CLAIMS

What is claimed is:

1. An isolated nucleic acid sequence comprising a sequence encoding a chimeric antigen receptor (CAR), wherein the CAR comprises an antigen binding domain derived from a bispecific antibody, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from the group consisting of a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof.

2. The isolated nucleic acid sequence of claim 1, comprising the nucleic acid sequence selected from the group consisting of SEQ ID NO: 20, SEQ ID NO: 21, and SEQ ID NO: 22.

3. The isolated nucleic acid sequence of claim 1, wherein the antigen-binding fragment is a Fab or a scFv.

4. The isolated nucleic acid sequence of claim 1, wherein the antigen binding domain binds to a tumor antigen.

5. The isolated nucleic acid sequence of claim 4, wherein the tumor antigen is associated with a hematologic malignancy.

6. The isolated nucleic acid sequence of claim 4, wherein the tumor antigen is associated with a solid tumor.

7. The isolated nucleic acid sequence of claim 4, wherein the tumor antigen is selected from the group consisting of CD19, CD20, CD22, ROR1, mesothelin, CD33/IL3Ra, c-Met, PSMA, Glycolipid F77, EGFRvIII, GD-2, NY-ESO-1 TCR, MAGE A3 TCR, and any combination thereof.

8. The isolated nucleic acid sequence of claim 1, wherein the CAR further comprises a costimulatory signaling region comprising the intracellular domain of a costimulatory molecule selected from the group consisting of CD27, CD28, 4-1BB, OX40, CD30, CD40, PD-1, lymphocyte function-associated antigen-1 (LFA-1), CD2, CD7, LIGHT,

NKG2C, B7-H3, a ligand that specifically binds with CD83, and any combination thereof.

9. The isolated nucleic acid sequence of claim 1, wherein the nucleic acid sequence of the antigen binding domain derived from a bispecific antibody encodes a bispecific antibody.

10. The isolated nucleic acid of claim 9, wherein the nucleic acid sequence encoding the bispecific antibody comprises the nucleic acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 2, SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, SEQ ID NO: 19, and any combination thereof.

11. A cell comprising a nucleic acid sequence comprising a sequence encoding a chimeric antigen receptor (CAR), wherein the CAR comprises an antigen binding domain derived from a bispecific antibody, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from the group consisting of a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof.

12. The cell of claim 11, wherein the nucleic acid sequence comprises the nucleic acid sequence selected from the group consisting of SEQ ID NOs: 20, SEQ ID NO: 21, and SEQ ID NO: 22.

13. The cell of claim 11, wherein the antigen-binding fragment is a Fab or a scFv.

14. The cell of claim 11, wherein the antigen binding domain binds to a tumor antigen.

15. The cell of claim 14, wherein the tumor antigen is associated with a hematologic malignancy.

16. The cell of claim 14, wherein the tumor antigen is associated with a solid tumor.

17. The cell of claim 14, wherein the tumor antigen is selected from the group consisting of CD19, CD20, CD22, ROR1, mesothelin, CD33/IL3Ra, c-Met, PSMA, Glycolipid

F77, EGFRvIII, GD-2, NY-ESO-1 TCR, MAGE A3 TCR, and any combination thereof.

18. The cell of claim 11, wherein the CAR further comprises a costimulatory signaling region comprising the intracellular domain of a costimulatory molecule selected from the group consisting of CD27, CD28, 4-1BB, OX40, CD30, CD40, PD-1, lymphocyte function-associated antigen-1 (LFA-1), CD2, CD7, LIGHT, NKG2C, B7-H3, a ligand that specifically binds with CD83, and any combination thereof.

19. The cell of claim 11, wherein the cell is a T cell.

20. The cell of claim 11, wherein the cell exhibits an anti-tumor immunity when the antigen binding domain binds to its corresponding antigen.

21. The cell of claim 11, wherein the nucleic acid sequence of the antigen binding domain derived from a bispecific antibody encodes a bispecific antibody.

22. The cell of claim 21, wherein the nucleic acid sequence encoding the bispecific antibody comprises the nucleic acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 2, SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, SEQ ID NO: 19, and any combination thereof.

23. The cell of claim 11, wherein the cell further comprises a nucleic acid encoding a bispecific antibody.

24. The cell of claim 23, wherein the nucleic acid sequence encoding the bispecific antibody comprises the nucleic acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 2, SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, SEQ ID NO: 19, and any combination thereof.

25. The cell of claim 23, wherein the bispecific antibody comprises a human antibody, or an antigen-binding fragment thereof.

26. The cell of claim 23, wherein the bispecific antibody comprises a humanized antibody, or an antigen-binding fragment thereof.

27. An effective amount of a cell genetically modified to express a CAR and a bispecific antibody for use as a medicament for stimulating a T cell-mediated immune response to a target cell population or tissue in a mammal, wherein the CAR comprises an antigen binding domain, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from the group consisting of a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof.

28. An effective amount of a cell genetically modified to express a CAR for use as a medicament for stimulating a T cell-mediated immune response to a target cell population or tissue in a mammal, wherein the CAR comprises an antigen binding domain derived from a bispecific antibody, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof.

29. An effective amount of a cell genetically modified to express a CAR and a bispecific antibody for use as a medicament for providing an anti-tumor immunity in a mammal, wherein the CAR comprises an antigen binding domain, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof.

30. An effective amount of a cell genetically modified to express a CAR for use as a medicament for providing an anti-tumor immunity in a mammal, wherein the CAR comprises an antigen binding domain derived from a bispecific antibody, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof.

31. An effective amount of a cell genetically modified to express a CAR and a bispecific antibody for use in a medicament for treating a mammal having a disease, disorder or condition associated with an elevated expression of a tumor antigen, wherein the CAR comprises an antigen binding domain, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof.

32. An effective amount of a cell genetically modified to express a CAR for use in a medicament for treating a mammal having a disease, disorder or condition associated with an elevated expression of a tumor antigen, wherein the CAR comprises an antigen binding domain derived from a bispecific antibody, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof, thereby treating the mammal.

33. A cell genetically engineered to express a CAR and a bispecific antibody for use as a medicament for treating a human with cancer, wherein the CAR comprises an antigen binding domain, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof, wherein the cell is a T cell.

34. A cell genetically engineered to express a CAR for use as a medicament for treating a human with cancer, the method comprising administering to the human a, wherein the CAR comprises an antigen binding domain derived from a bispecific antibody, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof, wherein the cell is a T cell.

35. An isolated nucleic acid sequence encoding a bispecific antibody, wherein the nucleic acid sequence comprises the nucleic acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 2, SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, SEQ

ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, and SEQ ID NO: 19.

36. A cell comprising a nucleic acid sequence encoding a bispecific antibody, wherein the nucleic acid sequence comprises the nucleic acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 2, SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, and SEQ ID NO: 19.

37. An effective amount of a cell genetically modified to express a bispecific antibody for use as a medicament for stimulating a T cell-mediated immune response to a target cell population or tissue in a mammal.

38. An effective amount of a cell genetically modified to express a bispecific antibody for use as a medicament for providing an anti-tumor immunity in a mammal.

39. An effective amount of a cell genetically modified to express a bispecific antibody for use as a medicament for treating a mammal having a disease, disorder or condition associated with an elevated expression of a tumor antigen.

40. The cell of claim 39, wherein the cell is a T cell.

41. The cell of claim 43, wherein the tumor antigen is selected from the group consisting of CD19, CD20, CD22, ROR1, mesothelin, CD33/IL3Ra, c-Met, PSMA, Glycolipid F77, EGFRvIII, GD-2, NY-ESO-1 TCR, MAGE A3 TCR, and any combination thereof.

42. A cell genetically engineered to express a bispecific antibody for use as a medicament for treating a human with cancer.

43. The cell of claim 42, wherein the cell genetically engineered is an autologous T cell.

44. The cell of claim 43, wherein the cell secretes the bispecific antibody.

45. The cell of claim 44, wherein the bispecific antibody is encoded by a nucleic acid sequence comprising the nucleic acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 2, SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ

ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, and SEQ ID NO: 19.

46. The cell of claim 44, wherein the bispecific antibody comprises a human antibody, or an antigen-binding fragment thereof.

47. The cell of claim 44, wherein the bispecific antibody comprises a humanized antibody, or an antigen-binding fragment thereof.

CLAIMS

1. An isolated nucleic acid sequence comprising a sequence encoding a chimeric antigen receptor (CAR), wherein the CAR comprises an antigen binding domain derived from a bispecific antibody and the antigen binding domain binds to two different epitopes, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from the group consisting of a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof.

2. The isolated nucleic acid sequence of claim 1, comprising the nucleic acid sequence selected from the group consisting of SEQ ID NO: 20, SEQ ID NO: 21, and SEQ ID NO: 22.

3. The isolated nucleic acid sequence of claim 1, wherein the antigen-binding fragment is a Fab or a scFv.

4. The isolated nucleic acid sequence of claim 1, wherein the antigen binding domain binds to a tumor antigen.

5. The isolated nucleic acid sequence of claim 4, wherein the tumor antigen is associated with a hematologic malignancy.

6. The isolated nucleic acid sequence of claim 4, wherein the tumor antigen is associated with a solid tumor.

7. The isolated nucleic acid sequence of claim 4, wherein the tumor antigen is selected from the group consisting of CD19, CD20, CD22, ROR1, mesothelin, CD33/IL3Ra, c-Met, PSMA, Glycolipid F77, EGFRvIII, GD-2, NY-ESO-1 TCR, MAGE A3 TCR, and any combination thereof.

8. The isolated nucleic acid sequence of claim 1, wherein the CAR further comprises a costimulatory signaling region comprising the intracellular domain of a costimulatory molecule selected from the group consisting of CD27, CD28, 4-1BB, OX40, CD30, CD40, PD-1, lymphocyte function-associated antigen-1 (LFA-1), CD2, CD7, LIGHT, NKG2C, B7-H3, a ligand that specifically binds with CD83, and any combination thereof.

9. The isolated nucleic acid sequence of claim 1, wherein the nucleic acid sequence of the antigen binding domain derived from a bispecific antibody encodes a bispecific antibody.

10. The isolated nucleic acid of claim 9, wherein the nucleic acid sequence encoding the bispecific antibody comprises the nucleic acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 2, SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, SEQ ID NO: 19, and any combination thereof.

11. A cell comprising a nucleic acid sequence comprising a sequence encoding a chimeric antigen receptor (CAR), wherein the CAR comprises an antigen binding domain derived from a bispecific antibody and the antigen binding domain binds to two different epitopes, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from the group consisting of a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof.

12. The cell of claim 11, wherein the nucleic acid sequence comprises the nucleic acid sequence selected from the group consisting of SEQ ID NOs: 20, SEQ ID NO: 21, and SEQ ID NO: 22.

13. The cell of claim 11, wherein the antigen-binding fragment is a Fab or a scFv.

14. The cell of claim 11, wherein the antigen binding domain binds to a tumor antigen.

15. The cell of claim 14, wherein the tumor antigen is associated with a hematologic malignancy.

16. The cell of claim 14, wherein the tumor antigen is associated with a solid tumor.

17. The cell of claim 14, wherein the tumor antigen is selected from the group consisting of CD19, CD20, CD22, ROR1, mesothelin, CD33/IL3Ra, c-Met, PSMA, Glycolipid F77, EGFRvIII, GD-2, NY-ESO-1 TCR, MAGE A3 TCR, and any combination thereof.

18. The cell of claim 11, wherein the CAR further comprises a costimulatory signaling region comprising the intracellular domain of a costimulatory molecule selected from the group consisting of CD27, CD28, 4-1BB, OX40, CD30, CD40, PD-1, lymphocyte function-associated antigen-1 (LFA-1), CD2, CD7, LIGHT, NKG2C, B7-H3, a ligand that specifically binds with CD83, and any combination thereof.

19. The cell of claim 11, wherein the cell is a T cell.

20. The cell of claim 11, wherein the cell exhibits an anti-tumor immunity when the antigen binding domain binds to its corresponding antigen.

21. The cell of claim 11, wherein the nucleic acid sequence comprises the nucleic acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 2, SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, SEQ ID NO: 19, and any combination thereof.

22. The cell of claim 11, wherein the nucleic acid sequence comprises the nucleic acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 2, SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, SEQ ID NO: 19, and any combination thereof.

23. The cell of claim 11, wherein the bispecific antibody comprises a human antibody, or an antigen-binding fragment thereof.

24. The cell of claim 11, wherein the bispecific antibody comprises a humanized antibody, or an antigen-binding fragment thereof.

25. An effective amount of a cell genetically modified to express a CAR and a bispecific antibody for use as a medicament for stimulating a T cell-mediated immune response to a target cell population or tissue in a mammal, wherein the CAR comprises an antigen binding domain, a transmembrane domain, and a CD3 zeta signaling domain, wherein the antigen binding domain is selected from the group consisting of a human

antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof, and wherein the bispecific antibody binds to two different epitopes.

26. An effective amount of a cell genetically modified to express a CAR for use as a medicament for stimulating a T cell-mediated immune response to a target cell population or tissue in a mammal, wherein the CAR comprises an antigen binding domain derived from a bispecific antibody and the antigen binding domain binds to two different epitopes, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof.

27. An effective amount of a cell genetically modified to express a CAR and a bispecific antibody for use as a medicament for providing an anti-tumor immunity in a mammal, wherein the CAR comprises an antigen binding domain, a transmembrane domain, and a CD3 zeta signaling domain, wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof, and wherein the bispecific antibody binds to two different epitopes.

28. An effective amount of a cell genetically modified to express a CAR for use as a medicament for providing an anti-tumor immunity in a mammal, wherein the CAR comprises an antigen binding domain derived from a bispecific antibody and the antigen binding domain binds to two different epitopes, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof.

29. An effective amount of a cell genetically modified to express a CAR and a bispecific antibody for use in a medicament for treating a mammal having a disease, disorder or condition associated with an elevated expression of a tumor antigen, wherein the CAR comprises an antigen binding domain, a transmembrane domain, and a CD3 zeta signaling domain, wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any

combination thereof, and wherein the bispecific antibody binds to two different epitopes.

30. An effective amount of a cell genetically modified to express a CAR for use in a medicament for treating a mammal having a disease, disorder or condition associated with an elevated expression of a tumor antigen, wherein the CAR comprises an antigen binding domain derived from a bispecific antibody and the antigen binding domain binds to two different epitopes, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof, thereby treating the mammal.

31. A cell genetically engineered to express a CAR and a bispecific antibody for use as a medicament for treating a human with cancer, wherein the CAR comprises an antigen binding domain, a transmembrane domain, and a CD3 zeta signaling domain, wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof, wherein the bispecific antibody binds to two different epitopes, and wherein the cell is a T cell.

32. A cell genetically engineered to express a CAR for use as a medicament for treating a human with cancer, wherein the CAR comprises an antigen binding domain derived from a bispecific antibody and the antigen binding domain binds to two different antigens, a transmembrane domain, and a CD3 zeta signaling domain, further wherein the antigen binding domain is selected from a human antibody, a humanized antibody, an antigen binding fragment thereof, and any combination thereof, wherein the cell is a T cell.

33. A vector comprising a nucleic acid sequence encoding a CAR and a bispecific antibody, wherein the bispecific antibody binds to two different epitopes.

34. A cell comprising a transfected RNA encoding a bispecific antibody, wherein the nucleic acid sequence comprises the nucleic acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 2, SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, and SEQ ID NO: 19.

35. An effective amount of a cell comprising a transfected RNA encoding a bispecific antibody for use as a medicament for stimulating a T cell-mediated immune response to a target cell population or tissue in a mammal.

36. An effective amount of a cell comprising a transfected RNA encoding a bispecific antibody for use as a medicament for providing an anti-tumor immunity in a mammal.

37. An effective amount of a cell comprising a transfected RNA encoding a bispecific antibody for use as a medicament for treating a mammal having a disease, disorder or condition associated with an elevated expression of a tumor antigen.

38. The cell of claim 37, wherein the cell is a T cell.

39. The cell of claim 37, wherein the tumor antigen is selected from the group consisting of CD19, CD20, CD22, ROR1, mesothelin, CD33/IL3Ra, c-Met, PSMA, Glycolipid F77, EGFRvIII, GD-2, NY-ESO-1 TCR, MAGE A3 TCR, and any combination thereof.

40. A cell comprising a transfected RNA encodinga bispecific antibody for use as a medicament for treating a human with cancer.

41. The cell of claim 40, wherein the cell is an autologous T cell.

42. The cell of claim 41, wherein the cell secretes the bispecific antibody.

43. The cell of claim 42, wherein the bispecific antibody is encoded by a nucleic acid sequence comprising the nucleic acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 2, SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, and SEQ ID NO: 19.

44. The cell of claim 42, wherein the bispecific antibody comprises a human antibody, or an antigen-binding fragment thereof.

45. The cell of claim 42, wherein the bispecific antibody comprises a humanized antibody, or an antigen-binding fragment thereof.

46. The vector of claim 33, wherein the nucleic acid sequence comprises a nucleic acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 2, SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, and SEQ ID NO: 19.