

CLAIMS

What is claimed is:

1. A chimeric antigen receptor (CAR) comprising:
 - (a) an extracellular domain that specifically binds to the CD79b antigen,
 - (b) a transmembrane domain, and
 - (c) an intracellular signaling domain optionally comprising at least one co-stimulatory domain.
2. The CAR of claim 1, further comprising
 - (d) a CD8a-hinge region,wherein the transmembrane domain comprises a CD8a transmembrane region (CD8a-TM) polypeptide; and
wherein the intracellular signaling domain comprises a co-stimulatory domain comprising a TNF receptor superfamily member 9 (CD137) component and a primary signaling domain comprising a T-cell surface glycoprotein CD3 zeta chain (CD3z) component.
3. The CAR of claim 2, wherein
 - the CD8a-hinge region comprises an amino acid sequence that is at least 90% identical to SEQ ID NO: 38;
 - the transmembrane domain comprises an amino acid sequence that is at least 90% identical to SEQ ID NO: 39; and/or
 - the intracellular signaling domain comprises a co-stimulatory domain having an amino acid sequence that is at least 90% identical to SEQ ID NO: 40, and a primary signaling domain having an amino acid sequence that is at least 90% identical to SEQ ID NO: 41.
4. A chimeric antigen receptor (CAR), comprising an extracellular antigen-binding domain, a transmembrane domain and an intracellular signaling domain, wherein the extracellular antigen-binding domain comprises:

a heavy chain complementarity determining region 1 (CDR1) having the amino acid sequence of SEQ ID NO: 208, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 209, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 210;

a heavy chain CDR1 having the amino acid sequence of SEQ ID NO: 216, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 217, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 218;

a heavy chain CDR1 having the amino acid sequence of SEQ ID NO: 222, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 223, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 224;

a heavy chain CDR1 having the amino acid sequence of SEQ ID NO: 228, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 217, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 229;

a heavy chain CDR1 having the amino acid sequence of SEQ ID NO: 232, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 233, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 234;

a heavy chain CDR1 having the amino acid sequence of SEQ ID NO: 238, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 239, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 240;

a heavy chain CDR1 having the amino acid sequence of SEQ ID NO: 242, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 243, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 244;

a heavy chain CDR1 having the amino acid sequence of SEQ ID NO: 248, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 249, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 250;

a heavy chain CDR1 having the amino acid sequence of SEQ ID NO: 253, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 254, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 255;

a heavy chain CDR1 having the amino acid sequence of SEQ ID NO: 257, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 258, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 259;

a heavy chain CDR1 having the amino acid sequence of SEQ ID NO: 263, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 243, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 264;

a heavy chain CDR1 having the amino acid sequence of SEQ ID NO: 268, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 269, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 270; or

a heavy chain CDR1 having the amino acid sequence of SEQ ID NO: 274, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 275, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 276;

wherein the extracellular antigen-binding domain binds the CD79b antigen.

5. The CAR of claim 4, wherein the extracellular antigen-binding domain comprises the heavy chain CDR1 having the amino acid sequence of SEQ ID NO: 257, a heavy chain CDR2 having the amino acid sequence of SEQ ID NO: 258, and a heavy chain CDR3 having the amino acid sequence of SEQ ID NO: 259.

6. A chimeric antigen receptor (CAR), comprising an extracellular antigen-binding domain, a transmembrane domain and an intracellular signaling domain, wherein the extracellular antigen-binding domain comprises:

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 211, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 212, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 213;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 214, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 212, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 213;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 215, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 212, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 213;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 219, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 220, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 221;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 225, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 226, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 227;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 230, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 231, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 221;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 235, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 236, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 237;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 241, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 226, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 227;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 245, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 246, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 247;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 251, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 236, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 252;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 251, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 236, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 256;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 260, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 261, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 262;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 265, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 266, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 267;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 271, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 272, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 273; or

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 277, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 266, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 278;

wherein the extracellular antigen-binding domain binds the CD79b antigen.

7. The CAR of claim 6, wherein the extracellular antigen-binding domain comprises a light chain CDR1 having the amino acid sequence of SEQ ID NO: 260, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 261, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 262.
8. The CAR of claim 4 or claim 5, wherein the extracellular antigen-binding domain further comprises:
- a light chain CDR1 having the amino acid sequence of SEQ ID NO: 211, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 212, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 213;
 - a light chain CDR1 having the amino acid sequence of SEQ ID NO: 214, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 212, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 213;
 - a light chain CDR1 having the amino acid sequence of SEQ ID NO: 215, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 212, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 213;
 - a light chain CDR1 having the amino acid sequence of SEQ ID NO: 219, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 220, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 221;
 - a light chain CDR1 having the amino acid sequence of SEQ ID NO: 225, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 226, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 227;
 - a light chain CDR1 having the amino acid sequence of SEQ ID NO: 230, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 231, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 221;
 - a light chain CDR1 having the amino acid sequence of SEQ ID NO: 235, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 236, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 237;
 - a light chain CDR1 having the amino acid sequence of SEQ ID NO: 241, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 226, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 227;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 245, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 246, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 247;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 251, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 236, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 252;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 251, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 236, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 256;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 260, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 261, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 262;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 265, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 266, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 267;

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 271, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 272, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 273; or

a light chain CDR1 having the amino acid sequence of SEQ ID NO: 277, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 266, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 278.

9. The CAR of claim 8, wherein the extracellular antigen-binding domain comprises a light chain CDR1 having the amino acid sequence of SEQ ID NO: 260, a light chain CDR2 having the amino acid sequence of SEQ ID NO: 261, and a light chain CDR3 having the amino acid sequence of SEQ ID NO: 262.

10. A chimeric antigen receptor (CAR), comprising an extracellular antigen-binding domain, a transmembrane domain and an intracellular signaling domain, wherein the extracellular antigen-binding domain comprises the heavy chain CDR1 having the amino acid sequence of SEQ ID NOs: 208, 216, 222, 228, 232, 238, 242, 248, 253, 257, 263, 268, or 274, the heavy chain CDR2 having the amino acid sequence of SEQ ID NOs: 209, 217, 223, 233, 239, 243, 249, 254, 258, 269, or 275, the heavy chain CDR3 having the

amino acid sequence of SEQ ID NOs: 210, 218, 224, 229, 234, 240, 244, 250, 255, 259, 264, 270, or 276, the light chain CDR1 having the amino acid sequence of SEQ ID NOs: 211, 214, 215, 219, 225, 230, 235, 241, 245, 251, 260, 265, 271, or 277, the light chain CDR2 having the amino acid sequence of SEQ ID NOs: 212, 220, 226, 231, 236, 246, 261, 266, or 272, and the light chain CDR3 having the amino acid sequence of SEQ ID NOs: 213, 221, 227, 237, 247, 252, 256, 262, 267, 273, or 278.

11. The CAR of any one of claims 1-10, wherein the extracellular antigen-binding domain comprises the heavy chain CDR1, the heavy chain CDR2, the heavy chain CDR3, the light chain CDR1, the light chain CDR2 and the light chain CDR3 having the amino acid sequence of

- a) SEQ ID NOs: 208, 209, 210, 211, 212, and 213, respectively;
- b) SEQ ID NOs: 208, 209, 210, 214, 212, and 213, respectively;
- c) SEQ ID NOs: 208, 209, 210, 215, 212, and 213, respectively;
- d) SEQ ID NOs: 216, 217, 218, 219, 220, and 221, respectively;
- e) SEQ ID NOs: 222, 223, 224, 225, 226, and 227, respectively;
- f) SEQ ID NOs: 228, 217, 229, 230, 231, and 221, respectively;
- g) SEQ ID NOs: 232, 233, 234, 235, 236, and 237, respectively;
- h) SEQ ID NOs: 238, 239, 240, 241, 226, and 227, respectively;
- i) SEQ ID NOs: 242, 243, 244, 245, 246, and 247, respectively;
- j) SEQ ID NOs: 248, 249, 250, 251, 236, and 252, respectively;
- k) SEQ ID NOs: 253, 254, 255, 251, 236, and 256, respectively;
- l) SEQ ID NOs: 257, 258, 259, 260, 261, and 262, respectively;
- m) SEQ ID NOs: 263, 243, 264, 265, 266, and 267, respectively;
- n) SEQ ID NOs: 268, 269, 270, 271, 272, and 273, respectively; or
- o) SEQ ID NOs: 274, 275, 276, 277, 266, and 278, respectively.

12. The CAR of any one of claims 1-11, wherein the extracellular antigen-binding domain comprises the heavy chain CDR1, the heavy chain CDR2, the heavy chain CDR3, the light chain CDR1, the light chain CDR2 and the light chain CDR3 having the amino acid sequence of SEQ ID NOs: 257, 258, 259, 260, 261, and 262, respectively.

13. A chimeric antigen receptor (CAR), comprising an extracellular antigen-binding domain, a transmembrane domain and an intracellular signaling domain, wherein the extracellular antigen-binding domain comprises:

a heavy chain variable domain (VH) comprising an amino acid sequence that is at least 90% identical to a sequence selected from SEQ ID NOS: 1-18; and/or

a light chain variable domain (VL) comprising an amino acid sequence that is at least 90% identical to a sequence selected from SEQ ID NOS: 19-36;

wherein the extracellular antigen-binding domain binds the CD79b antigen.

14. The CAR of claim 13, wherein the extracellular antigen-binding domain comprises:

a heavy chain variable domain (VH) comprising an amino acid sequence selected from SEQ ID NOS: 1-18; and/or

a light chain variable domain (VL) comprising an amino acid sequence selected from SEQ ID NOS: 19-36;

wherein the extracellular antigen-binding domain binds the CD79b antigen.

15. The CAR of claim 13, wherein the extracellular antigen-binding domain comprises:

a heavy chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 1 and a light chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 19;

a heavy chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 1 and a light chain variable region comprising an amino acid sequence of SEQ ID NO: 20;

a heavy chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 2 and a light chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 19;

a heavy chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 2 and a light chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 20;

a heavy chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 3 and a light chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 20;

a heavy chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 14 and a light chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 32;

a heavy chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 15 and a light chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 33;

a heavy chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 16 and a light chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 34;

a heavy chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 16 and a light chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 35;

a heavy chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 17 and a light chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 33; or

a heavy chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 18 and a light chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 36.

16. The CAR of any of claims 13-15, wherein the extracellular antigen-binding domain comprises:

a heavy chain variable region comprising an amino acid sequence of SEQ ID NO: 1 and a light chain variable region comprising an amino acid sequence of SEQ ID NO: 19;

a heavy chain variable region comprising an amino acid sequence of SEQ ID NO: 1 and a light chain variable region comprising an amino acid sequence of SEQ ID NO: 20;

a heavy chain variable region comprising an amino acid sequence of SEQ ID NO: 2 and a light chain variable region comprising an amino acid of SEQ ID NO: 19;

a heavy chain variable region comprising an amino acid sequence of SEQ ID NO: 2 and a light chain variable region comprising an amino acid sequence of SEQ ID NO: 20;

a heavy chain variable region comprising an amino acid sequence of SEQ ID NO: 3 and a light chain variable region comprising an amino acid sequence of SEQ ID NO: 20;

a heavy chain variable region comprising an amino acid sequence of SEQ ID NO: 4 and a light chain variable region comprising an amino acid sequence of SEQ ID NO: 19;

17. The CAR of claim 13 or 15, wherein the extracellular antigen-binding domain comprises:
a heavy chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 14 and a light chain variable region comprising an amino acid sequence that is at least 90% identical to SEQ ID NO: 32.
18. The CAR of any of claims 13-17, wherein the extracellular antigen-binding domain comprises:
a heavy chain variable region comprising an amino acid sequence of SEQ ID NO: 14 and a light chain variable region comprising an amino acid sequence of SEQ ID NO: 32.
19. The CAR of any of claims 1-18, wherein the extracellular antigen-binding domain comprises a single-chain variable fragment (scFv), the scFv comprising a heavy chain variable region (VH) and a light chain variable region (VL).
20. The CAR of claim 19, wherein the scFv comprises a linker polypeptide between the heavy chain variable region (VH) and the light chain variable region (VL).
21. The CAR of claim 20, wherein the linker polypeptide comprises an amino acid sequence that is at least 90% identical to SEQ ID NO: 42.
22. The CAR of claim 20 or 21, wherein the linker polypeptide comprises an amino acid sequence of SEQ ID NO: 42.
23. The CAR of any of claims 19-22, wherein the scFv comprises an amino acid sequence that is at least 90% identical to a sequence selected from the group consisting of SEQ ID NOS: 75-118.
24. The CAR of any of claims 19-23, wherein the scFv comprises an amino acid sequence that is selected from the group consisting of SEQ ID NOS: 75-118.
25. The CAR of any of claims 19-23, wherein the scFv comprises an amino acid sequence that is at least 90% identical to SEQ ID NO: 113.

26. The CAR of any of claims 19-25, wherein the scFv comprises an amino acid sequence of SEQ ID NO: 113.
27. The CAR of any of claims 1-26, wherein the extracellular antigen-binding domain comprises a signal polypeptide.
28. The CAR of claim 27, wherein the signal polypeptide comprises an amino acid sequence that is at least 90% identical to a sequence SEQ ID NO: 37.
29. The CAR of claim 27 or 28, wherein the signal polypeptide comprises an amino acid sequence of SEQ ID NO: 37.
30. The CAR of any of claims 4-29, wherein the intracellular signaling domain comprises a polypeptide component selected from the group consisting of a TNF receptor superfamily member 9 (CD137) component, a T-cell surface glycoprotein CD3 zeta chain (CD3z) component, a cluster of differentiation (CD27) component, a cluster of differentiation superfamily member component, and a combination thereof.
31. The CAR of claim 30, wherein the CD137 component comprises an amino acid sequence that is at least 90% identical to a sequence SEQ ID NO: 40.
32. The CAR of claim 30 or 31, wherein the CD137 component comprises an amino acid sequence of SEQ ID NO: 40.
33. The CAR of any one of claims 30-32, wherein the CD3z component comprises an amino acid sequence that is at least 90% identical to a sequence SEQ ID NO: 41.
34. The CAR of any one of claims 30-33, wherein the CD3z component comprises an amino acid sequence of SEQ ID NO: 41.
35. The CAR of any one of claims 30-34, wherein the intracellular signaling domain comprises an amino acid sequence that is at least 90% identical to a sequence SEQ ID NO: 163.

36. The CAR of any one of claims 30-35, wherein the intracellular signaling domain comprises an amino acid sequence of SEQ ID NO: 163.
37. The CAR of any of claims 4-36, wherein the transmembrane domain comprises a CD8a transmembrane region (CD8a-TM) polypeptide.
38. The CAR of claim 37, wherein the CD8a-TM polypeptide comprises an amino acid sequence that is at least 90% identical to a sequence SEQ ID NO: 39.
39. The CAR of claim 37 or 38, wherein the CD8a-TM polypeptide comprises an amino acid sequence of SEQ ID NO: 39.
40. The CAR of any of claims 4-39, further comprising a hinge region linking the transmembrane domain to the extracellular antigen-binding domain.
41. The CAR of claim 40, wherein the hinge region is a CD8a-hinge region.
42. The CAR of claim 41, wherein the CD8a-hinge region comprises an amino acid sequence that is at least 90% identical to SEQ ID NO: 38.
43. The CAR of claim 41 or 42, wherein the CD8a-hinge region comprises an amino acid sequence of SEQ ID NO: 38.
44. The CAR of any of claims 1-43, wherein the extracellular antigen-binding domain comprises an amino acid sequence selected from the group consisting of SEQ ID NOS: 119-162, or a sequence having 90% identity thereof.
45. The CAR of any of claims 1-44, wherein the extracellular antigen-binding domain comprises an amino acid sequence that is at least 90% identical to SEQ ID NO: 157.
46. The CAR of any of claims 1-45, wherein the extracellular antigen-binding domain comprises an amino acid sequence of SEQ ID NO: 157.

47. The CAR of any of claims 1-46, wherein the CAR comprises an amino acid sequence selected from the group consisting of SEQ ID NOS: 164-207, or a sequence having 90% identity thereof.
48. The CAR of any of claims 1-47, wherein the CAR comprises an amino acid sequence that is at least 90% identical to SEQ ID NO: 202.
49. The CAR of any of claims 1-48, wherein the CAR comprises an amino acid sequence of SEQ ID NO: 202.
50. An isolated lymphocyte expressing the CAR of any of claims 1-49.
51. The isolated lymphocyte of claim 50, wherein the lymphocyte is a T lymphocyte.
52. The isolated lymphocyte of claim 51, wherein the lymphocyte is a natural killer (NK) cell.
53. An isolated nucleic acid molecule encoding the CAR of any of claims 1-49.
54. A vector comprising the nucleic acid molecule of claim 53.
55. A cell expressing the nucleic acid molecule of claim 53.
56. A pharmaceutical composition, comprising an effective amount of the lymphocyte of any of claims 50-52 and a pharmaceutically acceptable excipient.
57. Use of a therapeutically effective amount of the lymphocyte of any of claims 50-52 or the pharmaceutical composition of claim 56 in the manufacture of a medicament for A method of treating a subject having cancer, the method comprising:
administering a therapeutically effective amount of the lymphocyte of any of claims 50-52 or the pharmaceutical composition of claim 56 to the subject, whereby the lymphocyte induces killing of cancer cells in the subject.

58. The ~~method~~use of claim 57, wherein the cancer is a B-cell lymphoma.

59. The ~~method~~use of claim 57 or claim 58, wherein the cancer is a non-Hodgkin lymphoma.

60. The ~~method~~use of any one of claims 57-59, wherein the cancer is a diffuse large B-cell lymphoma (DLBCL), mantle cell lymphoma (MCL), follicular lymphoma (FL), marginal zone lymphoma (MZ), acute lymphoblastic leukemia (ALL), chronic lymphocytic leukemia (CLL), multiple myeloma (MM), mucosa-associated lymphoid tissue (MALT) lymphoma, Hodgkin's lymphoma, Burkitt's lymphoma, hairy-cell leukemia, or Plasmacytoma.

~~61. A method of targeted killing of a cancer cell, the method comprising:
contacting the cancer cell with the lymphocyte of any of claims 50-52, whereby the lymphocyte induces killing of the cancer cell.~~

~~62. The method of claim 61, wherein the cancer cell is a malignant B cell.~~

~~63. The method of claim 61 or claim 62, wherein the cancer cell is a cell of a non-Hodgkin lymphoma.~~

~~64. The method of any of claims 61-63, wherein the cancer cell is a cell of diffuse large B-cell lymphoma (DLBCL), mantle cell lymphoma (MCL), follicular lymphoma (FL), marginal zone lymphoma (MZ), acute lymphoblastic leukemia (ALL), chronic lymphocytic leukemia (CLL), multiple myeloma (MM), mucosa-associated lymphoid tissue (MALT) lymphoma, Hodgkin's lymphoma, Burkitt's lymphoma, hairy cell leukemia, or Plasmacytoma.~~

~~65.~~61. A method of detecting the presence of cancer in a subject, comprising:
contacting a cell sample obtained from the subject with the CAR of any one of claims 1-49, thereby forming a CAR-cell complex, and
detecting the complex, wherein detection of the complex is indicative of the presence of cancer in the subject.

62. A therapeutically effective amount of the lymphocyte of any of claims 50-52 or the pharmaceutical composition of claim 56 for use in treating a subject having cancer, whereby the lymphocyte induces killing of cancer cells in the subject.