CLAIMS

1. An isolated nucleic acid sequence encoding a chimeric antigen receptor (CAR), wherein the CAR comprises an antigen binding domain, a transmembrane domain, and an ICOS intracellular signaling domain.

2. The isolated nucleic acid sequence of claim 1, further comprising a CD3zeta signaling domain.

3. The isolated nucleic acid sequence of claim 1, comprising the nucleic acid sequence of SEQ ID NO: 8.

4. The isolated nucleic acid sequence of claim 1, wherein the antigen binding domain is an antibody or an antigen-binding fragment thereof.

5. The isolated nucleic acid sequence of claim 4, wherein the antigen-binding fragment is a Fab or a scFv.

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

7. The isolated nucleic acid sequence of claim 1, further comprising 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.

8. The isolated nucleic acid sequence of claim 1, wherein the ICOS intracellular signaling domain is encoded by the nucleic acid sequence of SEQ ID NO: 6.

9. The isolated nucleic acid sequence of claim 2, wherein the CD3 zeta signaling domain is encoded by the nucleic acid sequence of SEQ ID NO: 7.

10. A cell comprising a nucleic acid sequence encoding a chimeric antigen receptor (CAR), wherein the CAR comprises an antigen binding domain, a transmembrane domain, and an ICOS intracellular signaling domain.

11. The cell of claim 10, wherein the CAR further comprises a CD3zeta signaling domain.

12. The cell of claim 10, wherein the nucleic acid sequence comprises the nucleic acid sequence of SEQ ID NO: 8.

13. The cell of claim 10, wherein the antigen binding domain is an antibody or an antigen-binding fragment thereof.

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

15. The cell of claim 10, wherein the antigen binding domain binds to a tumor antigen.

16. The cell of claim 10, 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.

17. The cell of claim 10, wherein the ICOS intracellular signaling domain is encoded by the nucleic acid sequence of SEQ ID NO: 6.

18. The cell of claim 11, wherein the CD3 zeta signaling domain is encoded by the nucleic acid sequence of SEQ ID NO: 7.

19. The cell of claim 10, wherein the cell is selected from the group consisting of a Th17 cell and a Tc17 cell.

20. The cell of claim 10, wherein the cell exhibits an anti-tumor immunity when the antigen binding domain binds to its corresponding antigen.

21. An effective amount of a cell genetically modified to express a CAR for use as a medicament for the therapeutic and/or prophylactic treatment of 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 an ICOS intracellular signaling domain.

22. The cell of claim 21, wherein the CAR further comprises a CD3zeta signaling domain.

23. An effective amount of a cell genetically modified to express a CAR for use as a medicament for the therapeutic and/or prophylactic treatment of providing an anti-tumor immunity in a mammal, wherein the CAR comprises an antigen binding domain, a transmembrane domain, and an ICOS intracellular signaling domain.

24. The cell of claim 23, wherein the CAR further comprises a CD3zeta signaling domain.

25. An effective amount of a cell genetically modified to express a CAR for use as a medicament for the therapeutic and/or prophylactic treatment of 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 an ICOS intracellular signaling domain.

26. The cell of claim 25, wherein the CAR further comprises a CD3zeta signaling domain.

27. The cell of claim 25, wherein the cell is selected from the group consisting of an autologous Th17 cell and an autologous Tc17 cell.

28. A cell genetically engineered to express a CAR for use as a medicament for the therapeutic and/or prophylactic treatment of treating a human with cancer, wherein the CAR comprises an antigen binding domain, a transmembrane domain, and an ICOS intracellular signaling domain, wherein the cell is selected from the group consisting of a Th17 cell and a Tc17 cell.

29. The cell of claim 28, wherein the CAR further comprises a CD3zeta signaling domain.

30. The cell of claim 28, wherein the human is resistant to at least one chemotherapeutic agent.

31. A cell genetically engineered to express a CAR for use as a medicament for the therapeutic and/or prophylactic treatment of generating a persisting population of

genetically engineered T cells in a human diagnosed with cancer, wherein the CAR comprises an antigen binding domain, a transmembrane domain, and an ICOS intracellular signaling domain, wherein the persisting population of genetically engineered cells persists in the human for at least one month after administration, and wherein the cell is selected from the group consisting of a Th17 cell and a Tc17 cell.

32. The cell of claim 31, wherein the CAR further comprises a CD3zeta signaling domain.

33. The cell of claim 31, wherein the persisting population of genetically engineered T cells comprises at least one cell selected from the group consisting of a cell that was administered to the human, a progeny of a cell that was administered to the human, and a combination thereof.

34. The cell of claim 31, wherein the persisting population of genetically engineered T cells comprises a memory T cell.

35. The cell of claim 31, wherein the persisting population of genetically T engineered cells is capable of persisting in the human for at least three months after administration.

36. The cell of claim 31, wherein the persisting population of genetically engineered T cells is capable of persisting in the human for at least four months, five months, six months, seven months, eight months, nine months, ten months, eleven months, twelve months, two years, or three years after administration.

37. The cell of claim 31, wherein the cancer is treated.

38. A cell genetically engineered to express a CAR for use as a medicament for the therapeutic and/or prophylactic treatment of expanding a population of genetically engineered T cells in a human diagnosed with cancer, wherein the CAR comprises an antigen binding domain, a transmembrane domain, and an ICOS intracellular signaling domain, wherein the administered genetically engineered cell is selected from the group consisting of a Th17 cell and a Tc17 cell, further wherein the administered genetically engineered cell produces a population of progeny T cells in the human.

39. The cell of claim 38, wherein the CAR further comprises a CD3zeta signaling domain.

40. The cell of claim 38, wherein the progeny T cells in the human comprise a memory T cell.

41. The cell of claim 38, wherein the cell is an autologous cell.

42. The cell of claim 38, wherein the population of progeny T cells is capable of persisting in the human for at least three months after administration.

43. The cell of claim 38, wherein the population of progeny T cells is capable of persisting in the human for at least four months, five months, six months, seven months, eight months, nine months, ten months, eleven months, twelve months, two years, or three years after administration.

44. The cell of claim 38, wherein the cancer is treated.

CLAIMS

1. An isolated nucleic acid sequence encoding a chimeric antigen receptor (CAR), wherein the CAR comprises an antigen binding domain comprising an anti-mesothelin antibody or fragment thereof, a transmembrane domain, and an ICOS intracellular signaling domain.

2. The isolated nucleic acid sequence of claim 1, further comprising a CD3zeta signaling domain.

3. The isolated nucleic acid sequence of claim 1, comprising the nucleic acid sequence of SEQ ID NO: 8.

4. The isolated nucleic acid sequence of claim 1, wherein the antigen binding domain comprises SEQ ID NO: 3.

5. The isolated nucleic acid sequence of claim 4, wherein the antigen-binding fragment is a Fab or a scFv.

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

7. The isolated nucleic acid sequence of claim 1, further comprising 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.

8. The isolated nucleic acid sequence of claim 1, wherein the ICOS intracellular signaling domain is encoded by the nucleic acid sequence of SEQ ID NO: 6.

9. The isolated nucleic acid sequence of claim 2, wherein the CD3 zeta signaling domain is encoded by the nucleic acid sequence of SEQ ID NO: 7.

10. A cell comprising a nucleic acid sequence encoding a chimeric antigen receptor (CAR), wherein the CAR comprises an antigen binding domain comprising an anti-mesothelin antibody or fragment thereof, a transmembrane domain, and an ICOS intracellular signaling domain.

11. The cell of claim 10, wherein the CAR further comprises a CD3zeta signaling domain.

12. The cell of claim 10, wherein the nucleic acid sequence comprises the nucleic acid sequence of SEQ ID NO: 8.

13. The cell of claim 10, wherein the antigen binding domain comprises SEQ ID NO: 3.

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

15. The cell of claim 10, wherein the antigen binding domain binds to a tumor antigen.

16. The cell of claim 10, 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.

17. The cell of claim 10, wherein the ICOS intracellular signaling domain is encoded by the nucleic acid sequence of SEQ ID NO: 6.

18. The cell of claim 11, wherein the CD3 zeta signaling domain is encoded by the nucleic acid sequence of SEQ ID NO: 7.

19. The cell of claim 10, wherein the cell is selected from the group consisting of a Th17 cell and a Tc17 cell.

20. The cell of claim 10, wherein the cell exhibits an anti-tumor immunity when the antigen binding domain binds to its corresponding antigen.

21. An effective amount of a cell genetically modified to express a chimeric antigen receptor (CAR) for use as a medicament for the therapeutic and/or prophylactic treatment of 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 comprising an anti-mesothelin antibody or fragment thereof, a transmembrane domain, and an ICOS intracellular signaling domain.

22. The cell of claim 21, wherein the CAR further comprises a CD3zeta signaling domain.

23. An effective amount of a cell genetically modified to express a chimeric antigen receptor (CAR) for use as a medicament for the therapeutic and/or prophylactic treatment of providing an anti-tumor immunity in a mammal, wherein the CAR comprises an antigen binding domain comprising an anti-mesothelin antibody or fragment thereof, a transmembrane domain, and an ICOS intracellular signaling domain.

24. The cell of claim 23, wherein the CAR further comprises a CD3zeta signaling domain.

25. An effective amount of a cell genetically modified to express a chimeric antigen receptor (CAR) for use as a medicament for the therapeutic and/or prophylactic treatment of 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 comprising an anti-mesothelin antibody or fragment thereof, a transmembrane domain, and an ICOS intracellular signaling domain.

26. The cell of claim 25, wherein the CAR further comprises a CD3zeta signaling domain.

27. The cell of claim 25, wherein the cell is selected from the group consisting of an autologous Th17 cell and an autologous Tc17 cell.

28. A cell genetically engineered to express a chimeric antigen receptor (CAR) for use as a medicament for the therapeutic and/or prophylactic treatment of a human with cancer, wherein the CAR comprises an antigen binding domain comprising an anti-mesothelin antibody or fragment thereof, a transmembrane domain, and an ICOS intracellular signaling domain, wherein the cell is selected from the group consisting of a Th17 cell and a Tc17 cell.

29. The cell of claim 28, wherein the CAR further comprises a CD3zeta signaling domain.

30. The cell of claim 28, wherein the human is resistant to at least one chemotherapeutic agent.

31. A cell genetically engineered to express a chimeric antigen receptor (CAR) for use as a medicament for the therapeutic and/or prophylactic treatment of generating a persisting population of genetically engineered T cells in a human diagnosed with cancer, wherein the CAR comprises an antigen binding domain comprising an anti-mesothelin antibody or fragment thereof, a transmembrane domain, and an ICOS intracellular signaling domain, wherein the persisting population of genetically engineered cells persists in the human for at least one month after administration, and wherein the cell is selected from the group consisting of a Th17 cell and a Tc17 cell.

32. The cell of claim 31, wherein the CAR further comprises a CD3zeta signaling domain.

33. The cell of claim 31, wherein the persisting population of genetically engineered T cells comprises at least one cell selected from the group consisting of a cell that was administered to the human, a progeny of a cell that was administered to the human, and a combination thereof.

34. The cell of claim 31, wherein the persisting population of genetically engineered T cells comprises a memory T cell.

35. The cell of claim 31, wherein the persisting population of genetically T engineered cells is capable of persisting in the human for at least three months after administration.

36. The cell of claim 31, wherein the persisting population of genetically engineered T cells is capable of persisting in the human for at least four months, five months, six months, seven months, eight months, nine months, ten months, eleven months, twelve months, two years, or three years after administration.

37. The cell of claim 31, wherein the cancer is treated.

38. A cell genetically engineered to express a chimeric antigen receptor (CAR) for use as a medicament for the therapeutic and/or prophylactic treatment of expanding a population of genetically engineered T cells in a human diagnosed with cancer, wherein the CAR comprises an antigen binding domain comprising an anti-mesothelin antibody or fragment thereof, a transmembrane domain, and an ICOS intracellular signaling domain, wherein the administered genetically engineered cell is selected from the group consisting of a Th17 cell and a Tc17 cell, further wherein the administered genetically engineered cell produces a population of progeny T cells in the human.

39. The cell of claim 38, wherein the CAR further comprises a CD3zeta signaling domain.

40. The cell of claim 38, wherein the progeny T cells in the human comprise a memory T cell.

41. The cell of claim 38, wherein the cell is an autologous cell.

42. The cell of claim 38, wherein the population of progeny T cells is capable of persisting in the human for at least three months after administration.

43. The cell of claim 38, wherein the population of progeny T cells is capable of persisting in the human for at least four months, five months, six months, seven months, eight months, nine months, ten months, eleven months, twelve months, two years, or three years after

administration.

44. The cell of claim 38, wherein the cancer is treated.