What is claimed is:

1. A T cell, the T cell comprising

a) a chimeric antigen receptor (CAR) that binds to a first antigen with a dissociation constant (K_d) of 1×10^{-8} M or more; and,

b) a chimeric co-stimulating receptor (CCR) that binds to a second antigen;

wherein binding of the CAR to the first antigen is capable of delivering an activation signal to the T cell, and

wherein binding of the CCR to the second antigen is capable of delivering a costimulatory signal to the T cell but does not alone deliver an activation signal to the T cell.

2. The T cell of claim 1, wherein the cell exhibits no or negligible cytolytic activity against cells that are single positive for the first antigen.

3. The T cell of claim 1, wherein the CAR binds to a first antigen with a dissociation constant (K_d) of 5×10^{-8} M or more, 1×10^{-7} M or more, or 1×10^{-6} M or more.

4. The T cell of claim 1, wherein the CAR binds to the first antigen with a binding affinity that is lower compared to the binding affinity with which the CCR binds to the second antigen.

5. The T cell of claim 1, wherein the T cell exhibits higher cytolytic activity against cells that are positive for both the first antigen and second antigens, compared with cells that are single positive for the first antigen.

6. The T cell of any of claims 1 to 5, wherein the T cell is selected from the group consisting of a cytotoxic T lymphocyte (CTL), a regulatory T cell, and combinations thereof.

7. The T cell of any of claims 1 to 5, wherein the antigen is a tumor antigen or a pathogen antigen.

8. The T cell of any of claims 1 to 5, wherein the CAR is recombinantly expressed, or is expressed from a vector.

9. The T cell of any of claims 1 to 5, wherein the chimeric co-stimulating receptor (CCR) is expressed from a vector.

10. The T cell of any of claims 1 to 5, wherein the T cell is autologous.

11. The T cell of any of claims 1 to 5, wherein the first and second antigens are distinct antigens selected from the group consisting of PSCA, CAIX, CEA, CD5, CD7, CD10, CD19, CD20, CD22, CD30, CD33, CD34, CD38, CD41, CD44, CD49f, CD56, CD74, CD133, CD138, a cytomegalovirus (CMV) infected cell antigen, EGP-2, EGP-40, EpCAM, Erb-B2, Erb-B3, Erb-B4, FBP, fetal acetylcholine receptor, folate receptor-a, GD2, GD3, HER-2, hTERT, IL13R-a2, *κ*-light chain, KDR, LeY, L1 cell adhesion molecule, MAGE-A1, MUC1, Mesothelin, NKG2D ligands, NY-ESO-1, oncofetal antigen (h5T4), PSMA, ROR1, TAG-72, VEGF-R2, and WT-1.

12. The T cell of any of claims 1 to 5, wherein the first and second antigens are distinct antigens selected from the group consisting of CD133, a cytomegalovirus (CMV) infected cell antigen, Erb-B2, KDR, Mesothelin, NKG2D ligands, NY-ESO-1, oncofetal antigen (h5T4), PSCA, PSMA, CD19, VEGF-R2, and WT-1.

13. The T cell of any of claims 1 to 5, wherein the first and second antigens are distinct antigens selected from the group consisting of HER2, MUC1, CD44, CD49f, EpCAM, CEA, CD133, a cytomegalovirus (CMV) infected cell antigen, EGP-2, EGP-40, EpCAM, Erb-B2, Erb-B3, Erb-B4, FBP, KDR, Mesothelin, NKG2D ligands, NY-ESO-1, oncofetal antigen (h5T4), PSCA, PSMA, VEGF-R2, and WT-1.

14. The T cell of any of claims 1 to 5, wherein the first and second antigens are (a) PSCA and PSMA, (b) CD10 and CD19, or (c) CD56 and CD138.

15. The T cell of any of claims 1 to 5, wherein the first and second antigens are distinct antigens selected from the group consisting of Mesothelin, folate receptor-a, CD44, and CD133.

16. The T cell of any of claims 1 to 5, wherein the CAR comprises an intracellular signaling domain.

17. The T cell of claim 16, wherein the CAR's intracellular signaling domain comprises a CD3-chain signaling domain.

18. The T cell of any of claims 1 to 5, wherein the CCR comprises an intracellular signaling domain.

19. The T cell of claim 18, wherein the CCR's intracellular signaling domain comprises a CD97, CD11a-CD18, CD2, ICOS, CD27, CD154, CD5, OX40, 4-1BB, or CD28 signaling domain.

20. Use of a pharmaceutical composition in the manufacture of a medicament for the treatment of tumors, wherein the pharmaceutical composition comprises the T cell of any one of claims 1 to 5 and a pharmaceutically acceptable excipient.

21. The use of claim 20, wherein the T cell is of at least 1×10^4, at least 1×10^8, or at least 1×10^4, 1×10^5 to 1×10^9 M, or 1×10^6 to 1×10^8.

22. Use of the T cell of any of claims 1 to 5 in the manufacture of a medicament for inducing tumor cell death, and/or treating or preventing tumors in an individual organism.

23. The use of claim 22, wherein the cell reduces the number of tumor cells, reduces tumor size, and/or eradicates the tumor.

24. The use of claim 22, wherein the tumor is selected from the group consisting of prostate cancer, breast cancer, B cell leukemia, multiple myeloma, and ovarian cancer.

25. The use of any of claim 22, wherein the tumor is breast cancer, and wherein the first and second tumor antigens are distinct antigens selected from the group consisting of HER2, MUC1, CD44, CD49f, CEA, CD133, a cytomegalovirus (CMV) infected cell antigen, EGP-2, EGP-40, EpCAM, Erb-B2, Erb-B3, Erb-B4, FBP, KDR, Mesothelin, NKG2D ligands, NY-ESO-1, oncofetal antigen (h5T4), PSCA, PSMA, VEGF-R2, and WT-1.

26. The use of claim 22, wherein: (a) the tumor is B cell leukemia, and the first and second tumor antigens are CD10 and CD19; or, (b) the tumor is multiple myeloma, and the first and second tumor

antigens are CD56 and CD138; or, (c) the tumor is ovarian cancer, and the first and second tumor antigens are distinct antigens selected from the group consisting of Mesothelin, folate receptor-a, CD44, and CD133; or, (d) the tumor is prostate cancer, and the first and second tumor antigens are PSCA and PSMA.

27. The production method of a T cell of any one of claims 1 to 5 comprising introducing into the T cell a first nucleic acid molecule that encodes a CAR and a second nucleic acid molecule that encodes a CCR.

28. A kit comprising the T cell of any one of claims 1 to 5.

29. The use of claim 20 for inducing tumor cell death, and/or treating or preventing tumors in an individual organism.

30. The use of claim 29, wherein the tumor is selected from the group consisting of prostate cancer, breast cancer, B cell leukemia, multiple myeloma, and ovarian cancer.

31. A vector, the vector comprising

a) a first polynucleotide that encodes a chimeric antigen receptor (CAR) that binds to a first antigen with a dissociation constant (K_d) of 1×10^{-8} M or more; and,

b) a second polynucleotide that encodes a chimeric co-stimulating receptor (CCR);

wherein binding of the CAR to the first antigen is capable of delivering an activation signal to the T cell comprising the vector and,

wherein binding of the CCR to the second antigen is capable of delivering a costimulatory signal to the T cell but does not alone deliver an activation signal to the T cell.

32. The vector of claim 31, wherein the T cell comprising the vector exhibits no or negligible cytolytic activity against cells that are single positive for the first antigen.

33. The vector of claim 31, wherein the CAR binds to a first antigen with a dissociation constant (K_d) of 5×10^{-8} M or more, 1×10^{-7} M or more, or 1×10^{-6} M or more.

34. The vector of claim 31, wherein the CAR binds to the first antigen with a binding affinity that is lower compared to the binding affinity with which the CCR binds to the second antigen.

35. The vector of claim 31, wherein the T cell comprising the vector exhibits higher cytolytic activity against cells that are positive for both the first antigen and the second antigen, compared with cells that are single positive for the first antigen.

36. The vector of any of claims 31 to 35, wherein the T cell is selected from the group consisting of a cytotoxic T lymphocyte (CTL), a regulatory T cell, and combinations thereof.

37. The vector of any of claims 31 to 35, wherein the first antigen is a tumor antigen or a pathogen antigen.

38. The vector of any of claims 31 to 35, wherein the first and second antigens are distinct antigens selected from the group consisting of PSCA, CAIX, CEA, CD5, CD7, CD10, CD19, CD20, CD22, CD30, CD33, CD34, CD38, CD41, CD44, CD49f, CD56, CD74, CD133, CD138, a cytomegalovirus (CMV) infected cell antigen, EGP-2, EGP-40, EpCAM, Erb-B2, Erb-B3, Erb-B4, FBP, fetal acetylcholine receptor, folate receptor-a, GD2, GD3, HER-2, hTERT, IL13R-a2, x-light chain, KDR, LeY, L1 cell adhesion molecule, MAGE-A1, MUC1, Mesothelin, NKG2D ligands, NY-ESO-1, oncofetal antigen (h5T4), PSMA, ROR1, TAG-72, VEGF-R2, and WT-1.

39. The vector of any of claims 31 to 35,
wherein the first and second antigens are:
a. CD10 and CD19;
b. CD56 and CD138;
c. distinct antigens selected from the group consisting of CD133, a cytomegalovirus (CMV) antigen, Erb-B2, KDR, Mesothelin, NKG2D ligands, NY-ESO-1, oncofetal antigen (h5T4), PSCA, PSMA, CD19, VEGF-R2, and WT-1;
d. distinct antigens selected from the group consisting of Mesothelin, folate receptor-a, CD44, and CD133; or,
e. PSCA and PSMA.

40. The vector of any of claims 31 to 35, wherein the CAR comprises an intracellular signaling domain.

41. The vector of claim 40, wherein the CAR's intracellular signaling domain comprises a CD3-chain signaling domain.

42. The vector of any of claims 31 to 35, wherein the CCR comprises an intracellular signaling domain.

43. The vector of claim 42, wherein the CCR's intracellular signaling domain comprises a CD97, CD11a-CD18, CD2, ICOS, CD27, CD154, CD5, OX40, 4-1BB, or CD28 signaling domain.

44. The vector of any of claims 31 to 35, wherein the vector is viral vector.

45. The vector of any of claims 31 to 35, wherein the vector is retroviral vector.

46. A T cell comprising the vector of any of claims 31 to 35.

47. A pharmaceutical composition comprising the T cell of any one of claims 1 to 5 and a pharmaceutically acceptable excipient for use in therapy.

48. The T cell of any of claims 1 to 5 for use in therapy.