

CLAIMS

1. A polypeptide comprising an extracellular domain of a HER2 polypeptide comprising an amino acid sequence with at least 95% sequence identity to the sequence of amino acids 563 to 652 of SEQ ID NO:23 linked via a spacer to a transmembrane domain, wherein the spacer is selected from the group consisting of an IgG4 hinge domain, a CD28 hinge domain, and a polypeptide comprising the amino acid sequence of SEQ ID NO:45 having 0-3 conservative substitutions thereof.
2. The polypeptide of claim 1, wherein the spacer comprises the IgG4 hinge domain.
3. The polypeptide of claim 2, wherein the IgG4 hinge domain comprises the amino acid sequence of any one of SEQ ID NOs:09-13 having 0-3 conservative substitutions thereof.
4. The polypeptide of claim 3, wherein the IgG4 hinge domain comprises the amino acid sequence of SEQ ID NO:09 having 0-3 conservative substitutions thereof.
5. The polypeptide of claim 3, wherein the IgG4 hinge domain comprises the amino acid sequence of SEQ ID NO:09.
6. The polypeptide of claim 1, wherein the spacer comprises the amino acid sequence of SEQ ID NO:45 having 0-3 conservative substitutions thereof.
7. The polypeptide of claim 6, wherein the spacer comprises the amino acid sequence of SEQ ID NO:45.
8. The polypeptide of claim 1, wherein the spacer comprises the CD28 hinge domain.
9. The polypeptide of any one of claims 1-8, further comprising a leader peptide that provides for cell surface expression.
10. The polypeptide of claim 9, wherein the leader peptide comprises the amino acid sequence set forth in SEQ ID NO:17.
11. The polypeptide of any one of claims 1-8, wherein the polypeptide specifically binds to trastuzumab.
12. A nucleic acid encoding the polypeptide of any one of claims 1-8.
13. The nucleic acid of claim 12, further comprising a transgene, wherein the transgene encodes a first chimeric antigen receptor (CAR).
14. An isolated host cell comprising the nucleic acid of claim 12.

15. The isolated host cell of claim 14, further comprising a transgene encoding a first chimeric antigen receptor (CAR).

16. The isolated host cell of claim 14, wherein the isolated host cell is selected from the group consisting of a CD8 T cell, a CD4 T cell, a CD4 naïve T cell, a CD8 naïve T cell, a CD8 central memory cell, and a CD4 central memory cell.

17. The isolated host cell of claim 14, wherein the isolated host cell is a precursor T cell or a hematopoietic stem cell.

18. A pharmaceutical composition comprising the isolated host cell of claim 14 and a pharmaceutically acceptable excipient.

19. The isolated host cell of claim 15, for use in the manufacture of a medicament to treat or inhibit a cancer in a subject, wherein the isolated host cell expresses the first CAR and the polypeptide, and wherein the first CAR is capable of specifically binding to a tumor antigen expressed by the cancer.

20. The isolated host cell of claim 19, for use in the manufacture of a medicament to treat or inhibit a cancer in a subject, wherein the isolated host cell is administered in combination with an antibody that specifically binds to the polypeptide.

21. The isolated host cell of claim 20, where the antibody is trastuzumab.

22. The isolated host cell of claim 20, wherein the antibody is conjugated to a cytotoxic agent.

23. The isolated host cell of claim 20, wherein the antibody is detectably labeled.

24. An *ex vivo* method for preparing a population of cells for an infusion, the method comprising:

(a) introducing the nucleic acid of claim 12 into a cell; and

(b) culturing the cell to obtain a population of cells.

25. The method of claim 24, further comprising (c) enriching for cells expressing the nucleic acid.