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CLAIMS

1. A TCR comprising an alpha chain and a beta chain, wherein the alpha chain comprises a TCR alpha variable domain at least 90% identical to the amino acid sequence of SEQ ID NO:2; and the beta chain comprises a TCR beta variable domain at least 90% identical to SEQ ID NO:10, and wherein the TCR specifically binds to a IGF2BP3-001 peptide-MHC molecule complex.
2. The TCR of claim 1, further comprising a TCR alpha constant domain and a TCR beta constant domain, wherein the TCR alpha constant domain is at least 70% identical to a TCR alpha constant domain of SEQ ID NO:2, and the beta constant domain is at least 70% identical to a TCR beta constant domain of SEQ ID NO:10.
3. The TCR of any of claims 1 or 2, wherein the alpha constant domain comprises the alpha transmembrane domain VIGFRILLKLVAGFNLLMTL (SEQ ID NO:18) and the beta constant domain comprises the beta transmembrane domain TILYEILLGKATLYAVLVSAVL (SEQ ID NO:19).
4. The TCR of any of claims 1 to 3, wherein the TCR alpha variable domain consists of the amino acid sequence of SEQ ID NO:2; and the TCR beta variable domain consists of the amino acid sequence of SEQ ID NO:10.
5. The TCR of any of claims 1 to 4, wherein the TCR alpha constant domain consists of the TCR alpha constant domain of SEQ ID NO:2, and the TCR beta constant domain consists of the TCR beta constant domain of SEQ ID NO:10.
6. The TCR of any of claims 1 to 5, comprising an alpha chain consisting of SEQ ID NO:2 and a beta chain consisting of SEQ ID NO:10.
7. The TCR of any of claims 1 to 6, wherein the TCR alpha chain comprises at least one alpha chain complementarity determining region (CDR) selected from the group consisting of an alpha chain CDR1, CDR2 and CDR3 of SEQ ID NO:2; and/or the TCR beta chain comprises at least one beta chain complementarity determining

region (CDR) selected from the group consisting of a beta chain CDR1, CDR2 and CDR3 of SEQ ID NO:10.

8. The TCR of any of claims 1 to 7, wherein the TCR alpha chain comprises all three CDRs of SEQ ID NO:2.

9. The TCR of any of claims 1 to 8, wherein the TCR beta chain comprises all three CDRs of SEQ ID NO:10.

10. The TCR of any of claims 1 to 9, wherein the alpha chain and beta chain are fused to form a single chain TCR.

11. The TCR of any of claims 1 to 10, wherein the alpha and/or beta chain comprises a detectable label.

12. The TCR of claim 11, wherein the detectable label is selected from the group consisting of a radionuclide, a fluorophore and biotin.

13. The TCR of any of claims 1 to 12, wherein the alpha and/or beta chain is conjugated to a therapeutically active agent.

14. The TCR of claim 13, wherein the therapeutically active agent is selected from the group consisting of a radionuclide, a chemotherapeutic agent and a toxin.

15. A TCR comprising a gamma chain and a delta chain, wherein the gamma chain comprises at least one complementarity determining region (CDR) selected from the group consisting of an alpha chain CDR1, CDR2 and CDR3 of SEQ ID NO:2; and/or the TCR delta chain comprises at least one complementarity determining region (CDR) selected from the group consisting of a beta chain CDR1, CDR2 and CDR3 of SEQ ID NO:10, and wherein the TCR specifically binds to a IGF2BP3-001 peptide-MHC molecule complex.

16. The TCR of any of claims 1 to 21, wherein the TCR specifically binds to a IGF2BP3-001 peptide-MHC molecule complex, wherein the IGF2BP3-001 peptide

consists of SEQ ID NO:1, and the MHC molecule is an HLA class I or HLA class II molecule.

17. A nucleic acid encoding the alpha chain and/or beta chain of the TCR of any of claims 1 to 14, or the gamma chain and/or delta chain of the TCR of claim 15.

18. An expression vector comprising the nucleic acid of claim 17 operably linked to at least one promoter sequence.

19. A host cell transformed with the expression vector of claim 18.

20. The host cell of claim 19 which is a T cell or T cell progenitor.

21. The host cell of claim 20 wherein the T cell or T cell progenitor is obtained from a cancer patient.

22. The host cell of claim 20 wherein the T cell or T cell progenitor is obtained from a healthy donor.

23. A pharmaceutical composition comprising the TCR of any of claims 1 to 16, a nucleic acid of claim 17, an expression vector of claim 18, and/or a host cell of any one of claims 19 to 22; and a pharmaceutically acceptable carrier, and optionally, pharmaceutically acceptable excipients and/or stabilizers.

24. A method for producing a TCR that specifically binds to the peptide of SEQ ID NO:1 when presented by an MHC molecule, said method comprising culturing the host cell of any one of claims 19 to 22 under conditions suitable to promote expression of the TCR.

25. A method of treating cancer comprising administering to a subject in need thereof the TCR of any of claims 1 to 16, the nucleic acid of claim 17, the expression vector of claim 18, the host cell of any one of claims 19 to 22, and/or the pharmaceutical composition of claim 23.

26. The method of claim 25, wherein the TCR is expressed on the surface of a host cell.
27. The method of claim 25, wherein the host cell is selected from the group consisting of a T cell or T cell progenitor.
28. The method of claim 27, wherein the T cell or T cell progenitor is autologous.
29. The method of claim 27, wherein the T cell or T cell progenitor is allogeneic.
30. The method of claim 25, wherein the TCR is conjugated to a therapeutically active agent.
31. The method of claim 30, wherein the therapeutically active agent is selected from the group consisting of a radionuclide, a chemotherapeutic agent and a toxin.
32. The method of any of claims 25 to 31, wherein the cancer is non-small cell lung cancer, small cell lung cancer, renal cell cancer, brain cancer, gastric cancer, colorectal cancer, hepatocellular cancer, head and neck cancer, pancreatic cancer, prostate cancer, leukemia, breast cancer, Merkel cell carcinoma, melanoma, ovarian cancer, urinary bladder cancer, uterine cancer, gallbladder and bile duct cancer, esophageal cancer, or a combination thereof.
33. The method of any of claims 25 to 32, further comprising administering to the subject at least one chemotherapeutic agent.
34. The method of any of claims 32 to 33, further comprising administering radiation therapy to the subject.
35. A method of treating cancer in a subject in need thereof, comprising:
- a) isolating a cell from said subject;
 - b) transforming the cell with a vector encoding the TCR of any of claims 1 to 16 to produce a transformed cell;

- c) expanding the transformed cell to produce a plurality of transformed cells; and
 - d) administering the plurality of transformed cells to said subject.
- 36. The method of claim 35, wherein the cell is selected from a T cell or a T cell progenitor.
- 37. A method of treating cancer in a subject in need thereof, comprising:
 - a) isolating a cell from a healthy donor;
 - b) transforming the cell with a vector encoding the TCR of any of claims 1 to 16 to produce a transformed cell;
 - c) expanding the transformed cell to produce a plurality of transformed cells; and
 - d) administering the plurality of transformed cells to said subject.
- 38. The method of claim 37, wherein the cell is selected from a T cell or a T cell progenitor.
- 39. A method of detecting cancer in a biological sample comprising:
 - a) contacting the biological sample with the TCR of any of claims 1 to 16, and
 - b) detecting binding of the TCR to the biological sample.
- 40. The method of claim 39, wherein the TCR comprises a detectable label.
- 41. The method of claim 40, wherein the detectable label is selected from the group consisting of a radionuclide, a fluorophore and biotin.
- 42. The method of any of claims 39 to 41, wherein said detecting is carried out *in vitro*, *in vivo* or *in situ*.
- 43. The method of any of claims 39 to 42, wherein said cancer is non-small cell lung cancer, small cell lung cancer, renal cell cancer, brain cancer, gastric cancer, colorectal cancer, hepatocellular cancer, head and neck cancer, pancreatic cancer,

prostate cancer, leukemia, breast cancer, Merkel cell carcinoma, melanoma, ovarian cancer, urinary bladder cancer, uterine cancer, gallbladder and bile duct cancer, esophageal cancer, or a combination thereof.

44. The host cell of any of claims 19 to 22 wherein the T cell is a gamma/delta T cell.

45. A method of killing target-cells in a patient which target-cells aberrantly express IGF2BP3, the method comprising administering to the patient an effective number of T-cells expressing a TCR of any of claims 1 to 16, the nucleic acid of claim 17, the expression vector of claim 18, the host cell of any one of claims 19 to 22, and/or the pharmaceutical composition of claim 23.

46. The TCR of any of claims 1 to 16 which is a soluble TCR.

47. The TCR of any of claims 1 to 16, wherein the alpha chain comprises a TCR alpha variable domain at least 95% identical to the amino acid sequence of SEQ ID NO:2; and the beta chain comprises a TCR beta variable domain at least 95% identical to SEQ ID NO:10, and wherein the TCR specifically binds to a IGF2BP3-001 peptide-MHC molecule complex.

48. The TCR of any of claims 1 to 16 having at least one mutation in the alpha chain relative to SEQ ID NO:2 and/or having at least one mutation in the beta chain relative to SEQ ID NO:10, and wherein the TCR has a binding affinity for, and/or a binding half-life for, a IGF2BP3-001 peptide-HLA molecule complex, which is at least double that of the unmutated TCR for the same peptide.

49. The TCR of any of claims 1 to 16 having at least one mutation in the alpha chain relative to SEQ ID NO:2 and/or having at least one mutation in the beta chain relative to SEQ ID NO:10, and wherein the TCR has modified glycosylation compared to the unmutated TCR.

50. The method of any of claims 25 to 38 and 45, wherein the TCR of any of claims 1 to 16, the nucleic acid of claim 17, the expression vector of claim 18, the

host cell of any of claims 19 to 22 or the pharmaceutical composition of claim 23 is administered in at least two administrations separated by at least 24 hours.

51. The method of claim 50, wherein the TCR of any of claims 1 to 16, the nucleic acid of claim 17, the expression vector of claim 18, the host cell of any of claims 19 to 22 or the pharmaceutical composition of claim 23 is administered to the subject over a period of days, weeks or months.

52. The method of claims 50 or 51, wherein the TCR of any of claims 1 to 16, the nucleic acid of claim 17, the expression vector of claim 18, the host cell of any of claims 19 to 22 or the pharmaceutical composition of claim 23 is administered by local infusion.

53. The method of any of claim 52, wherein the local infusion is administered by an infusion pump and/or a catheter system.

54. The method of claims 52 or 53, wherein said local infusion is into a solid tumor, a blood vessel that feeds a solid tumor, and/or the area surrounding a solid tumor.

55. The method of any of claims 25 to 38, 45 and 50 to 54, wherein the TCR of any of claims 1 to 16, the nucleic acid of claim 17, the expression vector of claim 18, the host cell of any of claims 19 to 22 or the pharmaceutical composition of claim 23 is administered in a dose of about 10^4 to about 10^{10} cells per dose.

56. A TCR comprising at least one alpha chain complementarity determining region (CDR) selected from the group consisting of an alpha chain CDR1, CDR2 and CDR3 of SEQ ID NO:2 and/or at least one beta chain complementarity determining region (CDR) selected from the group consisting of a beta chain CDR1, CDR2 and CDR3 of SEQ ID NO:10, and wherein the TCR specifically binds to a IGF2BP3-001 peptide-MHC molecule complex.