

What is claimed is:

1. An isolated nucleic acid, comprising a nucleotide sequence that encodes the polypeptide of SEQ ID NO: 3.
- 5 2. The isolated nucleic acid of claim 1, wherein the nucleotide sequence is SEQ ID NO: 1.
3. A recombinant cell comprising the isolated nucleic acid of claim 2,
10 wherein the recombinant cell expresses the polypeptide of SEQ ID NO: 2.
4. The recombinant cell of claim 3, wherein the cell is a T cell.
5. A viral vector comprising the isolated nucleic acid of claim 1, wherein
15 the viral vector is a lentiviral vector, a gamma-retroviral vector, or an adeno-associated viral vector.
6. The viral vector of claim 5, wherein the nucleotide sequence is SEQ ID NO: 1.
- 20 7. An isolated polypeptide comprising the sequence of SEQ ID NO: 3, wherein the isolated polypeptide specifically binds to stage-specific embryonic antigen 4.
- 25 8. A chimeric antigen receptor, comprising a single chain Fv (scFv) that specifically binds to stage-specific embryonic antigen 4, and a first endodomain from CD3 ζ or Fc ϵ RI γ , wherein the scFv has the sequence of SEQ ID NO: 3.
9. The chimeric antigen receptor of claim 8, further comprising a second
30 endodomain from CD28, CD137, CD4, OX40, or ICOS, wherein the scFv is fused to the second endodomain and the second endodomain is fused to the first endodomain.
10. The chimeric antigen receptor of claim 9, wherein the chimeric antigen receptor has the sequence of SEQ ID NO: 4.

11. A method for treating a tumor in a subject, the method comprising:
obtaining T cells from a subject having a tumor;
transducing the T cells *in vitro* with a vector that contains a nucleic
acid encoding a chimeric antigen receptor (CAR) including a scFv that specifically
5 recognizes stage-specific embryonic antigen 4 (SSEA4), whereby the transduced T
cells express the CAR;
expanding the transduced T cells *in vitro*; and
infusing the expanded transduced T cells into the subject having a
tumor, whereby an anti-tumor T cell response is raised,
10 wherein the scFv has the amino acid sequence of SEQ ID NO: 3 and cells in the
tumor express SSEA4.
12. The method of claim 11, wherein the CAR has the amino acid
sequence of SEQ ID NO: 4.
13. The method of claim 12, wherein the vector is a lentivirus, a gamma
retrovirus, or an adeno-associated virus.
14. The method of claim 13, wherein the tumor is a breast, colon,
20 gastrointestinal, kidney, lung, liver, ovarian, pancreatic, rectal, stomach, testicular,
thymic, cervical, prostate, bladder, skin, nasopharyngeal, esophageal, oral, head and
neck, bone, cartilage, muscle, lymph node, bone marrow, or brain tumor.
15. The method of claim 11, wherein the transduced T cells further express
25 the polypeptide of SEQ ID NO: 5, whereby the infused expanded T cells can be
deleted *in vivo* with an anti-epidermal growth factor receptor antibody.
16. The method of claim 15, wherein the CAR has the amino acid
sequence of SEQ ID NO: 4.
17. The method of claim 16, wherein the nucleic acid has the sequence of
SEQ ID NO: 1.

18. The method of claim 15, wherein the tumor is a breast, colon, gastrointestinal, kidney, lung, liver, ovarian, pancreatic, rectal, stomach, testicular, thymic, cervical, prostate, bladder, skin, nasopharyngeal, esophageal, oral, head and neck, bone, cartilage, muscle, lymph node, bone marrow, or brain tumor.

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19. The method of claim 16, wherein the tumor is a breast, colon, gastrointestinal, kidney, lung, liver, ovarian, pancreatic, rectal, stomach, testicular, thymic, cervical, prostate, bladder, skin, nasopharyngeal, esophageal, oral, head and neck, bone, cartilage, muscle, lymph node, bone marrow, or brain tumor.

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20. The method of claim 17, wherein the tumor is a breast, colon, gastrointestinal, kidney, lung, liver, ovarian, pancreatic, rectal, stomach, testicular, thymic, cervical, prostate, bladder, skin, nasopharyngeal, esophageal, oral, head and neck, bone, cartilage, muscle, lymph node, bone marrow, or brain tumor.