

CLAIMS:

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, wherein the ligand binding domain comprises an amino acid sequence having at least 90% sequence identity to the amino acid sequence set forth in any one of SEQ ID NOs:01-12;
 - 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% sequence identity to the amino acid sequence set forth in SEQ ID NOs:01, 02, 09, or 10.
3. The nucleic acid of claim 1 or 2, wherein the spacer comprises an IgG4 hinge domain, an IgG4 hinge-CH3 domain, or an IgG4 hinge-CH2-CH3 domain.
4. The nucleic acid of claim any one of claims 1-3, wherein the spacer has a length of at least 229 consecutive amino acid residues.
5. The nucleic acid of claim any one of claims 1-4, wherein the transmembrane domain comprises a CD28 transmembrane domain; and the intracellular signaling domain comprises a portion of CD3 zeta and/or a portion of 4-1BB.
6. The nucleic acid of claim any one of claims 1-5, further comprising a polynucleotide encoding (i) a dihydrofolate reductase; (ii) a cell surface selectable marker selected from the group consisting of a truncated EGFR (EGFRt), a truncated Her2 (Her2tG), and a truncated CD19 (CD19t); and/or (iii) a cleavable linker comprising a ribosome skip sequence selected from the group consisting of P2A, T2A, E2A and F2A.
7. A vector comprising the nucleic acid of any one of claims 1-6.
8. The vector of claim 7, wherein the vector comprises a lentiviral vector.
9. A method for preparing a population of cells for an infusion, comprising:
 - introducing the nucleic acid of any one of claims 1-8 into a cell; and

culturing the cell under conditions suitable to obtain a population of cells sufficient for an infusion.

10. A chimeric antigen receptor (CAR) encoded by the nucleic acid of any one of claims 1-6.

11. A cell comprising the nucleic acid of any one of claims 1-6, or a chimeric antigen receptor (CAR) encoded by the nucleic acid.

12. The cell of claim 11, wherein the cell is derived from a CD4⁺ T cell, a CD8⁺ T cell, a precursor T cell, or a hematopoietic stem cell.

13. The cell of claim 12, 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; or 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.

14. A composition comprising:

the chimeric antigen receptor (CAR) of claim 10; and

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

15. The composition of claim 14, wherein the DNP moiety is attached to the target cell via an antibody or antigen binding fragment thereof that binds to the target cell; or via a lipid integrated into the cell surface.

16. Use of the cell of any one of claims 11-13, in the preparation of a medicament for treating, inhibiting or ameliorating a cancer in a subject, wherein the treating, inhibiting or ameliorating is in combination with a composition comprising a dinitrophenol (DNP) moiety, wherein the composition is configured to target the cancer.

17. The use of claim 16, wherein the DNP moiety is attached to an antibody or antigen binding fragment thereof which specifically binds to the cancer, a folate, or a lipid.

18. The use of claim 17, wherein the lipid is a phospholipid ether (PLE).

19. The use of any one of claims 16-18, 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.

20. The use of any one of claims 16-19, wherein the subject is human.