WHAT IS CLAIMED IS:

1. An isolated nucleic acid sequence encoding a chimeric antigen receptor (CAR), wherein the CAR comprises an antigen binding domain specific for glypican 3 (GPC3), wherein the antigen binding domain has an equilibrium dissociation constant (K_D) of about 100 nanomolar (nM) or less, and wherein the CAR construct does not induce cytokine production in GPC3- cells.

2. The isolated nucleic acid sequence of claim 1, wherein the encoded CAR antigen binding domain comprises an antibody or antigen-binding fragment thereof.

3. The isolated nucleic acid sequence of claim 2, wherein the encoded CAR antigen binding domain is a Fab or a single chain variable fragment (scFv).

4. The isolated nucleic acid sequence of claim 3, wherein the antigen binding domain is an scFv comprising the nucleic acid sequence of SEQ ID NO: 33 or SEQ ID NO: 34.

5. The isolated nucleic acid sequence according to any of the preceding claims further encoding a transmembrane domain, a costimulatory domain, and a signal domain.

6. The isolated nucleic acid sequence of claim 5, wherein the encoded transmembrane domain comprises a CD28 transmembrane domain.

7. The isolated nucleic acid sequence of claim 5, wherein the encoded costimulatory domain comprises one or more of CD28, 4-1BB, CD3zeta, OX-40, ICOS, CD27, GITR, and MyD88/CD40 costimulatory domains.

8. The isolated nucleic acid sequence of claim 5, wherein the encoded costimulatory domain comprises one or more of CD28, 4-1BB, and CD3zeta costimulatory domains.

9. The isolated nucleic acid sequence of claim 5, wherein the encoded signal domain comprises a sequence encoding a CSFR2 signal peptide.

10. The isolated nucleic acid sequence according to any of the preceding claims further encoding a hinge/spacer domain.

11. The isolated nucleic acid sequence of claim 10, wherein the encoded hinge/spacer domain is an IgG4P hinge/spacer.

12. The isolated nucleic acid sequence of claim 1, wherein the nucleic acid sequence comprises SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, or SEQ ID NO: 26.

13. An anti-GPC3 chimeric antigen receptor (CAR) comprising an antigen binding domain, wherein the antigen binding domain comprises an antibody, Fab, or an scFv comprising a heavy chain variable region (VH) and a light chain variable region (VL);

wherein the VH comprises a CDR1 comprising the amino acid sequence of SEQ ID NO: 37, a CDR2 comprising the amino acid sequence of SEQ ID NO: 38, and a CDR3 comprising the amino acid sequence of SEQ ID NO: 39; and

wherein the VL comprises a CDR1 comprising the amino acid sequence of SEQ ID NO: 40 or SEQ ID NO: 43, a CDR2 comprising the amino acid sequence of SEQ ID NO: 41 or SEQ ID NO: 44, and a CDR3 comprising the amino acid sequence of SEQ ID NO: 42 or SEQ ID NO: 45.

14. The anti-GPC3 CAR of claim 13, wherein the VH comprises the amino acid sequence of SEQ ID NO: 27 or SEQ ID NO: 29.

15. The anti-GPC3 CAR of claim 13, wherein the VL comprises the amino acid sequence of SEQ ID NO: 28 or SEQ ID NO: 30.

16. The anti-GPC3 CAR of any of claims 13-15, wherein the CAR further comprises a transmembrane domain, a costimulatory domain, and a signal domain.

17. The anti-GPC3 CAR of claim 16, wherein the CAR comprises the amino acid sequence of SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, or SEQ ID NO: 25.

18. A vector comprising a nucleic acid sequence encoding a chimeric antigen receptor (CAR), wherein the nucleic acid sequence comprises SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, SEQ ID NO: 26, SEQ ID NO: 33, or SEQ ID NO: 34.

19. A cell comprising the vector of claim 18.

20. A cell comprising a nucleic acid sequence encoding a chimeric antigen receptor (CAR), wherein the CAR comprises an antigen binding domain specific for glypican 3 (GPC3), wherein the antigen binding domain has an equilibrium dissociation constant (K_D) of about 100 nanomolar (nM) or less, and wherein the CAR construct does not induce cytokine production in GPC3- cells.

21. The cell of claim 20, wherein the nucleic acid sequence comprises SEQ ID NO: 11, SEQ ID NO: 12, SEQ ID NO: 13, SEQ ID NO: 14, SEQ ID NO: 15, SEQ ID NO: 16, SEQ ID NO: 17, SEQ ID NO: 18, SEQ ID NO: 26, SEQ ID NO: 33, or SEQ ID NO: 34.

22. A cell comprising an anti-GPC3 chimeric antigen receptor (CAR) comprising an antigen binding domain, wherein the antigen binding domain comprises an antibody, Fab, or an scFv comprising a heavy chain variable region (VH) and a light chain variable region (VL),

wherein the VH comprises a CDR1 comprising the amino acid sequence of SEQ ID NO: 37, a CDR2 comprising the amino acid sequence of SEQ ID NO: 38, and a CDR3 comprising the amino acid sequence of SEQ ID NO: 39, and

wherein the VL comprises a CDR1 comprising the amino acid sequence of SEQ ID NO: 40 or SEQ ID NO: 43, a CDR2 comprising the amino acid sequence of SEQ ID NO: 41 or SEQ ID NO: 44, and a CDR3 comprising the amino acid sequence of SEQ ID NO: 42 or SEQ ID NO: 45.

23. The cell of claim 22, wherein the VH comprises the amino acid sequence of SEQ ID NO: 27 or SEQ ID NO: 29.

24. The cell of claim 22, wherein the VL comprises the amino acid sequence of SEQ ID NO: 28 or SEQ ID NO: 30.

25. The cell of any of claims 22-24, wherein the CAR further comprises a transmembrane domain, a costimulatory domain, and a signal domain.

26. The cell of any of claims 22-25, wherein the CAR comprises the amino acid sequence of SEQ ID NO: 3, SEQ ID NO: 4, SEQ ID NO: 5, SEQ ID NO: 6, SEQ ID NO: 7, SEQ ID NO: 8, SEQ ID NO: 9, SEQ ID NO: 10, or SEQ ID NO: 25.

27. The cell of any of claims 19-26, wherein the cell is selected from the group consisting of a T cell, a Natural Killer (NK) cell, a cytotoxic T lymphocyte (CTL), and a regulatory T cell.

28. The cell of claim 27, wherein the cell exhibits an anti-tumor immunity upon contacting a tumor cell expressing GPC3.

29. Use of a cell comprising an anti-GPC3 chimeric antigen receptor (CAR) comprising an antigen binding domain in the manufacture of a medicament for treating cancer, wherein an effective amount of the cell comprising the anti-GPC3 CAR comprising the antigen binding domain is to be administered to a subject in need thereof, wherein the antigen binding domain comprises an antibody, Fab, or an scFv comprising a heavy chain variable region (VH) and a light chain variable region (VL),

wherein the VH comprises a CDR1 comprising the amino acid sequence of SEQ ID NO: 37, a CDR2 comprising the amino acid sequence of SEQ ID NO: 38, and a CDR3 comprising the amino acid sequence of SEQ ID NO: 39, and

wherein the VL comprises a CDR1 comprising the amino acid sequence of SEQ ID NO: 40 or SEQ ID NO: 43, a CDR2 comprising the amino acid sequence of SEQ ID NO: 41 or SEQ ID NO: 44, and a CDR3 comprising the amino acid sequence of SEQ ID NO: 42 or SEQ ID NO: 45.

30. The use of claim 29 wherein the medicament is capable of inhibiting tumor growth, inducing tumor regression, and/or prolonging survival of the subject.

31. The use of claim 29, wherein the cell is an autologous cell.

32. The use of claim 31, wherein the autologous cell is selected from the group consisting of a T cell, a Natural Killer (NK) cell, a cytotoxic T lymphocyte (CTL), and a regulatory T cell.

33. The use of any of claims 29-32, wherein the cancer is a solid tumor.

34. The use of claim 33, wherein the cancer is hepatocellular carcinoma, non-small cell lung cancer, ovarian cancer, and/or squamous cell lung carcinoma.

35. The use of claim 34, wherein the cancer is hepatocellular carcinoma.

36. The use of any of claims 29-35, wherein an effective amount of an anti-TNFα antibody is to be administered to the subject.

37. The isolated nucleic acid sequence of any of claims 1-12, the anti-GPC3 CAR of any of claims 13-17, the vector of claim 18, or the cell of any of claims 19-28 for use in therapy.