

We claim:

1. An engineered murine T cell receptor (mTCR) V α chain polypeptide comprising at least 90% sequence identity to SEQ ID NO:2, 3, 4, 5, 6, 7, 8, 9, or 10, wherein the mTCR specifically binds hAFP158 (SEQ ID NO:1).
2. An engineered murine T cell receptor (mTCR) V β chain polypeptide comprising at least 90% sequence identity to SEQ ID NO:11, 12, 13, or 14, wherein the mTCR specifically binds hAFP158 (SEQ ID NO:1).
3. An engineered murine T cell receptor (mTCR) full length α chain polypeptide comprising at least 90% sequence identity to SEQ ID NO:15, 16, 17, 18, 19, 20, 21, 22, or 23, wherein the mTCR specifically binds hAFP158 (SEQ ID NO:1).
4. An engineered murine T cell receptor (mTCR) full length β chain polypeptide comprising at least 90% sequence identity to SEQ ID NO:24, 25, 26, or 27, wherein the mTCR specifically binds hAFP158 (SEQ ID NO:1).
5. An engineered murine T cell receptor (mTCR) α chain polypeptide comprising a CDR3 region with at least 90% sequence identity to SEQ ID NO:28, 29, 30, 31, 32, 33, 34, 35, or 36, wherein the mTCR specifically binds hAFP158 (SEQ ID NO:1).
6. An engineered murine T cell receptor (mTCR) β chain polypeptide comprising a CDR3 region with at least 90% sequence identity to SEQ ID NO:37, 38, 39, or 40, wherein the mTCR specifically binds hAFP158 (SEQ ID NO:1).
7. An engineered murine T cell receptor (mTCR) comprising:
 - a) a V α domain having at least 90% sequence identity to SEQ ID NO:2, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:28; and
 - b) a V β domain having at least 90% sequence identity to SEQ ID NO:11, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:37.
8. An engineered murine T cell receptor (mTCR) comprising:
 - a) a V α domain having at least 90% sequence identity to SEQ ID NO:3, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:29; and
 - b) a V β domain having at least 90% sequence identity to SEQ ID NO:11, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:37.
9. An engineered murine T cell receptor (mTCR) comprising:

- a) a V α domain having at least 90% sequence identity to SEQ ID NO:4, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:30; and
- b) a V β domain having at least 90% sequence identity to SEQ ID NO:12, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:38.
10. An engineered murine T cell receptor (mTCR) comprising:
- a) a V α domain having at least 90% sequence identity to SEQ ID NO:5, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:31; and
- b) a V β domain having at least 90% sequence identity to SEQ ID NO:13, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:39.
11. An engineered murine T cell receptor (mTCR) comprising:
- a) a V α domain having at least 90% sequence identity to SEQ ID NO:6, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:32; and
- b) a V β domain having at least 90% sequence identity to SEQ ID NO:11, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:37.
12. An engineered murine T cell receptor (mTCR) comprising:
- a) a V α domain with at least 90% sequence identity to SEQ ID NO:7, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:33; and
- b) a V β domain having at least 90% sequence identity to SEQ ID NO:14, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:40.
13. An engineered murine T cell receptor (mTCR) comprising:
- a) a V α domain having at least 90% sequence identity to SEQ ID NO:8, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:34; and
- b) a V β domain having at least 90% sequence identity to SEQ ID NO:11, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:37.
14. An engineered murine T cell receptor (mTCR) comprising:
- a) a V α domain having at least 90% sequence identity to SEQ ID NO:9, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:35; and
- b) a V β domain having at least 90% sequence identity to SEQ ID NO:11, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:37.
15. An engineered murine T cell receptor (mTCR) comprising:

a) a V α domain having at least 90% sequence identity to SEQ ID NO:10, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:36; and

b) a V β domain having at least 90% sequence identity to SEQ ID NO:11, wherein the CDR3 region has at least 90% sequence identity to SEQ ID NO:37.

16. The engineered murine T cell receptor (mTCR) of any one of claims 7-15, wherein the mTCR is humanized.

17. A T cell engineered to express the mTCR of any one of claims 7-16.

18. The T cell of claim 17, wherein the T cell is human.

19. The T cell of claim 18, wherein the T cell is autologous.

20. A soluble mTCR α chain comprising Q21 to L242 of SEQ ID NO:2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18, 19, 20, 21, 22, or 23.

21. The extracellular domain of an engineered mTCR β chain comprising SEQ ID NO:50, 51, 52, or 53, or E18 to Y276 of SEQ ID NO:24, 25, 26, or 27.

22. A fusion protein comprising at least 90% sequence identity to SEQ ID NO:54, 55, 56, 57, 58, 59, 60, 61, or 62.

23. A nucleic acid comprising at least 90% sequence identity to SEQ ID NO:63, 64, 65, 66, 67, 68, 69, 70, or 71.

24. A non-naturally occurring hAFP158 epitope-specific murine T cell receptor comprising:

a). an α chain variable domain (V α) having at least 90% sequence identity to amino acid residues 21-132 of SEQ ID NO:2, 3, 4, 5, 6, 7, 8, 9, or 10; and

b). a β chain variable domain (V β) having at least 90% sequence identity to amino acid residues 18-131 of SEQ ID NO:11, 12, 13, or 14.

25. A fusion protein comprising a first polypeptide having at least 90% sequence identity to an amino acid sequence selected from the group consisting of SEQ ID NO:2, 3, 4, 5, 6, 7, 8, 9, or 10, linked to a second polypeptide having at least 90% sequence identity to an amino acid sequence selected from the group consisting of SEQ ID NO:11, 12, 13, or 14.

26. A fusion protein comprising a first polypeptide having at least 90% sequence identity to an amino acid sequence selected from the group consisting of SEQ ID NO:15, 16, 17, 18, 19, 20, 21, 22, or 23 linked to a second polypeptide having at least 90% sequence identity to an amino acid sequence selected from the group consisting of SEQ ID NO:24, 25, 26, or 27.

27. A T cell engineered to express the mTCR encoded by SEQ ID NO:63, 64, 65, 66, 67, 68, 69, 70, or 71.
28. The T cell of claim 27, wherein the T cell is human.
29. A hybridoma comprising a CD8⁺Tet158⁺ cell fused to a donor cell lacking TCR α and β chains.
30. The hybridoma of claim 29, wherein the hybridoma responds to hAFP⁺ tumor cells.
31. The hybridoma of claim 29, wherein the hybridoma secretes IL-2.
32. A fusion protein comprising a first polypeptide having at least 90% sequence identity to an amino acid sequence selected from the group consisting of SEQ ID NO:2, 3, 4, 5, 6, 7, 8, 9 or 10 linked to a second polypeptide having at least 90% sequence identity to an amino acid sequence selected from the group consisting of SEQ ID NO:11, 12, 13, 14, 24, 25, 26, or 27, wherein the fusion protein is linked to a single chain anti-CD3 antibody.
33. A method for treating tumors in a subject in need thereof comprising genetically engineering human T cells to express the mTCR of any one of claims 7-16 and administering the engineered T cells to the subject in an amount effective to reduce tumor burden in the subject.
34. The method of claim 33, wherein the tumors are hepatocellular carcinoma.
35. The method of claim 33, wherein the T cells are autologous T cells.
36. The polypeptide or protein according to any one of claims 1-15 and 24-26 further comprising a detectable label.
37. A method for detecting hepatocellular carcinoma comprising contacting the polypeptide or protein of claim 36 to a sample of cells, wherein specific binding of the polypeptide or protein to a cell is indicative of a hepatocellular carcinoma cell.
38. An antibody or antigen binding fragment thereof that specifically binds to the polypeptide or protein according to any one of claims 1-6 and 20-22.