765

Asp His Leu Trp Asn Asn Asn Gln Gln Met Phe Trp Ile Gln Leu Leu
770 775 780

Ile Pro Leu Ala Ala Leu Ile Val Val Thr Arg Leu Leu Arg Cys Val
785 790 795 800

Cys Cys Val Val Pro Phe Leu Val Met Ala Gly Ala Ala Gly Ala Gly
805 810 815

Ala Tyr Glu His Ala Thr Thr Met Pro Ser Gln Ala Gly Ile Ser Tyr
820 825 830

Asn Thr Ile Val Asn Arg Ala Gly Tyr Ala Pro Leu Pro Ile Ser Ile
835 840 845

Thr Pro Thr Lys Ile Lys Leu Ile Pro Thr Val Asn Leu Glu Tyr Val
850 855 860

Thr Cys His Tyr Lys Thr Gly Met Asp Ser Pro Ala Ile Lys Cys Cys
865 870 875 880

Gly Ser Gln Glu Cys Thr Pro Thr Tyr Arg Pro Asp Glu Gln Cys Lys
885 890 895

Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe
 900 905 910

Cys Asp Thr Glu Asn Thr Gln Val Ser Lys Ala Tyr Val Met Lys Ser
 915 920 925

Asp Asp Cys Leu Ala Asp His Ala Glu Ala Tyr Lys Ala His Thr Ala
 930 935 940

Ser Val Gln Ala Phe Leu Asn Ile Thr Val Gly Glu His Ser Ile Val
 945 950 955 960

Thr Thr Val Tyr Val Asn Gly Glu Thr Pro Val Asn Phe Asn Gly Val
 965 970 975

Lys Ile Thr Ala Gly Pro Leu Ser Thr Ala Trp Thr Pro Phe Asp Arg
 980 985 990

Lys Ile Val Gln Tyr Ala Gly Glu Ile Tyr Asn Tyr Asp Phe Pro Glu
 995 1000 1005

Tyr Gly Ala Gly Gln Pro Gly Ala Phe Gly Asp Ile Gln Ser Arg
 1010 1015 1020

Thr Val Ser Ser Ser Asp Leu Tyr Ala Asn Thr Asn Leu Val Leu
 1025 1030 1035

Gln Arg Pro Lys Ala Gly Ala Ile His Val Pro Tyr Thr Gln Ala
 1040 1045 1050

Pro Ser Gly Phe Glu Gln Trp Lys Lys Asp Lys Ala Pro Ser Leu
 1055 1060 1065

Lys Phe Thr Ala Pro Phe Gly Cys Glu Ile Tyr Thr Asn Pro Ile
 1070 1075 1080

Arg Ala Glu Asn Cys Ala Val Gly Ser Ile Pro Leu Ala Phe Asp
 1085 1090 1095

Ile Pro Asp Ala Leu Phe Thr Arg Val Ser Glu Thr Pro Thr Leu
 1100 1105 1110

Ser Ala Ala Glu Cys Thr Leu Asn Glu Cys Val Tyr Ser Ser Asp
 1115 1120 1125

Phe Gly Gly Ile Ala Thr Val Lys Tyr Ser Ala Ser Lys Ser Gly
 1130 1135 1140

Lys Cys Ala Val His Val Pro Ser Gly Thr Ala Thr Leu Lys Glu

1145	1150	1155
Ala Ala Val Glu Leu Thr Glu Gln Gly Ser Ala Thr Ile His Phe		
1160	1165	1170
Ser Thr Ala Asn Ile His Pro Glu Phe Arg Leu Gln Ile Cys Thr		
1175	1180	1185
Ser Tyr Val Thr Cys Lys Gly Asp Cys His Pro Pro Lys Asp His		
1190	1195	1200
Ile Val Thr His Pro Gln Tyr His Ala Gln Thr Phe Thr Ala Ala		
1205	1210	1215
Val Ser Lys Thr Ala Trp Thr Trp Leu Thr Ser Leu Leu Gly Gly		
1220	1225	1230
Ser Ala Val Ile Ile Ile Ile Gly Leu Val Leu Ala Thr Ile Val		
1235	1240	1245
Ala Met Tyr Val Leu Thr Asn Gln Lys His Asn		
1250	1255	

<210> 21
 <211> 3777
 <212> DNA
 <213> Artificial

<220>
 <223> VLP_VEEV VLP 538 vector-VEEV VLP

<400> 21
 atgttcccgt tccagccaat giatccgatg cagccaatgc cctatcgcaa cccgttcgcg 60
 gccccgcgca ggccttggtt ccccagaacc gacccttttc tggcgatgca ggtgcaggaa 120
 ttaaccgct cgatggctaa cctgacgttc aagcaacgcc gggacgcgcc acctgagggg 180
 ccatccgcta ataaaccgaa gaaggaggcc tcgcaaaaac agaaaggggg aggccaaggg 240
 aagaagaaga agaaccaagg gaagaagaag gctaagacag ggccgcctaa tccgaaggca 300
 cagaatggaa acaagaagaa gaccaacaag aaaccaggca agagacagcg catggtcatg 360
 aaattggaat ctgacaagac gttcccaatc atgttggaag ggaagataaa cggctacgct 420
 tgttgtgtcg gagggaaagt attcaggccg atgcatgttg aaggcaagat cgacaacgac 480

gttctggccg cgcttaagac gaagaaagca tccaaatagc atcttgagta tgcagatgtg	540
ccacagaaca tgcgggcccga tacattcaaa tacacccatg agaaacccca aggctattac	600
agctggcatc atggagcagt ccaatatgaa aatgggcgtt tcacggtgcc gaaaggagtt	660
ggggccaagg gagacagcgg acgacccatt ctggataacc agggacgggt ggtcgtatt	720
gtgctgggag gtgtgaatga aggatctagg acagcccttt cagtcgtcat gtggaacgag	780
aaggagatta ccgtgaagta tactccagag aactgcgagc aatggtcact agtgaccacc	840
atgtgtctgc tcgccaatgt gacgttccca tgtgtctaac caccaatttg ctacgacaga	900
aaaccagcag agactttggc catgctcagc gttaacgttg acaaccggg ctacgatgag	960
ctgctggaag cagctgttaa gtgccccgga aggaaaagga gatccaccga ggagctgttt	1020
aatgagtata agctaacgcg cccttacatg gccagatgca tcagatgtgc agttgggagc	1080
tgccatagtc caatagcaat cgaggcagta aagagcgacg ggcacgacgg ttatgttaga	1140
cttcagactt cctcgcagta tggcctggat tcctccggca acttaaggg caggaccatg	1200
cggtatgaca tgcacgggac cattaaagag ataccactac atcaagtgtc actctataca	1260
tctcgccgt gtcacattgt ggatgggcac ggtattttcc tgcttgccag gtgccccgca	1320
ggggactcca tcacatgga atttaagaaa gattccgtca gacactcctg ctcggtgccg	1380
tatgaagiga aatttaatcc tgtaggcaga gaactctata ctcatcccc agaacacgga	1440
gtagagcaag cgtgccaaagt ctacgcacat gatgcacaga acagaggagc ttatgtcgag	1500
atgcacctcc cgggctcaga agtggacagc agtttggttt ccttgagcgg cagttcagtc	1560
accgtgacac ctctgatgg gactagcgc ctggtggaat gcgagtgtgg ctccggagga	1620
tccggcacia agatctccga gaccatcaac aagacaaaac agttcagcca gtgcacaaag	1680
aaggagcagt gcagagcata tcggctgcag aacgataagt ggggtgtataa ttctgacaaa	1740
ctgccccaaag cagcgggagc caccttaaaa ggaaaactgc atgtccatt cttgctggca	1800
gacggcaaatt gcaccgtgcc tctagcacca gaacctatga taaccttcgg tttcagatca	1860
gtgtcactga aactgcaccc taagaatccc acatatctaa tcaccgcga acttgctgat	1920
gagcctcact acacgcacga gctcatatct gaaccagctg ttaggaattt taccgtcacc	1980

gaaaaagggt gggagtittgt atggggaaac caccgcgga aaaggttttg ggcacaggaa	2040
acagcaccgg gaaatccaca tgggctaccg cagcaggatga taactcatta ttaccacaga	2100
taccctatgt ccaccatcct gggtttgtca atttgtgccg ccattgcaac cgtttccgtt	2160
gcagcgtcta cctggctgtt ttgcagatca agagttagct gcctaactcc ttaccggcta	2220
acacctaacg ctaggatacc attttgtctg gctgtgcttt gctgcgcccg cactgcccgg	2280
gccgagacca cctgggagtc cttggatcac ctatggaaca ataaccaaca gatgttctgg	2340
attcaattgc tgatccctct ggccgccttg atcgtagtga ctgcctgct caggtagctg	2400
tgctgtgtcg tgccTTTT agtcattggc ggccgcgag gcgccggcg ctacgagcac	2460
gcgaccacga tgccgagcca agcgggaatc tcgtataaca ctatagtcaa cagagcaggc	2520
tacgcaccac tccctatcag cataacacca acaagatca agctgatacc tacagtgaac	2580
ttggagtacg tcacctgcca ctacaaaaca ggaatggatt caccagccat caaatgctgc	2640
ggatctcagg aatgcactcc aacttacagg cctgatgaac agtgcaaagt cttcacagg	2700
gtttaccctg tcatgtgggg tgggtgatat tgcttttgcg aactgagaa caccgaagtc	2760
agcaaggcct acgtaatgaa atctgacgac tgccctgcgg atcatgctga agcatataaa	2820
gcgcacacag cctcagtga ggcgttcctc aacatcacag tgggagaaca ctctattgtg	2880
actaccgtgt atgtgaatgg agaaactcct gtgaatttca atggggtaa aataactgca	2940
ggtcgccttt ccacagcttg gacaccttt gatcgcaaaa tcgtgcagta tgccggggag	3000
atctataatt atgattttcc tgagtatggg gcaggacaac caggagcatt tggagatata	3060
caatccagaa cagtctcaag ctctgatctg tatgccaata ccaacctagt gctgcagaga	3120
cccaaagcag gagcgatcca cgtgccatac actcaggcac cttcgggttt tgagcaatgg	3180
aagaaagata aagctccatc attgaaattt accgcccctt tcggatgca aatatataca	3240
aacccattc gcgccgaaaa ctgtgctgta gggtaattc cattagcctt tgacattccc	3300
gacgccttgt tcaccagggt gtcagaaaca ccgacacttt cagcggccga atgcactctt	3360
aacgagtgcg tgtattcttc cgactttgtt gggatcgcca cggtaagta ctcgccagc	3420

aagtcaggca agtgcgcagt ccatgtgcc aicaggactg ctaccctaaa agaagcagca 3480
 gtcgagctaa ccgagcaagg gtcggcgact atccatttct cgaccgcaaa tatccacccg 3540
 gaggtcaggc tccaaataig cacatcatat gttacgtgca aagggtgattg tcaccccccg 3600
 aaagaccata ttgtgacaca ccttcagtat cagcccaaaa catttacagc cgcgggtgtca 3660
 aaaaccgcgt ggacgtgggt aacatccctg ctgggaggat cagccgtaat tattataatt 3720
 ggcttgggtg tggctactat tctggccatg tacgigtga ccaaccagaa acataat 3777

<210> 22
 <211> 1259
 <212> PRT
 <213> Artificial

<220>
 <223> VLP_VEEV VLP 538 vector-VEEV VLP

<400> 22

Met Phe Pro Phe Gln Pro Met Tyr Pro Met Gln Pro Met Pro Tyr Arg
1 5 10 15

Asn Pro Phe Ala Ala Pro Arg Arg Pro Trp Phe Pro Arg Thr Asp Pro
20 25 30

Phe Leu Ala Met Gln Val Gln Glu Leu Thr Arg Ser Met Ala Asn Leu
35 40 45

Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Asn
50 55 60

Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly
65 70 75 80

Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro
85 90 95

Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro
100 105 110

Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe
115 120 125

Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly
130 135 140

Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp
 145 150 155 160

Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu
 165 170 175

Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr
 180 185 190

His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln
 195 200 205

Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly
 210 215 220

Asp Ser Gly Arg Pro Ile Leu Asp Asn Gln Gly Arg Val Val Ala Ile
 225 230 235 240

Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val
 245 250 255

Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys
 260 265 270

Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr
 275 280 285

Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu
 290 295 300

Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu
 305 310 315 320

Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr
 325 330 335

Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg
 340 345 350

Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu
 355 360 365

Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser
 370 375 380

Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met
 385 390 395 400

Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val
405 410 415

Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr
420 425 430

Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe
435 440 445

Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys
450 455 460

Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly
465 470 475 480

Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly
485 490 495

Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu
500 505 510

Val Ser Leu Ser Gly Ser Ser Val Thr Val Thr Pro Pro Asp Gly Thr
515 520 525

Ser Ala Leu Val Glu Cys Glu Cys Gly Ser Gly Gly Ser Gly Thr Lys
530 535 540

Ile Ser Glu Thr Ile Asn Lys Thr Lys Gln Phe Ser Gln Cys Thr Lys
545 550 555 560

Lys Glu Gln Cys Arg Ala Tyr Arg Leu Gln Asn Asp Lys Trp Val Tyr
565 570 575

Asn Ser Asp Lys Leu Pro Lys Ala Ala Gly Ala Thr Leu Lys Gly Lys
580 585 590

Leu His Val Pro Phe Leu Leu Ala Asp Gly Lys Cys Thr Val Pro Leu
595 600 605

Ala Pro Glu Pro Met Ile Thr Phe Gly Phe Arg Ser Val Ser Leu Lys
610 615 620

Leu His Pro Lys Asn Pro Thr Tyr Leu Ile Thr Arg Gln Leu Ala Asp
625 630 635 640

Glu Pro His Tyr Thr His Glu Leu Ile Ser Glu Pro Ala Val Arg Asn
645 650 655

Phe Thr Val Thr Glu Lys Gly Trp Glu Phe Val Trp Gly Asn His Pro

660	665	670
Pro Lys Arg Phe Trp Ala Gln Glu Thr Ala Pro Gly Asn Pro His Gly		
675	680	685
Leu Pro His Glu Val Ile Thr His Tyr Tyr His Arg Tyr Pro Met Ser		
690	695	700
Thr Ile Leu Gly Leu Ser Ile Cys Ala Ala Ile Ala Thr Val Ser Val		
705	710	715
Ala Ala Ser Thr Trp Leu Phe Cys Arg Ser Arg Val Ala Cys Leu Thr		
725	730	735
Pro Tyr Arg Leu Thr Pro Asn Ala Arg Ile Pro Phe Cys Leu Ala Val		
740	745	750
Leu Cys Cys Ala Arg Thr Ala Arg Ala Glu Thr Thr Trp Glu Ser Leu		
755	760	765
Asp His Leu Trp Asn Asn Asn Gln Gln Met Phe Trp Ile Gln Leu Leu		
770	775	780
Ile Pro Leu Ala Ala Leu Ile Val Val Thr Arg Leu Leu Arg Cys Val		
785	790	795
Cys Cys Val Val Pro Phe Leu Val Met Ala Gly Ala Ala Gly Ala Gly		
805	810	815
Ala Tyr Glu His Ala Thr Thr Met Pro Ser Gln Ala Gly Ile Ser Tyr		
820	825	830
Asn Thr Ile Val Asn Arg Ala Gly Tyr Ala Pro Leu Pro Ile Ser Ile		
835	840	845
Thr Pro Thr Lys Ile Lys Leu Ile Pro Thr Val Asn Leu Glu Tyr Val		
850	855	860
Thr Cys His Tyr Lys Thr Gly Met Asp Ser Pro Ala Ile Lys Cys Cys		
865	870	875
Gly Ser Gln Glu Cys Thr Pro Thr Tyr Arg Pro Asp Glu Gln Cys Lys		
885	890	895
Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe		
900	905	910
Cys Asp Thr Glu Asn Thr Gln Val Ser Lys Ala Tyr Val Met Lys Ser		
915	920	925

Asp Asp Cys Leu Ala Asp His Ala Glu Ala Tyr Lys Ala His Thr Ala
 930 935 940

Ser Val Gln Ala Phe Leu Asn Ile Thr Val Gly Glu His Ser Ile Val
 945 950 955 960

Thr Thr Val Tyr Val Asn Gly Glu Thr Pro Val Asn Phe Asn Gly Val
 965 970 975

Lys Ile Thr Ala Gly Pro Leu Ser Thr Ala Trp Thr Pro Phe Asp Arg
 980 985 990

Lys Ile Val Gln Tyr Ala Gly Glu Ile Tyr Asn Tyr Asp Phe Pro Glu
 995 1000 1005

Tyr Gly Ala Gly Gln Pro Gly Ala Phe Gly Asp Ile Gln Ser Arg
 1010 1015 1020

Thr Val Ser Ser Ser Asp Leu Tyr Ala Asn Thr Asn Leu Val Leu
 1025 1030 1035

Gln Arg Pro Lys Ala Gly Ala Ile His Val Pro Tyr Thr Gln Ala
 1040 1045 1050

Pro Ser Gly Phe Glu Gln Trp Lys Lys Asp Lys Ala Pro Ser Leu
 1055 1060 1065

Lys Phe Thr Ala Pro Phe Gly Cys Glu Ile Tyr Thr Asn Pro Ile
 1070 1075 1080

Arg Ala Glu Asn Cys Ala Val Gly Ser Ile Pro Leu Ala Phe Asp
 1085 1090 1095

Ile Pro Asp Ala Leu Phe Thr Arg Val Ser Glu Thr Pro Thr Leu
 1100 1105 1110

Ser Ala Ala Glu Cys Thr Leu Asn Glu Cys Val Tyr Ser Ser Asp
 1115 1120 1125

Phe Gly Gly Ile Ala Thr Val Lys Tyr Ser Ala Ser Lys Ser Gly
 1130 1135 1140

Lys Cys Ala Val His Val Pro Ser Gly Thr Ala Thr Leu Lys Glu
 1145 1150 1155

Ala Ala Val Glu Leu Thr Glu Gln Gly Ser Ala Thr Ile His Phe
 1160 1165 1170

Ser Thr Ala Asn Ile His Pro Glu Phe Arg Leu Gln Ile Cys Thr
1175 1180 1185

Ser Tyr Val Thr Cys Lys Gly Asp Cys His Pro Pro Lys Asp His
1190 1195 1200

Ile Val Thr His Pro Gln Tyr His Ala Gln Thr Phe Thr Ala Ala
1205 1210 1215

Val Ser Lys Thr Ala Trp Thr Trp Leu Thr Ser Leu Leu Gly Gly
1220 1225 1230

Ser Ala Val Ile Ile Ile Ile Gly Leu Val Leu Ala Thr Ile Val
1235 1240 1245

Ala Met Tyr Val Leu Thr Asn Gln Lys His Asn
1250 1255

<210> 23
<211> 8416
<212> DNA
<213> Artificial

<220>
<223> VLP_CHI 520 vector

<400> 23
gaattcccat tgcatacgtt gtatccatat cataatatgt acatttatat tggctcatgt 60
ccaacattac cgccatgttg acattgatta ttgactagtt attaatagta atcaattacg 120
gggtcattag ttcataagccc atatatggag ttccgcgtta cataacttac ggtaaatggc 180
ccgcctggct gaccgccccaa cgacccccgc ccattgacgt caataatgac gtatgttccc 240
atagtaacgc caataggac ttccattga cgtcaatggg tggagtattt acggtaaact 300
gcccacttgg cagtacatca agtgtatcat atgccaagta cgccccctat tgacgtcaat 360
gacggtaa at ggccgcctg gcattatgcc cagtacatga ccttatggga ctttcctact 420
tggcagtaca tctacgtatt agtcatcgct attaccatgg tgatgcggtt ttggcagtac 480
atcaatgggc gtggatagcg gtttgactca cggggatttc caagtctcca cccattgac 540
gtcaatggga gtttgttttg gcacccaaat caacgggact ttccaaaatg tcgtaacaac 600
tccgccccat tgacgcaaat gggcggtagg cgtgtacggt gggaggtcta tataagcaga 660

gctcgttttag tgaaccgtca gatcgccctgg agacgccatc cacgctgttt tgacctccat	720
agaagacacc gggaccgatc cagcctccgt taacgggtga gggcagtgtg gtctgagcag	780
tactcgttgc tgccgcgcgc gccaccagac ataatagctg acagactaac agactgttcc	840
tttccatggg tcttttctgc agtcaccgtc gtcgacacgt gtgatcagat atcgcgggccg	900
ccaccatgga gttcatcccg acgcaaactt tctataacag aaggtaccaa ccccgaccct	960
gggccccacg ccctacaatt caagtaatta gacctagacc acgtccacag aggcaggctg	1020
ggcaactcgc ccagctgatc tccgcagtca acaaattgac catgcgcgcg gtacctcaac	1080
agaagcctcg cagaaatcgg aaaaaacaaga agcaaaggca gaagaagcag gcgccgcaaa	1140
acgacccaaa gcaaaagaag caaccaccac aaaagaagcc ggctcaaaag aagaagaaac	1200
caggccgtag ggagagaatg tgcatgaaaa ttgaaatga ttgcatcttc gaagtcaagc	1260
atgaaggcaa agtgatgggc tacgcatgcc tgggtgggga taaagtaatg aaaccagcac	1320
atgtgaaggg aactatcgac aatgccgatc tggctaaact ggccctttaag cggctgtcta	1380
aatacgatct tgaatgtgca cagataccgg tgcacatgaa gtctgatgcc tcgaagtta	1440
cccacgagaa acccgagggg tactataact ggcatcacgg agcagtgcag tattcaggag	1500
gccggttcac tatcccgcgc ggtgcaggca agccgggaga cagcggcaga ccgatcttcg	1560
acaacaaagg acgggtggtg gccatcgtcc taggaggggc caacgaaggt gcccgcacgg	1620
ccctctccgt ggtgacgtgg aacaaagaca tcgtcacaaa aattaccctt gagggagccg	1680
aagagtggag cctcgccctc ccggtcttgt gcctgttggc aaacactaca ttcccctgct	1740
ctcagccgcc ttgcacacc tgctgctacg aaaaggaacc ggaaagcacc ttgcgcatgc	1800
ttgaggacaa cgtgatgaga cccggatact accagctact aaaagcatcg ctgacttgct	1860
ctccccaccg ccaaagacgc agtactaagg acaattttta tgtctataaa gccacaagac	1920
catatctagc tcattgtcct gactgctggag aagggcattc gtgccacagc cctatcgcat	1980
tggagcgcat cagaaatgaa gcaacggacg gaacgctgaa aatccaggtc tctttgcaga	2040
tcgggataaa gacagatgac agccacgatt ggaccaagct gcgctatatg gatagccata	2100

cgccagcgga cgccgagcga gccggattgc ttgtaaggac ttcagcaccg tgcacgatca	2160
ccgggaccat gggacacttt attctcgccc gatgcccgaa aggagagacg ctgacagtgg	2220
gatttacgga cagcagaaag atcagccaca catgcacaca cccgttccat catgaaccac	2280
ctgtgatagg tagggagagg ttccactctc gaccacaaca tggtaaagag ttaccttgca	2340
gcacgtacgt gcagagcacc gctgccactg ctgaggagat agaggtgcat atgccccag	2400
atactcctga ccgcacgctg atgacgcagc agtctggcaa cgtaagatc acagttaatg	2460
gctccggagg atccggcggg cagacggctg ggtacaagtg caactgcggt ggctcaaacg	2520
agggactgac aaccacagac aaagtgatca ataactgcaa aattgatcag tgccatgctg	2580
cagtcactaa tcacaagaat tggcaatata actccccitt agtccccgcg aacgctgaac	2640
tcggggaccg taaaggaaag atccacatcc cattcccatt ggcaaacgtg acttgacagag	2700
tgccaaaagc aagaaccct acagtaactt acggaaaaaa ccaagtcacc atgtgctgt	2760
atcctgacca tccgacactc ttgtcttacc gtaacatggg acaggaacca aattaccacg	2820
aggagtgggt gacacacaag aaggaggtta ccttgaccgt gcctactgag ggtctggagg	2880
tcacttgggg caacaacgaa ccatacaagt actggccgca gatgtctacg aacggtactg	2940
ctcatggica cccacatgag ataactttgt actattatga gctgtacccc actatgactg	3000
tagtcattgt gtcggtggcc tcgttcgtgc ttctgtcgat ggtgggcaca gcagtgggaa	3060
tggtgtgtgt cgcacggcgc agatgcatta caccatatga attaacacca ggagccactg	3120
ttcccttctt gctcagcctg ctatgctgcg tcagaacgac caaggcggcc acatattacg	3180
aggctcggc atatctatgg aacgaacagc agcccctgtt ctggttgacg gctcttatcc	3240
cgctggccgc ctgatcgtc ctgtgcaact gtctgaaact ctgccatgc tgctgtaaga	3300
ccctggcitt tttagccgta atgagcatcg gtgccacac tgtagcgcg tacgaacacg	3360
taacagtgat cccgaacacg gtgggagtac cgtataagac tcttgtcaac agaccgggtt	3420
acagccccat ggtgttgag atggagctac aatcagtcac ctggaacca acactgtcac	3480
ttgactacat cacgtgcgag tacaaaactg tcatccccct cccgtacgtg aagtgtgtg	3540
gtacagcaga gtgcaaggac aagagcctac cagactacag ctgcaaggtc ttactggag	3600

tctacccatt tatgtggggc ggcgccctact gcttttgcga cgccgaaaat acgcaattga	3660
gcgaggcaca tgtagagaaa tctgaatctt gcaaaacaga gtttgcacgc gcctacagag	3720
cccacaccgc atcggcgctc gcgaagctcc gcgtccttta ccaaggaaac aacattaccg	3780
tagctgccta cgctaacggc gaccatgccg tcacagtaaa ggacgccaag tttgtcgtgg	3840
gcccattgtc ctccgcctgg acaccttttg acaacaaaat cgtgggtgtac aaaggcgacg	3900
tctacaacat ggactaccca ccttttggcg caggaagacc aggacaattt ggtgacattc	3960
aaagtcgtac accggaaagt aaagacgttt atgccaacac tcagttggta ctacagaggc	4020
cagcagcagg caggtacat gtaccatact ctacggcacc atctgecttc aagtattggc	4080
tgaaggaacg aggagcatcg ctacagcaca cggcaccgtt cggttgccag attgcgacaa	4140
acccggtaag agctgtaaat tgcgctgtgg ggaacatacc aatttccatc gacataccgg	4200
atgcggcctt tactaggggt gtcgatgcac cctctgtaac ggacatgtca tgcgaagtac	4260
cagcctgcac tcactcctcc gactttgggg gcgtcgccat catcaaatac acagctagca	4320
agaaaggtaa atgtgcagta cattcgatga ccaacgccgt taccattcga gaagccgacg	4380
tagaagtaga ggggaactcc cagctgcaaa tatccttctc aacagccctg gcaagcgccg	4440
agtttcgcgt gcaagtgtgc tccacacaag tacactgcgc agccgcatgc caccctccaa	4500
aggaccacat agtcaattac ccagcatcac acaccacct tgggggtccag gatatatcca	4560
caacggcaat gtcttgggtg cagaagatta cgggaggagt aggattiaatt gttgctgttg	4620
ctgccittaat titaattgtg gtgctatgcg tgtcgtttag caggcactaa ggatctagat	4680
ctgctgtgcc ttctagtgc cagccatctg ttgtttgccc ctccccgtg ccttccttga	4740
ccctggaagg tgccactccc actgtccttt cctaataaaa tgaggaaatt gcatcgcat	4800
gtctgagtag gtgtcattct attctggggg gtgggggtgg gcaggacagc aagggggagg	4860
attgggaaga caatagcagg catgctgggg atgcgggtgg ctctatgggt acccagggtc	4920
tgaagaattg acccggttcc tcctgggcca gaaagaagca ggcacatccc cttctctgtg	4980
acacaccctg tccacgcccc tggttcttag ttccagcccc actcatagga cactcatagc	5040

tcaggagggc tccgccttca atcccacccg cttaaagtact tggagcggtc tctccctccc	5100
tcatcagccc accaaaccaa acctagcctc caagagtggg aagaaattaa agcaagatag	5160
gctattaagt gcagagggag agaaaatgcc tccaacatgt gaggaagtaa tgagagaaat	5220
catagaatit taaggccatg atttaaggcc atcatggcct aagcttgaaa ggagatagga	5280
tcaaagcttg gcgtaatcat ggtcatagct gtttcctgtg tgaattgtt atccgctcac	5340
aattccacac aacatacgag ccggaagcat aaagtgtaaa gcctggggtg cctaattgagt	5400
gagctaactc acattaattg cgttcgctc actgcccgtt ttccagtcgg gaaacctgtc	5460
gtgccagctg cattaatgaa tcggccaacg cgcggggaga ggcggtttgc gtattggcg	5520
ctcttcgctt tctcgtcga ctgactcgtt gcgctcggtc gttcggctgc ggcgagcgtt	5580
atcagctcac tcaaaggcgg taatacgtt atccacagaa tcaggggata acgcaggaaa	5640
gaacatgtga gcaaaaggcc agcaaaaggc caggaaccgt aaaaaggccg cgttgctggc	5700
gtttttccat aggctccgcc cccctgacga gcatacaaaa aatcgacgtt caagtcagag	5760
gtggcgaaac ccgacaggac tataaagata ccaggcggtt ccccttgaa gctccctgt	5820
gcgctctcct gttccgacct tgcgccttac cggatacctg tccgcctttc tcccttcggg	5880
aagcgtggcg ctttctcata gctcacgtg taggtatctc agttcgggtt aggtcgttcg	5940
ctccaagctg ggctgtgtgc acgaaccccc cgttcagccc gaccgctgcg ccttatccgg	6000
taactatcgt cttgagtcca acccggttaag acacgactta tgcacctgg cagcagccac	6060
tggtaacagg attagcagag cgaggtatgt aggcgggtgt acagagtctt tgaagtgggtg	6120
gcctaactac ggctacacta gaagaacagt atttggatc tgcgctctgc tgaagccagt	6180
taccttcgga aaaagagttg gtagctcttg atccggcaaa caaaccaccg ctggtagcgg	6240
tggttttttt gtttgcaagc agcagattac gcgcagaaaa aaaggatctc aagaagatcc	6300
tttgatcttt tctacgggtt ctgacgtcga gtggaacgaa aactcacgtt aagggatttt	6360
ggtcatgaga ttatcaaaaa ggatcttcac ctagatcctt tttaaattaaa aatgaagttt	6420
taaataaatc taaagtatat atgagtaaac ttggtctgac agttaccaat gcttaatcag	6480
tgaggcacct atctcagcga tctgtctatt tcgttcaccc atagtgcct gactccccgt	6540

cggttagata actacgatac gggagggtt accatctggc cccagtgtg caatgatacc	6600
gcgagaacca cgctcaccgg ctccagattt atcagcaata aaccagccag ccggaagggc	6660
cgagcgcaga agtggctctg caactttatc cgcctccatc cagtctatta attgttgccg	6720
ggaagctaga gtaagtagtt cgccagttaa tagtttgcgc aacgttggtt ccattgctac	6780
aggcatcgtg ggttcacgct cgtcgtttgg tatggcttca ttacgtccg gttcccaacg	6840
atcaaggcga gttacatgat ccccatgtt gtgcaaaaaa gcggttagct ccttcgggtc	6900
tccgatcgtt gtcagaagta agttggccgc agtgttatca ctcatggtta tggcagcact	6960
gcataattct cttactgtca tgccatccgt aagatgcttt tctgtgactg gtgagtactc	7020
aaccaagtca ttctgagaat agtgtatgcg gcgaccgagt tgctcttgcc cggcgtaat	7080
acgggataat accgcgccac atagcagaac tttaaaagt ctcacattg gaaaacgtt	7140
ttcggggcga aaactctcaa ggatcttacc gctgttgaga tccagttcga tgaaccac	7200
tcgtgcaccc aactgatctt cagcatcttt tactttcacc agcgtttctg ggtgagcaaa	7260
aacaggaagg caaaatgccg caaaaaagg aataaggcg acacggaat gttgaatact	7320
catactcttc ctttttcaat attattgaag catttatcag ggttattgtc tcatgagcgg	7380
atacatattt gaatgtattt agaaaaataa acaaataggg gttccgcgca catttccccg	7440
aaaagtcca cctgacgtct aagaaacat tattatcatg acattaacct ataaaaatag	7500
gcgtatcacg agggcccttc gggtcgcgcg tticgggtgat gacggtgaaa acctctgaca	7560
catgcagctc ccgttgacgg tcacagcttg tctgtaagcg gatgccgga gcagacaagc	7620
ccgtcagggc gcgtcagcgg gtgttgccgg gtgtcggggc tggcttaact atgcggcatc	7680
agagcagatt gtactgagag tgcaccataa aattgtaaac gttaatattt tgttaaaatt	7740
cgcgttaaatt tttgtttaa tcagctcatt ttttaacaa taggccgaaa tcggcaaaat	7800
cccttataaa tcaaaagaat agcccagat aggggtgagt gtgtttccag tttggaacaa	7860
gagtccacta ttaaagaacg tggactccaa cgtcaaagg cgaaaaaccg tctatcaggg	7920
cgatggccca ctacgtgaac catcaccaa atcaagttt ttggggtcga ggtgccgtaa	7980

agcactaaat cggaacccta aaggagagccc ccgattitaga gcttgacggg gaaagccggc 8040
 gaacgtggcg agaaaggaag ggaagaaagc gaaaggagcg ggcgctaggg cgctggcaag 8100
 ttagcggtc acgctgcgcg taaccaccac acccgccgcg cttaatgcgc cgctacagg 8160
 cgcgtactat ggttgctttg acgtatgcgg tctgaaatac cgcacagatg cgtaaggaga 8220
 aaataccgca tcaggcgcca ttcgccattc aggcctgcga actggtggga agggcgatcg 8280
 gtgcgggcct cttcgctatt acgccagctg gcgaaagggg gatgtgctgc aagcgatta 8340
 agttgggtaa cgccagggtt ttccagtcga cgacgttgta aaacgacggc cagtgaattc 8400
 catggtctca actttc 8416

<210> 24
 <211> 3762
 <212> DNA
 <213> Artificial

<220>
 <223> VLP_CHI 520 vector insert

<400> 24
 atggagtcca tcccgacgca aactttctat aacagaaggt accaaccg accctgggcc 60
 ccacgcccta caattcaagt aattagacct agaccacgtc cacagaggca gctgggcaa 120
 ctgcgccagc tgatctccgc agtcaacaaa ttgaccatgc gcgcggtacc tcaacagaag 180
 cctgcgagaa atcggaacaa caagaagcaa aggcagaaga agcaggcgcc gcaaacgac 240
 ccaaagcaaa agaagcaacc accacaaaag aagccggctc aaaagaaga gaaaccaggc 300
 cgtagggaga gaatgtgcat gaaaattgaa aatgattgca tcttgaagt caagcatgaa 360
 ggcaaagtga tgggtacgc atgcttggtg ggggataaag taatgaaacc agcacatgtg 420
 aagggaacta tcgacaatgc cgatctggct aaactggcct ttaagcggtc gtctaaatac 480
 gatcttgaat gtgcacagat accggtgcac atgaagtctg atgcctcgaa gtttaccac 540
 gagaaaccg aggggtacta taactggcat cacggagcag tgcagtattc aggaggccg 600
 ttactatcc cgacgggtgc aggcaagccg ggagacagcg gcagaccgat cttcgacaac 660
 aaaggacggg tegtggccat cgtcctagga ggggccaacg aaggtgcccg cacggccctc 720

tccgtggtga cgiggaacaa agacatcgtc acaaaaatta cccctgaggg agccgaagag	780
tggagcctcg ccttcccggt ctgtgacctg ttggcaaaca ctacattccc ctgctctcag	840
ccgccttgca caccctgctg ctacgaaaag gaaccggaaa gcaccttgcg catgcttgag	900
gacaacgtga tgagaccggg atactaccag ctactaaaag catcgctgac ttgctctccc	960
caccgccaaa gacgcagtac taaggacaat tttaatgtct ataaagccac aagaccatat	1020
ctagctcatt gtcctgactg cggagaaggg cattcgtgcc acagccctat cgcatggag	1080
cgcatcagaa atgaagcaac ggacggaacg ctgaaaatcc aggtctcttt gcagatcggg	1140
ataaagacag atgacagcca cgattggacc aagctgcgct atatggatag ccatacgcca	1200
gcgagcgcgg agcgagccgg attgcttgta aggacttcag caccgtgcac gatcaccggg	1260
accatgggac actttattct cgcccgatgc ccgaaaggag agacgtgac agtgggattt	1320
acggacagca gaaagatcag ccacacatgc acacaccgt tccatcatga accacctgtg	1380
ataggtaggg agaggttcca ctctcgacca caacatggta aagagttacc ttgcagcacg	1440
tacgtgcaga gcaccgctgc cactgctgag gagatagagg tgcataatgcc ccagatact	1500
cctgaccgca cgtgatgac gcagcagtct ggcaacgtga agatcacagt taatggctcc	1560
ggaggatccg gcgggcagac ggtgcggtac aagtgcaact gcggtggctc aaacgagga	1620
ctgacaacca cagacaaagt gatcaataac tgcaaaattg atcagtgcca tgctgcagtc	1680
actaatcaca agaattggca atacaactcc cctttagtcc cgcgcaacgc tgaactcggg	1740
gaccgtaaag gaaagatcca catcccattc ccattggcaa acgtgacttg cagagtcca	1800
aaagcaagaa accctacagt aacttacgga aaaaaccaag tcaccatgct gctgtatcct	1860
gaccatccga cactcttgct ttaccgtaac atgggacagg aaccaaatta ccacgaggag	1920
tgggtgacac acaagaagga ggttaccttg accgtgccta ctgaggtct ggaggtcact	1980
tggggcaaca acgaaccata caagtactgg ccgcagatgt ctacgaacgg tactgctcat	2040
ggtcaccac atgagataat ctgttactat tatgagctgt accccactat gactgtagtc	2100
attgtgtcgg tggcctcgtt cgtgcttctg tcgatgggtg gcacagcagt gggaatgtgt	2160

gtgtgcgcac ggcgagatg cattacacca tatgaattaa caccaggagc cactgttccc	2220
ttcctgtcca gcctgctaig ctgcgtcaga acgaccaagg cgccacata ttacaggct	2280
gcggcatatc tatggaacga acagcagccc ctgttctggt tgcaggctct tatcccgtg	2340
gccgccttga tcgtcctgtg caactgtctg aaactcttgc catgctgctg taagaccctg	2400
gcttttttag ccgtaatgag catcgggtgcc cacactgtga gcgcgtacga acacgtaaca	2460
gtgatccga acacgggtgg agtaccgtat aagactcttg tcaacagacc gggttacagc	2520
cccatggtgt tggagatgga gctacaatca gtcaccttgg aaccaacact gtcacttgac	2580
tacatcacgt gcgagtacaa aactgtcatc cctccccgt acgtgaagtg ctgtggtaca	2640
gcagagtga aggacaagag cctaccagac tacagctgca aggtctttac tggagtctac	2700
ccatttatgt gggcgcgcg cttactgctt tgcgacgccg aaaatacgca attgagcgag	2760
gcacatgtag agaaatctga atcttgcaaa acagagtttg catcgcccta cagagcccac	2820
accgcatcgg cgtcggcgaa gctccgcgtc cttaccaag gaaacaacat taccgtagct	2880
gcctacgcta acggtgacca tgccgtcaca gtaaaggacg ccaagtttgt cgtgggcca	2940
atgtcctccg cctggacacc ttttgacaac aaaatcgttg tgtacaaagg cgacgtctac	3000
aacatggact acccaccttt tggcgagga agaccaggac aatttgggtga cattcaaagt	3060
cgtacaccgg aaagtaaaga cgtttatgcc aacactcagt tgggtactaca gaggccagca	3120
gcaggcacgg tacatgtacc atactctcag gcaccatctg gcttcaagta ttggctgaag	3180
gaacgaggag catcgttaca gcacacggca ccgttcggtt gccagattgc gacaaacccg	3240
gtaagagctg taaattgcgc tgtggggaac ataccaattt ccatcgacat accggtatcg	3300
gcctttacta ggttgttga tgacacctct gtaacggaca tgtcatgca agtaccagcc	3360
tgcactcact cctccgactt tggggcgct gccatcatca aatacacagc tagcaagaaa	3420
ggtaaagtgt cagtacattc gatgaccaac gccgttacca ttcgagaagc cgacgtagaa	3480
gtagagggga actcccagct gcaaatatcc ttctcaacag ccctggcaag cgccgagttt	3540
cgcggtgcaag tgtgtccac acaagtacac tgcgcagccg catgccaccc tccaaaggac	3600
cacatagtca attaccagc atcacacacc acccttgggg tccaggatat atccacaacg	3660

gcaatgtctt gggtcagaa gattacggga ggagtaggat taattgttcg tgttgctgcc 3720

ttaattttaa ttgtggtgct atgcgtgtcg tttagcaggc ac 3762

<210> 25

<211> 1254

<212> PRT

<213> Artificial

<220>

<223> VLP_CHI 520 vector

<400> 25

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
1 5 10 15

Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro
20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
50 55 60

Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp
65 70 75 80

Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys
85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys
115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
 180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
 195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
 210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
 225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
 245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala
 260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
 275 280 285

Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met
 290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro
 305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
 325 330 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
 340 345 350

Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
 355 360 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp
 370 375 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro
 385 390 395 400

Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys
 405 410 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
 420 425 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His

435	440	445
Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu		
450	455	460
Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr		
465	470	475
		480
Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met		
	485	490
		495
Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn		
	500	505
		510
Val Lys Ile Thr Val Asn Gly Ser Gly Gly Ser Gly Gly Gln Thr Val		
	515	520
		525
Arg Tyr Lys Cys Asn Cys Gly Gly Ser Asn Glu Gly Leu Thr Thr Thr		
530	535	540
Asp Lys Val Ile Asn Asn Cys Lys Ile Asp Gln Cys His Ala Ala Val		
545	550	555
		560
Thr Asn His Lys Asn Trp Gln Tyr Asn Ser Pro Leu Val Pro Arg Asn		
	565	570
		575
Ala Glu Leu Gly Asp Arg Lys Gly Lys Ile His Ile Pro Phe Pro Leu		
	580	585
		590
Ala Asn Val Thr Cys Arg Val Pro Lys Ala Arg Asn Pro Thr Val Thr		
	595	600
		605
Tyr Gly Lys Asn Gln Val Thr Met Leu Leu Tyr Pro Asp His Pro Thr		
610	615	620
Leu Leu Ser Tyr Arg Asn Met Gly Gln Glu Pro Asn Tyr His Glu Glu		
625	630	635
		640
Trp Val Thr His Lys Lys Glu Val Thr Leu Thr Val Pro Thr Glu Gly		
	645	650
		655
Leu Glu Val Thr Trp Gly Asn Asn Glu Pro Tyr Lys Tyr Trp Pro Gln		
	660	665
		670
Met Ser Thr Asn Gly Thr Ala His Gly His Pro His Glu Ile Ile Leu		
675	680	685
Tyr Tyr Tyr Glu Leu Tyr Pro Thr Met Thr Val Val Ile Val Ser Val		
690	695	700

Ala Ser Phe Val Leu Leu Ser Met Val Gly Thr Ala Val Gly Met Cys
 705 710 715 720
 Val Cys Ala Arg Arg Arg Cys Ile Thr Pro Tyr Glu Leu Thr Pro Gly
 725 730 735
 Ala Thr Val Pro Phe Leu Leu Ser Leu Leu Cys Cys Val Arg Thr Thr
 740 745 750
 Lys Ala Ala Thr Tyr Tyr Glu Ala Ala Ala Tyr Leu Trp Asn Glu Gln
 755 760 765
 Gln Pro Leu Phe Trp Leu Gln Ala Leu Ile Pro Leu Ala Ala Leu Ile
 770 775 780
 Val Leu Cys Asn Cys Leu Lys Leu Leu Pro Cys Cys Cys Lys Thr Leu
 785 790 795 800
 Ala Phe Leu Ala Val Met Ser Ile Gly Ala His Thr Val Ser Ala Tyr
 805 810 815
 Glu His Val Thr Val Ile Pro Asn Thr Val Gly Val Pro Tyr Lys Thr
 820 825 830
 Leu Val Asn Arg Pro Gly Tyr Ser Pro Met Val Leu Glu Met Glu Leu
 835 840 845
 Gln Ser Val Thr Leu Glu Pro Thr Leu Ser Leu Asp Tyr Ile Thr Cys
 850 855 860
 Glu Tyr Lys Thr Val Ile Pro Ser Pro Tyr Val Lys Cys Cys Gly Thr
 865 870 875 880
 Ala Glu Cys Lys Asp Lys Ser Leu Pro Asp Tyr Ser Cys Lys Val Phe
 885 890 895
 Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp
 900 905 910
 Ala Glu Asn Thr Gln Leu Ser Glu Ala His Val Glu Lys Ser Glu Ser
 915 920 925
 Cys Lys Thr Glu Phe Ala Ser Ala Tyr Arg Ala His Thr Ala Ser Ala
 930 935 940
 Ser Ala Lys Leu Arg Val Leu Tyr Gln Gly Asn Asn Ile Thr Val Ala
 945 950 955 960

Ala Tyr Ala Asn Gly Asp His Ala Val Thr Val Lys Asp Ala Lys Phe
 965 970 975

Val Val Gly Pro Met Ser Ser Ala Trp Thr Pro Phe Asp Asn Lys Ile
 980 985 990

Val Val Tyr Lys Gly Asp Val Tyr Asn Met Asp Tyr Pro Pro Phe Gly
 995 1000 1005

Ala Gly Arg Pro Gly Gln Phe Gly Asp Ile Gln Ser Arg Thr Pro
 1010 1015 1020

Glu Ser Lys Asp Val Tyr Ala Asn Thr Gln Leu Val Leu Gln Arg
 1025 1030 1035

Pro Ala Ala Gly Thr Val His Val Pro Tyr Ser Gln Ala Pro Ser
 1040 1045 1050

Gly Phe Lys Tyr Trp Leu Lys Glu Arg Gly Ala Ser Leu Gln His
 1055 1060 1065

Thr Ala Pro Phe Gly Cys Gln Ile Ala Thr Asn Pro Val Arg Ala
 1070 1075 1080

Val Asn Cys Ala Val Gly Asn Ile Pro Ile Ser Ile Asp Ile Pro
 1085 1090 1095

Asp Ala Ala Phe Thr Arg Val Val Asp Ala Pro Ser Val Thr Asp
 1100 1105 1110

Met Ser Cys Glu Val Pro Ala Cys Thr His Ser Ser Asp Phe Gly
 1115 1120 1125

Gly Val Ala Ile Ile Lys Tyr Thr Ala Ser Lys Lys Gly Lys Cys
 1130 1135 1140

Ala Val His Ser Met Thr Asn Ala Val Thr Ile Arg Glu Ala Asp
 1145 1150 1155

Val Glu Val Glu Gly Asn Ser Gln Leu Gln Ile Ser Phe Ser Thr
 1160 1165 1170

Ala Leu Ala Ser Ala Glu Phe Arg Val Gln Val Cys Ser Thr Gln
 1175 1180 1185

Val His Cys Ala Ala Ala Cys His Pro Pro Lys Asp His Ile Val
 1190 1195 1200

Asn Tyr Pro Ala Ser His Thr Thr Leu Gly Val Gln Asp Ile Ser

1205	1210	1215
Thr Thr Ala Met Ser Trp Val Gln Lys Ile Thr Gly Gly Val Gly		
1220	1225	1230
Leu Ile Val Ala Val Ala Ala Leu Ile Leu Ile Val Val Leu Cys		
1235	1240	1245
Val Ser Phe Ser Arg His		
1250		

<210> 26
 <211> 8485
 <212> DNA
 <213> Artificial

<220>
 <223> VLP74_11 (CHI VLP 532_NPNx6) whole sequence

<400> 26
 gaattcccat tgcatacgtt gtatccatat cataataigt acatttatat tggctcatgt 60
 ccaacattac cgccatgttg acattgatta ttgactagtt attaatagta atcaattacg 120
 gggtcattag ttcatagccc atatatggag ttccgcgita cataacttac ggtaaattggc 180
 ccgcctggct gaccgcccac cgacccccgc ccattgacgt caataatgac gtatgttccc 240
 atagtaacgc caataggacgac ttccattga cgtcaatggg tggagtattt acggtaaact 300
 gccacttgg cagtacatca agtgtatcat atgccaagta cggcccctat tgacgtcaat 360
 gacggtaaat ggccgcctg gcattatgcc cagtacatga ctttatggga ctttcctact 420
 tggcagtaca tctacgtatt agtcatcgct attaccatgg tgatgcggtt ttggcagtac 480
 atcaatgggc gtggatagcg gtttgactca cggggatttc caagctcca cccattgac 540
 gtcaatggga gtttgttttg gcacaaaaat caacgggact ttccaaaatg tcgtaacaac 600
 tccgccccat tgacgcaaat gggcggtagg cgtgtacgtt gggaggctta tataagcaga 660
 gctcgittag tgaaccgtca gatcgcttg agacgccatc cagctgttt tgacctccat 720
 agaagacacc gggaccgatc cagcctccgt taacgggtga gggcagtga gtctgagcag 780
 tactcgttgc tgccgcgcgc gccaccagac ataatactg acagactaac agactgttcc 840

tttccatggg tcttttctgc agtcaccgtc gtcgacacgt gtgatcagat atcgcgcccg	900
ccaccatgga gttcatcccg acgcaaactt tctataacag aaggtaccaa ccccgaccct	960
gggccccacg ccctacaatt caagtaatta gacctagacc acgtccacag aggcaggctg	1020
ggcaactcgc ccagctgac tccgcagtca acaaattgac catgcgcgcg gtacctcaac	1080
agaagcctcg cagaaatcgg aaaaacaaga agcaaaggca gaagaagcag gcgccgcaaa	1140
acgacccaaa gcaaaagaag caaccaccac aaaagaagcc ggctcaaaag aagaagaaac	1200
caggccgtag ggagagaatg tgcataaaaa ttgaaatga ttgcatcttc gaagtcaagc	1260
atgaaggcaa agtgatgggc tacgcatgcc tgggtgggga taaagtaatg aaaccagcac	1320
atgtgaaggg aactatcgac aatgccgac tggctaaact ggcctttaag cggtcgtcta	1380
aatacgatct tgaatgtgca cagataccgg tgcacatgaa gtctgatgcc tcgaagtta	1440
cccacgagaa acccgagggg tactataact ggcacacgg agcagtgcag tattcaggag	1500
gccggttcac tatcccgacg ggtgcaggca agccgggaga cagcggcaga ccgatcttcg	1560
acaacaaagg acgggtggcg gccatcgtcc taggaggggc caacgaaggt gccgcacgg	1620
ccctctccgt ggtgacgtgg aacaaagaca tcgtcacaaa aattaccctt gagggagccg	1680
aagagtggag cctcgccctc ccggtcttgt gcctgttggc aaacactaca ttcccctgct	1740
ctcagccgcc ttgcacacc ttgtctacg aaaaggaacc ggaaagcacc ttgcgcatgc	1800
ttgaggacaa cgtgatgaga cccggatact accagctact aaaagcatcg ctgacttgct	1860
ctccccaccg ccaaagacgc agtactaagg acaattttaa tgtctataaa gccacaagac	1920
catatctagc tcattgtcct gactgcggag aagggcattc gtgccacagc cctatcgcat	1980
tggagcgcat cagaaatgaa gcaacggacg gaacgctgaa aatccaggtc tctttgcaga	2040
tcgggataaa gacagatgac agccacgatt ggaccaagct gcgctatatg gatagccata	2100
cgccagcgga cgcggagcga gccggattgc ttgtaaggac ttcagcaccg tgcacgatca	2160
ccgggaccat gggacacttt attctcgccc gatgcccgaaggagagacg ctgacagtgg	2220
gatttacgga cagcagaaag atcagccaca catgcacaca cccgttccat catgaaccac	2280
ctgtgatagg tagggagagg ttccactctc gaccacaaca tggtaaagag ttaccttgca	2340

gcacgtacgt gcagagcacc gctgccactg ctgaggagat agaggtgcat atgccccag	2400
atactcctga ccgcacgctg atgacgcagc agtctggcaa cgtgaagatc acagttaatg	2460
ggcagacggt gcggtacaag tgcaactgcg gtggctccgg aggaaacccg aatgccaatc	2520
ccaacgcgaa cccaatgct aacccaaatg ccaacccaaa cgccaacccc aacgctggtg	2580
gatccaacga gggactgaca accacagaca aagtgatcaa taactgcaaa attgatcagt	2640
gccatgctgc agtcactaat cacaagaatt ggcaatacaa ctccccttta gtcccgcgca	2700
acgcigaact cggggaccgt aaaggaaaga tccacatccc attcccatig gcaaacgtga	2760
cttgcagagt gccaaaagca agaaacccta cagtaactta cggaaaaaac caagtcacca	2820
tgtgtctgta tcttgacct cgcacactct tgccttaccg taacatggga caggaaccaa	2880
attaccacga ggagtgggtg acacacaaga aggaggttac ctigaccgtg cctactgagg	2940
gtctggaggt cacttggggc aacaacgaac catacaagta ctggccgcag atgtctacga	3000
acggtactgc tcatggtcac ccacatgaga taatcttgta ctattatgag ctgtacccca	3060
ctatgactgt agtcattgtg tgggtgcct cgttcgtgct tctgtcgatg gtgggcacag	3120
cagtgggaat gtgtgtgtgc gcacggcgca gatgcattac accatatgaa ttaacaccag	3180
gagccactgt tcccttcctg ctgagcctgc tatgtgcgt cagaacgacc aaggcggcca	3240
catattacga ggctgcggca tatctatgga acgaacagca gcccctgttc tggttgcagg	3300
ctcttatccc gctggccgcc ttgatcgctc tgtgcaactg tctgaaactc ttgccatgct	3360
gctgtaagac cctggctttt ttagccgtaa tgagcatcgg tgcccacact gtgagcgcgt	3420
acgaacacgt aacagtgatc ccgaacacgg tgggagtacc gtataagact cttgtcaaca	3480
gaccgggta cagcccatg gtgttgaga tggagctaca atcagtcacc ttggaaccaa	3540
cactgtcact tgactacatc acgtgcgagt acaaaactgt catcccctcc ccgtacgtga	3600
agtgtctgtg tacagcagag tgcaaggaca agagcctacc agactacagc tgcaaggctc	3660
ttactggagt ctacccattt atgtggggcg gcgcctactg cttttgcgac gccgaaaata	3720
cgcaattgag cgaggcacat gtagagaaat ctgaatcttg caaaacagag tttgcatcgg	3780

cctacagagc ccacaccgca tcggcgtcgg cgaagctccg cgtcctttac caaggaaaca	3840
acattaccgt agctgcctac gctaaccgtg accatgccgt cacagtaaag gacgccaaagt	3900
ttgtcgtggg cccaatgtcc tccgcctgga caccitttga caacaaaatc gtggigtaca	3960
aaggcgacgt ctacaacatg gactaccac cttttggcgc aggaagacca ggacaatttg	4020
gtgacattca aagtcgtaca ccggaagta aagacgttta tgccaacact cagttggtac	4080
tacagaggcc agcagcaggc acggtacatg taccatactc tcaggcacca tctggcttca	4140
agtattggct gaaggaacga ggagcatcgc tacagcacac ggcaccgttc ggttgccaga	4200
ttgcgacaaa cccggtaaga gctgtaaatt gcgctgtggg gaacatacca atttccatcg	4260
acataccgga tgcggccttt actagggttg tcgatgcacc ctctgtaacg gacatgtcat	4320
gcgaagtacc agcctgcact cactcctccg actttggggg cgtcgccatc atcaaataca	4380
cagctagcaa gaaaggtaaa tgtgcagtac attcgatgac caacgccgtt accattcgag	4440
aagccgacgt agaagtagag gggaactccc agctgcaaat atccttctca acagccctgg	4500
caagcgccga gtttcgcgtg caagtgtgct ccacacaagt aacttgcgca gccgcatgcc	4560
accctccaaa ggaccacata gtcaattacc cagcatcaca caccaccctt ggggtccagg	4620
atatatccac aacggcaatg tcttgggtgc agaagattac gggaggagta ggattaattg	4680
ttgctgttgc tgccttaatt ttaattgtgg tgctatgcgt gtcgtttagc aggcactaag	4740
gatctagatc tgctgtgcct tctagtggc agccatctgt tgtttgcccc tccccgtgc	4800
cttccttgac cctggaaggt gccactccca ctgtcctttc ctaataaaat gaggaaattg	4860
catcgcaattg tctgagtagg tgtcattcta ttctgggggg tgggtgggg caggacagca	4920
agggggagga ttgggaagac aatagcaggc atgctgggga tgcggtgggc tctatgggta	4980
cccaggtgct gaagaattga cccggttcct cctgggccag aaagaagcag gcacatcccc	5040
ttctctgtga cacaccctgt ccacggccct ggttcttagt tccagcccca ctcataggac	5100
actcatagct caggagggtc ccgccttcaa tcccaccgc taaagtactt ggagcggctc	5160
ctccctccct catcagccca ccaaaccaaa cctagcctcc aagagtggga agaaattaaa	5220
gcaagatagg ctattaagtg cagagggaga gaaaatgcct ccaacatgtg aggaagtaat	5280

gagagaaatc atagaatttt aaggccatga ttttaaggcca tcatggccta agcttgaaag	5340
gagataggat caaagcttgg cgtaatcatg gtcatactg tttcctgtgt gaaattgtta	5400
tccgctcaca attccacaca acatacgagc cggaagcata aagtgtaaag cctgggggtgc	5460
ctaattgagt agctaactca catttaattgc gttgcgctca ctgcccgtt tccagtcggg	5520
aaacctgtcg tgccagctgc attaatgaat cggccaacgc gcggggagag gcggtttgcg	5580
tattggggcg tcttccgctt cctcgctcac tgactcgctg cgctcggtcg ttcggctgcg	5640
gcgagcggta tcagctcact caaaggcggc aatacggta tccacagaat caggggataa	5700
gcgaggaaag aacatgtgag caaaaggcca gcaaaaggcc aggaaccgta aaaaggccgc	5760
gttgctggcg tttttcata ggctccgccc cctgacgag catcacaaaa atcgacgctc	5820
aagtcagagg tggcgaaacc cgacaggact ataaagatac caggcgtttc cccctggaag	5880
ctccctcgtg cgctctctg ttcggaccct gccgcttacc ggatacctgt cgcctttct	5940
cccttcggga agcgtggcg tttctcatag ctacgctgt aggtatctca gttcggtgta	6000
ggtcgttcgc tccaagctgg gctgtgtgca cgaaccccc gttcagccc accgctgcgc	6060
cttatccggt aactatcgtc ttgagtcgaa cccggtaaga cagacttat cgccactggc	6120
agcagccact gtaacagga ttagcagagc gaggtatgta ggcgggtgta cagagttctt	6180
gaagtgggtg cctaactacg gctacactag aagaacagta ttgggtatct gcgctctgct	6240
gaagccagtt accttcggaa aaagagttgg tagctcttga tccggcaaac aaaccaccgc	6300
tggtagcggg ggtttttttg tttgcaagca gcagattacg cgagaaaaa aaggatctca	6360
agaagatcct ttgatctttt ctacggggtc tgacgctcag tggaacgaaa actcaggtta	6420
agggatittg gtcatagat tatcaaaaag gatcttcacc tagatccttt taaattaaaa	6480
atgaagtttt aaatcaatct aaagtatata tgagttaaact tggcttgaca gttaccaatg	6540
cttaatcagt gaggcaccta tctcagcgat ctgtctatct cgttcaccca tagttgcctg	6600
actccccgtc gtgtagataa ctacgatacg ggagggttta ccatctggcc ccagtgctgc	6660
aatgataccg cgagaaccac gctcaccggc tccagattta tcagcaataa accagccagc	6720

cggaagggcc gagcgagaa gtggtcctgc aactttatcc gcctccatcc agtctattaa	6780
ttgttgccgg gaagctagag taagtagtgc gccagttaat agtttgcga acgttggtgc	6840
cattgctaca ggcatcgtgg tgcacgctc gtcgtttggt atggcttcat tcagctccgg	6900
ttccaacga tcaaggcgag ttacatgac ccccatgttg tgcaaaaaag cggtagctc	6960
cttcggctct ccgatcgttg tcagaagtaa gtggccgca gtgttatcac tcatggttat	7020
ggcagcactg cataattctc ttactgtcat gccatccgta agatgctttt ctgtgactgg	7080
tgagtactca accaagtcac tctgagaata gtgtatgcgg cgaccgagtt gctcttgccc	7140
ggcgtcaata cgggataata ccgcgccaca tagcagaact ttaaaagtgc tcatcattgg	7200
aaaacgttct tcggggcgaa aactctcaag gatcttaccg ctgttgagat ccagttcgat	7260
gtaaccactc cgtgcaccca actgatcttc agcatctttt actttacca gcgtttctgg	7320
gtgagcaaaa acaggaaggc aaaatgccgc aaaaaagga ataaggcgga cacggaaatg	7380
ttgaatactc atactcttcc tttttcaata ttattgaagc atttatcagg gttattgtct	7440
catgagcgga tacatatttg aatgtattta gaaaaataaa caaatagggg ttccgcgcac	7500
atttccccga aaagtgccac ctgacgtcta agaaaccatt attatcatga cattaacct	7560
taaaaatagg cgtatcacga ggccctttcg ggtcgcgcgt ttccgtgatg acggtgaaaa	7620
cctctgacac atgcagctcc cgttgacggt cacagcttgt ctgtaagcgg atgccgggag	7680
cagacaagcc cgtcagggcg cgtcagcggg tgttggcggg tgcggggct ggcttaacta	7740
tgcggcatca gagcagattg tactgagagt gcaccataaa attgtaaagc ttaatatatt	7800
gttaaaattc gcgttaaatt tttgttaaat cagctcattt ttttaaccaat aggccgaaat	7860
cggcaaaatc cttataaat caaaagaata gcccgagata gggttgagtg ttgttcagtt	7920
ttggaacaag agtccactat taaagaacgt ggactccaac gtcaaaggcg gaaaaaccgt	7980
ctatcaggcg gatggccac tacgtgaacc atcaccctaa tcaagttttt tgggtcgag	8040
gtccgtaaa gcactaaatc ggaaccctaa agggagcccc cgatttagag ctgacgggg	8100
aaagccggcg aacgtggcga gaaaggaagg gaagaaagcg aaaggagcgg gcgctaggcg	8160
gctggcaagt gtagcgggtc cgctgcgcgt aaccaccaca cccgccgcgc ttaatgcgcc	8220

gctacagggc gcgtactatg gttgctttga cgtatgcggt gtgaaatacc gcacagatgc 8280
 gtaaggagaa aataccgcat caggcgccat tcgccattca ggctgcgcaa ctgttgggaa 8340
 gggcgatcgg tgcgggcctc ttcgctatta cgccagctgg cgaaaggggg atgtgctgca 8400
 aggcgattaa gttgggtaac gccagggttt tccagtcac gacgttgtaa aacgacggcc 8460
 agtgaattcc atggctcctc ctttc 8485

<210> 27

<211> 3831

<212> DNA

<213> Artificial

<220>

<223> VLP74_11 (CHI VLP 532 NPNx6) CHIKV-NPNx6 sequence only

<400> 27

atggagtca tcccgacgca aactttctat aacagaaggt accaaccgac accctgggccc 60
 ccacgccccta caattcaagt aattagacct agaccacgtc cacagaggca ggctgggcaa 120
 ctgcccagc tgatctccgc agtcaacaaa ttgaccatgc gcgcggtacc tcaacagaag 180
 cctgcagaa atcggaacaa caagaagcaa aggcagaaga agcaggcgcc gcaaacgac 240
 ccaagcaaa agaagcaacc accacaaaag aagccggctc aaaagaagaa gaaaccaggc 300
 cgtagggaga gaatgtgcat gaaaattgaa aatgattgca tcttcgaagt caagcatgaa 360
 ggcaaagtga tgggctacgc atgcctggcg ggggataaag taatgaaacc agcacatgtg 420
 aagggaacta tcgacaatgc cgatctggct aaactggcct ttaagcggtc gtctaaatac 480
 gatcttgaat gtgcacagat accggtgcac atgaagtctg atgcctcgaa gtttaccac 540
 gagaaacccg aggggtacta taactggcat caccgagcag tgcagtattc aggaggccgg 600
 ttactatcc cgacgggtgc aggcaagccg ggagacagcg gcagaccgat cttcgacaac 660
 aaaggacggg tgggtggccat cgtcctagga gggccaacg aaggtgcccg cacggccctc 720
 tccgtgtgta cgtggaacaa agacatcgtc acaaaaatta cccctgaggg agccgaagag 780
 tggagcctcg ccctcccggt cttgtgcctg ttggcaaaca ctacattccc ctgctctcag 840

ccgccttgca caccctgctg ctacgaaaag gaaccggaaa gcaccttgcg catgcttgag	900
gacaacgtga tgagacccgg atactaccag ctactaaaag catcgctgac ttgctctccc	960
caccgccaaa gacgcagtac taaggacaat tttaatgtct ataaagccac aagaccatat	1020
ctagctcatt gtcctgactg cggagaaggg cattcgctgc acagccctat cgcattggag	1080
cgcatcagaa atgaagcaac ggacggaacg ctgaaaatcc aggtctcttt gcagatcggg	1140
ataaagacag atgacagcca cgattggacc aagctgcgct atatggatag ccatacgcca	1200
gcggacgcgg agcgagccgg attgcttgta aggacttcag caccgtgcac gatcaccggg	1260
accatgggac actttattct cgcccgatgc ccgaaaggag agacgctgac agtgggattt	1320
acggacagca gaaagatcag ccacacatgc acacaccgt tccatcatga accacctgtg	1380
ataggtaggg agaggttcca ctctcgacca caacatggta aagagttacc ttgcagcacg	1440
tacgtgcaga gcaccgctgc cactgctgag gagatagagg tgcatatgcc cccagatact	1500
cctgaccgca cgctgatgac gcagcagctt ggcaacgtga agatcacagt taatgggcag	1560
acggtgcggt acaagtgcaa ctgcggtggc tccggaggaa acccgaatgc caatcccaac	1620
gcgaacccca atgctaacct aaatgccaac ccaaacgcca accccaacgc tggatggatcc	1680
aacgagggac tgacaaccac agacaaagtg atcaataact gcaaaattga tcagtgccat	1740
gctgcagtca ctaatcacia gaattggcaa tacaactccc cttagtccc gcgcaacgct	1800
gaactcgggg accgtaaagg aaagatccac atccattcc cattggcaaa cgtgacttgc	1860
agagtgccta aagcaagaaa ccctacagta acttacggaa aaaaccaagt caccatgctg	1920
ctgtatcctg accatccgac actcttgtct taccgtaaca tgggacagga accaaattac	1980
cacgaggagt gggtagacaca caagaaggag gttaccttga ccgtgcctac tgagggtctg	2040
gaggtcactt ggggcaacaa cgaaccatac aagtactggc cgcagatgtc tacgaacggt	2100
actgctcatg gtcaccaca tgagataatc ttgtactatt atgagctgta cccactatg	2160
actgtagtca ttgtgtcggg ggccctgttc gtgcttctgt cgatggtggg cacagcagtg	2220
ggaatgtgtg tgtgcgcacg gcgcagatgc attacacat atgaattaac accaggagcc	2280
actgttcctt tcctgtcag cctgctatgc tgcgtcagaa cgaccaaggc ggccacatat	2340

tacgaggctg cggcataict atggaacgaa cagcagcccc tgttctggtt gcaggctctt	2400
atcccgctgg ccgccttgat cgtccigtgc aactgtctga aactcttgcc atgctgctgt	2460
aagaccttgg ctttttttagc cgtaatgagc atcggtgccc acactgtgag cgcgtacgaa	2520
cacgtaacag tgatcccga caggtggga gtaccgtata agactcttgt caacagaccg	2580
ggttacagcc ccatggtgtt ggagatggag ctacaatcag tcaccttga accaactg	2640
tcacttgact acatcacgtg cgagtacaaa actgtcatcc cctccccgta cgtgaagtgc	2700
tgtgttacag cagagtcaa ggacaagagc ctaccagact acagctgcaa ggtctttact	2760
ggagtctacc cttttatgtg ggccggcgcc tactgctttt gcgacgccga aaatacgcaa	2820
ttgagcgagg cacatgtaga gaaatctgaa tcttgcaaaa cagagtttgc atcggcctac	2880
agagcccaca ccgcatcggc gtccggcgaag ctcccgctcc ttaccaagg aaacaacatt	2940
accgtagctg cctacgctaa cggtgaccat gccgtcacag taaaggacgc caagtttgc	3000
gtgggccc aa tgtcctccgc ctggacacct ttgacaaca aaatcgtggt gtacaaaggc	3060
gacgtctaca acatggacta cccacctttt ggccgaggaa gaccaggaca atttggtgac	3120
attcaaagtc gtacaccgga aagtaaagac gtttatgcc aactcagtt ggtactacag	3180
aggccagcag caggcacggt acatgtacca tactctcagg caccatctgg ctcaagtat	3240
tggctgaagg aacgaggagc atcgctacag cacacggcac cgttcggtt ccagattgcg	3300
acaaaccgg taagagctgt aaattgcgt gtgggaaca taccaatttc catcgacata	3360
ccggatgcgg cttttactag ggttgcgat gcacctctg taacggacat gtcatgcgaa	3420
gtaccagcct gcactcactc ctccgacttt gggggcgtcg ccatcatcaa atacacagct	3480
agcaagaaag gtaaatgtgc agtacattcg atgaccaacg ccgttaccat tcgagaagcc	3540
gacgtagaag tagaggggaa ctcccagctg caaatatcct tctcaacagc cctggcaagc	3600
gccgagtttc gcgtgcaagt gtgctccaca caagtacact gcgcagccgc atgccacct	3660
ccaaaggacc acatagtcaa ttaccagca tcacacacca cccttgggt ccaggatata	3720
tccacaacgg caatgtcttg ggtgcagaag attacgggag gagtaggatt aattgttgc	3780

gttgctgcct taattttaat tgtggtgcta tgcgtgtcgt ttagcaggca c

3831

<210> 28
 <211> 1277
 <212> PRT
 <213> Artificial

<220>

<223> VLP74_11 (CHI VLP 532 NPNx6) amino acid sequence

<400> 28

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
 1 5 10 15

Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro
 20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
 35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
 50 55 60

Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp
 65 70 75 80

Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys
 85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
 100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys
 115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
 130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
 145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
 165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
 180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
 195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
 210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
 225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
 245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala
 260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
 275 280 285

Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met
 290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro
 305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
 325 330 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
 340 345 350

Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
 355 360 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp
 370 375 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro
 385 390 395 400

Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys
 405 410 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
 420 425 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His
 435 440 445

Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu

450	455	460
Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr		
465	470	475 480
Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met		
	485	490 495
Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn		
	500	505 510
Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys		
	515	520 525
Gly Gly Ser Gly Gly Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
	530	535 540
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Gly Gly Ser		
545	550	555 560
Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn Cys Lys Ile		
	565	570 575
Asp Gln Cys His Ala Ala Val Thr Asn His Lys Asn Trp Gln Tyr Asn		
	580	585 590
Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg Lys Gly Lys		
	595	600 605
Ile His Ile Pro Phe Pro Leu Ala Asn Val Thr Cys Arg Val Pro Lys		
	610	615 620
Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val Thr Met Leu		
625	630	635 640
Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn Met Gly Gln		
	645	650 655
Glu Pro Asn Tyr His Glu Glu Trp Val Thr His Lys Lys Glu Val Thr		
	660	665 670
Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly Asn Asn Glu		
	675	680 685
Pro Tyr Lys Tyr Trp Pro Gln Met Ser Thr Asn Gly Thr Ala His Gly		
	690	695 700
His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr Pro Thr Met		
705	710	715 720

Thr Val Val Ile Val Ser Val Ala Ser Phe Val Leu Leu Ser Met Val
 725 730 735

Gly Thr Ala Val Gly Met Cys Val Cys Ala Arg Arg Arg Cys Ile Thr
 740 745 750

Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu Leu Ser Leu
 755 760 765

Leu Cys Cys Val Arg Thr Thr Lys Ala Ala Thr Tyr Tyr Glu Ala Ala
 770 775 780

Ala Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu Gln Ala Leu
 785 790 795 800

Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu Lys Leu Leu
 805 810 815

Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met Ser Ile Gly
 820 825 830

Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile Pro Asn Thr
 835 840 845

Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly Tyr Ser Pro
 850 855 860

Met Val Leu Glu Met Glu Leu Gln Ser Val Thr Leu Glu Pro Thr Leu
 865 870 875 880

Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile Pro Ser Pro
 885 890 895

Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys Ser Leu Pro
 900 905 910

Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly
 915 920 925

Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu Ser Glu Ala
 930 935 940

His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala Ser Ala Tyr
 945 950 955 960

Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val Leu Tyr Gln
 965 970 975

Gly Asn Asn Ile Thr Val Ala Ala Tyr Ala Asn Gly Asp His Ala Val
 980 985 990

Thr Val Lys Asp Ala Lys Phe Val Val Gly Pro Met Ser Ser Ala Trp
 995 1000 1005

Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp Val Tyr
 1010 1015 1020

Asn Met Asp Tyr Pro Pro Phe Gly Ala Gly Arg Pro Gly Gln Phe
 1025 1030 1035

Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser Lys Asp Val Tyr Ala
 1040 1045 1050

Asn Thr Gln Leu Val Leu Gln Arg Pro Ala Ala Gly Thr Val His
 1055 1060 1065

Val Pro Tyr Ser Gln Ala Pro Ser Gly Phe Lys Tyr Trp Leu Lys
 1070 1075 1080

Glu Arg Gly Ala Ser Leu Gln His Thr Ala Pro Phe Gly Cys Gln
 1085 1090 1095

Ile Ala Thr Asn Pro Val Arg Ala Val Asn Cys Ala Val Gly Asn
 1100 1105 1110

Ile Pro Ile Ser Ile Asp Ile Pro Asp Ala Ala Phe Thr Arg Val
 1115 1120 1125

Val Asp Ala Pro Ser Val Thr Asp Met Ser Cys Glu Val Pro Ala
 1130 1135 1140

Cys Thr His Ser Ser Asp Phe Gly Gly Val Ala Ile Ile Lys Tyr
 1145 1150 1155

Thr Ala Ser Lys Lys Gly Lys Cys Ala Val His Ser Met Thr Asn
 1160 1165 1170

Ala Val Thr Ile Arg Glu Ala Asp Val Glu Val Glu Gly Asn Ser
 1175 1180 1185

Gln Leu Gln Ile Ser Phe Ser Thr Ala Leu Ala Ser Ala Glu Phe
 1190 1195 1200

Arg Val Gln Val Cys Ser Thr Gln Val His Cys Ala Ala Ala Cys
 1205 1210 1215

His Pro Pro Lys Asp His Ile Val Asn Tyr Pro Ala Ser His Thr

1220	1225	1230
Thr Leu Gly Val Gln Asp Ile Ser Thr Thr Ala Met Ser Trp Val		
1235	1240	1245
Gln Lys Ile Thr Gly Gly Val Gly Leu Ile Val Ala Val Ala Ala		
1250	1255	1260
Leu Ile Leu Ile Val Val Leu Cys Val Ser Phe Ser Arg His		
1265	1270	1275

<210> 29
 <211> 8713
 <212> DNA
 <213> Artificial

<220>
 <223> VLP78_11 (CHI VLP 532 NPNx25) whole sequence

<400> 29
 gaattcccat tgcatacggt gtatccatat cataatatgt acatttatat tggctcatgt 60
 ccaacattac cgccatgttg acattgatta ttgactagtt attaatagta atcaattacg 120
 gggtcattag ttcataagccc atatatggag ttccgcgtta cataacttac ggtaaattggc 180
 ccgcctggct gaccgcccac cgaccccgcc ccattgacgt caataatgac gtatgttccc 240
 atagtaacgc caataggagc ttccattga cgtcaatggg tggagtattt acggtaaaact 300
 gccacttgg cagtacatca agtgtatcat atgccaagta cggcccctat tgacgtcaat 360
 gacggtaaatt gggccgctg gcattatgcc cagtacatga cttatggga ctttcctact 420
 tggcagtaca tctacgtatt agtcatcgct attaccatgg tgatgcgggt ttggcagtac 480
 atcaatgggc gtggatagcg gtttgactca cggggatttc caagtctcca cccattgac 540
 gtcaatggga gtttgttttg gcacaaaaat caacgggact ttccaaaatg tcgtaacaac 600
 tccgccccat tgacgcaaat gggcggtagg cgtgtacggg gggagggtcta tataagcaga 660
 gctcgtttag tgaaccgtca gatgcctgg agacgccatc cagctgttt tgacctccat 720
 agaagacacc gggaccgatc cagcctccgt taacgggtga gggcagtgtg gtctgagcag 780
 tactcgttgc tgccgcgcgc gccaccagac ataataagctg acagactaac agactgttcc 840

tttccatggg tcttttctgc agtcaccgtc gtcgacacgt gtgatcagat atcgcggccg	900
ccaccatgga gticattccg acgcaaactt tctataacag aaggtaccaa ccccgaccct	960
gggccccacg ccctacaatt caagtaatta gacctagacc acgtccacag aggcaggctg	1020
ggcaactcgc ccagctgac tccgcagica acaaatigac catgcgcgcg gtacctcaac	1080
agaagcctcg cagaaatcgg aaaaacaaga agcaaaggca gaagaagcag gcgccgcaa	1140
acgacccaaa gcaaaagaag caaccaccac aaaagaagcc ggctcaaaag aagaagaaac	1200
caggccgtag ggagagaatg tgcataaaaa ttgaaaatga ttgcatcttc gaagtcaagc	1260
atgaaggcaa agtgatgggc tacgcatgcc tgggtgggga taaagtaatg aaaccagcac	1320
atgtgaaggg aactatcgac aatgccgac tggctaaact ggcctttaag cggctgtcta	1380
aatacgtct tgaatgtgca cagataccgg tgcacatgaa gtctgatgcc tcgaagtta	1440
cccacgagaa acccgagggg tactataact ggcatcacgg agcagtcag tattcaggag	1500
gccggttcac tatcccgacg ggtgcaggca agccgggaga cagcggcaga ccgatcttcg	1560
acaacaaagg acgggtggtg gccatcgtcc tagggagggc caacgaaggt gcccgcacgg	1620
ccctctccgt ggtgacgtgg aacaagaca tcgtcacaaa aattaccctt gagggagccg	1680
aagagtggag cctcgccctc ccggtcttgt gcctgttggc aaacactaca tccccctgct	1740
ctcagccgcc ttgcacacc tgctgctacg aaaaggaacc ggaaagcacc ttgcgcatgc	1800
ttgaggacaa cgtgatgaga cccggatact accagctact aaaagcatcg ctgacttgct	1860
ctccccaccg ccaaagacgc agtactaagg acaattttaa tgtctataaa gccacaagac	1920
catatctagc tcattgtcct gactgcggag aagggcattc gtgccacagc cctatcgcat	1980
tggagcgcac cagaaatgaa gcaacggacg gaacgctgaa aatccaggtc tctttgcaga	2040
tcgggataaa gacagatgac agccacgatt ggaccaagct gcgctatatg gatagccata	2100
cggcagcgga cgcggagcga gccggattgc ttgtaaggac ttcagcaccg tgcacgatca	2160
ccgggaccat gggacacitt attctcgccc gatgcccgaa aggagagacg ctgacagtgg	2220
gatttacgga cagcagaaag atcagccaca catgcacaca cccgttccat catgaaccac	2280
ctgtgatagg tagggagagg ttccactctc gaccacaaca tggtaaagag ttaccttgca	2340

gcacgtacgt gcagagcacc gctgccactg ctgaggagat agaggtgcat atgccccag	2400
atactcctga ccgcacgctg atgacgcagc agtctggcaa cgtgaagatc acagttaatg	2460
ggcagacggt gcggtacaag tgcaactgcg gtggctccgg aggaaacccg aatgccaatc	2520
ccaacgcgaa cccaacgct aacccaacg ccaatccgaa tgcaaaccg aacgttgacc	2580
caaacgccaa cccgaatgcc aatccaacg cgaacccaa tgctaacca aatgccaaacc	2640
caaacgccaa cccaacgct aatccaacg ccaaccctaa cgccaatccc aacgcgaatc	2700
ctaacgctaa tccaacgca aatccaatg ctaatccgaa cgcgaaacct aatgcaaacc	2760
ccaacgccaa cccgaacgct aacccaacg ctaatccaa cgccggtgga tccaacgagg	2820
gactgacaac cacagacaaa gtgatcaata actgcaaaat tgatcagtgc catgctgcag	2880
tcactaatca caagaattgg caatacaact cccctttagt cccgcgcaac gctgaactcg	2940
gggaccgtaa aggaaagatc cacatcccat tccattggc aaacgtgact tgcagagtgc	3000
caaaagcaag aaaccctaca gtaacttacg gaaaaaacca agtcaccatg ctgctgtatc	3060
ctgaccatcc gacactcttg tcttaccgta acatgggaca ggaaccaa at taccacgagg	3120
agtgggtgac acacaagaag gaggttacct tgaccgtgcc tactgagggt ctggagggtca	3180
cttggggcaa caacgaacca tacaagtact ggccgcagat gtctacgaac ggtactgctc	3240
atggtcaccc acatgagata atcttgtact attatgagct gtacccact atgactgtag	3300
tcattgtgtc ggtggcctcg ttcgtgcttc tgtcgatggt gggcacagca gtgggaatgt	3360
gtgtgtgcgc acggcgaga tgcattacac catatgaatt aacaccagga gccactgttc	3420
ccctcctgct cagcctgcta tgcctgcgta gaacgaccaa ggccggccaca tattacgagg	3480
ctgcggcata tctatggaac gaacagcagc cctgttctg gtgcaggct cttatccgc	3540
tggccgcctt gatcgtcctg tgcaactgtc tgaaactctt gccatgctgc tgtaagaccc	3600
tggctttttt agccgtaatg agcatcgggtg ccacacactgt gagcggtac gaacacgtaa	3660
cagtatccc gaacacgggtg ggagtaccgt ataagactct tgtcaacaga ccgggttaca	3720
gccccatggt gtggagatg gagctacaat cagtcacctt ggaaccaaca ctgtcacttg	3780

actacatcac gtgcgagtac aaaactgtca tcccccccc gtacgtgaag tgctgtggt	3840
cagcagagtg caaggacaag agcctaccag actacagctg caaggtcttt actggagtct	3900
acccatttat gtggggcggc gcctactgct ttgcgacgc cgaaaatag caattgagcg	3960
aggcacatgt agagaaatct gaatcttgca aaacagagtt tgcacggcc tacagagccc	4020
acaccgcacg ggcgtcgcg aagctccgcg tcctttacca aggaaacaac attaccgtag	4080
ctgcctacgc taacggtgac catgccgtca cagtaaagga cgccaagttt gtcgtgggc	4140
caatgtcctc cgcctggaca ccttttgaca aaaaaatcgt ggtgtacaaa ggcgacgtct	4200
acaacatgga ctaccacct ttggcgag gaagaccagg acaatttggg gacattcaaa	4260
gtcgtacacc ggaaagtaaa gacgttatg ccaacactca gtgtgtacta cagaggccag	4320
cagcaggcac ggtacatgta ccatactctc aggcaccatc tggcttcaag tattggctga	4380
aggaacgagg agcatcgta cagcacacgg caccgttcgg ttgccagatt gcgacaaacc	4440
cggtaagagc tgtaaattgc gctgtggga acataccaat ttccatcgac ataccggatg	4500
cggcctttac tagggttgtc gatgcaccct ctgtaacgga catgtcatgc gaagtaccag	4560
cctgcactca ctctccgac ttggggcg tgcctcat caaatacaca gctagcaaga	4620
aaggtaaatg tgcagtacat tcatgacca acgccgttac cattcgagaa gccgacgtag	4680
aagtagaggg gaactcccag ctgcaaatac ctttctcaac agccctggca agcgccgagt	4740
ttcgcgtgca agtgtgtcc acacaagtac actgcgcagc cgcatgccac cctccaaagg	4800
accacatagt caattaccca gcatcacaca ccacccttg ggtccaggat atatccaaa	4860
cggcaatgtc ttgggtgcag aagattacgg gaggagtagg attaattgtt gctgttctg	4920
ccttaatttt aattgtgtg ctatgcgtgt cgtttagcag gcactaagga tctagatctg	4980
ctgtgccttc tagttgccag ccactgttg ttggccctc ccccgtcct tccttgacct	5040
tggaagggtc cactcccact gtcctttcct aataaaatga ggaaattgca tcgcattgtc	5100
tgagtaggtg tcattctatt ctgggggtg ggtggggca ggacagcaag ggggaggatt	5160
gggaagacaa tagcaggcat gctgggatg cggtgggctc tatgggtacc caggtgctga	5220
agaattgacc cgttctctc tgggccagaa agaagcaggc acatccctt ctctgtgaca	5280

caccctgtcc acgccccctgg ttcitagtcc cagccccact cataggacac tcatagctca	5340
ggagggctcc gccttcaatc ccacccgcta aagtacttgg agcggctctt ccttcctca	5400
tcagcccacc aaaccaaacc tagcctccaa gagtgggaag aaattaaagc aagataggct	5460
attaagtga gagggagaga aaatgcctcc aacatgtgag gaagtaatga gagaaatcat	5520
agaattttaa ggccatgatt taaggccatc atggcctaag cttgaaagga gataggatca	5580
aagcttggcg taatcatggt catagctgtt tccgtgtga aattgttacc cgctcacaat	5640
tccacacaac atacgagccg gaagcataaa gtgtaaagcc tggggtgcct aatgagtga	5700
ctaactcaca ttaattgcgt tgcgtcact gcccgcttc cagtcggga accgtgcgt	5760
ccagctgcat taatgaatcg gccaacgcgc ggggagaggc ggtttgcgt tgggcgctc	5820
ttccgcttc tgcgtcactg actcgtcgc ctcggctgtt cggctcggc gagcggatc	5880
agctcactca aaggcggtaa tacggttacc cacagaatca ggggataac caggaaagaa	5940
catgtgagca aaaggccagc aaaaggccag gaaccgtaaa aaggccgcgt tgctggcgtt	6000
tttccatagg ctccgcccc ctgacgagca tcacaaaaat cgacgtcaa gtcagaggcg	6060
gcgaaacccg acaggactat aaagatacca ggcgtttccc cctggaagct cctcgtgcg	6120
ctctcctgtt ccgaccctgc cgcttaccg atacctgtcc gcctttctcc cttcgggaag	6180
cgtggcgctt tctcatagct cagctgttag gttatcagt tcggtgtagg tcgttcgctc	6240
caagctgggc tgtgtgcag aacccccgt tcagcccgac cgtcgcct tatccgtaa	6300
ctatcgtctt gattccaacc cgtaagaca cgacttatcg ccactggcag cagccactgg	6360
taacaggatt agcagagcga ggtatgtagg cggctgtaca gatttctga agtggtgcc	6420
taactacggc tacactagaa gaacagtatt tggatctgc gctctgtga agccagttac	6480
cttcggaaaa agatttgga gctcttgatc cggcaaaaa accaccgtg gtagcggtag	6540
ttttttgtt tgcaagcagc agattacgc cagaaaaaa ggaatcctaa aagatcctt	6600
gatctttct acggggtcgt acgctcagt gaacgaaaac tcacgttaag ggattttgt	6660
catgagaita tcaaaaagga tcttcacct gatcctttta aattaaaaat gaagttttaa	6720

atcaatctaa agtatataig agtaaacttg gtctgacagt taccaatgct taatcagtga	6780
ggcacctatc tcagcgatct gtctatttcg ttcatccata gtigcctgac tccccgtcgt	6840
gtagataact acgatacggg agggccttacc atctggcccc agtgctgcaa tgataccgcg	6900
agaaccacgc tcaccggctc cagatttatc agcaataaac cagccagccg gaagggccga	6960
gcgcagaagt ggtcctgcaa ctttatccgc ctccatccag tctattaatt gtigccggga	7020
agctagagta agtagttcgc cagttaatag ttgcgcaac gtigtgtcca ttgctacagg	7080
catcgtggtg tcacgctcgt cgtttggtat ggcttcattc agctccggtt cccaacgatc	7140
aaggcgagtt acatgatccc ccatgttgtg caaaaaagcg gttagctcct tcggtcctcc	7200
gatcgttgtc agaagtaagt tggccgcagt gttatcactc atggttatgg cagcactgca	7260
taattctctt actgtcatgc catccgtaag atgcttttct gtgactggtg agtactcaac	7320
caagtcattc tgagaatagt gtatgcggcg accgagttgc tcttccccgg cgtcaatagc	7380
ggataatacc gcgccacata gcagaacttt aaaagtgtc atcattggaa aacgttcttc	7440
ggggcgaaaa ctctcaagga tcttaccgct gttgagatcc agttcgatgt aaccactcg	7500
tgcacccaac tgatcttcag catcttttac ttccaccagc gttcttgggt gagcaaaaac	7560
aggaaggcaa aatgccgcaa aaaagggaat aaggcgaca cggaaatgtt gaatactcat	7620
actcttctt ttcaatatt attgaagcat ttatcagggt tattgtctca tgagcggata	7680
catatttgaa tgtatttaga aaaataaaca aataggggtt ccgcgcacat ttccccgaaa	7740
agtccacct gacgtctaag aaaccattat tatcatgaca ttaacctata aaaataggcg	7800
tatcacgagg ccctttcggg tcgcgcgttt cggtagtac ggtgaaaacc tctgacacat	7860
gcagctcccc ttgacggica cagcttgtct gtaagcggat gccgggagca gacaagcccc	7920
tcaggcgcg tcagcgggtg ttggcgggtg tcgggctgg cttactatg cggcatcaga	7980
gcagattgta ctgagagtgc accataaaat tgtaaacgtt aatattttgt taaaattcgc	8040
gttaaatttt tgttaaata gtcattttt taaccaatag gccgaaatcg gcaaaatccc	8100
ttataaatca aaagaatagc ccgagatagg gttgagtgtt gtccagttt ggaacaagag	8160
tccactatta aagaacgtgg actccaacgt caaaggcgca aaaaccgtct atcaggcgca	8220

tggcccacta cgtgaacat caccctaaatc aagttttttg gggtcgaggt gccgtaaagc	8280
actaaatcgg aaccctaaag ggagcccccg atttagagct tgacggggaa agccggcgaa	8340
cgtggcgaga aaggaaggga agaaagcgaa aggagcgggc gctagggcgc tggcaagtgt	8400
agcggtcacg ctgcgcgtaa ccaccacacc cgccgcgctt aatgcgccgc tacagggcgc	8460
gtactatggt tgctttgacg tatgcggtgt gaaataccgc acagatgcgt aaggagaaaa	8520
taccgcatca ggcgccattc gccattcagg ctgcgcaact gttgggaagg gcgatcggtg	8580
cgggcctctt cgctattacg ccagctggcg aaaggggat gtgctgcaag gcgattaagt	8640
tgggtaacgc cagggttttc ccagtcacga cgttgtaaaa cgacggccag tgaattccat	8700
ggtctcaact ttc	8713

<210> 30
 <211> 4059
 <212> DNA
 <213> Artificial

<220>

<223> VLP78_11 (CHI VLP 532 NPNAx25) CHIKV-NPNAx25 sequence only

<400> 30

atggagtca tcccgacgca aactttctat aacagaaggt accaaccctg accctgggcc	60
ccacgcccta caattcaagt aattagacct agaccacgtc cacagaggca ggctgggcaa	120
ctcgcccagc tgatctccgc agtcaacaaa ttgacatgc gcgcggtacc tcaacagaag	180
cctcgcagaa atcggaacaa caagaagcaa aggcagaaga agcaggcgcc gcaaacgac	240
ccaaagcaaa agaagcaacc accacaaaag aagccggctc aaaagaagaa gaaaccaggc	300
cgtagggaga gaatgtgcat gaaaattgaa aatgattgca tcttcgaagt caagcatgaa	360
ggcaaagtga tgggctacgc atgcctgggtg ggggataaag taatgaaacc agcacatgtg	420
aagggaacta tcgacaatgc cgatctggct aaactggcct ttaagcggtc gtctaaatac	480
gatcttgaat gtgcacagat accgggtgcac atgaagtctg atgcctcgaa gtttaccac	540
gagaaacccg aggggtacta taactggcat cacggagcag tgcagtattc aggaggccgg	600

ttcactatcc cgacgggtgc aggcaagccg ggagacagcg gcagaccgat cttcgacaac	660
aaaggacggg tggiggccat cgtcctagga ggggccaacg aagggtcccg cacggccctc	720
tccgtggtga cgtggaacaa agacatcgic aaaaaaatta cccctgaggg agccgaagag	780
tggagcctcg ccttcccgtt cttgtgcctg ttggcaaaca ctacattccc ctgctctcag	840
cgccttgca caccctgtg ctacgaaaag gaaccggaaa gcaccttgcg catgcttgag	900
gacaacgtga tgagaccggg atactaccag ctactaaaag catcgctgac ttgctctccc	960
caccgccaaa gacgcagtac taaggacaat tttaatgtct ataaagccac aagaccatat	1020
ctagctcatt gtctgactg cggagaaggg cattcgtgcc acagccctat cgcattggag	1080
cgcctcagaa atgaagcaac ggacggaacg ctgaaaatcc aggtctcttt gcagatcggg	1140
ataaagacag atgacagcca cgattggacc aagctgcgct atatggatag ccatacgcca	1200
gcggacgcgg agcgagccgg attgcttgta aggacttcag caccgtgcac gatcaccggg	1260
accatgggac actttattct cggccgatgc ccgaaaggag agacgctgac agtgggattt	1320
acggacagca gaaagatcag ccacacatgc acacaccctg tccatcatga accacctgtg	1380
ataggtaggg agagggtcca ctctcgacca caacatggta aagagttacc ttgcagcagc	1440
tacgtgcaga gcaccgctgc cactgctgag gagatagagg tgcatatgcc ccagatact	1500
cctgaccgca cgtgatgac gcagcagttt ggcaacgtga agatcacagt taatgggcag	1560
acggtgcggt acaagtgcaa ctgcggtggc tccggaggaa acccgaatgc caatcccaac	1620
gcgaacccca acgctaacc caacgccaat ccgaatgcaa acccgaacgt tgacccaaac	1680
gccaaaccga atgccaatcc caacgcgaac cccaatgcta acccaaatgc caacccaaac	1740
gccaaaccca acgctaattc aaacgccaac cctaacgcca atcccaacgc gaatcctaac	1800
gctaataccca acgcaaatcc caatgctaac ccgaacgcga accctaatgc aaacccaaac	1860
gccaaaccga acgctaacc gaacgctaac cccaacgccc gtggatccaa cgagggactg	1920
acaaccacag acaaagtgat caataactgc aaaattgatc agtgccatgc tgcagtcact	1980
aatcacaaga attggcaata caactcccct ttagtccgcg gcaacgctga actcggggac	2040
cgtaaaggaa agatccacat cccattccca ttggcaaacg tgacttgtag agtgccaaaa	2100

gcaagaaacc ctacagtaac ttacggaaaa aaccaagtca ccatgctgct gtatcctgac	2160
catccgacac tcttgtctta ccgtaacatg ggacaggaac caaattacca cgaggagtgg	2220
gtgacacaca agaaggaggt taccttgacc gtgcctactg agggctctgga ggtcacttgg	2280
ggcaacaacg aaccatacaa gtactggccg cagatgtcta cgaacggtag tgctcatggt	2340
caccacatg agataatctt gtactattat gagctgtacc ccactatgac tgtagtcat	2400
gtgtcggtag cctcgttcgt gcttctgtcg atggtgggca cagcagtggg aatgtgtgtg	2460
tgcgcacggc gcagatgcat tacaccatat gaattaacac caggagccac tgttcccttc	2520
ctgctcagcc tgctatgctg cgtcagaacg accaaggcgg ccacatatta cgaggctgcg	2580
gcatacttat ggaacgaaca gcagcccctg ttctggttgc aggtctttat cccgctggcc	2640
gccttgatcg tcctgtgcaa ctgtctgaaa ctcttgccat gctgctgtaa gaccctggct	2700
tttttagccg taatgagcat cggtgccac actgtgagcg cgtacgaaca cgtaacagtg	2760
atcccgaaca cggtgaggag accgtataag actcttgtca acagaccggg ttacagcccc	2820
atggtgttgg agatggagct acaatcagtc accttggaa caacactgtc acttgactac	2880
atcacgtcgg agtacaaaac tgcatacccc tcccgtacg tgaagtgtg tggtagagca	2940
gagtgaagg acaagagcct accagactac agctgcaagg tctttactgg agtctaccca	3000
tttatgtggg gcggcgcccta ctgcttttgc gacgccgaaa atacgcaatt gagcgaggca	3060
catgtagaga aatctgaatc ttgcaaaaca gagtttgcac cggcctacag agccccacac	3120
gcatcggcgt cggcgaagct ccgcgtcctt taccaaggaa acaacattac cgtagctgcc	3180
tacgctaacg gtgaccatgc cgtcacagta aaggacgcca agtttgtcgt gggcccaatg	3240
tcctccgcct ggacaccttt tgacaacaaa atcgtgggtg acaaaggcga cgtctacaac	3300
atggactacc caccttttgg cgcaggaaga ccaggacaat ttggtgacat tcaaagtcgt	3360
acaccggaag gtaaagacgt ttatgccaac actcagttgg tactacagag gccagcagca	3420
ggcacggtac atgtaccata ctctcaggca ccatctggct tcaagtattg gctgaaggaa	3480
cgaggagcat cgctacagca cacggcacccg ttcggttgcc agattgcgac aaacccggt	3540

```

agagctgtaa attgcgtgt ggggaacata ccaatttcca tcgacatacc ggatgcggcc 3600
tttactaggg ttgtcgatgc accctctgta acggacatgt catgcgaagt accagcctgc 3660
actcactcct ccgactttgg gggcgtcgcc atcatcaaat acacagctag caagaaaggt 3720
aaatgtgcag tacattcgat gaccaacgcc gttaccattc gagaagccga cgtagaagta 3780
gaggggaact cccagctgca aataiccttc tcaacagccc tggcaagcgc cgagtttcgc 3840
gtgcaagtgt gctccacaca agtacactgc gcagccgcat gccaccctcc aaaggaccac 3900
atagtcaatt acccagcatc acacaccacc cttggggctc aggatataac cacaacggca 3960
atgtcttggg tgcagaagat tacgggagga gtaggattaa ttgttgctgt tgctgcctta 4020
attttaattg tggctctatg cgtgtcgttt agcaggcac 4059

```

<210> 31
 <211> 1353
 <212> PRT
 <213> Artificial

<220>
 <223> VLP78_11 (CHI VLP 532 NPNAx25) amino acid sequence

<400> 31

```

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
1           5           10          15

```

```

Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro
20           25          30

```

```

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
35           40          45

```

```

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
50           55          60

```

```

Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp
65           70          75          80

```

```

Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys
85           90          95

```

```

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
100          105         110

```

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys
 115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
 130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
 145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
 165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
 180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
 195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
 210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
 225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
 245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala
 260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
 275 280 285

Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met
 290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro
 305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
 325 330 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
 340 345 350

Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
 355 360 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp
370 375 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro
385 390 395 400

Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys
405 410 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
420 425 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His
435 440 445

Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu
450 455 460

Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr
465 470 475 480

Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met
485 490 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn
500 505 510

Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys
515 520 525

Gly Gly Ser Gly Gly Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn
530 535 540

Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Val Asp Pro Asn
545 550 555 560

Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn
565 570 575

Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn
580 585 590

Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn
595 600 605

Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn
610 615 620

Ala Asn Pro Asn Ala Asn Pro Asn Ala Gly Gly Ser Asn Glu Gly Leu

625	630	635	640
Thr Thr Thr Asp Lys Val Ile Asn Asn Cys Lys Ile Asp Gln Cys His	645	650	655
Ala Ala Val Thr Asn His Lys Asn Trp Gln Tyr Asn Ser Pro Leu Val	660	665	670
Pro Arg Asn Ala Glu Leu Gly Asp Arg Lys Gly Lys Ile His Ile Pro	675	680	685
Phe Pro Leu Ala Asn Val Thr Cys Arg Val Pro Lys Ala Arg Asn Pro	690	695	700
Thr Val Thr Tyr Gly Lys Asn Gln Val Thr Met Leu Leu Tyr Pro Asp	705	710	715
His Pro Thr Leu Leu Ser Tyr Arg Asn Met Gly Gln Glu Pro Asn Tyr	725	730	735
His Glu Glu Trp Val Thr His Lys Lys Glu Val Thr Leu Thr Val Pro	740	745	750
Thr Glu Gly Leu Glu Val Thr Trp Gly Asn Asn Glu Pro Tyr Lys Tyr	755	760	765
Trp Pro Gln Met Ser Thr Asn Gly Thr Ala His Gly His Pro His Glu	770	775	780
Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr Pro Thr Met Thr Val Val Ile	785	790	795
Val Ser Val Ala Ser Phe Val Leu Leu Ser Met Val Gly Thr Ala Val	805	810	815
Gly Met Cys Val Cys Ala Arg Arg Arg Cys Ile Thr Pro Tyr Glu Leu	820	825	830
Thr Pro Gly Ala Thr Val Pro Phe Leu Leu Ser Leu Leu Cys Cys Val	835	840	845
Arg Thr Thr Lys Ala Ala Thr Tyr Tyr Glu Ala Ala Ala Tyr Leu Trp	850	855	860
Asn Glu Gln Gln Pro Leu Phe Trp Leu Gln Ala Leu Ile Pro Leu Ala	865	870	875
Ala Leu Ile Val Leu Cys Asn Cys Leu Lys Leu Leu Pro Cys Cys Cys	885	890	895

Lys Thr Leu Ala Phe Leu Ala Val Met Ser Ile Gly Ala His Thr Val
 900 905 910

Ser Ala Tyr Glu His Val Thr Val Ile Pro Asn Thr Val Gly Val Pro
 915 920 925

Tyr Lys Thr Leu Val Asn Arg Pro Gly Tyr Ser Pro Met Val Leu Glu
 930 935 940

Met Glu Leu Gln Ser Val Thr Leu Glu Pro Thr Leu Ser Leu Asp Tyr
 945 950 955 960

Ile Thr Cys Glu Tyr Lys Thr Val Ile Pro Ser Pro Tyr Val Lys Cys
 965 970 975

Cys Gly Thr Ala Glu Cys Lys Asp Lys Ser Leu Pro Asp Tyr Ser Cys
 980 985 990

Lys Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys
 995 1000 1005

Phe Cys Asp Ala Glu Asn Thr Gln Leu Ser Glu Ala His Val Glu
 1010 1015 1020

Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala Ser Ala Tyr Arg Ala
 1025 1030 1035

His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val Leu Tyr Gln Gly
 1040 1045 1050

Asn Asn Ile Thr Val Ala Ala Tyr Ala Asn Gly Asp His Ala Val
 1055 1060 1065

Thr Val Lys Asp Ala Lys Phe Val Val Gly Pro Met Ser Ser Ala
 1070 1075 1080

Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp Val
 1085 1090 1095

Tyr Asn Met Asp Tyr Pro Pro Phe Gly Ala Gly Arg Pro Gly Gln
 1100 1105 1110

Phe Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser Lys Asp Val Tyr
 1115 1120 1125

Ala Asn Thr Gln Leu Val Leu Gln Arg Pro Ala Ala Gly Thr Val
 1130 1135 1140

His Val	Pro Tyr Ser Gln Ala	Pro Ser Gly Phe Lys	Tyr Trp Leu
1145	1150	1155	
Lys Glu	Arg Gly Ala Ser Leu	Gln His Thr Ala Pro	Phe Gly Cys
1160	1165	1170	
Gln Ile	Ala Thr Asn Pro Val	Arg Ala Val Asn Cys	Ala Val Gly
1175	1180	1185	
Asn Ile	Pro Ile Ser Ile Asp	Ile Pro Asp Ala Ala	Phe Thr Arg
1190	1195	1200	
Val Val	Asp Ala Pro Ser Val	Thr Asp Met Ser Cys	Glu Val Pro
1205	1210	1215	
Ala Cys	Thr His Ser Ser Asp	Phe Gly Gly Val Ala	Ile Ile Lys
1220	1225	1230	
Tyr Thr	Ala Ser Lys Lys Gly	Lys Cys Ala Val His	Ser Met Thr
1235	1240	1245	
Asn Ala	Val Thr Ile Arg Glu	Ala Asp Val Glu Val	Glu Gly Asn
1250	1255	1260	
Ser Gln	Leu Gln Ile Ser Phe	Ser Thr Ala Leu Ala	Ser Ala Glu
1265	1270	1275	
Phe Arg	Val Gln Val Cys Ser	Thr Gln Val His Cys	Ala Ala Ala
1280	1285	1290	
Cys His	Pro Pro Lys Asp His	Ile Val Asn Tyr Pro	Ala Ser His
1295	1300	1305	
Thr Thr	Leu Gly Val Gln Asp	Ile Ser Thr Thr Ala	Met Ser Trp
1310	1315	1320	
Val Gln	Lys Ile Thr Gly Gly	Val Gly Leu Ile Val	Ala Val Ala
1325	1330	1335	
Ala Leu	Ile Leu Ile Val Val	Leu Cys Val Ser Phe	Ser Arg His
1340	1345	1350	

<210> 32
 <211> 8737
 <212> DNA
 <213> Artificial

<220>

<223> VLP78_21 (VEEV VLP 519 NPNAx25) whole sequence

<400> 32

gaattcccat tgcatacgtt gtatccatat cataatatgt acatttatat tggctcatgt	60
ccaacattac cgccatgttg acattgatta ttgactagtt attaatagta atcaattacg	120
gggtcattag ttcataagccc atataaggag ttccgcgtta cataacttac ggtaaattggc	180
ccgcctggct gaccgcccac cgacccccgc ccattgacgt caataatgac gtatgttccc	240
atagtaacgc caatagggac ttccattga cgtcaatggg tggagtattt acggtaaact	300
gcccacttgg cagtacatca agtgtatcat atgccaagta cgccccctat tgacgtcaat	360
gacggtaaat ggccccctg gcattatgcc cagtacatga ccttatggga ctttctact	420
tggcagtaca tctacgtatt agtcatcgct attaccatgg tgatgcggtt ttggcagtac	480
atcaatgggc gtggatagcg gtttgactca cggggatttc caagtctcca cccattgac	540
gtcaatggga gtttgtttg gcacaaaaat caacgggact ttccaaaatg tcgtaacaac	600
tccgccccat tgacgcaaat gggcggtagg cgtgtacggt gggaggctta tataagcaga	660
gtcgttttag tgaaccgtca gatcgcttg agacgccatc cagctgttt tgacctccat	720
agaagacacc gggaccgatc cagcctccgt taacgggtga gggcagtgtg gtcigagcag	780
tactcgttgc tgccgcgcgc gccaccagac ataatagctg acagactaac agactgttcc	840
tttccatggg tcttttctgc agtcaccgtc gtcgacacgt gtgatcagat atcgcgccgc	900
ccaccatgtt ccggttccag ccaatgtatc cgatgcagcc aatgccctat cgcaaccgt	960
tcgcggcccc gcgcaggccc tggttccca gaaccgaccc ttttctggcg atgcaggtgc	1020
aggaattaac ccgctcgatg gctaacctga cgttcaagca acgcccggac gcgccacctg	1080
aggggccatc cgctaataaa ccgaagaagg aggcctcgca aaaacagaaa gggggaggcc	1140
aagggaagaa gaagaagaac caagggaaga agaaggctaa gacagggccg cctaattcga	1200
aggcacagaa tggaaacaag aagaagacca acaagaaacc aggcaagaga cagcgcatgg	1260
tcatgaaatt ggaatctgac aagacgttcc caatcatgtt ggaagggaag ataaacggct	1320
acgcttgtgt ggtcggaggg aagttattca ggccgatgca tgtggaaggc aagatcgaca	1380

acgacgttct ggccgcgctt aagacgaaga aagcatccaa atacgatctt gagtatgcag	1440
atgtgccaca gaacatgcgg gccgatacat tcaaatacac ccatgagaaa cccaaggct	1500
attacagctg gcatcatgga gcagtcgaat atgaaaatgg gcgtttcacg gtgccgaaag	1560
gagttggggc caaggagac agcggacgac ccattctgga taaccaggga cgggtggtcg	1620
ctattgtgct gggagggttg aatgaaggat ctaggacagc cctttcagtc gtcattgga	1680
acgagaaggg agttaccgtg aagtatactc cagagaactg cgagcaatgg tcactagtga	1740
ccaccatgtg tctgctcgcc aatgtgacgt tcccatgtgc tcaaccacca attgctacg	1800
acagaaaacc agcagagact ttggccatgc tcagcggtta cgttgacaac ccgggctacg	1860
atgagctgct ggaagcagct gttaagtgcc ccggaaggaa aaggagatcc accgaggagc	1920
tgtttaatga gtataagcta acgcgccctt acatggccag atgcatcaga tgtgcagttg	1980
ggagctgcc tagtccaata gcaatcgagg cagtaaagag cgacgggcac gacggttatg	2040
ttagacttca gacttcctcg cagtatggcc tggattcctc cggcaactta aagggcagga	2100
ccatgcggta tgacatgcac gggaccatta aagagatacc actacatcaa gtgtcactct	2160
atacatctcg ccggtgtcac attgtggatg ggcacggtta ttctctgctt gccaggtgcc	2220
cggcagggga ctccatcacc atggaattta agaaagattc cgtcagacac tctgtctcgg	2280
tgccgtatga agtgaattt aatcctgtag gcagagaact ctatactcat ccccagaaac	2340
acggagtaga gcaagcgtgc caagtctacg cacatgatgc acagaacaga ggagcttatg	2400
tcgagatgca cctcccgggc tcagaagtgg acagcagttt ggtttccttg agcggcagtt	2460
ccggaggaaa ccggaatgcc aatccaacg cgaaccccaa cgctaaccac aacgccaatc	2520
cgaatgcaaa ccggaacgtt gacccaaacg ccaaccgaa tgccaatccc aacggaacc	2580
ccaatgctaa cccaatgcc aacccaaacg ccaaccccaa cgctaatacca aacgccaacc	2640
ctaacgcaa tccaacgcg aatcctaacg ctaatcccaa cgcaaatccc aatgctaatac	2700
cgaacgcgaa ccctaatacga aaccccaacg ccaaccgaa cgctaaccg aacgctaatac	2760
ccaacgccgg tggatcctca gtcaccgtga cacctcctga tgggactagc gccctgggtg	2820
aatgcgagtg tggcggcaca aagatctccg agaccatcaa caagacaaaa cagttcagcc	2880

agtgacaaaa gaaggagcag tgcagagcat atcggctgca gaacgataag tgggtgtata	2940
attctgacaa actgccccaa gcagcgggag ccaccttaaa aggaaaactg catgtcccat	3000
tcttgctggc agacggcaaa tgcaccgtgc ctctagcacc agaacctatg ataaccttcg	3060
gtttcagatc agtgtcactg aaactgcacc ctaagaatcc cacatatcta atcacccgcc	3120
aacttgctga tgagcctcac tacacgcacg agctcatatc tgaaccagct gttaggaatt	3180
ttaccgtcac cgaaaaaggg tgggagtttg tatggggaaa ccacccgccg aaaaggtttt	3240
gggcacagga aacagcaccg ggaaatccac atgggctacc gcacgaggtg ataactcatt	3300
attaccacag ataccctatg tccaccatcc tgggtttgtc aatttgtgcc gccattgcaa	3360
ccgtttccgt tgcagcgtct acctggctgt ttgacagatc aagagttgcg tgcctaactc	3420
cttaccggct aacacctaac gctaggatac cttttgtct ggctgtgctt tgcgtcgccc	3480
gcactgcccc ggccgagacc acctgggagt ccttggatca cctatggaac aataaccaac	3540
agatgttctg gattcaattg ctgatccctc tggccgcctt gatcgtagtg actcgctgc	3600
tcaggtgcgt gtgctgtgtc gtgccitttt tagtcatggc cggcgccgca ggcgcccgcg	3660
cctacgagca cgcgaccacg atgccgagcc aagcgggaat ctggtataac actatagtca	3720
acagagcagg ctacgcacca ctccctatca gcataacacc aacaaagatc aagctgatac	3780
ctacagtga cttggagtac gtcacctgcc actacaaaac aggaatggat tcaccagcca	3840
tcaaattgtc cggatctcag gaatgcactc caacttacag gcctgatgaa cagtgcaaag	3900
tcttcacagg ggtttacccg ttcattgtgg gtgggtcata ttgcttttgc gacactgaga	3960
acaccaagt cagcaaggcc tacgtaatga aatctgacga ctgccttgcg gatcatgctg	4020
aagcatataa agcgcacaca gccctagtc aggcgttcct caacatcaca gtgggagaac	4080
actctattgt gactaccgtg tatgtgaatg gagaaactcc tgtgaatttc aatggggtca	4140
aaataactgc aggtccgctt tccacagctt ggacaccctt tgatcgcaaa atcgtgcagt	4200
atgccgggga gatctataat tatgattttc ctgagtatgg ggcaggacaa ccaggagcat	4260
ttggagatat acaatccaga acagtctcaa gctctgatct gtatgccaat accaacctag	4320

tgctgcagag acccaaagca ggagcgatcc acgtgccata cactcaggca ccttcgggtt	4380
ttgagcaatg gaagaaagat aaagctccat catigaaatt taccgcccct ttcggatgcg	4440
aaatatatac aaaccccatt cgcgccgaaa actgtgctgt agggtaatt ccattagcct	4500
ttgacattcc cgacgccttg ttcaccaggg tgcagaaac accgacactt tcagcgcccg	4560
aatgcactct taacgagtgc gtgtattctt ccgactttgg tgggatcgcc acggtcaagt	4620
actcgccag caagtcaggc aagtgcgcag tccatgtgcc atcaggagct gctaccctaa	4680
aagaagcagc agtcgagcta accgagcaag ggtcggcgac tatccatttc tcgaccgcaa	4740
atatccaccc ggagttcagg ctccaaatat gcacatcata tgttacgtgc aaaggtgatt	4800
gtcaccccc gaaagaccat attgtgacac accctcagta tcacgcccac acatttacag	4860
ccgcggtgtc aaaaaccgcg tggacgtggt taacatccct gctgggagga tcagccgtaa	4920
ttattataat tggcttggtg ctggctacta ttgtggccat gtacgtgctg accaaccaga	4980
aacataatta aggatctaga tctgctgtgc ctctagttg ccagccatct gttgtttgcc	5040
cctccccgt gccttccttg accctggaag gtgccactcc cactgtcctt tcctaataaa	5100
atgaggaaat tgcacgcacat tgtctgagta ggtgtcattc tattctgggg ggtggggtgg	5160
ggcaggacag caagggggag gattgggaag acaatagcag gcacgtggg gatgcggtgg	5220
gctctatggg taccagggtg ctgaagaatt gaccgggttc ctctgggcc agaaagaagc	5280
aggcacatcc ctttctctgt gacacaccct gtccacgccc ctggttctta gttccagccc	5340
cactcatagg acactcatag ctccaggagg ctccgccttc aatcccaccc gctaaagtac	5400
ttggagcggc ctctccctcc ctcatcagcc caccaaacca aacctagcct ccaagagtgg	5460
gaagaaatta aagcaagata ggctattaag tgcagaggga gagaaaatgc ctccaacatg	5520
tgaggaagta atgagagaaa tcatagaatt ttaaggccat gatttaaggc catcatggcc	5580
taagcttgaa aggagatagg atcaaagctt ggcgtaatca tggcatagc tgttctctgt	5640
gtgaaattgt tatccgctca caattccaca caacatacga gccggaagca taaagtgtaa	5700
agcctggggc gcctaattgag tgagctaact cacattaatt gcgttgcgt cactgcccgc	5760
tttccagtcg ggaaacctgt cgtgccagct gcattaatga atcgccaac gcgcggggag	5820

aggcggtttg cgtattgggc gctcttccgc ttcctcgcctc actgactcgc tgcgctcgg	5880
cgttcggctg cggcgagcgg tatcagctca ctcaaaggcg gtaatacggg tatccacaga	5940
atcaggggat aacgcaggaa agaacatgtg agcaaaaggc cagcaaaagg ccaggaaccg	6000
taaaaaggcc gcgttgctgg cgtttttcca taggctccgc cccctgacg agcatcacia	6060
aaatcgacgc tcaagtcaga ggtggcgaaa cccgacagga ctataaagat accaggcggt	6120
tccccctgga agctccctcg tgcgctctcc tgttccgacc ctgccgctta ccggatacct	6180
gtccgccttt ctcccttcgg gaagcgtggc gctttctcat agctcacgct gtaggtatct	6240
cagttcggtg taggtcggtc gctccaagct gggctgtgtg cacgaacccc ccgttcagcc	6300
cgaccgctgc gccttatccg gtaactatcg tcttgagtc aaccggtaa gacacgactt	6360
atgccactg gcagcagcca ctggtaacag gattagcaga gcgaggtatg taggcggtgc	6420
tacagagttc ttgaagtggg ggcctaacta cggctacact agaagaacag tatttggtat	6480
ctgcgctctg ctgaagccag ttaccttcgg aaaaagagtt ggtagctctt gatccggcaa	6540
acaaaccacc gctggtagcg gtggtttttt tgtttgcaag cagcagatta cgcgcagaaa	6600
aaaaggatct caagaagatc ctttgatctt ttctacgggg tctgacgctc agtggaacga	6660
aaactcacgt taagggattt tggatcatgag attatcaaaa aggatcttca cctagatcct	6720
tttaaattaa aaatgaagtt ttaaataaat ctaaagtata tatgagtaaa ctgtgtctga	6780
cagttaccaa tgcttaatca gtgaggcacc tatctcagcg atctgtctat ttcgttcac	6840
catagttgcc tgactccccg tcgtgtagat aactacgata cgggagggct taccatctgg	6900
ccccagtgt gcaatgatac cgcgagaacc acgctcacgg gctccagatt tatcagcaat	6960
aaaccagcca gccggaaggc cggagcgag aagtggctct gcaactttat ccgcctccat	7020
ccagtctatt aattgttgcc gggaagctag agtaagtagt tcgccagtta atagtttgcg	7080
caacgttgtt gccattgcta caggcatcgt ggtgtcacgc tcgtcgtttg gtatggcttc	7140
attcagctcc ggttcccaac gatcaaggcg agttacatga tccccatgt tgtgcaaaaa	7200
agcggttagc tccttcggtc ctccgacgt tgtcagaagt aagtggccg cagtgttatc	7260

actcatggtt atggcagcac tgcataattc tcttactgtc atgcatccg taagatgctt	7320
ttctgtgact ggtgagtact caaccaagtc attctgagaa tagtgtatgc ggcgaccgag	7380
ttgctcttgc ccggcgtaaa tacgggataa taccgcgcca catagcagaa ctttaaaagt	7440
gctcatcatt ggaaaacgtt cttcggggcg aaaactctca aggatcttac cgctgttgag	7500
atccagttcg atgtaacca ctcgtgcacc caactgatct tcagcatctt ttactttcac	7560
cagcgtttct gggtagcaaa aaacaggaag gcaaaatgcc gcaaaaaagg gaataagggc	7620
gacacggaaa tgttgaatac tcatactctt cctttttcaa tattattgaa gcatttatca	7680
gggttattgt ctcatgagcg gatacatatt tgaatgtatt tagaaaaata acaaatagg	7740
ggttcgcgc acatttcccc gaaaagtccc acctgacgtc taagaaacca ttattatcat	7800
gacattaacc tataaaaaata ggcgtatcac gaggcccttt cgggtcgcgc gtttcgggtga	7860
tgacggtgaa aacctctgac acatgcagct cccgttgacg gtcacagctt gtcgtgaagc	7920
ggatgccggg agcagacaag cccgtcaggc cgcctcagcg ggtgttgccg ggtgtcgggg	7980
ctggcctaac tatgcggcat cagagcagat tgtactgaga gtgcaccata aaattgtaaa	8040
cgtaaatatt ttgttaaaat tcgcgttaaa tttttgttaa atcagctcat tttttaacca	8100
ataggccgaa atcgccaaaa tcccttataa atcaaaagaa tagcccgaga tagggttgag	8160
tgtttttcca gtttgaaca agagtccact attaaagaac gtggactcca acgtcaaagg	8220
gcgaaaaacc gtctatcagg gcgatggccc actacgtgaa ccatcaccca aatcaagttt	8280
tttggggtcg aggtgccgtt aagcactaaa tcggaaccct aaaggagcc cccgatttag	8340
agcttgacgg ggaaagccgg cgaacgtggc gagaagggaa gggaagaaag cgaaaggagc	8400
gggcgctagg gcgctggcaa gtgtagcggc cagcctgcgc gtaaccacca caccgcccgc	8460
gcctaatecg ccgctacagg gcgcgtacta tggttgcttt gacgtatgcg gtgtgaaata	8520
ccgcacagat gcgtaaggag aaaataccgc atcaggcgcc attcgccatt caggctgcgc	8580
aactgttggg aaggcgatc ggtgcgggcc tcttcgctat tacgccagct ggcgaaaggg	8640
ggatgtgctg caaggcgatt aagtgggta acgccagggt ttcccagtc acgacgttgt	8700
aaaacgacgg ccagtgaatt ccatggtctc aactttc	8737

<210> 33
 <211> 4086
 <212> DNA
 <213> Artificial

<220>

<223> VLP78_21 (VEEV VLP 519 NPNAx25) VEEV-NPNAx25 sequence only

<400> 33

atgttcccg	tccagccaat	gtatccgatg	cagccaatgc	cctatcgcaa	cccgttcgcg	60
gccccgcgc	ggccctggtt	ccccagaacc	gaccttttc	tggcgatgca	ggcgcaggaa	120
ttaaccgcgt	cgatggctaa	cctgacgttc	aagcaacgcc	gggacgcgcc	acctgagggg	180
ccatccgcta	ataaacgaa	gaaggaggcc	tcgcaaaaac	agaaaggggg	aggccaaggg	240
aagaagaaga	agaaccaagg	gaagaagaag	gctaagacag	ggccgcctaa	tccgaaggca	300
cagaatggaa	acaagaagaa	gaccaacaag	aaaccaggca	agagacagcg	catggtcatg	360
aaattggaat	ctgacaagac	gttccaatc	atgttggaag	ggaagataaa	cggctacgct	420
tgtgtggtcg	gaggggaagt	attcaggccg	atgcatgtgg	aaggcaagat	cgacaacgac	480
gttctggccg	cgcttaagac	gaagaaagca	tccaaatacg	atcttgagta	tgcagatgtg	540
ccacagaaca	tgcgggccga	tacattcaaa	tacacccaig	agaaacccca	aggctattac	600
agctggcaic	atggagcagt	ccaatatgaa	aatgggcgtt	tcacggtgcc	gaaaggagtt	660
ggggccaagg	gagacagcgg	acgaccatt	ctggataacc	aggacgggt	ggtcgtatt	720
gtgctgggag	gtgtgaatga	aggatctagg	acagcccttt	cagtcgtcat	gtggaacgag	780
aaggaggtta	ccgtgaagta	tactccagag	aactgcgagc	aatggtcact	agtgaccacc	840
atgtgtctgc	tcgccaatgt	gacgttccca	tgtgtcaac	caccaatttg	ctacgacaga	900
aaaccagcag	agactttggc	catgctcagc	gttaacgttg	acaacccggg	ctacgatgag	960
ctgctggaag	cagctgttaa	gtccccgga	aggaaaagga	gatccaccga	ggagctgttt	1020
aatgagtata	agctaacgcg	cccttacatg	gccagatgca	tcagatgtgc	agttgggagc	1080
tgccatagtc	caatagcaat	cgaggcagta	aagagcgacg	ggcacgacgg	ttatgttaga	1140

cttcagactt cctcgcagta tggcctggat tcctccggca acttaaaggg caggaccatg	1200
cggtatgaca tgcacgggac cattaaagag ataccactac atcaagtgtc actctataca	1260
tctcgcccggt gtcacatigt ggatgggcac ggttatttcc tgcctgccag gtgcccggca	1320
ggggactcca tcacatgga atttaagaaa gattccgtca gacactcctg ctcggtgccg	1380
tatgaagtga aatttaatcc tgtaggcaga gaactctata ctcatcccc agaacacgga	1440
gtagagcaag cgtgccaat ctacgcacat gatgcacaga acagaggagc ttatgtcgag	1500
atgcacctcc cgggctcaga agtggacagc agtttggtt ccttgagcgg cagttccgga	1560
ggaaacccga atgccaatcc caacgcgaac cccaacgcta accccaacgc caatccgaat	1620
gcaaacccga acgttgacct aaacgccaac ccgaatgcc aatccaacgc gaacccaat	1680
gctaaccxaa atgccaaacc aaacgccaac cccaacgcta atccaaacgc caaccctaac	1740
gccaatccca acgcgaatcc taacgcta at cccaacgcaa atcccaatgc taatccgaac	1800
gcgaacccta atgcaaacc caacgccaac ccgaacgcta acccgaacgc taatcccaac	1860
gccggtggat cctcagtcac cgtgacacct cctgatggga ctacgcctt ggtggaatgc	1920
gagtgtggcg gcacaaagat ctccgagacc atcaacaaga caaacagtt cagccagtgc	1980
acaaagaagg agcagtgcag agcatatcgg ctgcagaacg ataagtgggt gtataattct	2040
gacaaactgc ccaaagcagc gggagccacc ttaaaaggaa aactgcatgt cccattcttg	2100
ctggcagacg gcaaatgcac cgtgcctcta gcaccagaac ctatgataac cttcggtttc	2160
agatcagtgt cactgaaact gcaccctaag aatcccat atctaatac ccgccaactt	2220
gctgatgagc ctactacac gcacgagctc atatctgaac cagctgttag gaattttacc	2280
gtcaccgaaa aagggtggga gtttgtatgg ggaaaccacc cgcgaaaag gttttggca	2340
caggaaacag caccggaaa tccacatggg ctaccgcacg aggtgataac tcattattac	2400
cacagatacc ctatgtccac catcctgggt ttgtcaattt gtccgcat tgcaaccgtt	2460
tccgttgagc cgtctacctg gctgttttgc agatcaagag ttgcgtgcct aactccttac	2520
cggctaacac ctaacgctag gataccattt tgtctggctg tgccttgctg cgcgcgact	2580
gccccggccg agaccacctg ggagtccttg gatcacctat ggaacaataa ccaacagatg	2640

ttctggattc aatigctgat cccctcggcc gccttgatcg tagtgactcg cctgctcagg	2700
tgctgtgtgt gtgtcgtgcc ttttttagtc atggccggcg ccgcaggcgc cggcgcctac	2760
gagcacgcga ccacgatgcc gagccaagcg ggaatctcgt ataacactat agtcaacaga	2820
gcaggctacg caccactccc talcagcata acaccaacaa agatcaagct gatacctaca	2880
gtgaacttgg agtacgtcac ctgccactac aaaacaggaa tggattcacc agccatcaaa	2940
tgctgcggat ctcaggaatg cactccaact tacaggcctg atgaacagtg caaagtcttc	3000
acaggggttt acccgttcat gtgggtggt gcataatgct ttgcgacac tgagaacacc	3060
caagtcagca aggcctacgt aatgaaatct gacgactgcc ttgcggatca tgctgaagca	3120
tataaagcgc acacagcctc agtgcaggcg ttccitcaaca tcacagtggg agaacactct	3180
attgtgacta ccgtgtatgt gaatggagaa actcctgtga atttcaatgg ggtcaaaata	3240
actgcaggtc cgctttccac agcttggaca ccccttgatc gcaaaatcgt gcagtatgcc	3300
ggggagatct ataattatga ttttctgag tatggggcag gacaaccagg agcatttga	3360
gatatacaat ccagaacagt ctcaagctct gatctgtatg ccaataccaa cctagtgtg	3420
cagagaccca aagcaggagc gatccacgtg ccatacactc aggcaccttc gggttttgag	3480
caatggaaga aagataaagc tccatcattg aaatttaccg cccctttcgg atgcgaaata	3540
tatacaaacc ccattcgcgc cgaaaactgt gctgtagggt caattccatt agcctttgac	3600
attcccgacg ccttggtcac cagggtgtca gaaacaccga cactttcagc ggccgaatgc	3660
actcttaacg agtgcgtgta ttcttccgac ttgggtggga tcgccacggt caagtactcg	3720
gccagcaagt caggcaagtg cgcagtcctat gtgccatcag ggactgtctac cctaaaagaa	3780
gcagcagtcg agctaaccga gcaagggtcg gcgactatcc atttctcgac cgcaaatatc	3840
cacccggagt tcaggctcca aatatgcaca tcatatgtta cgtgcaaagg tgattgtcac	3900
ccccgaaag accatattgt gacacaccct cagtatcacg cccaaacatt tacagccgcg	3960
gtgtcaaaaa ccgcgtggac gtggttaaca tccctgctgg gaggatcagc cgtaatatt	4020
ataattggct tggctcggc tactattgtg gccatgtacg tctgaccaa ccagaaacat	4080

aattaa

4086

<210> 34
 <211> 1361
 <212> PRT
 <213> Artificial

<220>

<223> VLP78_21 (VEEV VLP 519 NPNx25) amino acid sequence

<400> 34

Met Phe Pro Phe Gln Pro Met Tyr Pro Met Gln Pro Met Pro Tyr Arg
 1 5 10 15

Asn Pro Phe Ala Ala Pro Arg Arg Pro Trp Phe Pro Arg Thr Asp Pro
 20 25 30

Phe Leu Ala Met Gln Val Gln Glu Leu Thr Arg Ser Met Ala Asn Leu
 35 40 45

Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Asn
 50 55 60

Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly
 65 70 75 80

Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro
 85 90 95

Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro
 100 105 110

Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe
 115 120 125

Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly
 130 135 140

Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp
 145 150 155 160

Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu
 165 170 175

Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr
 180 185 190

His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln
 195 200 205

Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly
 210 215 220

Asp Ser Gly Arg Pro Ile Leu Asp Asn Gln Gly Arg Val Val Ala Ile
 225 230 235 240

Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val
 245 250 255

Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys
 260 265 270

Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr
 275 280 285

Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu
 290 295 300

Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu
 305 310 315 320

Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr
 325 330 335

Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg
 340 345 350

Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu
 355 360 365

Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser
 370 375 380

Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met
 385 390 395 400

Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val
 405 410 415

Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr
 420 425 430

Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe
 435 440 445

Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys

450	455	460
Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly		
465	470	475 480
Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly		
	485	490 495
Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu		
	500	505 510
Val Ser Leu Ser Gly Ser Ser Gly Gly Asn Pro Asn Ala Asn Pro Asn		
	515	520 525
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
	530	535 540
Val Asp Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
	545	550 555 560
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
	565	570 575
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
	580	585 590
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
	595	600 605
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Gly Gly Ser		
	610	615 620
Ser Val Thr Val Thr Pro Pro Asp Gly Thr Ser Ala Leu Val Glu Cys		
	625	630 635 640
Glu Cys Gly Gly Thr Lys Ile Ser Glu Thr Ile Asn Lys Thr Lys Gln		
	645	650 655
Phe Ser Gln Cys Thr Lys Lys Glu Gln Cys Arg Ala Tyr Arg Leu Gln		
	660	665 670
Asn Asp Lys Trp Val Tyr Asn Ser Asp Lys Leu Pro Lys Ala Ala Gly		
	675	680 685
Ala Thr Leu Lys Gly Lys Leu His Val Pro Phe Leu Leu Ala Asp Gly		
	690	695 700
Lys Cys Thr Val Pro Leu Ala Pro Glu Pro Met Ile Thr Phe Gly Phe		
	705	710 715 720

Arg Ser Val Ser Leu Lys Leu His Pro Lys Asn Pro Thr Tyr Leu Ile
 725 730 735
 Thr Arg Gln Leu Ala Asp Glu Pro His Tyr Thr His Glu Leu Ile Ser
 740 745 750
 Glu Pro Ala Val Arg Asn Phe Thr Val Thr Glu Lys Gly Trp Glu Phe
 755 760 765
 Val Trp Gly Asn His Pro Pro Lys Arg Phe Trp Ala Gln Glu Thr Ala
 770 775 780
 Pro Gly Asn Pro His Gly Leu Pro His Glu Val Ile Thr His Tyr Tyr
 785 790 795 800
 His Arg Tyr Pro Met Ser Thr Ile Leu Gly Leu Ser Ile Cys Ala Ala
 805 810 815
 Ile Ala Thr Val Ser Val Ala Ala Ser Thr Trp Leu Phe Cys Arg Ser
 820 825 830
 Arg Val Ala Cys Leu Thr Pro Tyr Arg Leu Thr Pro Asn Ala Arg Ile
 835 840 845
 Pro Phe Cys Leu Ala Val Leu Cys Cys Ala Arg Thr Ala Arg Ala Glu
 850 855 860
 Thr Thr Trp Glu Ser Leu Asp His Leu Trp Asn Asn Asn Gln Gln Met
 865 870 875 880
 Phe Trp Ile Gln Leu Leu Ile Pro Leu Ala Ala Leu Ile Val Val Thr
 885 890 895
 Arg Leu Leu Arg Cys Val Cys Cys Val Val Pro Phe Leu Val Met Ala
 900 905 910
 Gly Ala Ala Gly Ala Gly Ala Tyr Glu His Ala Thr Thr Met Pro Ser
 915 920 925
 Gln Ala Gly Ile Ser Tyr Asn Thr Ile Val Asn Arg Ala Gly Tyr Ala
 930 935 940
 Pro Leu Pro Ile Ser Ile Thr Pro Thr Lys Ile Lys Leu Ile Pro Thr
 945 950 955 960
 Val Asn Leu Glu Tyr Val Thr Cys His Tyr Lys Thr Gly Met Asp Ser
 965 970 975

Pro Ala Ile Lys Cys Cys Gly Ser Gln Glu Cys Thr Pro Thr Tyr Arg
 980 985 990

Pro Asp Glu Gln Cys Lys Val Phe Thr Gly Val Tyr Pro Phe Met Trp
 995 1000 1005

Gly Gly Ala Tyr Cys Phe Cys Asp Thr Glu Asn Thr Gln Val Ser
 1010 1015 1020

Lys Ala Tyr Val Met Lys Ser Asp Asp Cys Leu Ala Asp His Ala
 1025 1030 1035

Glu Ala Tyr Lys Ala His Thr Ala Ser Val Gln Ala Phe Leu Asn
 1040 1045 1050

Ile Thr Val Gly Glu His Ser Ile Val Thr Thr Val Tyr Val Asn
 1055 1060 1065

Gly Glu Thr Pro Val Asn Phe Asn Gly Val Lys Ile Thr Ala Gly
 1070 1075 1080

Pro Leu Ser Thr Ala Trp Thr Pro Phe Asp Arg Lys Ile Val Gln
 1085 1090 1095

Tyr Ala Gly Glu Ile Tyr Asn Tyr Asp Phe Pro Glu Tyr Gly Ala
 1100 1105 1110

Gly Gln Pro Gly Ala Phe Gly Asp Ile Gln Ser Arg Thr Val Ser
 1115 1120 1125

Ser Ser Asp Leu Tyr Ala Asn Thr Asn Leu Val Leu Gln Arg Pro
 1130 1135 1140

Lys Ala Gly Ala Ile His Val Pro Tyr Thr Gln Ala Pro Ser Gly
 1145 1150 1155

Phe Glu Gln Trp Lys Lys Asp Lys Ala Pro Ser Leu Lys Phe Thr
 1160 1165 1170

Ala Pro Phe Gly Cys Glu Ile Tyr Thr Asn Pro Ile Arg Ala Glu
 1175 1180 1185

Asn Cys Ala Val Gly Ser Ile Pro Leu Ala Phe Asp Ile Pro Asp
 1190 1195 1200

Ala Leu Phe Thr Arg Val Ser Glu Thr Pro Thr Leu Ser Ala Ala
 1205 1210 1215

Glu Cys Thr Leu Asn Glu Cys Val Tyr Ser Ser Asp Phe Gly Gly

1220	1225	1230
Ile Ala Thr Val Lys Tyr Ser	Ala Ser Lys Ser Gly	Lys Cys Ala
1235	1240	1245
Val His Val Pro Ser Gly Thr	Ala Thr Leu Lys Glu	Ala Ala Val
1250	1255	1260
Glu Leu Thr Glu Gln Gly Ser	Ala Thr Ile His Phe	Ser Thr Ala
1265	1270	1275
Asn Ile His Pro Glu Phe Arg	Leu Gln Ile Cys Thr	Ser Tyr Val
1280	1285	1290
Thr Cys Lys Gly Asp Cys His	Pro Pro Lys Asp His	Ile Val Thr
1295	1300	1305
His Pro Gln Tyr His Ala Gln	Thr Phe Thr Ala Ala	Val Ser Lys
1310	1315	1320
Thr Ala Trp Thr Trp Leu Thr	Ser Leu Leu Gly Gly	Ser Ala Val
1325	1330	1335
Ile Ile Ile Ile Gly Leu Val	Leu Ala Thr Ile Val	Ala Met Tyr
1340	1345	1350
Val Leu Thr Asn Gln Lys His	Asn	
1355	1360	

<210> 35

<211> 8509

<212> DNA

<213> Artificial

<220>

<223> VLP74_21 (VEEV VLP 519 NPNAx6) whole sequence

<400> 35

gaattcccat tgcatacggtt gtatccatat cataatatgt acatttatat tggctcatgt 60

ccaacattac cgccatgttg acattgatta ttgactagtt attaatagta atcaattacg 120

gggtcattag ttcatagccc atatatggag ttccgcgtta cataacttac ggtaaatggc 180

ccgcctggct gaccgcccac cgacccccgc ccattgacgt caataatgac gtatgttccc 240

atagtaacgc caataggac ttccattga cgtcaatggg tggagtattt acggtaaact 300

gcccacttgg cagtacaatca agtgtatcat atgccaagta cgccccctat tgacgtcaat	360
gacggtaaat ggcccgcttg gcattatgcc cagtacatga ccttatggga ctttcctact	420
tggcagtaca tctacgtatt agtcatcgct attaccatgg tgatgcggtt ttggcagtac	480
atcaatgggc gtggatagcg gtttgactca cggggatttc caagtctcca ccccatigac	540
gtcaatggga gtttgttttg gcacaaaaat caacgggact ttccaaaatg tcgtaacaac	600
tccgccccat tgacgcaaat gggcggtagg cgtgtacggt gggagggtcta tataagcaga	660
gctcgtttag tgaaccgtca gatcgcttg agacgccatc cagctgttt tgacctccat	720
agaagacacc gggaccgatc cagcctccgt taacggtgga gggcagtgtg gtctgagcag	780
tactcgttgc tgccgcgcgc gccaccagac ataatagctg acagactaac agactgttcc	840
tttccatggg tcttttctgc agtcaccgtc gtgcacacgt gtgatcagat atcgcgcccg	900
ccaccatgtt cccgttccag ccaatgtatc cgatgcagcc aatgccctat cgcaaccgt	960
tcgcgcccc gcgcaggccc tggttcccca gaaccgaccc ttttctggcg atgcagggtc	1020
aggaattaac ccgctcgatg gctaacctga cgttcaagca acgccgggac gcgccacctg	1080
aggggccatc cgctaataaa ccgaagaagg aggcctcgca aaaacagaaa gggggaggcc	1140
aagggaagaa gaagaagaac caagggaaga agaaggctaa gacagggccg cctaattcga	1200
aggcacagaa tggaaacaag aagaagacca acaagaaacc aggcaagaga cagcgcatgg	1260
tcatgaaatt ggaatctgac aagacgttcc caatcatgtt ggaagggaag ataaacggct	1320
acgcttgtgt ggtcggaggg aagttattca ggccgatgca tgtggaaggc aagatcgaca	1380
acgacgttct ggccgcgctt aagacgaaga aagcatccaa atacgatctt gagtatgcag	1440
atgtgccaca gaacatgcgg gccgatacat tcaaatacac ccatgagaaa cccaaggct	1500
attacagctg gcatcatgga gcagtccaat atgaaaatgg gcgtttcacg gtgccgaaag	1560
gagttggggc caaggagagc agcggacgac ccattctgga taaccaggga cgggtggtcg	1620
ctatttgtct gggagggtgt aatgaaggat ctaggacagc cctttcagtc gtcatgtgga	1680
acgagaaggg agttaccgtg aagtatactc cagagaactg cgagcaatgg tcactagtga	1740
ccaccatgtg tctgctcgcc aatgtgacgt tccatgtgc tcaaccacca atttgctacg	1800

acagaaaacc agcagagact ttggccatgc tcagcgtaa cggtgacaac ccgggctacg	1860
atgagctgct ggaagcagct gtttaagtcc ccggaaggaa aaggagatcc accgaggagc	1920
tgtttaatga gtataagcta acgcgccctt acatggccag atgcatcaga tgtgcagttg	1980
ggagctgcc tagtccaata gcaatcgagg cagtaaagag cgacgggcac gacggttatg	2040
ttagacttca gacttcctcg cagtatggcc tggattcctc cggcaactta aagggcagga	2100
ccatgcggta tgacatgcac gggaccatta aagagatacc actacatcaa gtgtcactct	2160
atcacatctcg cccgtgtcac attgtggatg ggcacggta tttcctgctt gccaggtgcc	2220
cggcagggga ctccatcacc atggaattta agaaagattc cgtcagacac tctgtctcgg	2280
tgccgtatga agtgaattt aatcctgtag gcagagaact ctatactcat cccccagAAC	2340
acggagtaga gcaagcgtgc caagtctacg cacatgatgc acagaacaga ggagcttatg	2400
tcgagatgca cctcccgggc tcagaagtgg acagcagttt ggttccttg agcggcagtt	2460
ccggaggaaa cccgaatgcc aatcccaacg cgaaccccaa tgctaacca aatgccaacc	2520
caaacccaa cccaacgct ggtggatcct cagtcaccgt gacacctcct gatgggacta	2580
gcgccctggt ggaatgcgag tgtggcgcca caaagatctc cgagaccatc aacaagacaa	2640
aacagttcag ccagtgcaca aagaaggagc agtgcagagc atatcggtg cagaacgata	2700
agtgggtgta taattctgac aaactgcccc aagcagcggg agccacctta aaaggaaaac	2760
tgcattgtcc attcttgctg gcagacggca aatgcaccgt gcctctagca ccagaacctA	2820
tgataacctt cggtttcaga tcagtgtcac tgaaactgca ccctaagaat cccacatatc	2880
taatcaccgg ccaacttgct gatgagcctc actacacgca cgagctcata tctgaaccag	2940
ctgttaggaa ttttaccgtc accgaaaaag ggtgggagtt tgtatgggga aaccacccgc,	3000
cgaaaaggtt ttgggcacag gaaacagcac ccggaatcc acatgggcta ccgcacgagg	3060
tgataactca ttattaccac agatacccta tgtccaccat cctgggtttg tcaatttgtg	3120
ccgccattgc aaccgtttcc gttgcagcgt ctacctggct gttttgcaga tcaagagttg	3180
cgtgcctaac tccttaccgg ctaacaccta acgctaggat accattttgt ctggctgtgc	3240

tttgctgcg cgcactgcc cgggccgaga ccacctggga gtccttggat cacctatgga	3300
acaataacca acagatgttc tggattcaat tgctgatccc tctggccgcc ttgatcgtag	3360
tgactcgctt gctcagggtc gtgtgctgtg tctgtccitt tttagtcatg gccggcgccg	3420
caggcgccgg cgctacgag cagcgacca cgtgccgag ccaagcggga atctcgtata	3480
acactatagt caacagagca ggctacgcac cactccctat cagcataaca ccaacaaaga	3540
tcaagctgat acctacagt aacttggagt acgtcacctg ccactacaaa acaggaatgg	3600
attcaccagc catcaaatgc tgcggatctc aggaatgcac tccaacttac aggcctgatg	3660
aacagtgcaa agtcttcaca ggggtttacc cgttcattgt ggggtgtgca tattgctttt	3720
gcgacactga gaacacccaa gtcagcaagg cctacgtaat gaaatctgac gactgccttg	3780
cggatcatgc tgaagcatat aaagcgaca cagcctcagt gcaggcgctt ctcaacatca	3840
cagtgggaga acactctatt gtgactaccg tgtatgtgaa tggagaaact cctgtgaatt	3900
tcaatgggg caaaataact gcaggtcgc tttccacagc ttggacaccc ttgatcgca	3960
aaatcgtgca gtatgccggg gagatctata attatgattt tctgagtat ggggcaggac	4020
aaccaggagc atttggagat atacaatcca gaacagctc aagctctgat ctgtatgcca	4080
ataccaacct agtctgcag agacccaaag caggagcgt ccacgtgcca tacactcagg	4140
caccttcggg ttttgagcaa tggaaagaa ataaagctc atcattgaaa ttaccgccc	4200
ctttcggatg cgaaatatat acaaacccca ttccgcccga aaactgtgct gtagggicaa	4260
ttccattagc ctttgacatt cccgagcct tgttcaccag ggtgtcagaa acaccgacac	4320
tttcagcggc cgaatgcact cttaacgagt gcgtgtattc ttccgacttt ggtgggatcg	4380
ccacggtcaa gtactcgcc agcaagtcag gcaagtgcg agtccatgtg ccatcaggga	4440
ctgctaccct aaaagaagca gcagtcgagc taaccgagca aggtcggcg actatccatt	4500
tctcgaccgc aaatatccac ccggagttca ggctccaaat atgcacatca tatgttacgt	4560
gcaaagggtga ttgtcacccc ccgaaagacc atattgtgac acaccctcag tatcacgccc	4620
aaacatttac agccgcggtg tcaaaaaccg cgtggacgtg gttaacatcc ctgctgggag	4680
gatcagccgt aattattata attggcttgg tgctggctac tattgtggcc atgtacgtgc	4740

tgaccaacca gaaacataat taaggatcta gatctgctgt gccttctagt tgccagccat	4800
ctgttgtttg cccctcccc gtgccttcct tgacctgga aggtgccact cccactgtcc	4860
tttcctaata aaatgaggaa attgcatcgc attgtctgag taggtgtcat tctattctgg	4920
gggttgggtt ggggcaggac agcaaggggg aggattggga agacaatagc aggcattgctg	4980
gggatgcggt gggctctatg ggtaccagg tgcgaagaa tigacccggt tcctcctggg	5040
ccagaaagaa gcaggcacat ccccttctct gtgacacacc ctgtccagc cctgtgtct	5100
tagttccagc cccactcata ggacactcat agctcaggag ggctccgcct tcaatccac	5160
ccgctaaagt acttgagcg gtctctccct cctcatcag cccaccaaac caaacctagc	5220
ctccaagagt gggaagaaat taaagcaaga taggctatta agtcagagg gagagaaat	5280
gcctccaaca tgtgaggaag taatgagaga aatcatagaa ttttaaggcc atgatttaag	5340
gccatcatgg cctaagcttg aaaggagata ggatcaaagc ttggcgtaat catggtcata	5400
gctgtttcct gtgtgaaatt gttatccgct cacaattcca cacaacatac gagccggaag	5460
cataaagtgt aaagcctggg gtgcctaatt agtgagctaa ctcacattaa ttgcgttgcg	5520
ctcactgccc gctttccagt cgggaaacct gtcgtgccag ctgcattaat gaatcgcca	5580
acgcgcgggg agaggcggtt tgcgtattgg gcgctcttc gcttcctgc tactgactc	5640
gctgcgctcg gtcgttcgac tgcggcgagc ggtatcagct cactcaaagg cgtaatacg	5700
gttatccaca gaatcagggg ataacgcagg aaagaacatg tgagcaaaag gccagcaaaa	5760
ggccaggaac cgtaaaaagg ccgcgttgct ggcgtttttc cataggctcc gccccctga	5820
cgagcatcac aaaaatcgac gctcaagtca gaggtggcga aacccgacag gactataaag	5880
ataccaggcg tttccccctg gaagctccct cgtgcgctct cctgttccga cctgccgct	5940
taccggatac ctgtccgctt ttctcccttc gggaagcgtg gcgctttctc atagctcacg	6000
ctgtaggtat ctgattcgg tgtaggtcgt tcgctccaag ctgggctgtg tgcacgaacc	6060
ccccgttcag cccgaccgct gcgccttata cggttaactat cgtcttgagt ccaaccgggt	6120
aagacacgac ttatcgccac tggcagcagc cactggtaac aggattagca gagcgaggta	6180

tgtaggcggt gctacagagt tcttgaagtg gtggcctaac tacggctaca ctagaagaac	6240
agiatattggt atctgcgctc tgctgaagcc agttaccttc ggaaaaagag ttggtagctc	6300
ttgatccggc aaacaaacca ccgctggtag cggtggtttt ttgttttga agcagcagat	6360
tacgcgcaga aaaaaaggat ctcaagaaga tcctttagtc ttttctacgg ggtctgacgc	6420
tcagtggaac gaaaactcac gttaagggat tttggtcatg agattatcaa aaaggatctt	6480
cacctagatc cttttaaatt aaaaatgaag ttttaaatca atctaaagta tatatgagta	6540
aacttggctc gacagttacc aatgcttaat cagtgaggca cctatctcag cgatctgtct	6600
atttcgttca tccatagttag cctgactccc cgtcgttag ataactacga tacgggaggg	6660
cttaccatct ggccccagtg ctgcaatgat accgcgagaa ccacgctcac cggctccaga	6720
tttatcagca ataaaccagc cagccggaag ggccgagcgc agaagtggtc ctgcaacttt	6780
atccgcctcc atccagtcta ttaattgttg ccgggaagct agagtaagta gttcgccagt	6840
taatagttag cgcaacgttg ttgccattgc tacaggcatc gtgggtgcac gctcgtcgtt	6900
tggtatggct tcattcagct ccggttccca acgatcaagg cgagttacat gatccccat	6960
gttgtcmeta aaagcggtta gctccttcgg tcctccgac gttgtcagaa gtaagtggc	7020
cgcagtgtta tcactcatgg ttatggcagc actgcataat tctcttactg tcatgccatc	7080
cgtaagatgc ttttctgtga ctggtagta ctcaaccaag tcattctgag aatagtgtat	7140
gcggcgaccg agttgctctt gcccggcgtc aatacgggat aataccgcgc cacatagcag	7200
aactttaaaa gtgctcatca ttggaaaacg ttcttcgggg cgaaaactct caaggatctt	7260
accgctgttg agatccagtt cgatgtaacc cactcgtgca cccaactgat cttcagcatc	7320
ttttactttc accagcgttt ctgggtgagc aaaaacagga aggcaaaatg ccgcaaaaaa	7380
gggaataagg gcgacacgga aatgttgaat actcatactc ttctttttc aatattattg	7440
aagcatttat cagggttatt gtctcatgag cggatacata ttggaatgta tttagaaaaa	7500
taaacaaata ggggttccgc gcacatttcc ccgaaaagt ccacctgacg tctaagaaac	7560
cattattatc atgacattaa cctataaaaa taggcgtatc acgaggccct ttcgggtcgc	7620
gcgtttcggg gatgacggtg aaaacctctg acacatgcag ctcccgttga cggtcacagc	7680

ttgtctgtaa gcggatgccg ggagcagaca agcccgctcag ggcgcgctcag cgggtgttgg	7740
cgggtgtcgg ggctggctta actatgcggc atcagagcag attgtactga gagtgcacca	7800
taaaattgta aacgttaata ttttgttaaa attcgcgtta aatttttgtt aaatcagctc	7860
attttttaac caataggccg aaatcggcaa aatcccttat aaatcaaaag aatagcccca	7920
gatagggttg agtgtgttgc cagtttggaa caagagtcca ctattaaaga acgtggactc	7980
caacgtcaaa gggcgaaaaa ccgtctatca gggcgatggc ccactacgtg aaccatcacc	8040
caaatcaagt tttttgggt cgaggtgccg taaagcacta aatcggaacc ctaaaggag	8100
ccccgattt agagcttgac ggggaaagcc ggccaacgtg gcgagaaagg aagggaagaa	8160
agcgaaagga gcgggcgcta gggcgctggc aagtgtagcg gtcacgtgc gcgtaaccac	8220
cacaccgcc gcgcttaatg cgccgctaca gggcgcgta c tatggttgc ttgacgtatg	8280
cgggtgtgaaa taccgcacag atgcgtaagg agaaaatacc gcacagggc ccattcgcca	8340
ttcaggctgc gcaactgttg ggaaggcgca tcggtgcggg cctcttcgct attacgccag	8400
ctggcgaaag ggggatgtgc tgcaaggcga ttaagtggg taacgccagg gttttccag	8460
tcacgacgtt gtaaaacgac ggccagtga ttcattgtc tcaacttc	8509

<210> 36
 <211> 3858
 <212> DNA
 <213> Artificial

<220>
 <223> VLP74_21 (VEEV VLP 519 NPNAx6) VEEV-NPNAx6 sequence only

<400> 36	
atgttccgt tccagccaat gtatccgatg cagccaatgc cctatcgcaa cccgttcgcg	60
gccccgcgca gggcctgggt cccagaacc gacccttttc tggcgatgca ggtgcaggaa	120
ttaaccgct ccatggctaa cctgacgttc aagcaacgcc gggacgcgcc acctgagggg	180
ccatccgcta ataaaccgaa gaaggaggcc tcgcaaaaac agaaaggggg aggccaaagg	240
aagaagaaga agaaccaagg gaagaagaag gctaagacag ggccgcctaa tccgaaggca	300

cagaatggaa acaagaagaa gaccaacaag aaaccaggca agagacagcg catggtcatg	360
aaattggaat ctgacaagac gticccaatc atgttggag ggaagataaa cggctacgct	420
tgtgtggtcg gagggaggtt attcaggccg atgcatgttg aaggcaagat cgacaacgac	480
gttcctggccg cgcctaagac gaagaaagca tccaataacg atcttgagta tgcagatgtg	540
ccacagaaca tgcgggccga tacattcaaa tacacccatg agaaaccca aggctattac	600
agctggcatc atggagcagt ccaatatgaa aatgggcgtt tcacggtgcc gaaaggagtt	660
ggggccaagg gagacagcgg acgaccatt ctggataacc agggacgggt ggtcgtatt	720
gtctgggag gtgtgaatga aggatctagg acagcccttt cagtcgtcat gtggaacgag	780
aaggagtta cctgaagta tactccagag aactgcgagc aatggtcact agtgaccacc	840
atgtgtctgc tcgccaatgt gacgttccca tgtgtcaac caccaatttg ctacgacaga	900
aaaccagcag agactttggc catgctcagc gttaacgttg acaacccggg ctacgatgag	960
ctgctggaag cagctgttaa gtgccccgga aggaaaagga gatccaccga ggagctgttt	1020
aatgagtata agctaacgcg cccttacatg gccagatgca tcagatgtgc agtigggagc	1080
tgccatagtc caatagcaat cgaggcagta aagagcgacg ggcacgacgg ttatgttaga	1140
cttcagactt cctcgagta tggcctggat tcttccggca acttaaaggg caggaccatg	1200
cggatgaca tgcacgggac cattaaagag ataccactac atcaagtgtc actctataca	1260
tctgcccgt gtcacattgt ggatgggcac ggttatttcc tgcttgccag gtgcccggca	1320
ggggactcca tcacatgga atttaagaaa gattccgtca gacactcctg ctcggtgccg	1380
tatgaagtga aatttaatcc tgtaggcaga gaactctata ctcatcccc agaacacgga	1440
gtagagcaag cgtgccaat ctacgcacat gatgcacaga acagaggagc ttatgtcgag	1500
atgcacctcc cgggctcaga agtgacagc agtttggttt ccttgagcgg cagttccgga	1560
ggaaacccga atgccaatcc caacgcgaac cccaatgcta acccaaagtc caacccaac	1620
gccaaccca acgctgggtg atcctcagtc accgtgacac ctctgatgg gactagcggc	1680
ctggtggaat gcgagtgttg cggcacaag atctccgaga ccatcaacaa gacaaaacag	1740
ttcagccagt gcacaaagaa ggagcagtc agagcatatc ggctgcagaa cgataagtgg	1800

gtgtataatt ctgacaaact gcccaaagca gcgggagcca ccttaaaagg aaaactgcat	1860
gtcccattct tgctggcaga cggcaaatgc accgtgcctc tagcaccaga acctatgata	1920
accttcggtt tcagatcagt gtcactgaaa ctgcacccta agaatccac atatctaatac	1980
acccgccaac ttgctgatga gcctcactac acgcacgagc tcatatctga accagctgtt	2040
aggaatttta ccgtcaccga aaaaggggtgg gagtttgtat ggggaaacca cccgccgaaa	2100
aggttttggg cacaggaaac agcaccggga aatccacatg ggctaccgca cgaggtgata	2160
actcattatt accacagata ccctatgtcc accatcctgg gtttgtcaat ttgtccgcc	2220
attgcaaccg tttccgttgc agcgtctacc tggctgtttt gcagatcaag agttgcgtgc	2280
ctaactcctt accggctaac acctaacgct aggataccat ttgtctggc tgtgctttgc	2340
tgcgccgca ctgcccgggc cgagaccacc tgggagtcct tggatcacct atggaacaat	2400
aaccaacaga tgttctggat tcaattgctg atccctctgg ccgccttgat cgtagtgact	2460
cgctgtctca ggtgcgtgtg ctgtgtcgtg ctttttttag tcatggccgg cgccgcaggc	2520
gccggcgctt acgagcacgc gaccacgatg ccgagccaag cgggaatctc gtataacact	2580
atagtcaaca gagcaggcta cgcaccactc cctatcagca taacaccaac aaagatcaag	2640
ctgataccta cagtgaactt ggagtacgtc acctgccact aaaaacagg aatggattca	2700
ccagccatca aatgctgcgg atctcaggaa tgcactcaa cttacaggcc tgatgaacag	2760
tgcaaagtct tcacaggggt ttaccgcttc atgtgggtg gtgcatattg cttttgcgac	2820
actgagaaca cccaagtcag caaggcctac gtaatgaaat ctgacgactg ccttgccgat	2880
catgctgaag catataaagc gcacacagcc tcagtgcagg cgttcctcaa catcacagt	2940
ggagaacact ctattgtgac taccgtgtat gtgaatggag aaactcctgt gaatttcaat	3000
ggggtcaaaa taactgcagg tccgctttcc acagcttggg caccctttga tcgaaaatc	3060
gtgcagtatg ccggggagat ctataattat gattttcctg agtatggggc aggacaacca	3120
ggagcatttg gagatataca atccagaaca gtctcaagct ctgatctgta tgccaatacc	3180
aacctagtgc tgcagagacc caaagcagga gcgatccag tgccatacac tcaggcacct	3240

tcgggttttg agcaatggaa gaaagataaa gctccatcat tgaaatttac cgcccccttc 3300
 ggatgcgaaa tatatacaaa ccccatcgc gccgaaaact gtgctgtagg gtcaattcca 3360
 ttagcctttg acattcccga cgccttggtc accagggtgt cagaaacacc gacactttca 3420
 gcggccgaat gcactcttaa cgagtgcgtg taitcttccg acittggtgg gatcgccacg 3480
 gtcaagtact cggccagcaa gtcaggcaag tgcgcagtcc atgtgccatc agggactgct 3540
 accctaaaag aagcagcagt cgagctaacc gagcaagggt cggcgactat ccatttctcg 3600
 accgcaaata tccacccgga gttcaggctc caaatatgca catcatatgt tacgtgcaaa 3660
 ggtgattgtc accccccgaa agaccatatt gtgacacacc ctgagtatca cgcccaaaca 3720
 ttacagccg cgggtgtcaaa aaccgcgtgg acgtggttaa catccctgct gggaggatca 3780
 gccgtaatta ttataattgg ctggtgctg gctactattg tggccatgia cgtgctgacc 3840
 aaccagaaac ataattaa 3858

<210> 37
 <211> 1285
 <212> PRT
 <213> Artificial

<220>
 <223> VLP74_21 (VEEV VLP 519 NPNx6) amino acid sequence

<400> 37

Met Phe Pro Phe Gln Pro Met Tyr Pro Met Gln Pro Met Pro Tyr Arg
 1 5 10 15

Asn Pro Phe Ala Ala Pro Arg Arg Pro Trp Phe Pro Arg Thr Asp Pro
 20 25 30

Phe Leu Ala Met Gln Val Gln Glu Leu Thr Arg Ser Met Ala Asn Leu
 35 40 45

Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Asn
 50 55 60

Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly
 65 70 75 80

Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro

85	90	95
Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro		
100	105	110
Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe		
115	120	125
Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly		
130	135	140
Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp		
145	150	155
Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu		
165	170	175
Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr		
180	185	190
His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln		
195	200	205
Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly		
210	215	220
Asp Ser Gly Arg Pro Ile Leu Asp Asn Gln Gly Arg Val Val Ala Ile		
225	230	235
Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val		
245	250	255
Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys		
260	265	270
Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr		
275	280	285
Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu		
290	295	300
Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu		
305	310	315
Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr		
325	330	335
Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg		
340	345	350

Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu
355 360 365

Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser
370 375 380

Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met
385 390 395 400

Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val
405 410 415

Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr
420 425 430

Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe
435 440 445

Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys
450 455 460

Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly
465 470 475 480

Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly
485 490 495

Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu
500 505 510

Val Ser Leu Ser Gly Ser Ser Gly Gly Asn Pro Asn Ala Asn Pro Asn
515 520 525

Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn
530 535 540

Ala Gly Gly Ser Ser Val Thr Val Thr Pro Pro Asp Gly Thr Ser Ala
545 550 555 560

Leu Val Glu Cys Glu Cys Gly Gly Thr Lys Ile Ser Glu Thr Ile Asn
565 570 575

Lys Thr Lys Gln Phe Ser Gln Cys Thr Lys Lys Glu Gln Cys Arg Ala
580 585 590

Tyr Arg Leu Gln Asn Asp Lys Trp Val Tyr Asn Ser Asp Lys Leu Pro
595 600 605

Lys Ala Ala Gly Ala Thr Leu Lys Gly Lys Leu His Val Pro Phe Leu
610 615 620

Leu Ala Asp Gly Lys Cys Thr Val Pro Leu Ala Pro Glu Pro Met Ile
625 630 635 640

Thr Phe Gly Phe Arg Ser Val Ser Leu Lys Leu His Pro Lys Asn Pro
645 650 655

Thr Tyr Leu Ile Thr Arg Gln Leu Ala Asp Glu Pro His Tyr Thr His
660 665 670

Glu Leu Ile Ser Glu Pro Ala Val Arg Asn Phe Thr Val Thr Glu Lys
675 680 685

Gly Trp Glu Phe Val Trp Gly Asn His Pro Pro Lys Arg Phe Trp Ala
690 695 700

Gln Glu Thr Ala Pro Gly Asn Pro His Gly Leu Pro His Glu Val Ile
705 710 715 720

Thr His Tyr Tyr His Arg Tyr Pro Met Ser Thr Ile Leu Gly Leu Ser
725 730 735

Ile Cys Ala Ala Ile Ala Thr Val Ser Val Ala Ala Ser Thr Trp Leu
740 745 750

Phe Cys Arg Ser Arg Val Ala Cys Leu Thr Pro Tyr Arg Leu Thr Pro
755 760 765

Asn Ala Arg Ile Pro Phe Cys Leu Ala Val Leu Cys Cys Ala Arg Thr
770 775 780

Ala Arg Ala Glu Thr Thr Trp Glu Ser Leu Asp His Leu Trp Asn Asn
785 790 795 800

Asn Gln Gln Met Phe Trp Ile Gln Leu Leu Ile Pro Leu Ala Ala Leu
805 810 815

Ile Val Val Thr Arg Leu Leu Arg Cys Val Cys Cys Val Val Pro Phe
820 825 830

Leu Val Met Ala Gly Ala Ala Gly Ala Gly Ala Tyr Glu His Ala Thr
835 840 845

Thr Met Pro Ser Gln Ala Gly Ile Ser Tyr Asn Thr Ile Val Asn Arg
850 855 860

Ala Gly Tyr Ala Pro Leu Pro Ile Ser Ile Thr Pro Thr Lys Ile Lys

865	870	875	880
Leu Ile Pro Thr Val Asn Leu Glu Tyr Val Thr Cys His Tyr Lys Thr			
	885	890	895
Gly Met Asp Ser Pro Ala Ile Lys Cys Cys Gly Ser Gln Glu Cys Thr			
	900	905	910
Pro Thr Tyr Arg Pro Asp Glu Gln Cys Lys Val Phe Thr Gly Val Tyr			
	915	920	925
Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Thr Glu Asn Thr			
	930	935	940
Gln Val Ser Lys Ala Tyr Val Met Lys Ser Asp Asp Cys Leu Ala Asp			
945	950	955	960
His Ala Glu Ala Tyr Lys Ala His Thr Ala Ser Val Gln Ala Phe Leu			
	965	970	975
Asn Ile Thr Val Gly Glu His Ser Ile Val Thr Thr Val Tyr Val Asn			
	980	985	990
Gly Glu Thr Pro Val Asn Phe Asn Gly Val Lys Ile Thr Ala Gly Pro			
	995	1000	1005
Leu Ser Thr Ala Trp Thr Pro Phe Asp Arg Lys Ile Val Gln Tyr			
	1010	1015	1020
Ala Gly Glu Ile Tyr Asn Tyr Asp Phe Pro Glu Tyr Gly Ala Gly			
	1025	1030	1035
Gln Pro Gly Ala Phe Gly Asp Ile Gln Ser Arg Thr Val Ser Ser			
	1040	1045	1050
Ser Asp Leu Tyr Ala Asn Thr Asn Leu Val Leu Gln Arg Pro Lys			
	1055	1060	1065
Ala Gly Ala Ile His Val Pro Tyr Thr Gln Ala Pro Ser Gly Phe			
	1070	1075	1080
Glu Gln Trp Lys Lys Asp Lys Ala Pro Ser Leu Lys Phe Thr Ala			
	1085	1090	1095
Pro Phe Gly Cys Glu Ile Tyr Thr Asn Pro Ile Arg Ala Glu Asn			
	1100	1105	1110
Cys Ala Val Gly Ser Ile Pro Leu Ala Phe Asp Ile Pro Asp Ala			
	1115	1120	1125

Leu Phe Thr Arg Val Ser Glu Thr Pro Thr Leu Ser Ala Ala Glu
1130 1135 1140

Cys Thr Leu Asn Glu Cys Val Tyr Ser Ser Asp Phe Gly Gly Ile
1145 1150 1155

Ala Thr Val Lys Tyr Ser Ala Ser Lys Ser Gly Lys Cys Ala Val
1160 1165 1170

His Val Pro Ser Gly Thr Ala Thr Leu Lys Glu Ala Ala Val Glu
1175 1180 1185

Leu Thr Glu Gln Gly Ser Ala Thr Ile His Phe Ser Thr Ala Asn
1190 1195 1200

Ile His Pro Glu Phe Arg Leu Gln Ile Cys Thr Ser Tyr Val Thr
1205 1210 1215

Cys Lys Gly Asp Cys His Pro Pro Lys Asp His Ile Val Thr His
1220 1225 1230

Pro Gln Tyr His Ala Gln Thr Phe Thr Ala Ala Val Ser Lys Thr
1235 1240 1245

Ala Trp Thr Trp Leu Thr Ser Leu Leu Gly Gly Ser Ala Val Ile
1250 1255 1260

Ile Ile Ile Gly Leu Val Leu Ala Thr Ile Val Ala Met Tyr Val
1265 1270 1275

Leu Thr Asn Gln Lys His Asn
1280 1285

<210> 38

<211> 7305

<212> DNA

<213> Artificial

<220>

<223> VLP74_15 (CHI VLP 532 NPNx6) Whole sequence

<400> 38

tcgcgcgttt cggatgatgac ggtgaaaacc tctgacacat gcagctcccg gagacgggtca 60

cagcttgtct gtaagcggat gccgggagca gacaagcccg tcagggcgcg tcagcgggtg 120

ttggcgggtg tcggggctgg cttaactatg cggcatcaga gcagattgta ctgagagtgc 180

accatatgcg gtgtgaaata ccgcacagat gcgtaaggag aaaataccgc atcaggcgcc	240
attcgccatt caggctgcgc aactgttggg aaggcgatc ggtgcgggcc tcttcgctat	300
tacgccagct ggcgaaaggg gcatgtgtc caaggcgatt aagtgggta acgccagggt	360
tttcccagtc acgacgttgt aaaacgacgg ccagtgaatt gacgcgtgtt ggcattgatt	420
attgactagt tattaatagt aatcaattac ggggtcatta gtcatagcc catatatgga	480
gttcgcggtt acataactta cegtaaatgg cccgcctggc tgaccgcca acgacccccg	540
cccatlgacg tcaataatga cgtatgttc catagtaacg ccaataggga ctttcattg	600
acgtcaatgg gtggagtatt tacggtaaac tgcccacttg gcagtacatc aagtgtatca	660
tatgccaaagt acgcccccta ttgacgtcaa tgacggtaaa tggccgcctt ggcattatgc	720
ccagtacatg accttatggg actttcctac ttggcagtac atctacgtat tagtcatcgc	780
tattaccatg gtgatgcggt tttggcagta catcaatggg cgtggatagc ggtttgactc	840
acggggattt ccaagtctcc accccattga cgtaaatggg agtttgtttt ggcacaaaaa	900
tcaacgggac ttccaaaat gtcgtaacaa ctccgcccc ttgacgcaa tgggcggtag	960
gcgtgtacgg tgggaggtct atataagcag agctcgttta gtgaaccgtc agataactgc	1020
aggtcgacga tatcgcggcc gccaccatgg agttcatccc gacgcaaact ttctataaca	1080
gaaggtacca accccgaccc tgggccccac gccctacaat tcaagtaatt agacctagac	1140
cacgtccaca gaggcaggct gggcaactcg ccagctgat ctccgcagtc aacaaattga	1200
ccatgcgcgc ggtacctcaa cagaagcctc gcagaaatcg gaaaaacaag aagcaaaggc	1260
agaagaagca ggccgcccga aacgacccaa agcaaaagaa gcaaccacca caaaagaagc	1320
cggctcaaaa gaagaagaaa ccaggccgta gggagagaat gtgcatgaaa attgaaaatg	1380
attgcatctt cgaagtcaag catgaaggca aagtgatggg ctacgcatgc ctggtggggg	1440
ataaagtaat gaaaccagca catgtgaagg gaactatcga caatgccgat ctggctaaac	1500
tggcctttaa gcggtcgtct aaatacgac ttgaatgtgc acagataccg gtgcacatga	1560
agtctgatgc ctgaagttt acccagaga aaccgaggg gtactataac tggcatcacg	1620

gagcagtgcg	gtattcagga	ggccgggtca	ctatcccgac	gggtgcaggc	aagccgggag	1680
acagcggcag	accgatcttc	gacaacaaag	gacgggtggt	ggccatcgtc	ctaggagggg	1740
ccaacgaagg	tgcccgacag	gccctctccg	tggtgacgtg	gaacaaagac	atcgtcacia	1800
aaattacccc	tgaggagacc	gaagagtggg	gcctcgccct	cccggctctg	tgctgtttgg	1860
caaacactac	attccccctg	tctcagccgc	cttgacacac	ctgtgtctac	gaaaaggaac	1920
cggaaagcac	cttgcgcatt	cttgaggaca	acgtgatgag	acccggatac	taccagctac	1980
taaaagcatc	gctgacttgc	tctccccacc	gccaaagacg	cagtactaag	gacaatttta	2040
atgtctataa	agccacaaga	ccatatctag	ctcattgtcc	tgactgcgga	gaagggcatt	2100
cgtgccacag	ccctatcgca	ttggagcgca	tcagaaatga	agcaacggac	ggaacgctga	2160
aaatccaggt	ctctttgcag	atcgggataa	agacagatga	cagccacgat	tggaccaagc	2220
tgcgctatat	ggatagccat	acgccagcgg	acgcggagcg	agccggattg	cttgtaagga	2280
cttcagcacc	gtgcacgac	accgggacca	tgggacactt	tattctcgcc	cgatgcccga	2340
aaggagagac	gctgacagtg	ggatttacgg	acagcagaaa	gatcagccac	acatgcacac	2400
accggttcca	tcatgaacca	cctgtgatag	gtaggagag	gttccactct	cgaccacaac	2460
atggtaaaga	gttaccttgc	agcacgtacg	tgacagagac	cgctgccact	gctgaggaga	2520
tagagggtca	tatgccccca	gatactcctg	accgcacgct	gatgacgcag	cagtctggca	2580
acgtgaagat	cacagttaat	gggcagacgg	tgcggtacaa	gtgcaactgc	ggtggctccg	2640
gaggaaaccc	gaatgccaat	cccaacgcga	accccaatgc	taaccctaat	gccaacccaa	2700
acgccaaacc	caacgctggt	ggatccaacg	aggactgac	aaccacagac	aaagtgatca	2760
ataactgcaa	aattgatcag	tgccatgctg	cagtcactaa	tcacaagaat	tggcaataca	2820
actccccctt	agtcccgccg	aacgtgaac	tcggggaccg	taaaggaaaag	atccacatcc	2880
cattcccatt	ggcaaacgtg	acttgacag	tgccaaaagc	aagaaaccct	acagtaactt	2940
acggaaaaaa	ccaagtcacc	atgtgtctgt	atcctgacca	tccgacactc	tigtcttacc	3000
gtaacatggg	acaggaacca	aattaccacg	aggagtgggt	gacacacaag	aaggaggtta	3060
ccctgaccgt	gcctactgag	ggtctggagg	tcacttgggg	caacaacgaa	ccatacaagt	3120

actggccgca gatgtctacg aacggtactg ctcatgggtca cccacatgag ataattcttgt	3180
actattatga gctgtacccc actatgactg tagtcattgt gtcggtggcc tcgttcgtgc	3240
tictgtcgat ggtgggcaca gcagtgggaa tgtgtgtgtg cgcacggcgc agatgcatta	3300
caccatatga attaacacca ggagccactg ttcccttcct gctcagcctg ctatgctgcg	3360
tcagaacgac caaggcggcc acatattacg aggctgcggc atatctatgg aacgaacagc	3420
agcccctgtt ctggttgacg gctcttatcc cgctggccgc cttagatcgtc ctgtgcaact	3480
gtctgaaact cttgccatgc tgctgtaaga ccttggtttt tttagccgta atgagcatcg	3540
gtgcccacac tgtgagcgcg tacgaacacg taacagtgat cccgaacacg gtgggagtac	3600
cgtataagac tcttgtcaac agaccgggtt acagcccat ggtgttgag atggagctac	3660
aatcagtcac cttggaacca aactgtcac ttgactacat cagtgcgag tacaaaactg	3720
tcattccctc cccgtacgtg aagtgtgtg gtacagcaga gtgcaaggac aagagcctac	3780
cagactacag ctgcaaggtc ttactggag tctaccatt tatgtggggc ggcgcctact	3840
gcttttgcga cgccgaaaat acgcaattga gcgaggcaca tgtagagaaa tctgaatctt	3900
gcaaaacaga gtttgcacgc gcctacagag cccacaccgc atcggcgtcg gcgaagctcc	3960
gcgtccttta ccaaggaaac aacattaccg tagctgccta cgctaacggt gaccatgccg	4020
tcacagtaaa ggacgccaag ttgtcgtgg gcccaatgtc ctccgcctgg acacctttg	4080
acaacaaaat cgtggtgtac aaaggcgacg tctacaacat ggactacca cttttggcg	4140
caggaagacc aggacaattt ggtgacattc aaagtcgtac accggaagt aaagacgttt	4200
atgccaacac tcagttggta ctacagaggc cagcagcagg cacgtacat gtaccatact	4260
ctcaggcacc atctggcttc aagtattgac tgaaggacg aggagcatcg ctacagcaca	4320
cggcaccgtt cggttgccag attgcgaca acccggtaa agctgtaaat tgcgctgtgg	4380
ggaacatacc aatttcacgc gacataccgg atgcggcctt tactagggtt gtcgatgcac	4440
cctctgtaac ggacatgtca tgcgaagtac cagcctgcac tcactcctcc gactttgggg	4500
gcgtcgccat catcaaatac acagctagca agaaaggtaa atgtgcagta cattcgatga	4560

ccaacgccgt taccattcga gaagccgacg tagaagtaga ggggaactcc cagctgcaaa	4620
tatccttctc aacagccctg gcaagcgccg agtttcgctg gcaagtgtgc tccacacaag	4680
tacactgcgc agccgcatgc caccctccaa aggaccacat agtcaattac ccagcatcac	4740
acaccaccct tgggtgccag gatatatcca caacggcaat gtcttgggtg cagaagatta	4800
cgggaggagt aggattaatt gttgctgttg ctgccttaat ttttaattgtg gtgctatgcg	4860
tgtcgtttag caggcactaa ggatctagat ctgctgtgcc ttctagtgtc cagccatctg	4920
ttgtttgccc ctccccgtg ccttccttga ccttggaagg tgccactccc actgtccttt	4980
cctaataaaa tgaggaaatt gcatcgcaat gtctgagtag gtgtcattct attctggggg	5040
gtgggtggg gcaggacagc aagggggagg attgggaaga caatagcagg catgctgggg	5100
atgcggtggg ctctatggct cgagcatggt catagctgtt tcctgtgtga aattgttatc	5160
cgctcacaat tccacacaac atacgagccg gaagcataaa gtgtaaagcc tggggtgcct	5220
aatgagttag ctaactcaca ttaattgcgt tgcgctcact gccgccttc cagtcgggaa	5280
acctgtcgtg ccagctgcat taatgaatcg gccaacgcgc ggggagaggc ggtttgcgt	5340
ttgggcgctc ttccgcttcc tgcctcactg actcgctgcg ctcggtcgtt cggctgcggc	5400
gagcggatc agctcactca aaggcggtaa tacggttatc cacagaatca ggggataacg	5460
caggaaagaa catgtgagca aaaggccagc aaaaggccag gaaccgtaaa aaggccgcgt	5520
tgctggcgtt ttccatagg ctccgcccc ctgacgagca tcacaaaaat cgacgctcaa	5580
gtcagaggtg gcgaaacccg acaggactat aaagatacca ggcgtttccc cctggaagct	5640
ccctcgtcgc ctctcctgtt ccgaccctgc cgcttaccgg atacctgtcc gcctttctcc	5700
cttcgggaag cgtggcgctt tctcatagct cagcgttag gtatctcagt tcggtgtagg	5760
tcgttcgctc caagctgggc tgtgtgcacg aacccccgt tcagcccgac cgctgcgcct	5820
tatccgtaa ctatcgtctt ggtccaacc cggtaaagaca cgacttatcg ccactggcag	5880
cagccactgg taacaggatt agcagagcga ggtatgtagg cggctgctaca gattcttga	5940
agtggtgccc taactacggc tacactagaa gaacagtatt tggatatctgc gctctgtga	6000
agccagttac cttcggaaaa agagtggta gctcttgatc cggcaaaca accaccgctg	6060

gtagcggtag tttttttgtt tgcaagcagc agattacgcg cagaaaaaaa ggatctcaag	6120
aagatccttt gatcttttct acggggtctg acgctcagtg gaacgaaaac tcacgttaag	6180
ggattttggt catgagatta tcaaaaagga tcttcaccta gatccttita aattaaaaat	6240
gaagttttta atcaatctaa agtatatatg agtaaacttg gcttgacagt tagaaaaact	6300
catcgagcat caaatgaaac tgcaatttat tcatacagg attatcaata ccatattttt	6360
gaaaaagccg tttctgtaat gaaggagaaa actcaccgag gcagttccat aggatggcaa	6420
gatcctggta tcggctcgcg attccgactc gtccaacatc aatacaacct attaatctcc	6480
cctcgtcaaa aataaggtta tcaagtgaga aatcaccatg agtgacgact gaatccggtg	6540
agaatggcaa aagtttatgc atttctttcc agacttgctt aacaggccag ccattacgct	6600
cgatcatcaa atcacctgca tcaaccaaac cgttattcat tcgtgattgc gcctgagcga	6660
gacgaaatac gcgatcgtg ttaaaaggac aattacaaac aggaatcgaa tgcaaccggc	6720
gcaggaacac tgccagcgca tcaacaatat ttccacctga atcaggatat tcttctaata	6780
cctggaatgc tgttttcca gggatcgagc tggtagtaa ccatgcatca tcaggagtac	6840
ggataaaatg ctgatggct ggaagaggca taaattccgt cagccagttt agtctgacca	6900
tctcatctgt aacatcattg gcaacgctac ctttgccatg ttcagaaac aactctggcg	6960
catcgggctt cccatacaat cgatagattg tcgcacctga ttgcccgaac ttatcgcgag	7020
cccatttata cccatataaa tcagcatcca tgttggattt taatcgcggc cttagagcaag	7080
acgtttcccg ttgaatatgg ctcatactct tcctttttca atattattga agcattttatc	7140
agggttattg tctcatgagc ggatacatat ttgaatgtat ttagaaaaat aaacaaatag	7200
gggttcgcgc cacatttccc cgaaaagtgc cacctgacgt ctaagaaacc attattatca	7260
tgacattaac ctataaaaaat aggcgtatca cgaggccctt tcgtc	7305

<210> 39
 <211> 1277
 <212> PRT
 <213> Artificial

<220>

<223> VLP74_15 (CHI VLP 532 NPNAX6) amino acid sequence

<400> 39

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
1 5 10 15

Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro
20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
50 55 60

Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp
65 70 75 80

Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys
85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys
115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala
260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
275 280 285

Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met
290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro
305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
325 330 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
340 345 350

Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp
355 360 365

Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp
370 375 380

Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro
385 390 395 400

Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys
405 410 415

Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys
420 425 430

Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His
435 440 445

Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu
450 455 460

Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr
465 470 475 480

Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met
485 490 495

Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn
500 505 510

Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys
515 520 525

Gly Gly Ser Gly Gly Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn
530 535 540

Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Gly Gly Ser
545 550 555 560

Asn Glu Gly Leu Thr Thr Thr Asp Lys Val Ile Asn Asn Cys Lys Ile
565 570 575

Asp Gln Cys His Ala Ala Val Thr Asn His Lys Asn Trp Gln Tyr Asn
580 585 590

Ser Pro Leu Val Pro Arg Asn Ala Glu Leu Gly Asp Arg Lys Gly Lys
595 600 605

Ile His Ile Pro Phe Pro Leu Ala Asn Val Thr Cys Arg Val Pro Lys
610 615 620

Ala Arg Asn Pro Thr Val Thr Tyr Gly Lys Asn Gln Val Thr Met Leu
625 630 635 640

Leu Tyr Pro Asp His Pro Thr Leu Leu Ser Tyr Arg Asn Met Gly Gln
645 650 655

Glu Pro Asn Tyr His Glu Glu Trp Val Thr His Lys Lys Glu Val Thr
660 665 670

Leu Thr Val Pro Thr Glu Gly Leu Glu Val Thr Trp Gly Asn Asn Glu
675 680 685

Pro Tyr Lys Tyr Trp Pro Gln Met Ser Thr Asn Gly Thr Ala His Gly
690 695 700

His Pro His Glu Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr Pro Thr Met
705 710 715 720

Thr Val Val Ile Val Ser Val Ala Ser Phe Val Leu Leu Ser Met Val
725 730 735

Gly Thr Ala Val Gly Met Cys Val Cys Ala Arg Arg Arg Cys Ile Thr
740 745 750

Pro Tyr Glu Leu Thr Pro Gly Ala Thr Val Pro Phe Leu Leu Ser Leu

755	760	765
Leu Cys Cys Val Arg Thr Thr Lys Ala Ala Thr Tyr Tyr Glu Ala Ala		
770	775	780
Ala Tyr Leu Trp Asn Glu Gln Gln Pro Leu Phe Trp Leu Gln Ala Leu		
785	790	795 800
Ile Pro Leu Ala Ala Leu Ile Val Leu Cys Asn Cys Leu Lys Leu Leu		
805	810	815
Pro Cys Cys Cys Lys Thr Leu Ala Phe Leu Ala Val Met Ser Ile Gly		
820	825	830
Ala His Thr Val Ser Ala Tyr Glu His Val Thr Val Ile Pro Asn Thr		
835	840	845
Val Gly Val Pro Tyr Lys Thr Leu Val Asn Arg Pro Gly Tyr Ser Pro		
850	855	860
Met Val Leu Glu Met Glu Leu Gln Ser Val Thr Leu Glu Pro Thr Leu		
865	870	875 880
Ser Leu Asp Tyr Ile Thr Cys Glu Tyr Lys Thr Val Ile Pro Ser Pro		
885	890	895
Tyr Val Lys Cys Cys Gly Thr Ala Glu Cys Lys Asp Lys Ser Leu Pro		
900	905	910
Asp Tyr Ser Cys Lys Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly		
915	920	925
Gly Ala Tyr Cys Phe Cys Asp Ala Glu Asn Thr Gln Leu Ser Glu Ala		
930	935	940
His Val Glu Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala Ser Ala Tyr		
945	950	955 960
Arg Ala His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val Leu Tyr Gln		
965	970	975
Gly Asn Asn Ile Thr Val Ala Ala Tyr Ala Asn Gly Asp His Ala Val		
980	985	990
Thr Val Lys Asp Ala Lys Phe Val Val Gly Pro Met Ser Ser Ala Trp		
995	1000	1005
Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp Val Tyr		
1010	1015	1020

Asn Met	Asp Tyr	Pro Pro	Phe	Gly Ala	Gly Arg	Pro	Gly Gln	Phe	1025	1030	1035
Gly Asp	Ile Gln	Ser Arg	Thr	Pro Glu	Ser Lys	Asp	Val Tyr	Ala	1040	1045	1050
Asn Thr	Gln Leu	Val Leu	Gln	Arg Pro	Ala Ala	Gly	Thr Val	His	1055	1060	1065
Val Pro	Tyr Ser	Gln Ala	Pro	Ser Gly	Phe Lys	Tyr	Trp Leu	Lys	1070	1075	1080
Glu Arg	Gly Ala	Ser Leu	Gln	His Thr	Ala Pro	Phe	Gly Cys	Gln	1085	1090	1095
Ile Ala	Thr Asn	Pro Val	Arg	Ala Val	Asn Cys	Ala	Val Gly	Asn	1100	1105	1110
Ile Pro	Ile Ser	Ile Asp	Ile	Pro Asp	Ala Ala	Phe	Thr Arg	Val	1115	1120	1125
Val Asp	Ala Pro	Ser Val	Thr	Asp Met	Ser Cys	Glu	Val Pro	Ala	1130	1135	1140
Cys Thr	His Ser	Ser Asp	Phe	Gly Gly	Val Ala	Ile	Ile Lys	Tyr	1145	1150	1155
Thr Ala	Ser Lys	Lys Gly	Lys	Cys Ala	Val His	Ser	Met Thr	Asn	1160	1165	1170
Ala Val	Thr Ile	Arg Glu	Ala	Asp Val	Glu Val	Glu	Gly Asn	Ser	1175	1180	1185
Gln Leu	Gln Ile	Ser Phe	Ser	Thr Ala	Leu Ala	Ser	Ala Glu	Phe	1190	1195	1200
Arg Val	Gln Val	Cys Ser	Thr	Gln Val	His Cys	Ala	Ala Ala	Cys	1205	1210	1215
His Pro	Pro Lys	Asp His	Ile	Val Asn	Tyr Pro	Ala	Ser His	Thr	1220	1225	1230
Thr Leu	Gly Val	Gln Asp	Ile	Ser Thr	Thr Ala	Met	Ser Trp	Val	1235	1240	1245
Gln Lys	Ile Thr	Gly Gly	Val	Gly Leu	Ile Val	Ala	Val Ala	Ala	1250	1255	1260

Leu Ile Leu Ile Val Val Leu Cys Val Ser Phe Ser Arg His
 1265 1270 1275

<210> 40
 <211> 7533
 <212> DNA
 <213> Artificial

<220>
 <223> VLP78_15 (CHI VLP 532 NPNx25) Whole sequence

<400> 40
 tcgcgcgttt cggatgac ggtgaaaacc tcgacacat gcagctccc gagacggta 60
 cagcttgct gtaagcggat gccgggagca gacaagccc tcagggcgc tcagcgggtg 120
 ttggcgggtg tcgggctgg cttaactatg cggcatcaga gcagattgta ctgagagtgc 180
 accatatgc gtgtgaaata ccgcacagat gcgtaaggag aaaataccgc atcaggcggc 240
 attgccatt caggctgcgc aactgttggg aaggcgatc ggtgcgggccc tcttcgtat 300
 tacgccagct ggcgaaagg gtagtgctg caaggcgatt aagtgggta acgccagggt 360
 tttccagtc acgacgttgt aaaacgacgg ccagtgaatt gacgcgtgtt ggcatgtatt 420
 attgactagt tattaatagt aatcaattac ggggtcatta gtcatagcc catatatgga 480
 gttccgcgtt acataactta cggtaaattg cccgcctggc tgaccgcca acgacccccg 540
 cccattgacg tcaataatga cgtatgttc catagtaacg ccaataggga ctttcattg 600
 acgtcaatgg gtggagtatt tacggtaaac tgcccattg gcagtacatc aagtgtatca 660
 tatgccaagt acgcccccta ttgacgtcaa tgacggtaaa tggccgcct ggcatatgc 720
 ccagtacatg accttatggg acttcctac ttggcagtac atctacgtat tagtcatgc 780
 tattaccatg gtgatgcgtt ttggcagta catcaatggg cgtggatagc ggtttgactc 840
 acggggattt ccaagctcc accccattga cgtcaatggg agtttgttt ggcacaaaa 900
 tcaacgggac ttccaaaat gtcgtaaca ctccgcccc ttgacgcaa tgggcggtag 960
 gcgtgtacgg tgggaggtct atataagcag agctcgitta gtgaaccgtc agataactgc 1020
 aggtcgacga tatcgcgccc gccacatgg agttcatccc gacgcaaact ttctataaca 1080

gaaggtacca accccgaccc tgggccccac gccctacaat tcaagtaatt agacctagac	1140
cacgtccaca gaggcaggct gggcaactcg cccagctgat ctccgcagtc aacaaattga	1200
ccatgcgcgc ggtacctcaa cagaagcctc gcagaaatcg gaaaaacaag aagcaaaggc	1260
agaagaagca ggcgcccga aacgacccaa agcaaaagaa gcaaccacca caaaagaagc	1320
cggctcaaaa gaagaagaaa ccaggccgta gggagagaat gtgcatgaaa attgaaaatg	1380
attgcatctt cgaagtcaag catgaaggca aagtgatggg ctacgcatgc ctggtggggg	1440
ataaagtaat gaaaccagca catgtgaagg gaactatcga caatgccgat ctggctaaac	1500
tggcctttta gcggtcgtct aaatacgatc ttgaatgtgc acagataccg gtgcacatga	1560
agtctgatgc ctgaagttt acccagcaga aaccggaggg gtactataac tggcatcacg	1620
gagcagtcca gtattcagga ggccgggtca ctatcccgac gggcgcaggc aagccgggag	1680
acagcggcag accgatcttc gacaacaaag gacgggtggt ggccatcgtc ctaggagggg	1740
ccaacgaagg tggccgcacg gccctctccg tggtagctg gaacaaagac atcgtcacia	1800
aaattacccc tgaggagacc gaagagtga gcctcgccct cccggtcttg tgcctgttgg	1860
caaacactac attccctgct tctcagccgc ctgacacacc ctgctgctac gaaaaggaac	1920
cggaaagcac ctgacgatg ctgaggaca acgtgatgag acccgatac taccagctac	1980
taaaagcatc gctgacttgc tctccccacc gccaaagacg cagtactaag gacaatttta	2040
atgtctataa agccacaaga ccatacttag ctcatgttcc tgactgcgga gaagggcatt	2100
cgtgccacag ccctatcgca ttggagcgca tcagaaatga agcaacggac ggaacgtga	2160
aatccagggt ctctttgcag atcgggataa agacagatga cagccacgat tggaccaagc	2220
tgcgtatat ggatagccat acgccagcg acgaggagcg agccggattg ctgtgaagga	2280
cttcagcacc gtgcacgatc accgggacca tgggacactt tattctcgcc cgatgccga	2340
aaggagagac gctgacagtg ggatttacgg acagcagaaa gatcagccac acatgcacac	2400
accgttcca tcatgaacca cctgtgatag gtagggagag gticcactct cgaccacaac	2460
atggtaaaga gttaccttgc agcacgtacg tgcagagcac cgctgccact gctgaggaga	2520
tagaggtgca tatgccccca gatactcctg accgcacgct gatgacgcag cagcttgga	2580

acgtgaagat cacagttaat gggcagacgg tgcggtacaa gtgcaactgc ggtggctccg	2640
gaggaaaccc gaatgccaat cccaacgcga accccaacgc taacccaac gccaatccga	2700
atgcaaaccc gaacgttgac ccaaacgcc aaccgaatgc caatccaac gcgaacccca	2760
atgctaaccc aaatgccaac ccaaacgcc accccaacgc taatccaac gccaaccta	2820
acgccaatcc caacgcgaat cctaacgcta atcccaacgc aaatccaat gctaattcga	2880
acgcgaaccc taatgcaaac cccaacgcc aaccgaacgc taacccgaac gctaattcca	2940
acgccggtgg atccaacgag ggactgacaa ccacagacaa agtgatcaat aactgcaaaa	3000
ttgatcagtg ccatgctgca gtcactaatc acaagaattg gcaatacaac tccccittag	3060
tcccgcgcaa cgctgaactc ggggaccgta aaggaaagat ccacatcca tcccattgg	3120
caaacgtgac ttgcagagtg ccaaagcaa gaaaccctac agtaacttac ggaaaaaacc	3180
aagtcacat gctgctgtat cctgaccatc cgacactctt gtcttaccgt aacatgggac	3240
aggaacaaaa ttaccacgag gagtgggiga cacacaagaa ggaggttacc ttgaccgtgc	3300
ctactgaggg tctggaggtc acttggggca acaacgaacc atacaagtac tggccgcaga	3360
tgtctacgaa cggctactgt catggtcacc cacatgagat aatcttgtac tattatgagc	3420
tgtacccac tatgactgta gtcatttgtt cggtagcctc gttcgtgctt ctgtcgatgg	3480
tgggcacagc agtgggaatg tgtgtgtgcg cacggcgag atgcattaca ccatatgaat	3540
taacaccagg agccactgtt ccttcctgct tcagcctgct atgctgcgtc agaacgacca	3600
aggcggccac atattacgag gctgcggcat atctatggaa cgaacagcag cccctgttct	3660
ggttgacggc tcttatcccg ctggccgcct tgatcgtcct gtgcaactgt ctgaaactct	3720
tgccatgctg ctgtaagacc ctggcttttt tagccgtaat gagcatcggg gccacactg	3780
tgagcgcgta cgaacacgta acagtgatcc cgaacacggg gggagtaccg tataagactc	3840
ttgtcaacag accgggttac agccccatgg tgttgagat ggagctacaa tcagtcacct	3900
tggaaccaac actgtcactt gactacatca cgtgcgagta caaaactgtc atccccctcc	3960
cgtacgtgaa gtgctgtggt acagcagagt gcaaggacaa gaggctacca gactacagct	4020

gcaaggtctt tactggagtc taccatttta tgtggggcgg cgcctactgc ttttgcgacg	4080
ccgaaaatac gcaattgagc gaggcacatg tagagaaatc tgaatcttgc aaaacagagt	4140
ttgcatcggc ctacagagcc cacaccgcat cggcgtcggc gaagctccgc gtcctttacc	4200
aaggaaacaa cattaccgta gctgcctacg ctaacggatga ccatgccgtc acagtaaagg	4260
acgccaagtt tgtcgtgggc ccaatgtcct cgccttggac accctttgac aacaaaatcg	4320
tgggtgtaca aggcgacgtc tacaacatgg actaccaccc ttttggcgca ggaagaccag	4380
gacaatttgg tgacattcaa agtcgtacac cggaaagtaa agacgtttat gccaacactc	4440
agttggtact acagaggcca gcagcaggca cggtagatgt accatactct caggcaccat	4500
ctggcttcaa gtattggctg aaggaacgag gagcatcgct acagcacacg gcaccgttcg	4560
gttgccagat tgcgacaaac ccgtaagag ctgtaaattg cgcgtgggg aacataccaa	4620
tttccatcga cataccgat gcggccttta ctagggtgt cgatgcaccc tctgtaacgg	4680
acatgtcatg cgaagtacca gcctgcactc actcctccga ctttgggggc gtcgccatca	4740
tcaaatacac agctagcaag aaaggtaa atgtcagtaca ttcgatgacc aacgccgtta	4800
ccattcgaga agccgacgta gaagtagagg ggaactccca gctgcaaata tccttctcaa	4860
cagccctggc aagcccgag tttcgcgtgc aagtgtgctc cacacaagta cactgcgcag	4920
ccgcatgcca cctccaaag gaccacatag tcaattacc agcatcacac accacccttg	4980
gggtccagga tatatccaca acggcaatgt ctgggtgca gaagattacg ggaggagtag	5040
gattaattgt tgctgttgc gccttaattt taattgtggt gctatgcgtg tcgtttagca	5100
ggcactaagg atctagatct gctgtgcctt ctagttgcca gccatctgtt gtttggccct	5160
ccccgtgcc ttcttgacc ctggaaggcg ccactccac tgcctttcc taataaaatg	5220
aggaaattgc atcgattgt ctgagtaggt gtcattctat tctgggggt ggggtgggc	5280
aggacagcaa ggggaggat tgggaagaca atagcaggca tgctgggat gcggtggct	5340
ctaiggtcg agcatgtca tagctgttc ctgtgtgaaa ttgttatccg ctcaaatc	5400
cacacaacat acgagccgga agcataaagt gtaaagcctg ggtgcctaa tgagttagct	5460
aactcacatt aattgcgtg cgtcactgc ccgctttcca gtcgggaaac ctgtcgtgcc	5520

agctgcatta atgaatcggc caacgcgcgg ggagagggcg tttgcgtatt gggcgctctt 5580
 ccgcttcctc gctcactgac tgcgtgcgt cggtcgttcg gctgcggcga gcggtatcag 5640
 ctactcaaaa ggccgtaata cggttatcca cagaatcagg ggataacgca ggaaagaaca 5700
 tgtgagcaaa aggccagcaa aaggccagga accgtaaaaa ggccgcgttg ctggcgtttt 5760
 tccataggct ccgccccct gacgagcatc acaaaaatcg acgctcaagt cagaggtagc 5820
 gaaacccgac aggactataa agataccagg cgtttcccc tggaagctcc ctctgcgt 5880
 ctctgttcc gaccctgccg cttaccgat accgtccgc cttctcct tcgggaagcg 5940
 tggcgcttc tcatagctca cgcttaggt atctcagtc ggttaggtc gttcgtcca 6000
 agctggcctg tgtgcagaa ccccgcttc agccgaccg ctgcgcctta tccgtaact 6060
 atcgtcttga gtccaacccg gtaagacagc acitacgcc actggcagca gccactgta 6120
 acaggattag cagagcgagg tatgtaggcg gtgctacaga gttctgaag tggtagccta 6180
 actacggcta cactagaaga acagtatttg gtatctgcgc tctgctgaag ccagttacct 6240
 tcggaaaaag agttgtagc tctgatccg gcaacaaac caccgctggt agcggtaggt 6300
 ttttgtttg caagcagcag attacgcga gaaaaaagg atctcaagaa gatccttga 6360
 tctttctac ggggtcigac gctcagtga acgaaaactc acgttaaggg attttggtca 6420
 tgagattatc aaaaaggatc ttcacctaga tccttttaa ttaaaatga agttttaat 6480
 caatctaaag tatatatgag taaacttggc ctgacagta gaaaaactca tcgagcatca 6540
 aatgaaactg caatttattc atatcaggat tatcaatacc atattttga aaaagccgtt 6600
 tctgtaatga aggagaaaac tcaccgaggc agttccatag gatggcaaga tcctggtatc 6660
 ggtctcgat tccgactcgt ccaacatcaa tacaacctat taatttccc tcgtcaaaaa 6720
 taaggttatc aagtgagaaa tcaccatgag tgacgactga atccggtgag aatggcaaaa 6780
 gtttatgcat ttctttccag acttggtcaa caggccagcc attacgctcg tcatcaaat 6840
 cactcgcatc aaccaaacgg ttattcattc gtgattgcgc ctgagcgaga cgaaatacgc 6900
 gatcgctgtt aaaaggacaa ttacaaacag gaatcgaatg caaccggcgc aggaacactg 6960

ccagcgcatc aacaatattt tcacctgaat caggatatct ttctaatacc tggaatgctg 7020
 ttttcccagg gatcgcatg gtgagtaacc atgcatcatc aggagtacgg ataaaatgct 7080
 tgatggtcgg aagaggcata aattccgtca gccagtttag tctgaccatc tcactctgtg 7140
 catcattggc aacgctacct ttgcatgtt tcagaaacaa ctctggcgca tcgggcttcc 7200
 catacaatcg atagattgtc gcacctgatt gcccgcacatt atcgcgagcc catttatacc 7260
 catataaatc agcatccatg ttggaattta atcgcgccct agagcaagac gtttccggt 7320
 gaatatggct catactcttc ctttttcaat attattgaag catttatcag gttattgtc 7380
 tcatgagcgg atacatattt gaatgtattt agaaaaataa acaaataagg gttccgcgca 7440
 catttccccg aaaagtgccg cctgacgtct aagaaacat tattatcatg acattaacct 7500
 ataaaaatag gcgtatcacg aggccctttc gtc 7533

<210> 41
 <211> 1353
 <212> PRT
 <213> Artificial

<220>
 <223> VLP78_15 (CHI VLP 532 NPNx25) amino acid sequence

<400> 41

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
 1 5 10 15

Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro
 20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
 35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
 50 55 60

Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp
 65 70 75 80

Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys
 85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
 100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys
 115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
 130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
 145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
 165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
 180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
 195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
 210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
 225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
 245 250 255

Gly Ala Glu Glu Trp Ser Leu Ala Leu Pro Val Leu Cys Leu Leu Ala
 260 265 270

Asn Thr Thr Phe Pro Cys Ser Gln Pro Pro Cys Thr Pro Cys Cys Tyr
 275 280 285

Glu Lys Glu Pro Glu Ser Thr Leu Arg Met Leu Glu Asp Asn Val Met
 290 295 300

Arg Pro Gly Tyr Tyr Gln Leu Leu Lys Ala Ser Leu Thr Cys Ser Pro
 305 310 315 320

His Arg Gln Arg Arg Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala
 325 330 335

Thr Arg Pro Tyr Leu Ala His Cys Pro Asp Cys Gly Glu Gly His Ser
 340 345 350

Cys His Ser Pro Ile Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp

355	360	365
Gly Thr Leu Lys Ile Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp		
370	375	380
Asp Ser His Asp Trp Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro		
385	390	395 400
Ala Asp Ala Glu Arg Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys		
405	410	415
Thr Ile Thr Gly Thr Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys		
420	425	430
Gly Glu Thr Leu Thr Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His		
435	440	445
Thr Cys Thr His Pro Phe His His Glu Pro Pro Val Ile Gly Arg Glu		
450	455	460
Arg Phe His Ser Arg Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr		
465	470	475 480
Tyr Val Gln Ser Thr Ala Ala Thr Ala Glu Glu Ile Glu Val His Met		
485	490	495
Pro Pro Asp Thr Pro Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn		
500	505	510
Val Lys Ile Thr Val Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys		
515	520	525
Gly Gly Ser Gly Gly Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
530	535	540
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Val Asp Pro Asn		
545	550	555 560
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
565	570	575
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
580	585	590
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
595	600	605
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
610	615	620

Ala Asn Pro Asn Ala Asn Pro Asn Ala Gly Gly Ser Asn Glu Gly Leu
625 630 635 640

Thr Thr Thr Asp Lys Val Ile Asn Asn Cys Lys Ile Asp Gln Cys His
 645 650 655

Ala Ala Val Thr Asn His Lys Asn Trp Gln Tyr Asn Ser Pro Leu Val
 660 665 670

Pro Arg Asn Ala Glu Leu Gly Asp Arg Lys Gly Lys Ile His Ile Pro
 675 680 685

Phe Pro Leu Ala Asn Val Thr Cys Arg Val Pro Lys Ala Arg Asn Pro
 690 695 700

Thr Val Thr Tyr Gly Lys Asn Gln Val Thr Met Leu Leu Tyr Pro Asp
705 710 715 720

His Pro Thr Leu Leu Ser Tyr Arg Asn Met Gly Gln Glu Pro Asn Tyr
 725 730 735

His Glu Glu Trp Val Thr His Lys Lys Glu Val Thr Leu Thr Val Pro
 740 745 750

Thr Glu Gly Leu Glu Val Thr Trp Gly Asn Asn Glu Pro Tyr Lys Tyr
 755 760 765

Trp Pro Gln Met Ser Thr Asn Gly Thr Ala His Gly His Pro His Glu
 770 775 780

Ile Ile Leu Tyr Tyr Tyr Glu Leu Tyr Pro Thr Met Thr Val Val Ile
785 790 795 800

Val Ser Val Ala Ser Phe Val Leu Leu Ser Met Val Gly Thr Ala Val
 805 810 815

Gly Met Cys Val Cys Ala Arg Arg Arg Cys Ile Thr Pro Tyr Glu Leu
 820 825 830

Thr Pro Gly Ala Thr Val Pro Phe Leu Leu Ser Leu Leu Cys Cys Val
 835 840 845

Arg Thr Thr Lys Ala Ala Thr Tyr Tyr Glu Ala Ala Ala Tyr Leu Trp
 850 855 860

Asn Glu Gln Gln Pro Leu Phe Trp Leu Gln Ala Leu Ile Pro Leu Ala
865 870 875 880

Ala Leu Ile Val Leu Cys Asn Cys Leu Lys Leu Leu Pro Cys Cys Cys
 885 890 895

Lys Thr Leu Ala Phe Leu Ala Val Met Ser Ile Gly Ala His Thr Val
 900 905 910

Ser Ala Tyr Glu His Val Thr Val Ile Pro Asn Thr Val Gly Val Pro
 915 920 925

Tyr Lys Thr Leu Val Asn Arg Pro Gly Tyr Ser Pro Met Val Leu Glu
 930 935 940

Met Glu Leu Gln Ser Val Thr Leu Glu Pro Thr Leu Ser Leu Asp Tyr
 945 950 955 960

Ile Thr Cys Glu Tyr Lys Thr Val Ile Pro Ser Pro Tyr Val Lys Cys
 965 970 975

Cys Gly Thr Ala Glu Cys Lys Asp Lys Ser Leu Pro Asp Tyr Ser Cys
 980 985 990

Lys Val Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys
 995 1000 1005

Phe Cys Asp Ala Glu Asn Thr Gln Leu Ser Glu Ala His Val Glu
 1010 1015 1020

Lys Ser Glu Ser Cys Lys Thr Glu Phe Ala Ser Ala Tyr Arg Ala
 1025 1030 1035

His Thr Ala Ser Ala Ser Ala Lys Leu Arg Val Leu Tyr Gln Gly
 1040 1045 1050

Asn Asn Ile Thr Val Ala Ala Tyr Ala Asn Gly Asp His Ala Val
 1055 1060 1065

Thr Val Lys Asp Ala Lys Phe Val Val Gly Pro Met Ser Ser Ala
 1070 1075 1080

Trp Thr Pro Phe Asp Asn Lys Ile Val Val Tyr Lys Gly Asp Val
 1085 1090 1095

Tyr Asn Met Asp Tyr Pro Pro Phe Gly Ala Gly Arg Pro Gly Gln
 1100 1105 1110

Phe Gly Asp Ile Gln Ser Arg Thr Pro Glu Ser Lys Asp Val Tyr
 1115 1120 1125

Ala Asn Thr Gln Leu Val Leu Gln Arg Pro Ala Ala Gly Thr Val

1130	1135	1140
His Val Pro Tyr Ser Gln Ala	Pro Ser Gly Phe Lys	Tyr Trp Leu
1145	1150	1155
Lys Glu Arg Gly Ala Ser Leu	Gln His Thr Ala Pro	Phe Gly Cys
1160	1165	1170
Gln Ile Ala Thr Asn Pro Val	Arg Ala Val Asn Cys	Ala Val Gly
1175	1180	1185
Asn Ile Pro Ile Ser Ile Asp	Ile Pro Asp Ala Ala	Phe Thr Arg
1190	1195	1200
Val Val Asp Ala Pro Ser Val	Thr Asp Met Ser Cys	Glu Val Pro
1205	1210	1215
Ala Cys Thr His Ser Ser Asp	Phe Gly Gly Val Ala	Ile Ile Lys
1220	1225	1230
Tyr Thr Ala Ser Lys Lys Gly	Lys Cys Ala Val His	Ser Met Thr
1235	1240	1245
Asn Ala Val Thr Ile Arg Glu	Ala Asp Val Glu Val	Glu Gly Asn
1250	1255	1260
Ser Gln Leu Gln Ile Ser Phe	Ser Thr Ala Leu Ala	Ser Ala Glu
1265	1270	1275
Phe Arg Val Gln Val Cys Ser	Thr Gln Val His Cys	Ala Ala Ala
1280	1285	1290
Cys His Pro Pro Lys Asp His	Ile Val Asn Tyr Pro	Ala Ser His
1295	1300	1305
Thr Thr Leu Gly Val Gln Asp	Ile Ser Thr Thr Ala	Met Ser Trp
1310	1315	1320
Val Gln Lys Ile Thr Gly Gly	Val Gly Leu Ile Val	Ala Val Ala
1325	1330	1335
Ala Leu Ile Leu Ile Val Val	Leu Cys Val Ser Phe	Ser Arg His
1340	1345	1350

<210> 42
 <211> 7329
 <212> DNA
 <213> Artificial

<220>

<223> VLP74_25 (VEEV VLP 519 NPNAx6) Whole sequence

<400> 42

tcgcgcgttt cggigatgac ggtgaaaacc tctgacacat gcagctcccc gagacgggtca	60
cagcttgtct gtaagcggat gccgggagca gacaagcccc tcaggcgccg tcagcgggtg	120
ttagcgggtg tcggggcttg cttaactatg cggcatcaga gcagattgta ctgagagtgc	180
accatatgcg gtgtgaaata ccgcacagat gcgtaaggag aaaataccgc atcaggcgcc	240
attcgccatt caggctgcgc aactgttggg aaggcgcatc ggtgcgggcc tcttcgctat	300
tacgccagct ggcgaaaggg ggatgtgtcg caaggcgatt aagttaggta acgccagggt	360
tttcccagtc acgacgttgt aaaacgacgg ccagtgaatt gacgcgtgtt ggcatgtatt	420
attgactagt tattaatagt aatcaattac ggggtcatta gticatatgcc catatatgga	480
gttcgcggtt acataactta cggtaaatgg cccgcctggc tgaccgcca acgacccccg	540
cccatgtacg tcaataatga cgtatgttcc catagtaacg ccaataggga ctttcattg	600
acgtcaatgg gtggagtatt tacggtaaac tgcccacttg gcagtacatc aagtgtatca	660
tatgccaaagt acgcccccta ttgacgtcaa tgacggtaaa tggccgcct ggcatatgc	720
ccagtacatg accttatggg actttcctac ttggcagtac atctacgtat tagtcatcgc	780
tattaccatg gtgatgcggg ttggcagta catcaatggg cgtggatagc ggtttgactc	840
acggggattt ccaagtcicc accccattga cgtcaatggg agtttgtttt ggcacaaaaa	900
tcaacgggac tticccaaat gtcgtaacaa ctccgcccc ttgacgcaaa tggcggtag	960
gcgtgtacgg tgggaggtct atataagcag agctcgttta gtgaaccgtc agataactgc	1020
aggtcgacga tatcgcggcc gccacatgt tccggtcca gccaatgtat ccgatgcagc	1080
caatgcccta tcgcaacccg ttgcggcccc cgcgcaggcc ctggttcccc agaaccgacc	1140
cttttctggc gatgcagggt caggaattaa cccgctcgat ggctaacctg acgttcaagc	1200
aacgccggga cgcgccacct gaggggcat ccgctaataa accgaagaag gaggcctcgc	1260
aaaaacagaa agggggaggc caagggaaga agaagaagaa ccaagggaag aagaaggcta	1320

agacagggcc gcctaatccg aaggcacaga atggaaacaa gaagaagacc aacaagaaac	1380
caggcaagag acagcgcatt gtcattgaaat tggaattcga caagacgttc ccaattcatt	1440
tggaagggaa gataaacggc tacgcttggt tggcggagg gaagttattc aggccgatgc	1500
atgtggaagg caagatcgac aacgacgttc tggccgcgt taagacgaag aaagcatcca	1560
aatacgatct tgagtatgca gatgtgccac agaacatgcg ggccgataca ttcaaataca	1620
cccatgagaa accccaaggc tattacagct ggcatcattg agcagtccaa tatgaaaatg	1680
ggcgtttcac ggtgccgaaa ggagttgggg ccaagggaga cagcggacga cccattctgg	1740
ataaccaggg acgggtggtc gctattgtgc tgggaggtgt gaatgaagga tctaggacag	1800
ccctttcagt cgtcattgtg aacgagaagg gagttaccgt gaagtatact ccagagaact	1860
gcgagcaatg gtcactatg accaccattg gtctgctgc caatgtgacg ttcccatgtg	1920
ctcaaccacc aatttgctac gacagaaaac cagcagagac ttggccatg ctacgcgtta	1980
acgttgacaa cccgggctac gatgagctgc tggaagcagc tgtaagtgc cccggaagga	2040
aaaggagatc caccgaggag ctgtttaatg agtataagct aacgcgcct tacatggcca	2100
gatgcatcag atgtgcagtt gggagctgcc atagtccaat agcaatcgag gcagtaaaga	2160
gcgacgggca cgacggttat gttagacttc agacttcctc gcagtatggc ctggattcct	2220
ccggcaactt aaagggcagg accatgcgtt atgacatgca cgggaccatt aaagagatac	2280
cactacatca agtgcactc tatacatctc gcccggtca cattgtggat gggcacggtt	2340
atttctgct tgccaggtgc cggcagggg actccatcac catggaattt aagaaagatt	2400
ccgtcagaca ctctgctcg gtgccgatg aagtgaatt taatcctgta ggcagagaac	2460
tctatactca tccccagaa cacggagtag agcaagcgt ccaagtctac gcacatgatg	2520
cacagaacag aggagcttat gtcgagatgc acctccggg ctcagaagtg gacagcagtt	2580
tggtttcctt gagcggcagt tccggaggaa acccgaatgc caatcccaac gcgaaccca	2640
atgctaacc aaatgccaac ccaaagcca acccaacgc tggatgatcc tcagtcaccg	2700
tgacacctcc tgatgggact agcgccttg tggaatgcga gtgtggcggc acaaagatct	2760
ccgagacat caacaagaca aaacagttca gccagtgcac aaagaaggag cagtgcagag	2820

catatcggct gcagaacgat aagtgggtgt ataattctga caaactgccc aaagcagcgg	2880
gagccacctt aaaaggaaaa ctgcatgtcc cattcttgct ggcagacggc aaatgcaccg	2940
tgctcttagc accagaacct atgataacct tcggtttcag atcagtgta ctgaaactgc	3000
accctaagaa tcccacatat ctaatcaccg gccaaactgc tgatgagcct cactacacgc	3060
acgagctcat atctgaacca gctgttagga attttaccgt caccgaaaaa gggteggagt	3120
ttgtatgggg aaaccacccg ccgaaaaggt tttgggcaca ggaaacagca cccggaaatc	3180
cacatgggct accgcacgag gtgataactc attattacca cagataccct atgtccacca	3240
tcctgggttt gtcaatttgt gccgccattg caaccgtttc cgttgcagcg tctacctggc	3300
tgttttgcag atcaagagtt gcgtgcctaa ctcttaccg gctaacacct aacgctagga	3360
taccattttg tctggctgtg ctttgcctgc ccgcactgc ccgggccgag accacctggg	3420
agtccttggg tcacctatgg aacaataacc aacagatgtt ctggattcaa ttgctgatcc	3480
ctctggccgc ctgatcgtg gtgactcggc tgcctcagtg cgtgtcctgt gtcgtgcctt	3540
ttttagtcat ggccggcgcc gcaggcgccg gcgcctacga gcacgcgacc acgatgccga	3600
gccaaagcggg aatctcgtat aacactatag tcaacagagc aggctacgca ccactcccta	3660
tcagcataac accaacaag atcaagctga tacctacagt gaacttggag tacgtcacct	3720
gccactacaa aacaggaatg gattcaccag ccatcaaatg ctgcggatct caggaatgca	3780
ctccaactta caggcctgat gaacagtgc aagtcttcac aggggtttac ccgttcatgt	3840
ggggtggtgc atattgcttt tgcgacactg agaacaccca agtcagcaag gcctacgtaa	3900
tgaaatctga cgactgcctt gcggatcatg ctgaagcata taaagcgac acagcctcag	3960
tgcaggcgtt cctcaacatc acagtgggag aacactctat tgtgactacc gtgtatgtga	4020
atggagaaac tcctgtgaat ttcaatgggg tcaaaataac tgcaggtcg ctttccacag	4080
cttggacacc ctttgatcgc aaaatcgtgc agtatgccg ggagatatat aattatgatt	4140
ttcctgagta tggggcagga caaccaggag catttggaga tataaatcc agaacagtct	4200
caagctctga tctgtatgcc aataccaacc tagtgctgca gagacccaaa gcaggagcga	4260

tccacgtgcc atacactcag gcaccttcgg gttttgagca atggaagaaa gataaagctc	4320
catcattgaa atttaccgcc cctttcggat gcgaaatata taaaaacccc attcgcgccg	4380
aaaactgtgc tgtagggtca attccattag cctttgacat tcccgaagcc ttgttcacca	4440
gggtgtcaga aacaccgaca ctttcagcgg ccgaatgcac tcttaacgag tgcgtgtatt	4500
cttccgactt tgggtgggac gccacggta agtactcggc cagcaagtca ggcaagtgcg	4560
cagtccaigt gccatcaggg actgctaccc taaaagaagc agcagtcgag ctaaccgagc	4620
aagggtcggc gactatccat ttctcgaccg caaatatcca cccggagttc aggctccaaa	4680
tatgcacatc atatgttacg tgcaaaggta attgtcaccg cccgaaagac catattgtga	4740
cacaccctca gtatcagcc caaacattta cagccgcggt gtcaaaaacc gcgtggacgt	4800
ggttaacatc cctgctggga ggatcagccg taattattat aattggcttg gtgctggcta	4860
ctattgtggc catgtacgtg ctgaccaacc agaaacataa ttaaggatct agatcgtcg	4920
tgccttctag ttgccagcca tctgttgttt gccctcccc cgtgccttcc ttgacctgg	4980
aagggtccac tccactgtc ctttctaata aaaatgagga aattgcatcg cattgtctga	5040
gtagggtgtca ttctattctg gggggtgggg tggggcagga cagcaagggg gaggattggg	5100
aagacaatag caggcatgct ggggatgcgg tgggctctat ggctcgagca tggcatagc	5160
tgtttctgt gtgaaattgt tatccgctca caattccaca caacatacga gccggaagca	5220
taaagtgtaa agcctggggg gcctaataag tgagctaact cacattaatt gcgttgcgct	5280
cactgcccgc tttccagtcg ggaaacctgt cgtgccagct gcattaatga atcgccaac	5340
gcgcggggag aggcggtttg cgtattgggc gctcttcgc ttcctcgctc actgactcg	5400
tgcgctcggc cgttcggctg cggcgagcgg tatcagctca ctcaaagcgg gtaatacgg	5460
tatccacaga atcaggggat aacgcaggaa agaacaigtg agcaaaaggc cagcaaaagg	5520
ccaggaaccg taaaaaggcc gcgttgctgg cgtttttcca taggctcgc cccctgacg	5580
agcatcaca aaatcgacgc tcaagtcaga ggtggcgaaa cccgacagga ctataaagat	5640
accaggcgtt tccccctgga agctccctcg tgcgctctcc tgttccgacc ctgccgtta	5700
ccggatacct gtccgccttt ctcccttcgg gaagcgtggc gctttctcat agctcacgct	5760

gtaggtatct cagttcggtg taggtcgttc gctccaagct gggctgtgtg cacgaacccc	5820
ccgttcagcc cgaccgctgc gccttatccg gtaactatcg tcttgagtcc aaccggtaa	5880
gacacgactt atcgccactg gcagcagcca ctggtaacag gattagcaga gcgaggtatg	5940
taggcggctg tacagagttc ttgaagtggg ggcctaacta cggctacact agaagaacag	6000
tatttggat ctgcgctctg ctgaagccag ttaccttcgg aaaaagagtt ggtagctctt	6060
gatccggcaa acaaaccacc gctggtagcg gtggttttt tgtttgcaag cagcagatta	6120
cgcgagaaa aaaaggatct caagaagatc ctttgatctt ttctacgggg tctgacgctc	6180
agtggaacga aaactcacgt taagggattt tggcatgag attatcaaaa aggatcttca	6240
cctagatcct tttaaattaa aaatgaagtt ttaaatcaat ctaaagtata tatgagtaaa	6300
cttggctga cagttagaaa aactcatcga gcatcaaatg aaactgcaat ttattcatat	6360
caggattatc aataccatat ttttggaaaa gccgtttctg taatgaagga gaaaactcac	6420
cgaggcagtt ccataggatg gcaagatcct ggtatcggtc tgcgattccg actcgtccaa	6480
catcaataca acctattaat ttcccctcgt caaaaataag gttatcaagt gagaaatcac	6540
catgagtac gactgaatcc ggtgagaatg gcaaaagttt atgcatttct ttccagactt	6600
gttcaacagg ccagccatta cgctcgtcat caaaatcact cgcatcaacc aaaccgttat	6660
tcattcgtga ttgcgcctga gcgagacgaa atacgcgac gctgttaaaa ggacaattac	6720
aaacaggaat cgaatgcaac cggcgcagga acactgccag cgcatcaaca atattttcac	6780
ctgaatcagg atattcttct aatacctgga atgctgtttt cccagggatc gcagtgggta	6840
gtaaccatgc atcatcagga gtacggataa aatgcttgat ggtcggaaga ggcataaatt	6900
ccgtcagcca gtttagtctg accatctcat ctgtaacatc attggcaacg ctaccttgc	6960
catgtttcag aaacaactct ggcgcatcgg gcttccata caatcgatag attgtcgac	7020
ctgattgccc gacattatcg cgagcccatt tatacccata taaatcagca tccatgttg	7080
aatttaatcg cggcctagag caagacgttt cccgttgaat atggctcata ctcttccttt	7140
ttcaatatta ttgaagcatt tatcagggtt attgtctcat gagcggatac atatttgaat	7200

gtatttagaa aaataaaca ataggggttc cgcgcacatt tccccgaaaa gtgccacctg 7260
 acgtctaaga aaccattatt atcatgacat taacctataa aaataggcgt atcacgaggc 7320
 cctttcgtc 7329

<210> 43
 <211> 1285
 <212> PRT
 <213> Artificial

<220>
 <223> VLP74_25 (VEEV VLP 519 NPNAx6) amino acid sequence

<400> 43

Met Phe Pro Phe Gln Pro Met Tyr Pro Met Gln Pro Met Pro Tyr Arg
 1 5 10 15

Asn Pro Phe Ala Ala Pro Arg Arg Pro Trp Phe Pro Arg Thr Asp Pro
 20 25 30

Phe Leu Ala Met Gln Val Gln Glu Leu Thr Arg Ser Met Ala Asn Leu
 35 40 45

Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Asn
 50 55 60

Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly
 65 70 75 80

Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro
 85 90 95

Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro
 100 105 110

Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe
 115 120 125

Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly
 130 135 140

Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp
 145 150 155 160

Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu
 165 170 175

Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr
 180 185 190

His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln
 195 200 205

Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly
 210 215 220

Asp Ser Gly Arg Pro Ile Leu Asp Asn Gln Gly Arg Val Val Ala Ile
 225 230 235 240

Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val
 245 250 255

Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys
 260 265 270

Glu Gln Trp Ser Leu Val Thr Thr Met Cys Leu Leu Ala Asn Val Thr
 275 280 285

Phe Pro Cys Ala Gln Pro Pro Ile Cys Tyr Asp Arg Lys Pro Ala Glu
 290 295 300

Thr Leu Ala Met Leu Ser Val Asn Val Asp Asn Pro Gly Tyr Asp Glu
 305 310 315 320

Leu Leu Glu Ala Ala Val Lys Cys Pro Gly Arg Lys Arg Arg Ser Thr
 325 330 335

Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met Ala Arg
 340 345 350

Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala Ile Glu
 355 360 365

Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln Thr Ser
 370 375 380

Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg Thr Met
 385 390 395 400

Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His Gln Val
 405 410 415

Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His Gly Tyr
 420 425 430

Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met Glu Phe
 435 440 445

Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu Val Lys
 450 455 460

Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu His Gly
 465 470 475 480

Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn Arg Gly
 485 490 495

Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser Ser Leu
 500 505 510

Val Ser Leu Ser Gly Ser Ser Gly Gly Asn Pro Asn Ala Asn Pro Asn
 515 520 525

Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn
 530 535 540

Ala Gly Gly Ser Ser Val Thr Val Thr Pro Pro Asp Gly Thr Ser Ala
 545 550 555 560

Leu Val Glu Cys Glu Cys Gly Gly Thr Lys Ile Ser Glu Thr Ile Asn
 565 570 575

Lys Thr Lys Gln Phe Ser Gln Cys Thr Lys Lys Glu Gln Cys Arg Ala
 580 585 590

Tyr Arg Leu Gln Asn Asp Lys Trp Val Tyr Asn Ser Asp Lys Leu Pro
 595 600 605

Lys Ala Ala Gly Ala Thr Leu Lys Gly Lys Leu His Val Pro Phe Leu
 610 615 620

Leu Ala Asp Gly Lys Cys Thr Val Pro Leu Ala Pro Glu Pro Met Ile
 625 630 635 640

Thr Phe Gly Phe Arg Ser Val Ser Leu Lys Leu His Pro Lys Asn Pro
 645 650 655

Thr Tyr Leu Ile Thr Arg Gln Leu Ala Asp Glu Pro His Tyr Thr His
 660 665 670

Glu Leu Ile Ser Glu Pro Ala Val Arg Asn Phe Thr Val Thr Glu Lys
 675 680 685

Gly Trp Glu Phe Val Trp Gly Asn His Pro Pro Lys Arg Phe Trp Ala

690	695	700
Gln Glu Thr Ala Pro Gly Asn Pro His Gly Leu Pro His Glu Val Ile		
705	710	715 720
Thr His Tyr Tyr His Arg Tyr Pro Met Ser Thr Ile Leu Gly Leu Ser		
	725	730 735
Ile Cys Ala Ala Ile Ala Thr Val Ser Val Ala Ala Ser Thr Trp Leu		
	740	745 750
Phe Cys Arg Ser Arg Val Ala Cys Leu Thr Pro Tyr Arg Leu Thr Pro		
	755	760 765
Asn Ala Arg Ile Pro Phe Cys Leu Ala Val Leu Cys Cys Ala Arg Thr		
	770	775 780
Ala Arg Ala Glu Thr Thr Trp Glu Ser Leu Asp His Leu Trp Asn Asn		
	785	790 795 800
Asn Gln Gln Met Phe Trp Ile Gln Leu Leu Ile Pro Leu Ala Ala Leu		
	805	810 815
Ile Val Val Thr Arg Leu Leu Arg Cys Val Cys Cys Val Val Pro Phe		
	820	825 830
Leu Val Met Ala Gly Ala Ala Gly Ala Gly Ala Tyr Glu His Ala Thr		
	835	840 845
Thr Met Pro Ser Gln Ala Gly Ile Ser Tyr Asn Thr Ile Val Asn Arg		
	850	855 860
Ala Gly Tyr Ala Pro Leu Pro Ile Ser Ile Thr Pro Thr Lys Ile Lys		
	865	870 875 880
Leu Ile Pro Thr Val Asn Leu Glu Tyr Val Thr Cys His Tyr Lys Thr		
	885	890 895
Gly Met Asp Ser Pro Ala Ile Lys Cys Cys Gly Ser Gln Glu Cys Thr		
	900	905 910
Pro Thr Tyr Arg Pro Asp Glu Gln Cys Lys Val Phe Thr Gly Val Tyr		
	915	920 925
Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys Asp Thr Glu Asn Thr		
	930	935 940
Gln Val Ser Lys Ala Tyr Val Met Lys Ser Asp Asp Cys Leu Ala Asp		
	945	950 955 960

His Ala Glu Ala Tyr Lys Ala His Thr Ala Ser Val Gln Ala Phe Leu
 965 970 975

Asn Ile Thr Val Gly Glu His Ser Ile Val Thr Thr Val Tyr Val Asn
 980 985 990

Gly Glu Thr Pro Val Asn Phe Asn Gly Val Lys Ile Thr Ala Gly Pro
 995 1000 1005

Leu Ser Thr Ala Trp Thr Pro Phe Asp Arg Lys Ile Val Gln Tyr
 1010 1015 1020

Ala Gly Glu Ile Tyr Asn Tyr Asp Phe Pro Glu Tyr Gly Ala Gly
 1025 1030 1035

Gln Pro Gly Ala Phe Gly Asp Ile Gln Ser Arg Thr Val Ser Ser
 1040 1045 1050

Ser Asp Leu Tyr Ala Asn Thr Asn Leu Val Leu Gln Arg Pro Lys
 1055 1060 1065

Ala Gly Ala Ile His Val Pro Tyr Thr Gln Ala Pro Ser Gly Phe
 1070 1075 1080

Glu Gln Trp Lys Lys Asp Lys Ala Pro Ser Leu Lys Phe Thr Ala
 1085 1090 1095

Pro Phe Gly Cys Glu Ile Tyr Thr Asn Pro Ile Arg Ala Glu Asn
 1100 1105 1110

Cys Ala Val Gly Ser Ile Pro Leu Ala Phe Asp Ile Pro Asp Ala
 1115 1120 1125

Leu Phe Thr Arg Val Ser Glu Thr Pro Thr Leu Ser Ala Ala Glu
 1130 1135 1140

Cys Thr Leu Asn Glu Cys Val Tyr Ser Ser Asp Phe Gly Gly Ile
 1145 1150 1155

Ala Thr Val Lys Tyr Ser Ala Ser Lys Ser Gly Lys Cys Ala Val
 1160 1165 1170

His Val Pro Ser Gly Thr Ala Thr Leu Lys Glu Ala Ala Val Glu
 1175 1180 1185

Leu Thr Glu Gln Gly Ser Ala Thr Ile His Phe Ser Thr Ala Asn
 1190 1195 1200

Ile His Pro Glu Phe Arg Leu Gln Ile Cys Thr Ser Tyr Val Thr
 1205 1210 1215

Cys Lys Gly Asp Cys His Pro Pro Lys Asp His Ile Val Thr His
 1220 1225 1230

Pro Gln Tyr His Ala Gln Thr Phe Thr Ala Ala Val Ser Lys Thr
 1235 1240 1245

Ala Trp Thr Trp Leu Thr Ser Leu Leu Gly Gly Ser Ala Val Ile
 1250 1255 1260

Ile Ile Ile Gly Leu Val Leu Ala Thr Ile Val Ala Met Tyr Val
 1265 1270 1275

Leu Thr Asn Gln Lys His Asn
 1280 1285

<210> 44
 <211> 20
 <212> PRT
 <213> Plasmodium falciparum

<400> 44

Glu Tyr Leu Asn Lys Ile Gln Asn Ser Leu Ser Thr Glu Trp Ser Pro
 1 5 10 15

Cys Ser Val Thr
 20

<210> 45
 <211> 20
 <212> PRT
 <213> Plasmodium yoelii

<400> 45

Tyr Asn Arg Asn Ile Val Asn Arg Leu Leu Gly Asp Ala Leu Asn Gly
 1 5 10 15

Pro Glu Glu Lys
 20

<210> 46
 <211> 30

<212> PRT
 <213> Artificial

<220>
 <223> VLP74 insert

<400> 46

Ser Gly Gly Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn
 1 5 10 15

Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Gly Gly Ser
 20 25 30

<210> 47
 <211> 90
 <212> DNA
 <213> Artificial

<220>
 <223> VLP74 insert

<400> 47
 tccggaggaa acccgaatgc caatcccaac gcgaacccca atgctaacc aaatgccaac 60
 ccaaacgcc aacccaacgc tggatgatcc 90

<210> 48
 <211> 106
 <212> PRT
 <213> Artificial

<220>
 <223> VLP78 insert

<400> 48

Ser Gly Gly Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn
 1 5 10 15

Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Val Asp Pro Asn Ala Asn
 20 25 30

Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn
 35 40 45

Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn

50

55

60

Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn
 65 70 75 80

Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn
 85 90 95

Pro Asn Ala Asn Pro Asn Ala Gly Gly Ser
 100 105

<210> 49

<211> 318

<212> DNA

<213> Artificial

<220>

<223> VLP74 insert

<400> 49

tccggaggaa acccgaatgc caatccaac gcgaaccca acgctaacc caacgccaat 60

ccgaatgcaa acccgaacgt tgacccaaac gccaacccga atgccaatcc caacgcgaac 120

cccaatgcta acccaaatgc caacccaaac gccaacccca acgctaattcc aaacgccaac 180

cctaacgcca atccaacgc gaatcctaac gctaatecca acgcaaatcc caatgctaatt 240

ccgaacgcga accctaattgc aaaccccaac gccaacccga acgctaacc gaacgctaatt 300

cccaacgccg gtggatcc 318

<210> 50

<211> 452

<212> PRT

<213> Artificial

<220>

<223> CHIKV E2-74 fusion protein

<400> 50

Ser Thr Lys Asp Asn Phe Asn Val Tyr Lys Ala Thr Arg Pro Tyr Leu
 1 5 10 15

Ala His Cys Pro Asp Cys Gly Glu Gly His Ser Cys His Ser Pro Ile
 20 25 30

Ala Leu Glu Arg Ile Arg Asn Glu Ala Thr Asp Gly Thr Leu Lys Ile
35 40 45

Gln Val Ser Leu Gln Ile Gly Ile Lys Thr Asp Asp Ser His Asp Trp
50 55 60

Thr Lys Leu Arg Tyr Met Asp Ser His Thr Pro Ala Asp Ala Glu Arg
65 70 75 80

Ala Gly Leu Leu Val Arg Thr Ser Ala Pro Cys Thr Ile Thr Gly Thr
85 90 95

Met Gly His Phe Ile Leu Ala Arg Cys Pro Lys Gly Glu Thr Leu Thr
100 105 110

Val Gly Phe Thr Asp Ser Arg Lys Ile Ser His Thr Cys Thr His Pro
115 120 125

Phe His His Glu Pro Pro Val Ile Gly Arg Glu Arg Phe His Ser Arg
130 135 140

Pro Gln His Gly Lys Glu Leu Pro Cys Ser Thr Tyr Val Gln Ser Thr
145 150 155 160

Ala Ala Thr Ala Glu Glu Ile Glu Val His Met Pro Pro Asp Thr Pro
165 170 175

Asp Arg Thr Leu Met Thr Gln Gln Ser Gly Asn Val Lys Ile Thr Val
180 185 190

Asn Gly Gln Thr Val Arg Tyr Lys Cys Asn Cys Gly Gly Ser Gly Gly
195 200 205

Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala
210 215 220

Asn Pro Asn Ala Asn Pro Asn Ala Gly Gly Ser Asn Glu Gly Leu Thr
225 230 235 240

Thr Thr Asp Lys Val Ile Asn Asn Cys Lys Ile Asp Gln Cys His Ala
245 250 255

Ala Val Thr Asn His Lys Asn Trp Gln Tyr Asn Ser Pro Leu Val Pro
260 265 270

Arg Asn Ala Glu Leu Gly Asp Arg Lys Gly Lys Ile His Ile Pro Phe
275 280 285

Pro Leu Ala Asn Val Thr Cys Arg Val Pro Lys Ala Arg Asn Pro Thr
290 295 300

Val Thr Tyr Gly Lys Asn Gln Val Thr Met Leu Leu Tyr Pro Asp His
305 310 315 320

Pro Thr Leu Leu Ser Tyr Arg Asn Met Gly Gln Glu Pro Asn Tyr His
325 330 335

Glu Glu Trp Val Thr His Lys Lys Glu Val Thr Leu Thr Val Pro Thr
340 345 350

Glu Gly Leu Glu Val Thr Trp Gly Asn Asn Glu Pro Tyr Lys Tyr Trp
355 360 365

Pro Gln Met Ser Thr Asn Gly Thr Ala His Gly His Pro His Glu Ile
370 375 380

Ile Leu Tyr Tyr Tyr Glu Leu Tyr Pro Thr Met Thr Val Val Ile Val
385 390 395 400

Ser Val Ala Ser Phe Val Leu Leu Ser Met Val Gly Thr Ala Val Gly
405 410 415

Met Cys Val Cys Ala Arg Arg Arg Cys Ile Thr Pro Tyr Glu Leu Thr
420 425 430

Pro Gly Ala Thr Val Pro Phe Leu Leu Ser Leu Leu Cys Cys Val Arg
435 440 445

Thr Thr Lys Ala
450

<210> 51
<211> 439
<212> PRT
<213> Artificial

<220>
<223> CHIKV E1

<400> 51

Tyr Glu His Val Thr Val Ile Pro Asn Thr Val Gly Val Pro Tyr Lys
1 5 10 15

Thr Leu Val Asn Arg Pro Gly Tyr Ser Pro Met Val Leu Glu Met Glu
20 25 30

Leu Gln Ser Val Thr Leu Glu Pro Thr Leu Ser Leu Asp Tyr Ile Thr
 35 40 45
 Cys Glu Tyr Lys Thr Val Ile Pro Ser Pro Tyr Val Lys Cys Cys Gly
 50 55 60
 Thr Ala Glu Cys Lys Asp Lys Ser Leu Pro Asp Tyr Ser Cys Lys Val
 65 70 75 80
 Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys
 85 90 95
 Asp Ala Glu Asn Thr Gln Leu Ser Glu Ala His Val Glu Lys Ser Glu
 100 105 110
 Ser Cys Lys Thr Glu Phe Ala Ser Ala Tyr Arg Ala His Thr Ala Ser
 115 120 125
 Ala Ser Ala Lys Leu Arg Val Leu Tyr Gln Gly Asn Asn Ile Thr Val
 130 135 140
 Ala Ala Tyr Ala Asn Gly Asp His Ala Val Thr Val Lys Asp Ala Lys
 145 150 155 160
 Phe Val Val Gly Pro Met Ser Ser Ala Trp Thr Pro Phe Asp Asn Lys
 165 170 175
 Ile Val Val Tyr Lys Gly Asp Val Tyr Asn Met Asp Tyr Pro Pro Phe
 180 185 190
 Gly Ala Gly Arg Pro Gly Gln Phe Gly Asp Ile Gln Ser Arg Thr Pro
 195 200 205
 Glu Ser Lys Asp Val Tyr Ala Asn Thr Gln Leu Val Leu Gln Arg Pro
 210 215 220
 Ala Ala Gly Thr Val His Val Pro Tyr Ser Gln Ala Pro Ser Gly Phe
 225 230 235 240
 Lys Tyr Trp Leu Lys Glu Arg Gly Ala Ser Leu Gln His Thr Ala Pro
 245 250 255
 Phe Gly Cys Gln Ile Ala Thr Asn Pro Val Arg Ala Val Asn Cys Ala
 260 265 270
 Val Gly Asn Ile Pro Ile Ser Ile Asp Ile Pro Asp Ala Ala Phe Thr
 275 280 285

Arg Val Val Asp Ala Pro Ser Val Thr Asp Met Ser Cys Glu Val Pro
 290 295 300

Ala Cys Thr His Ser Ser Asp Phe Gly Gly Val Ala Ile Ile Lys Tyr
 305 310 315 320

Thr Ala Ser Lys Lys Gly Lys Cys Ala Val His Ser Met Thr Asn Ala
 325 330 335

Val Thr Ile Arg Glu Ala Asp Val Glu Val Glu Gly Asn Ser Gln Leu
 340 345 350

Gln Ile Ser Phe Ser Thr Ala Leu Ala Ser Ala Glu Phe Arg Val Gln
 355 360 365

Val Cys Ser Thr Gln Val His Cys Ala Ala Ala Cys His Pro Pro Lys
 370 375 380

Asp His Ile Val Asn Tyr Pro Ala Ser His Thr Thr Leu Gly Val Gln
 385 390 395 400

Asp Ile Ser Thr Thr Ala Met Ser Trp Val Gln Lys Ile Thr Gly Gly
 405 410 415

Val Gly Leu Ile Val Ala Val Ala Ala Leu Ile Leu Ile Val Val Leu
 420 425 430

Cys Val Ser Phe Ser Arg His
 435

<210> 52

<211> 261

<212> PRT

<213> Artificial

<220>

<223> CHIKV capsid

<400> 52

Met Glu Phe Ile Pro Thr Gln Thr Phe Tyr Asn Arg Arg Tyr Gln Pro
 1 5 10 15

Arg Pro Trp Ala Pro Arg Pro Thr Ile Gln Val Ile Arg Pro Arg Pro
 20 25 30

Arg Pro Gln Arg Gln Ala Gly Gln Leu Ala Gln Leu Ile Ser Ala Val
 35 40 45

Asn Lys Leu Thr Met Arg Ala Val Pro Gln Gln Lys Pro Arg Arg Asn
 50 55 60

Arg Lys Asn Lys Lys Gln Arg Gln Lys Lys Gln Ala Pro Gln Asn Asp
 65 70 75 80

Pro Lys Gln Lys Lys Gln Pro Pro Gln Lys Lys Pro Ala Gln Lys Lys
 85 90 95

Lys Lys Pro Gly Arg Arg Glu Arg Met Cys Met Lys Ile Glu Asn Asp
 100 105 110

Cys Ile Phe Glu Val Lys His Glu Gly Lys Val Met Gly Tyr Ala Cys
 115 120 125

Leu Val Gly Asp Lys Val Met Lys Pro Ala His Val Lys Gly Thr Ile
 130 135 140

Asp Asn Ala Asp Leu Ala Lys Leu Ala Phe Lys Arg Ser Ser Lys Tyr
 145 150 155 160

Asp Leu Glu Cys Ala Gln Ile Pro Val His Met Lys Ser Asp Ala Ser
 165 170 175

Lys Phe Thr His Glu Lys Pro Glu Gly Tyr Tyr Asn Trp His His Gly
 180 185 190

Ala Val Gln Tyr Ser Gly Gly Arg Phe Thr Ile Pro Thr Gly Ala Gly
 195 200 205

Lys Pro Gly Asp Ser Gly Arg Pro Ile Phe Asp Asn Lys Gly Arg Val
 210 215 220

Val Ala Ile Val Leu Gly Gly Ala Asn Glu Gly Ala Arg Thr Ala Leu
 225 230 235 240

Ser Val Val Thr Trp Asn Lys Asp Ile Val Thr Lys Ile Thr Pro Glu
 245 250 255

Gly Ala Glu Glu Trp
 260

<210> 53
 <211> 453
 <212> PRT
 <213> Artificial

<220>

<223> VEEV E2-74 fusion protein

<400> 53

Ser Thr Glu Glu Leu Phe Asn Glu Tyr Lys Leu Thr Arg Pro Tyr Met
1 5 10 15

Ala Arg Cys Ile Arg Cys Ala Val Gly Ser Cys His Ser Pro Ile Ala
20 25 30

Ile Glu Ala Val Lys Ser Asp Gly His Asp Gly Tyr Val Arg Leu Gln
35 40 45

Thr Ser Ser Gln Tyr Gly Leu Asp Ser Ser Gly Asn Leu Lys Gly Arg
50 55 60

Thr Met Arg Tyr Asp Met His Gly Thr Ile Lys Glu Ile Pro Leu His
65 70 75 80

Gln Val Ser Leu Tyr Thr Ser Arg Pro Cys His Ile Val Asp Gly His
85 90 95

Gly Tyr Phe Leu Leu Ala Arg Cys Pro Ala Gly Asp Ser Ile Thr Met
100 105 110

Glu Phe Lys Lys Asp Ser Val Arg His Ser Cys Ser Val Pro Tyr Glu
115 120 125

Val Lys Phe Asn Pro Val Gly Arg Glu Leu Tyr Thr His Pro Pro Glu
130 135 140

His Gly Val Glu Gln Ala Cys Gln Val Tyr Ala His Asp Ala Gln Asn
145 150 155 160

Arg Gly Ala Tyr Val Glu Met His Leu Pro Gly Ser Glu Val Asp Ser
165 170 175

Ser Leu Val Ser Leu Ser Gly Ser Ser Gly Gly Asn Pro Asn Ala Asn
180 185 190

Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn
195 200 205

Pro Asn Ala Gly Gly Ser Ser Val Thr Val Thr Pro Pro Asp Gly Thr
210 215 220

Ser Ala Leu Val Glu Cys Glu Cys Gly Gly Thr Lys Ile Ser Glu Thr
225 230 235 240

Ile Asn Lys Thr Lys Gln Phe Ser Gln Cys Thr Lys Lys Glu Gln Cys
 245 250 255
 Arg Ala Tyr Arg Leu Gln Asn Asp Lys Trp Val Tyr Asn Ser Asp Lys
 260 265 270
 Leu Pro Lys Ala Ala Gly Ala Thr Leu Lys Gly Lys Leu His Val Pro
 275 280 285
 Phe Leu Leu Ala Asp Gly Lys Cys Thr Val Pro Leu Ala Pro Glu Pro
 290 295 300
 Met Ile Thr Phe Gly Phe Arg Ser Val Ser Leu Lys Leu His Pro Lys
 305 310 315 320
 Asn Pro Thr Tyr Leu Ile Thr Arg Gln Leu Ala Asp Glu Pro His Tyr
 325 330 335
 Thr His Glu Leu Ile Ser Glu Pro Ala Val Arg Asn Phe Thr Val Thr
 340 345 350
 Glu Lys Gly Trp Glu Phe Val Trp Gly Asn His Pro Pro Lys Arg Phe
 355 360 365
 Trp Ala Gln Glu Thr Ala Pro Gly Asn Pro His Gly Leu Pro His Glu
 370 375 380
 Val Ile Thr His Tyr Tyr His Arg Tyr Pro Met Ser Thr Ile Leu Gly
 385 390 395 400
 Leu Ser Ile Cys Ala Ala Ile Ala Thr Val Ser Val Ala Ala Ser Thr
 405 410 415
 Trp Leu Phe Cys Arg Ser Arg Val Ala Cys Leu Thr Pro Tyr Arg Leu
 420 425 430
 Thr Pro Asn Ala Arg Ile Pro Phe Cys Leu Ala Val Leu Cys Cys Ala
 435 440 445
 Arg Thr Ala Arg Ala
 450

<210> 54
 <211> 442
 <212> PRT
 <213> Artificial

<220>

<223> VEEV E1

<400> 54

Tyr Glu His Ala Thr Thr Met Pro Ser Gln Ala Gly Ile Ser Tyr Asn
1 5 10 15

Thr Ile Val Asn Arg Ala Gly Tyr Ala Pro Leu Pro Ile Ser Ile Thr
20 25 30

Pro Thr Lys Ile Lys Leu Ile Pro Thr Val Asn Leu Glu Tyr Val Thr
35 40 45

Cys His Tyr Lys Thr Gly Met Asp Ser Pro Ala Ile Lys Cys Cys Gly
50 55 60

Ser Gln Glu Cys Thr Pro Thr Tyr Arg Pro Asp Glu Gln Cys Lys Val
65 70 75 80

Phe Thr Gly Val Tyr Pro Phe Met Trp Gly Gly Ala Tyr Cys Phe Cys
85 90 95

Asp Thr Glu Asn Thr Gln Val Ser Lys Ala Tyr Val Met Lys Ser Asp
100 105 110

Asp Cys Leu Ala Asp His Ala Glu Ala Tyr Lys Ala His Thr Ala Ser
115 120 125

Val Gln Ala Phe Leu Asn Ile Thr Val Gly Glu His Ser Ile Val Thr
130 135 140

Thr Val Tyr Val Asn Gly Glu Thr Pro Val Asn Phe Asn Gly Val Lys
145 150 155 160

Ile Thr Ala Gly Pro Leu Ser Thr Ala Trp Thr Pro Phe Asp Arg Lys
165 170 175

Ile Val Gln Tyr Ala Gly Glu Ile Tyr Asn Tyr Asp Phe Pro Glu Tyr
180 185 190

Gly Ala Gly Gln Pro Gly Ala Phe Gly Asp Ile Gln Ser Arg Thr Val
195 200 205

Ser Ser Ser Asp Leu Tyr Ala Asn Thr Asn Leu Val Leu Gln Arg Pro
210 215 220

Lys Ala Gly Ala Ile His Val Pro Tyr Thr Gln Ala Pro Ser Gly Phe
225 230 235 240

Glu Gln Trp Lys Lys Asp Lys Ala Pro Ser Leu Lys Phe Thr Ala Pro
 245 250 255

Phe Gly Cys Glu Ile Tyr Thr Asn Pro Ile Arg Ala Glu Asn Cys Ala
 260 265 270

Val Gly Ser Ile Pro Leu Ala Phe Asp Ile Pro Asp Ala Leu Phe Thr
 275 280 285

Arg Val Ser Glu Thr Pro Thr Leu Ser Ala Ala Glu Cys Thr Leu Asn
 290 295 300

Glu Cys Val Tyr Ser Ser Asp Phe Gly Gly Ile Ala Thr Val Lys Tyr
 305 310 315 320

Ser Ala Ser Lys Ser Gly Lys Cys Ala Val His Val Pro Ser Gly Thr
 325 330 335

Ala Thr Leu Lys Glu Ala Ala Val Glu Leu Thr Glu Gln Gly Ser Ala
 340 345 350

Thr Ile His Phe Ser Thr Ala Asn Ile His Pro Glu Phe Arg Leu Gln
 355 360 365

Ile Cys Thr Ser Tyr Val Thr Cys Lys Gly Asp Cys His Pro Pro Lys
 370 375 380

Asp His Ile Val Thr His Pro Gln Tyr His Ala Gln Thr Phe Thr Ala
 385 390 395 400

Ala Val Ser Lys Thr Ala Trp Thr Trp Leu Thr Ser Leu Leu Gly Gly
 405 410 415

Ser Ala Val Ile Ile Ile Ile Gly Leu Val Leu Ala Thr Ile Val Ala
 420 425 430

Met Tyr Val Leu Thr Asn Gln Lys His Asn
 435 440

<210> 55
 <211> 275
 <212> PRT
 <213> Artificial

<220>
 <223> VEEV Capsid

<400> 55

Met Phe Pro Phe Gln Pro Met Tyr Pro Met Gln Pro Met Pro Tyr Arg
1 5 10 15

Asn Pro Phe Ala Ala Pro Arg Arg Pro Trp Phe Pro Arg Thr Asp Pro
20 25 30

Phe Leu Ala Met Gln Val Gln Glu Leu Thr Arg Ser Met Ala Asn Leu
35 40 45

Thr Phe Lys Gln Arg Arg Asp Ala Pro Pro Glu Gly Pro Ser Ala Asn
50 55 60

Lys Pro Lys Lys Glu Ala Ser Gln Lys Gln Lys Gly Gly Gly Gln Gly
65 70 75 80

Lys Lys Lys Lys Asn Gln Gly Lys Lys Lys Ala Lys Thr Gly Pro Pro
85 90 95

Asn Pro Lys Ala Gln Asn Gly Asn Lys Lys Lys Thr Asn Lys Lys Pro
100 105 110

Gly Lys Arg Gln Arg Met Val Met Lys Leu Glu Ser Asp Lys Thr Phe
115 120 125

Pro Ile Met Leu Glu Gly Lys Ile Asn Gly Tyr Ala Cys Val Val Gly
130 135 140

Gly Lys Leu Phe Arg Pro Met His Val Glu Gly Lys Ile Asp Asn Asp
145 150 155 160

Val Leu Ala Ala Leu Lys Thr Lys Lys Ala Ser Lys Tyr Asp Leu Glu
165 170 175

Tyr Ala Asp Val Pro Gln Asn Met Arg Ala Asp Thr Phe Lys Tyr Thr
180 185 190

His Glu Lys Pro Gln Gly Tyr Tyr Ser Trp His His Gly Ala Val Gln
195 200 205

Tyr Glu Asn Gly Arg Phe Thr Val Pro Lys Gly Val Gly Ala Lys Gly
210 215 220

Asp Ser Gly Arg Pro Ile Leu Asp Asn Gln Gly Arg Val Val Ala Ile
225 230 235 240

Val Leu Gly Gly Val Asn Glu Gly Ser Arg Thr Ala Leu Ser Val Val
245 250 255

Met Trp Asn Glu Lys Gly Val Thr Val Lys Tyr Thr Pro Glu Asn Cys
 260 265 270

Glu Gln Trp
 275

<210> 56
 <211> 414
 <212> PRT
 <213> Plasmodium falciparum

<400> 56

Met Met Arg Lys Leu Ala Ile Leu Ser Val Ser Ser Phe Leu Phe Val
 1 5 10 15

Glu Ala Leu Phe Gln Glu Tyr Gln Cys Tyr Gly Ser Ser Ser Asn Thr
 20 25 30

Arg Val Leu Asn Glu Leu Asn Tyr Asp Asn Ala Gly Thr Asn Leu Tyr
 35 40 45

Asn Glu Leu Glu Met Asn Tyr Tyr Gly Lys Gln Glu Asn Trp Tyr Ser
 50 55 60

Leu Lys Lys Asn Ser Arg Ser Leu Gly Glu Asn Asp Asp Gly Asn Asn
 65 70 75 80

Asn Asn Gly Asp Asn Gly Arg Glu Gly Lys Asp Glu Asp Lys Arg Asp
 85 90 95

Gly Asn Asn Glu Asp Asn Glu Lys Leu Arg Lys Pro Lys His Lys Lys
 100 105 110

Leu Lys Gln Pro Gly Asp Gly Asn Pro Asp Pro Asn Ala Asn Pro Asn
 115 120 125

Val Asp Pro Asn Ala Asn Pro Asn Val Asp Pro Asn Ala Asn Pro Asn
 130 135 140

Val Asp Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn
 145 150 155 160

Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn
 165 170 175

Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn

180	185	190
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
195	200	205
Val Asp Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
210	215	220
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
225	230	235
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
245	250	255
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
260	265	270
Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn Ala Asn Pro Asn		
275	280	285
Lys Asn Asn Gln Gly Asn Gly Gln Gly His Asn Met Pro Asn Asp Pro		
290	295	300
Asn Arg Asn Val Asp Glu Asn Ala Asn Ala Asn Asn Ala Val Lys Asn		
305	310	315
Asn Asn Asn Glu Glu Pro Ser Asp Lys His Ile Glu Gln Tyr Leu Lys		
325	330	335
Lys Ile Lys Asn Ser Ile Ser Thr Glu Trp Ser Pro Cys Ser Val Thr		
340	345	350
Cys Gly Asn Gly Ile Gln Val Arg Ile Lys Pro Gly Ser Ala Asn Lys		
355	360	365
Pro Lys Asp Glu Leu Asp Tyr Glu Asn Asp Ile Glu Lys Lys Ile Cys		
370	375	380
Lys Met Glu Lys Cys Ser Ser Val Phe Asn Val Val Asn Ser Ser Ile		
385	390	395
Gly Leu Ile Met Val Leu Ser Phe Leu Phe Leu Asn Thr Arg		
405	410	

CLAIMS

1. A particle comprising a virus structural polypeptide and at least one malaria antigen, wherein said virus structural polypeptide comprises at least one first attachment site and said at least one malaria antigen comprises at least one second attachment site, and wherein said virus structural polypeptide and said malaria antigen are linked through said at least one first and said at least one second attachment site, and wherein said particle is virus like particle.
2. The particle according to Claim 1, wherein said virus like particle is derived from alphavirus or Flavivirus.
3. The particle according to Claim 2, wherein said alphavirus or Flavivirus is selected from the group consisting of Aura virus, Babanki virus, Barmah Forest virus (BFV), Bebaru virus, Cabassou virus, Chikungunya virus (CHIKV), Eastern equine encephalitis virus (EEEV), Eilat virus, Everglades virus, Fort Morgan virus, Getah virus, Highlands J virus, Kyzytagach virus, Mayaro virus, Me Tri virus, Middelburg virus, Mosso das Pedras virus, Mucambo virus, Ndumu virus, O'nyong-nyong virus, Pixuna virus, Rio Negro virus, Ross River virus (RRV), Salmon pancreas disease virus, Semliki Forest virus, Sindbis virus, Southern elephant seal virus, Tonate virus, Trocara virus,

Una virus, Venezuelan equine encephalitis virus (VEEV), Western equine encephalitis virus (WEEV), Whataroa virus, West Nile virus, dengue virus, tick-borne encephalitis virus and yellow fever virus.

5 4. The particle according to Claim 3, wherein said alphavirus is Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV).

10 5. The particle according to any one of Claims 1-4, wherein said virus structural polypeptide comprises an envelope protein.

6. The particle according to any one of Claims 1-5, wherein said virus structural polypeptide comprises the capsid and/or the envelope proteins E1 and E2.

15 7. The particle according to Claim 6, wherein said at least one malaria antigen is inserted into E2 of the envelope protein.

20 8. The particle according to any one of Claims 1-7, wherein said virus structural polypeptide is a polypeptide derived from Chikungunya virus (CHIKV) or Venezuelan equine encephalitis virus (VEEV).

9. The particle according to any one of Claims 1-8, wherein the particle comprises an envelope protein E2 into which the antigen is inserted, an envelope protein E1 and a capsid.

25 10. The particle according to any one of Claims 1-8,

wherein the particle is Chikungunya virus like particle consisting of one or more envelope protein E2 into which the antigen is inserted, one or more envelope protein E1 and one or more capsid, and

5 wherein the envelope protein E2 into which the antigen is inserted consists of an amino acid sequence represented by SEQ ID No.50; the envelope protein E1 consists of an amino acid sequence represented by SEQ ID No.51; and the capsid consists of an amino acid sequence represented by SEQ ID
10 NO.: 52.

11. The particle according to any one of Claims 1-8, wherein the particle is Venezuelan equine virus like particle consisting of one or more envelope protein E2 into which the antigen is inserted, one or more envelope protein
15 E1 and one or more capsid, and

wherein the envelope protein E2 into which the antigen is inserted consists of an amino acid sequence represented by SEQ ID NO.53; the envelope protein E1 consists of an amino acid sequence represented by SEQ ID NO.54; and the capsid
20 consists of an amino acid sequence represented by SEQ ID NO.: 55.

12. The particle according to any one of Claims 1-11, wherein said at least one malaria antigen and said virus structural polypeptide are expressed as a fusion protein.

25 13. The particle according to Claim 12, wherein said virus

structural polypeptide and said at least one malaria antigen are directly fused.

14. The particle according to Claim 13, wherein said at least one malaria antigen are fused with said virus structural polypeptide, wherein one or two linkers intervenes between N-terminal residue of said antigen and said polypeptide and/or between C-terminal residue of said antigen and said virus structural polypeptide.

15. The particle according to any one of Claims 9-14, wherein said at least one malaria antigen is inserted between residues 531 and 532 of SEQ ID Nos.1 or 2, or between residues 518 and 519 of SEQ ID No.3.

16. The particle according to any one of Claims 9-15, wherein said particle comprising said fusion protein is expressed by transfecting a nucleic acid molecule corresponding to the amino acid sequence represented by SEQ ID Nos. 28, 31, 34, 37, 39, 41 or 43 into a mammalian cell.

17. The particle according to any one of Claims 9-15, wherein said particle comprising said fusion protein is expressed by transfecting a nucleic acid molecule corresponding to an amino acid sequence which has a sequence identity of 90% or more with an amino acid sequence represented by SEQ ID Nos. 28, 31, 34, 37, 39, 41 or 43 into a mammalian cell.

18. The particle according to any one of Claims 1-8,

wherein said at least one malaria antigen is linked to said virus structural polypeptide by way of chemical cross-linking.

19. The particle according to any one of Claims 1-18,
5 wherein said at least one malaria antigen is a fragment derived from the circumsporozoite protein.

20. The particle according to any one of Claims 1-19,
wherein said at least one malaria antigen is an antigen comprising (NPNA)_n wherein n is from 4 to 30 and/or an
10 antigen comprising (EYLNKIQSLSTEWSPCSVT)_y wherein y is from 1 to 6.

21. An isolated nucleic acid molecule comprising a nucleotide sequence for expressing the particle according to any one of Claims 1-20.

15 22. An isolated nucleic acid molecule consisting of a nucleotide sequence represented by SEQ ID Nos. 26-27, 29-30, 32-33, 35-36, 38, 40 or 42.

23. An isolated nucleic acid molecule consisting of a nucleotide sequence which has a sequence identity of 90% or
20 more with a nucleotide sequence encoding represented by SEQ ID Nos. 26-27, 29-30, 32-33, 35-36, 38, 40 or 42.

24. A vector comprising the nucleic acid molecule according to any one of Claims 21-23, wherein the vector optionally comprises an expression control sequence
25 operably linked to the nucleic acid molecule.

25. A composition comprising the particle according to any one of Claims 1-20 and/or the nucleic acid molecule according to any one of Claims 21-24.

26. A pharmaceutical composition comprising:

5 (a) the particle according to any one of Claims 1-20 and/or the nucleic acid molecule according to any one of Claims 21-24; and

(b) a pharmaceutically acceptable carrier.

27. A vaccine composition comprising the particle
10 according to any one of Claims 1-20.

28. A DNA vaccine composition comprising the nucleic acid molecule according to any one of Claims 21-24.

29. A method of producing an antibody, comprising contacting the particle according to any one of Claims 1-20
15 and/or the nucleic acid molecule according to any one of Claims 21-24 to a mammal.

30. The method according to Claim 29, wherein said antibody is a monoclonal antibody.

31. A method of immunomodulation, comprising administering
20 an immunologically effective amount of the composition of any one of Claims 25-28 to a mammal.

32. A method of inducing and/or enhancing immune response against a malaria antigen in a mammal, comprising administering an effective amount of the composition of any
25 one of Claims 25-28 to the mammal.

33. A method of treating malaria, comprising administering an effective amount of the composition of any one of claims 25-28 to a mammal.

5 34. A method of passive immunization against a malaria-causing pathogen, comprising administering the antibody obtained by the method according to Claim 29 or Claim 30 to a mammal.

35. A method of presenting an antigen on macrophage, comprising contacting the particle according to any one of
10 Claims 1-20 and/or the nucleic acid molecule according to any one of Claims 21-24 to a mammal.

36. A method for producing the particle according to any one of Claims 9-20, comprising preparing a vector designed for expression of said particle; culturing a cell which is
15 transfected with said vector to express said particle; and recovering said particle.

37. The method according to any one of Claims 29-36, wherein said at least one malaria antigen comprises at least a fragment of the circumsporozoite polypeptide.

20 38. A vaccine for use in the method of any one of Claims 31-33 comprising, as separate components, a priming composition comprising at least one first malaria antigen or at least one polynucleotide encoding at least one first malaria antigen; and a boosting composition comprising at
25 least one polypeptide comprising at least one second

malaria antigen or at least one polynucleotide encoding at least one second malaria antigen.

39. The vaccine of claim 38, wherein the polynucleotide encodes substantially all of the circumsporozoite protein.

5 40. The vaccine composition according to Claim 27 for use in the prevention or treatment of malaria, comprising a plurality of malaria-derived antigens.

41. A kit comprising

10 (a) a vaccine composition comprising the particle according to any one of Claims 1-20; and

(b) another vaccine composition comprising the particle according to any one of Claims 1-20,

wherein the particle contained in (a) is a virus like particle which is different from the particle contained in

15 (b).

42. The kit according to Claim 41, wherein the particle contained in (a) is Chikungunya virus like particle and the particle contained in (b) is Venezuelan equine encephalitis virus like particle, or the particle contained in (a) is
20 Venezuelan equine encephalitis virus like particle and the particle contained in (b) is Chikungunya virus like particle.

43. The kit according to Claims 41 or 42, further comprising (c) one or more vaccine compositions, each of
25 which comprises the particle according to any one of Claims

1-20, wherein (a) is used for priming immunization and (b) and (c) are used for boosting immunization, and the particle contained in (c) is different from the particle contained in (a) and (b), or the same as the particle
5 contained in (a) or (b).

44. The kit according to any one of Claims 41-43, wherein the respective vaccine compositions are administered simultaneously, separately or sequentially.