CLAIMS

1. A modified T cell receptor, or antigen binding fragment thereof, comprising a Vα and a Vβ derived from a wild type T cell receptor,

wherein the Vα and the Vβ each comprise a CDR1, a CDR2, and a CDR3,

wherein the Vα, the Vβ or both, comprise a mutation in one or more complementarity determining regions (CDRs) relative to the wild type T cell receptor,

wherein the modified T cell receptor binds to a non-cognate peptide-MHC not bound by the wild type T cell receptor,

wherein the non-cognate peptide-MHC is SURV:HLA.A2, and

wherein the modified T cell receptor comprises an amino acid substitution at one or more of CDR1α 31, CDR3α 98, CDR3β 99, CDR3α 97, CDR3β 102, CDR3α 99, CDR3β 100, CDR1α 32, CDR1β 30.

2. The modified T cell receptor of Claim 1, wherein the wild type T cell receptor comprises the Vα amino acid sequence set forth in SEQ ID NO:1 and the Vβ amino acid sequence set forth in SEQ ID NO: 2.

3. The modified T cell receptor of Claim 1, comprising a modified Vα comprising an amino acid sequence having at least 80% identity to the Vα amino acid sequence set forth in SEQ ID NO:1 and a modified Vβ comprising an amino acid sequence having at least 80% identity to the Vβ amino acid sequence set forth in SEQ ID NO:2.

4. The modified T cell receptor of Claim 1, wherein the wild type T cell receptor comprises the Vα region of the amino acid sequence set forth in SEQ ID NO:3 and the Vβ region of the amino acid sequence set forth in SEQ ID NO:3.

5. The modified T cell receptor of Claim 4, comprising a modified Vα comprising an amino acid sequence having at least 80% identity to the Vα region of the amino acid sequence set forth in SEQ ID NO:3 and a modified Vβ comprising an amino acid sequence having at least 80% identity to the Vβ region of the amino acid sequence set forth in SEQ ID NO:3.

6. The modified T cell receptor of Claim 1, wherein the modified T cell receptor comprises an amino acid substitution at one or more positions selected from the group consisting of CDR1α 31, CDR3α 97, CDR3α 98, CDR3α 99, CDR1β 30, CDR3β 99, CDR3β 100, and CDR3β 102.

7. The modified T cell receptor of Claim 1, wherein the modified T cell receptor comprises an amino acid substitution at one or more positions selected from the group consisting of CDR1α 32, CDR3α 97, CDR3α 98, CDR3α 99, CDR1β 30, CDR3β 100, and CDR3β 102.

8. The modified T cell receptor of Claim 1, wherein the modified T cell receptor comprises the wild type amino acid at position CDR2α 51.

9. The modified T cell receptor of Claim 1, wherein the modified T cell receptor further comprises the wild type amino acid at position CDR1α 31.

10. The modified T cell receptor of Claim 8, wherein the modified T cell receptor further comprises the wild type amino acid at position CDR1α 28 and CDR2α52.

11. The modified T cell receptor of Claim 1, wherein the wild type T cell receptor is a single-chain T cell receptor A6-X15 comprising the amino acid sequence set forth in SEQ ID NO:3.

12. The modified T cell receptor of Claim 1, comprising

1) a modified Vα region comprising an amino acid sequence having at least 90% identity to the Vα region of the amino acid sequence set forth in one of SEQ ID NOs:33, 41 or 42 and

2) a modified Vβ region comprising an amino acid sequence having at least 90% identity to the Vβ region of the amino acid sequence set forth in one of SEQ ID NOs:33, 41 or 42.

13. The modified T cell receptor of Claim 12, comprising the amino acid sequence set forth in one of SEQ ID NOs:33, 41 or 42.

14. The modified T cell receptor of Claim 1, wherein the modified T cell receptor is generated by *in vitro* selection of a yeast display library of mutant T cell receptors.

15. The modified T cell receptor of Claim 1, wherein the wild type T cell receptor is human.

16. The modified T cell receptor of Claim 1, wherein the modified T cell receptor is a single chain T cell receptor.

17. The modified T cell receptor of Claim 1, wherein the wild type T cell receptor binds HLA-A2.

18. A polynucleotide encoding the modified T cell receptor of Claim 1.

19. The modified T cell receptor of any one of the preceding claims, wherein the modified T cell receptor is attached to an effector molecule.

20. The modified T cell receptor of Claim 19, wherein the effector molecule is an antibody or a single-chain antibody fragment.

21. The modified T cell receptor of Claim 19, wherein the effector molecule is an anti-CD3 antibody or an anti-CD3 scFv.

22. The modified T cell receptor of Claim 19, wherein the effector molecule is selected from the group consisting of a cytokine, a toxin, a radioisotope, a chemotherapeutic agent or an antibody-drug conjugate.

23. A method for engineering a T cell receptor or an antigen binding fragment thereof, with a desired specificity comprising:

a) isolating a polynucleotide that encodes a wild type T cell receptor or an antigen binding fragment thereof;

b) generating a library of mutant T cell receptors or antigen binding fragments thereof, wherein the mutant T cell receptors or antigen-binding fragment thereof, comprise a Vα and the Vβ, and wherein the mutant T cell receptors, or antigen-binding fragments thereof, comprise a mutation in one or more complementarity determining regions relative to the wild type T cell receptor, wherein the mutation comprises an amino acid substitution at one or more of CDR1α 31, CDR3α 98, CDR3β 99, CDR3α 97, CDR3β 102, CDR3α 99, CDR3β 100, CDR1α 32, CDR1β 30;

c) expressing the mutant T cell receptors in a yeast surface display system; and

d) selecting mutant T cell receptors that bind to a non-cognate peptide-MHC, wherein the non-cognate peptide-MHC is SURV:HLA.A2.

24. The method of Claim 23 wherein the wild type T cell receptor comprises the Vα amino acid sequence set forth in SEQ ID NO:1 and the Vβ amino acid sequence set forth in SEQ ID NO:2.

25. The method of Claim 23 wherein the wild type T cell receptor is a single-chain T cell receptor A6-X15 comprising the amino acid sequence set forth in SEQ ID NO:3.

26. The method of Claim 23, further comprising a step of affinity maturation.