

**WHAT IS CLAIMED IS:**

1. An isolated monoclonal antibody or an antigen-binding fragment thereof comprising a heavy chain (HC) variable region (VH) and a light chain (LC) variable region (VL) comprising clone-paired CDR sequences as set forth in Table 2; and variants thereof wherein one or more of the HC-CDRs and/or LC-CDRs has one, two, or three amino acid substitutions, additions, deletions, or combinations thereof.
2. The isolated monoclonal antibody or an antigen binding fragment thereof of claim 1, wherein the isolated monoclonal antibody is a murine, a rodent, a rabbit, a chimeric, humanized, or human antibody.
3. The isolated monoclonal antibody or an antigen-binding fragment thereof of claim 1, wherein the antigen-binding fragment is a recombinant ScFv (single chain fragment variable) antibody, Fab fragment, F(ab')<sub>2</sub> fragment, or Fv fragment.
4. The isolated monoclonal antibody or an antigen binding fragment thereof of claim 1, wherein the isolated monoclonal antibody is a human antibody.
5. The isolated monoclonal antibody or an antigen-binding fragment thereof of claim 1, wherein the VH and VL chains have amino acid sequences at least 90% or 95% identical to clone-paired sequences of Appendices II and IV, respectively.
6. The isolated monoclonal antibody or an antigen-binding fragment thereof of claim 1, wherein the VH and VL chains are encoded by nucleic acid sequences at least 80% or 90% identical to clone-paired sequences of Appendices I and III respectively.
7. The isolated monoclonal antibody or an antigen-binding fragment thereof of claim 5, wherein the VH and VL chains have amino acid sequences identical to clone-paired sequences of Appendices II and IV, respectively.

8. The isolated monoclonal antibody or an antigen binding fragment thereof of claim 5, wherein the VH and VL chains are encoded by nucleic acid sequences identical to clone-paired sequences of Appendices I and III respectively.
9. The isolated monoclonal antibody or an antigen binding fragment thereof of claims 1-8, wherein the isolated monoclonal antibody is a humanized antibody.
10. The isolated monoclonal antibody or an antigen binding fragment thereof of claim 1, wherein the antibody is a chimeric antibody.
11. The isolated monoclonal antibody or an antigen binding fragment thereof of claim 1, which induces the activation of LILRB2.
12. The isolated monoclonal antibody or an antigen binding fragment thereof of claim 1, which suppresses the activation of LILRB2.
13. An isolated monoclonal antibody or an antigen binding fragment thereof, which competes for the same epitope with the isolated monoclonal antibody or an antigen-binding fragment thereof according to any of claims 1-12.
14. A pharmaceutical composition comprising the isolated monoclonal antibody or an antigen-binding fragment thereof according to any one of claims 1-13, and a pharmaceutically acceptable carrier.
15. An isolated nucleic acid that encodes the isolated monoclonal antibody according to any one of claims 1-13.
16. A vector comprising the isolated nucleic acid of claim 15.
17. A host cell comprising the vector of claim 16.
18. The host cell of claim 17, wherein the host cell is a mammalian cell.
19. The host cell of claim 17, wherein the host cell is a CHO cell.

20. A hybridoma or engineered cell encoding and/or producing the isolated monoclonal antibody according to any one of claims 1-13.
21. A process of producing an antibody, comprising culturing the host cell of claim 17 under conditions suitable for expressing the antibody, and recovering the antibody.
22. A chimeric antigen receptor (CAR) protein comprising an antigen-binding fragment according to any one of claims 1-13.
23. An isolated nucleic acid that encodes a CAR protein of claim 22.
24. A vector comprising the isolated nucleic acid of claim 23.
25. An engineered cell comprising the isolated nucleic acid of claim 23.
26. The engineered cell of claim 25, wherein the cell is a T cell, NK cell, or macrophage.
27. A method of treating or ameliorating the effect of a cancer in a subject, the method comprising administering to the subject a therapeutically effective amount of the antibody or an antigen-binding fragment thereof according to any one of claims 1-13 or the engineered cell of claims 25 or 26.
28. The method of claim 27, wherein the method reduces or eradicates the tumor burden in the subject.
29. The method of claim 27, wherein the method reduces the number of tumor cells and/or slows tumor growth rate.
30. The method of claim 27, wherein the method reduces tumor size.
31. The method of claim 27, wherein the method reduces or prevents tumor metastasis.
32. The method of claim 27, wherein the method eradicates the tumor in the subject.

33. The method of claim 27, wherein the cancer is a solid cancer.
34. The method of claim 33, wherein the solid cancer is selected from the group consisting of adrenal cancer, bile duct carcinoma, bone cancer, brain cancer, breast cancer, cervical cancer, choriocarcinoma, colon cancer, colorectal cancer, esophageal cancer, eye cancer, gastric cancer, glioblastoma, head and neck cancer, kidney cancer, liver cancer, lung cancer, mesothelioma, melanoma, merkel cell cancer, nasopharyngeal carcinoma, neuroblastoma, oral cancer, ovarian cancer, pancreatic cancer, penile cancer, pinealoma, prostate cancer, renal cell cancer, retinoblastoma, sarcoma, skin cancer, testicular cancer, thymic carcinoma, thyroid cancer, uterine cancer, and vaginal cancer.
35. The method of claim 27, wherein the monocytes, macrophages, dendritic cells, neutrophils and other myeloid cells, myeloid-derived suppressor cells, and tumor-associated macrophages are targeted.
36. The method of claim 27, wherein the cancer is a hematologic malignancy.
37. The method of claim 36, wherein the hematologic malignancy is selected from the group consisting of acute lymphocytic leukemia (ALL), acute myeloid leukemia (AML), B-cell leukemia, chronic lymphoblastic leukemia (CLL), blastic plasmacytoid dendritic cell neoplasm (BPDCN), chronic myelomonocytic leukemia (CMML), chronic myelocytic leukemia (CML), pre-B acute lymphocytic leukemia (Pre-B ALL), diffuse large B-cell lymphoma (DLBCL), extranodal NK/T-cell lymphoma, hairy cell leukemia, heavy chain disease, HHV8-associated primary effusion lymphoma, plasmablastic lymphoma, primary CNS lymphoma, primary mediastinal large B-cell lymphoma, T-cell/histiocyte-rich B-cell lymphoma, Hodgkin's lymphoma, non-Hodgkin's lymphoma, Waldenstrom's macroglobulinemia, multiple myeloma (MM), myelodysplastic syndromes (MDS), myeloproliferative neoplasms, and polycythemia vera.
38. The method of claim 27, wherein the antibody or an antigen-binding fragment thereof is administered intravenously, intra-arterially, intra-tumorally, or subcutaneously.

39. The method of claim 27, further comprising administering to the subject one or more drugs selected from the group consisting of a topoisomerase inhibitor, an anthracycline topoisomerase inhibitor, an anthracycline, a daunorubicin, a nucleoside metabolic inhibitor, a cytarabine, a hypomethylating agent, a low dose cytarabine (LDAC), a combination of daunorubicin and cytarabine, a daunorubicin and cytarabine liposome for injection, Vyxeos®, an azacytidine, Vidaza®, a decitabine, an all-trans-retinoic acid (ATRA), an arsenic, an arsenic trioxide, a histamine dihydrochloride, Ceplene®, an interleukin-2, an aldesleukin, Proleukin®, a gemtuzumab ozogamicin, Mylotarg®, an FLT-3 inhibitor, a midostaurin, Rydapt®, a clofarabine, a farnesyl transferase inhibitor, a decitabine, an IDH1 inhibitor, an ivosidenib, Tibsovo®, an IDH2 inhibitor, an enasidenib, Idhifa®, a smoothened (SMO) inhibitor, a glasdegib, an arginase inhibitor, an IDO inhibitor, an epacadostat, a BCL-2 inhibitor, a venetoclax, Venclexta®, a platinum complex derivative, oxaliplatin, a kinase inhibitor, a tyrosine kinase inhibitor, a PI3 kinase inhibitor, a BTK inhibitor, an ibrutinib, IMBRUVICA®, an acalabrutinib, CALQUENCE®, a zanubrutinib, a PD-1 antibody, a PD-L1 antibody, a CTLA-4 antibody, a LAG3 antibody, an ICOS antibody, a TIGIT antibody, a TIM3 antibody, a CD40 antibody, a 4-1BB antibody, a CD47 antibody, a SIRP1 $\alpha$  antibody or fusions protein, a CD70 antibody, and CLL1 antibody, a CD123 antibody, an antagonist of E-selectin, an antibody binding to a tumor antigen, an antibody binding to a T-cell surface marker, an antibody binding to a myeloid cell or NK cell surface marker, an alkylating agent, a nitrosourea agent, an antimetabolite, an antitumor antibiotic, an alkaloid derived from a plant, a hormone therapy medicine, a hormone antagonist, an aromatase inhibitor, and a P-glycoprotein inhibitor.
40. The method according to any of claims 27-39, wherein said isolated monoclonal antibody or an antigen binding fragment thereof further comprises an antitumor drug linked thereto.
41. The method of claim 40, wherein said antitumor drug is linked to said antibody through a photolabile linker.
42. The method of claim 40, wherein said antitumor drug is linked to said antibody through an enzymatically-cleaved linker.

43. The method of claim 40, wherein said antitumor drug is a toxin, a radioisotope, a cytokine, or an enzyme.
44. A method of detecting a cancer cell or cancer stem cell in a sample or subject comprising:
- (a) contacting a subject or a sample from the subject with the antibody or an antigen-binding fragment thereof according to any one of claims 1-11; and
  - (b) detecting binding of said antibody to a cancer cell or cancer stem cell in said subject or sample.
45. The method of claim 44, wherein the sample is a body fluid or biopsy.
46. The method of claim 44, wherein the sample is blood, bone marrow, sputum, tears, saliva, mucous, serum, urine or feces.
47. The method of claim 44, wherein detection comprises immunohistochemistry, flow cytometry, an immunoassay (including ELISA, RIA etc.) or Western blot.
48. The method of claim 44, further comprising performing steps (a) and (b) a second time and determining a change in detection levels as compared to the first time.
49. The method of claim 44, wherein said isolated monoclonal antibody or an antigen binding fragment thereof further comprises a label.
50. The method of claim 49, wherein said label is a peptide tag, an enzyme, a magnetic particle, a chromophore, a fluorescent molecule, a chemo-luminescent molecule, or a dye.
51. The method according to any of claims 27-50, wherein said isolated monoclonal antibody or an antigen binding fragment thereof is conjugated to a liposome or nanoparticle.

52. A method of treating or ameliorating the effect of an autoimmune disease in a subject, the method comprising administering to the subject a therapeutically effective amount of the antibody or an antigen-binding fragment thereof according to any one of claims 1-13 or the engineered cell of claims 25 or 26.
53. The method of claim 52, wherein the monocytes, macrophages, dendritic cells, and neutrophils and other myeloid cells are targeted.
54. The method of claim 52, wherein the antibody or an antigen-binding fragment thereof is administered intravenously, intra-arterially, intra-tumorally, or subcutaneously.
55. The method of claim 52, further comprising administering to the subject one or more drugs selected from the group consisting of a steroid or an NSAID.
56. The method of claim 52, wherein the autoimmune disease is Guillain-Barre syndrome, Chronic inflammatory demyelinating polyneuropathy, ankylosing spondylitis, psoriatic arthritis, enteropathic arthritis, reactive arthritis, undifferentiated spondyloarthropathy, juvenile spondyloarthropathy, Behcet's disease, enthesitis, ulcerative colitis, Crohn's disease, irritable bowel syndrome, inflammatory bowel disease, fibromyalgia, chronic fatigue syndrome, pain conditions associated with systemic inflammatory disease, systemic lupus erythematosus, Sjogren's syndrome, rheumatoid arthritis, juvenile rheumatoid arthritis, juvenile onset diabetes mellitus (also known as Type I diabetes mellitus), Wegener's granulomatosis, polymyositis, dermatomyositis, inclusion body myositis, multiple endocrine failure, Schmidt's syndrome, autoimmune uveitis, Addison's disease, Grave's Disease, Hashimoto's thyroiditis, autoimmune thyroid disease, pernicious anemia, gastric atrophy, chronic hepatitis, lupoid hepatitis, atherosclerosis, multiple sclerosis, amyotrophic lateral sclerosis, hypoparathyroidism, Dressler's syndrome, myasthenia gravis, Eaton-Lambert syndrome, autoimmune thrombocytopenia, idiopathic thrombocytopenic purpura, hemolytic anemia, pemphigus vulgaris, pemphigus, dermatitis herpetiformis, alopecia, scleroderma, progressive systemic sclerosis, CREST syndrome (calcinosis, Raynaud's phenomenon, esophageal dysmotility, sclerodactyly, and telangasia), adult onset diabetes mellitus (also known as Type II diabetes mellitus), mixed connective tissue disease, polyarteritis nodosa, systemic necrotizing vasculitis, glomerulonephritis, atopic dermatitis, atopic

rhinitis, Goodpasture's syndrome, Chagas' disease, sarcoidosis, rheumatic fever, asthma, anti-phospholipidsyndrome, erythema multiforme, Cushing's syndrome, autoimmune chronic active hepatitis, allergic disease, allergic encephalomyelitis, transfusion reaction, leprosy, malaria, leishmaniasis, trypanosomiasis, Takayasu's arteritis, polymyalgia rheumatica, temporal arteritis, shistosomiasis, giant cell arteritis, eczema, lymphomatoid granulomatosis, Kawasaki's disease, endophthalmitis, psoriasis, erythroblastosis fetalis, eosinophilic facitis, Shulman's syndrome, Felty's syndrome, Fuch's cyclitis, IgA nephropathy, Henoch-Schonlein purpura, graft versus host disease, transplantation rejection, tularemia, periodic fever syndromes, pyogenic arthritis, Familial Mediterranean Fever, TNF-receptor associated periodic syndrome (TRAPS), Muckle-Wells syndrome, or hyper-IgD syndrome.

57. A method for enhancing T cell activation in a subject, the method comprising administering to the subject the antibody or an antigen-binding fragment thereof according to any one of claims 1-13 or the engineered cell of claims 25 or 26.
58. A method for modulating M2a macrophage phenotype in a subject, the method comprising administering to the subject the antibody or an antigen-binding fragment thereof according to any one of claims 1-13 or the engineered cell of claims 25 or 26.
59. A monoclonal antibody that binds to LILRB2 and:
  - (a) does not bind to LILRA or another LILRB; or
  - (b) binds to LILRB2 Domain 1 or 4; or
  - (c) activates or antagonizes LILRB2; or
  - (d) enhances monocyte inflammatory potential; or
  - (e) enhances T cell activation; or
  - (f) modulates M2a macrophage phenotype; or
  - (g) prevents myeloid-derived suppressor cell function; or
  - (h) inhibits leukemia cell migration and/or infiltration *in vivo*.