

WHAT IS CLAIMED IS:

1. A nucleic acid encoding a chimeric antigen receptor (CAR), wherein the CAR comprises:
 - a ligand binding domain which specifically binds to a dinitrophenol (DNP) moiety;
 - a spacer;
 - a transmembrane domain; and
 - an intracellular signaling domain.
2. The nucleic acid of claim 1, wherein the ligand binding domain comprises an amino acid sequence having at least 90% identity to the amino acid sequence set forth in any one of SEQ ID NOs:01-12.
3. The nucleic acid of claim 2, wherein the ligand binding domain comprises the amino acid sequence set forth in any one of SEQ ID NOs:01-12.
4. The nucleic acid of claim 1, wherein the ligand binding domain comprises an amino acid sequence having at least 90% identity to the amino acid sequence set forth in SEQ ID NOs:01, 02, 09, or 10.
5. The nucleic acid of claim 4, wherein the ligand binding domain comprises the amino acid sequences set forth in SEQ ID NOs:01, 02, 09, or 10.
6. The nucleic acid of claim any one of claims 1-5, wherein the spacer is selected from the group consisting of:
 - a short spacer having a length of 12 consecutive amino acid residues or less but, preferably not 1 amino acid in length,
 - a medium spacer having a length of 119 consecutive amino acid residues or less but, preferably not 1 amino acid in length, and
 - a long spacer having a length greater than 119 consecutive amino acid residues.
7. The nucleic acid of claim any one of claims 1-6, wherein the spacer is selected from the group consisting of:
 - a short spacer comprising an IgG4 hinge domain,
 - a medium spacer comprising an IgG4 hinge-CH3 domain, and
 - a long spacer comprising an IgG4 hinge -CH2-CH3 domain.

8. The nucleic acid of claim any one of claims 1-7, wherein the spacer is a long spacer having a length of at least 229 consecutive amino acid residues.
9. The nucleic acid of claim any one of claims 1-8, wherein the transmembrane domain comprises a CD28 transmembrane domain.
10. The nucleic acid of claim any one of claims 1-9, wherein the intracellular signaling domain comprises a portion of CD3 zeta and/or a portion of 4-1BB.
11. The nucleic acid of claim any one of claims 1-10, further comprising a polynucleotide encoding a selectable gene, a cell surface selectable marker, or a cleavable linker.
12. The nucleic acid of claim 11, wherein the selectable gene comprises a dihydrofolate reductase double mutant (DHFRdm).
13. The nucleic acid of claim 11 or 12, wherein the cell surface selectable marker is selected from the group consisting of a truncated EGFR (EGFRt), a truncated Her2 (Her2tG), and a truncated CD19 (CD19t).
14. The nucleic acid of any one of claims 11-13, wherein the cleavable linker comprises a ribosome skip sequence is selected from the group consisting of P2A, T2A, E2A and F2A.
15. A vector comprising the nucleic acid of any one of claims 1-14.
16. The vector of claim 15, wherein the vector comprises a lentiviral vector.
17. A method for preparing a population of cells for an infusion, comprising:
introducing the nucleic acid of any one of claims 1-14 into a cell; and
culturing the cell under conditions suitable to obtain a population of cells sufficient for an infusion.
18. A chimeric antigen receptor (CAR) encoded by the nucleic acid of any one of claims 1-14.
19. A cell comprising the nucleic acids of any one of claims 1-14, or the chimeric antigen receptor (CAR) of claim 18.
20. The cell of claim 19, wherein the cell is derived from a CD4⁺ T cell, a CD8⁺ T cell, a precursor T cell, or a hematopoietic stem cell.

21. The cell of claim 20, wherein the CD8⁺ T cell is a CD8⁺ cytotoxic T lymphocyte cell selected from the group consisting of a naïve CD8⁺ T cell, a central memory CD8⁺ T cell, an effector memory CD8⁺ T cell, and a bulk CD8⁺ T cell.

22. The cell of claim 21, wherein the central memory CD8⁺ T cell is positive for CD45RO and CD62L.

23. The cell of claim 20, wherein the CD4⁺ cell is a CD4⁺ helper T lymphocyte cell selected from the group consisting of a naïve CD4⁺ T cell, a central memory CD4⁺ T cell, an effector memory CD4⁺ T cell, and a bulk CD4⁺ T cell.

24. The cell of claim 23, wherein the naïve CD4⁺ T cell is positive for CD45RA and CD62L, and negative for CD45RO.

25. The cell of any one claims 19-24, wherein the cell is *ex vivo*.

26. The cell of any one claims 19-24, wherein the cell is *in vivo*.

27. The cell of any one claims 19-26, wherein the cell is mammalian.

28. The cell of any one claims 19-27, wherein the cell is human.

29. A composition comprising:

the chimeric antigen receptor (CAR) of claim 18; and

a dinitrophenol (DNP) moiety attached to a target cell, wherein the CAR is specifically bound to the DNP moiety.

30. The composition of claim 29, wherein the DNP moiety is attached to the target cell via an antibody or antigen binding fragment thereof that binds to the target cell.

31. The composition of claim 29, wherein the DNP moiety is attached to a cell surface of the target cell via a lipid integrated into the cell surface.

32. The composition of claim 31, wherein the lipid comprises a polar head group and a hydrophobic group.

33. The composition of claim 32, wherein the polar head comprises a group selected from choline, phosphatidylcholine, phosphocholine, sphingomyelin, aphosphoethanolamine, a sugar residue, phosphatidyl serine, phosphatidyl inositol, a piperidine, or a trimethylarsenoethyl-phosphate.

34. The composition of claim 32 or 33, wherein the hydrophobic group comprises an aliphatic chain or a terpenoid moiety.

35. The composition of any one of claims 32-34, wherein the hydrophobic group comprises an ether linkage, wherein the ether linkage is between the polar head group and the aliphatic chain.

36. The composition of claim 34 or 35, wherein the aliphatic chain comprises a C₁₀₋₂₀ alkyl chain.

37. The composition of any one of claims 31-36, wherein the lipid is a phospholipid ether (PLE).

38. The composition of any one claims 29-37, wherein the target cell is a cancer cell.

39. The composition of claim 38, wherein the cancer cell is selected from the group consisting of a breast cancer cell, brain cancer cell, colon cancer cell, renal cancer cell, pancreatic cancer cell, and ovarian cancer cell.

40. The composition of any one claims 29-39, wherein the target cell is *ex vivo*.

41. The composition of any one claims 29-39, wherein the target cell is *in vivo*.

42. The composition of any one claims 29-41, wherein the target cell is mammalian.

43. The composition of any one claims 29-42, wherein the target cell is human.

44. A method of treating or ameliorating a cancer in a subject comprising:
administering the cell of any one of claims 19-28 to the subject in combination with a composition comprising a dinitrophenol (DNP) moiety.

45. The method of claim 44, wherein the cell is administered prior to administration of the composition.

46. The method of claim 44, wherein the cell is administered subsequent to administration of the composition.

47. The method of claim 44, wherein the cell is co-administered with the composition.

48. The method of any one claims 44-47, wherein the composition is adapted to target the cancer.

49. The method of any one claims 44-48, wherein the DNP moiety is attached to an antibody of antigen binding fragment thereof which specifically binds to the cancer.

50. The method of any one claims 44-48, wherein the DNP moiety is attached to a folate.

51. The method of any one claims 44-48, wherein the DNP moiety is attached to a lipid.
52. The method of claim 51, wherein the lipid comprises a polar head group and a hydrophobic group.
53. The method of claim 52, wherein the polar head comprises a group selected from choline, phosphatidylcholine, phosphocholine, sphingomyelin, aphosphoethanolamine, a sugar residue, phosphatidyl serine, phosphatidyl inositol, a piperidine, or a trimethylarsenoethyl-phosphate.
54. The method of claim 52 or 53, wherein the hydrophobic group comprises an aliphatic chain or a terpenoid moiety.
55. The method of any one claims 52-54, wherein the hydrophobic group comprises an ether linkage, wherein the ether linkage is between the polar head group and the aliphatic chain.
56. The method of claim 54 or 55, wherein the aliphatic chain comprises a C₁₀₋₂₀ alkyl chain.
57. The method of any one claims 52-56, wherein the lipid is a phospholipid ether (PLE).
58. The method of any one claims 44-57, wherein the cancer comprises a target cell selected from the group consisting of a breast cancer cell, brain cancer cell, colon cancer cell, renal cancer cell, pancreatic cancer cell, and ovarian cancer cell.
59. The method of any one claims 44-58, wherein the cell is autologous to the subject.
60. The method of any one claims 44-59, wherein the subject is mammalian.
61. The method of any one claims 44-60, wherein the subject is human.
62. Use of the cell of any one of claims 19-28 in combination with a composition comprising a dinitrophenol (DNP) moiety to treat a cancer in a subject.
63. Use of the cell of any one of claims 19-29 in combination with a composition comprising a dinitrophenol (DNP) moiety in the manufacture of a medicament a to treat a cancer in a subject.
64. The CAR T cells of any one of claims 19-28 for use in a medicament.