**What is claimed:**

1. A lentiviral particle for activating and efficiently transducing T cells, comprising a nucleic acid sequence encoding a small-molecule controllable T-cell/NK-cell activation receptor, the nucleic acid sequence operatively linked to a promoter, wherein the T-cell/NK-cell activation receptor is capable of being activated by a small molecule.

2. The lentiviral particle of claim 1, wherein the lentiviral particle is a surface-engineered lentiviral particle comprising a T-cell activation or co-stimulation molecule.

3. The lentiviral particle of claim 2, wherein the T-cell activation or co-stimulation molecule comprises one or more of an anti-CD3 antibody, CD28 ligand, and 41bb ligand.

4. The lentiviral particle of any one of claims 1-3, wherein the T-cell/NK-cell activation receptor comprises a signaling domain selected from the group consisting of (i) a cytokine receptor signaling domain, (ii) a co-stimulatory receptor signaling domain, (iii) a T-cell receptor subunit signaling domain, (iv) an NK-cell receptor subunit signaling domain, and (v) a growth factor receptor signaling domain.

5. The lentiviral particle of claim 4, wherein the signaling domain comprises a cytokine receptor signaling domain of a common cytokine receptor gamma chain.

6. The lentiviral particle of claim 4 or claim 5, wherein the signaling domain comprises a cytokine receptor signaling domain of a common cytokine receptor beta chain.

7. The lentiviral particle of any one of claims 4-6, wherein the signaling domain comprises an ITAM.

8. The lentiviral particle of any one of claims 4-7, wherein the signaling domain comprises a tyrosine capable of binding an SH2-domain when the tyrosine is phosphorylated.

9. The lentiviral particle of any one of claim 1-8, the T-cell/NK-cell activation receptor comprises FK506 binding protein (FKPB) or a functional homolog thereof.

10. The lentiviral particle of any one of claim 1-9, the T-cell/NK-cell activation receptor comprises FKBP12-rapamycin binding (FRB) protein or a functional homolog thereof.

11. The lentiviral particle of any one of claims 1-10, wherein the lentiviral particle further comprises a nucleic acid sequence encoding a checkpoint-inhibiting ligand.

12. The lentiviral particle of claim 11, wherein the checkpoint-inhibiting ligand is capable of blocking the PD-1/PD-L1 checkpoint.

13. The lentiviral particle of claim 11 or claim 12, wherein the checkpoint-inhibiting ligand is capable of blocking the Tim-3 checkpoint.

14. The lentiviral particle of any one of claims 1-13, further comprising a nucleic acid sequence encoding a protein that provides resistance to an immunosuppressive drug.

15. The lentiviral particle of claim 14, wherein the immunosuppressive drug is selected from the group consisting of methotrexate, rapamycin, a rapalog, tacrolimus, and cyclosporine.

16. The lentiviral particle of any one of claims 1-15, further comprising a nucleic acid sequence encoding a 2A peptide.

17. The lentiviral particle of any one of claims 1-16, further comprising a wPRE nucleic acid sequence.

18. The lentiviral particle of any one of claims 1-17, further comprising a nucleic acid sequence encoding a TGFbeta dominant-negative inhibiting receptor.

19. The lentiviral particle of any one of claims 1-18, wherein the promoter is selected from the group consisting of an MND promoter, a T-cell specific promoter, a CD4 T-cell specific promoter, a CD8 T-cell specific promoter, an NK-cell specific promoter, a T-cell and NK-cell specific promoter, a CD4 T-cell and NK-cell specific promoter, and a CD8 T-cell and NK-cell specific promoter.

20. The lentiviral particle of any one of claims 1-19, wherein the sequence of the promoter is at least 90% identical to a sequence selected from the group consisting of SEQ ID NOs: 1-4.

21. A method for treating a subject suffering from cancer, comprising:

a) administering a lentiviral particle of any one of claims 1-20 to the subject, and

b) administering the small molecule to the subject,

wherein the cancer is treated in the subject.

22. A method for expanding T-cells capable of recognizing and killing tumor cells in a subject in need thereof, comprising:

i) administering a lentiviral particle of any one of claims 1-20 to the subject, and

b) administering the small molecule to the subject,

wherein T-cells capable of recognizing and killing tumor cells in the subject are expanded.

23. The method of claim 21 or claim 22, wherein the lentiviral particle is administered by intravenous injection.

24. The method of claim 21 or claim 22, wherein the lentiviral particle is administered by intratumoral injection.

25. The method of any one of claims 21-24, wherein the small molecule is administered by intravenous injection.

26. The method of any one of claims 21-24, wherein the small molecule is administered orally.

27. The method of any one of claims 21-26, wherein the small molecule is administered at concentrations sufficient to activate the T-cell/NK-cell activation receptor.

28. The method of any one of claims 21-27, wherein the small molecule is rapamycin.

29. The method of claim 28, wherein rapamycin is administered at concentrations sufficient to maintain serum concentrations of rapamycin greater than 0.1 nM, 1 nM, or 10 nM.

30. The method of any one of claims 21-27, wherein the small molecule is a rapalog.

31. The method of claim 30, wherein the rapalog is administered at concentrations sufficient to maintain serum concentrations of the rapalog greater than 0.1 nM, 1 nM, or 10 nM.

32. The method of any one of claims 21-31, wherein the small molecule causes dimerization of the T-cell/NK-cell activation receptor resulting in a cell activation signal.

33. The method of any one of claims 21-32, wherein

i) the small molecule is administered simultaneously with the lentiviral particle; or

ii) the small molecule is administered about 30 minutes, about 1 hour, about 2 hours, about 4 hours, about 5 hours or about 10 hours before or after the lentiviral particle is administered.

34. The method of any one of claims 21-33, further comprising administering to the subject an immunosuppressive agent.

35. The method of claim 34, wherein the immunosuppressive agent is tacrolimus.

36. The method of claim 35, wherein tacrolimus is administered at concentrations sufficient to maintain serum concentrations of tacrolimus greater than 0.1 nM, 1 nM, or 10 nM.

37. The method of claim 34, wherein the immunosuppressive agent is cyclosporine.

38. The method of claim 37, wherein cyclosporine is administered at concentrations sufficient to maintain serum concentrations of cyclosporine greater than 0.1 nM, 1 nM, or 10 nM.

39. A nucleic acid comprising a promoter specific to T-cells, NK cells, or T-cells and NK cells, wherein the sequence of the nucleic acid is at least 90% identical to a sequence selected from the group consisting of SEQ ID NOs: 1-4.

40. A packaging cell line for generating lentiviral particles capable of activating and efficiently transducing T cells, comprising cultured cells capable of packaging a lentivirus vector, wherein the cultured cells are genetically engineered to express a T-cell activation or co-stimulation molecule.

41. The packaging cell line of claim 40, wherein the T-cell activation or co-stimulation molecule is selected from the group consisting of an anti-CD3 antibody, CD28 ligand, and 41bb ligand.

42. The packaging cell line of claim 40 or claim 41, wherein the packaging cell line is a HEK-293T cell line.

43. The packaging cell line of any one of claims 40-42, wherein the packaging cell line is genetically modified to lack MHC class I expression.

44. The packaging cell line of any of claims 40-43, wherein the packaging cell line is genetically modified to lack MHC class II expression.

45. The packaging cell line of any of claims 40-44, wherein the packaging cell line is genetically modified to lack expression of an inhibitory receptor ligand.

46. The packaging cell line of claim 45, wherein the inhibitor receptor ligand is PD-L1 ligand or Tim3 ligand.

47. A nucleic acid vector comprising a T-cell and/or NK-cell specific promoter operatively linked to a nucleic acid sequence encoding T-cell/NK-cell activation receptor, wherein the T-cell/NK-cell activation receptor is capable of being activated by a small molecule.

48. A nucleic acid vector comprising a strong promoter operatively linked to a nucleic acid sequence encoding a T-cell/NK-cell activation receptor, wherein the T-cell/NK-cell activation receptor is capable of being activated by a small molecule.

49. The nucleic acid vector of claim 48, wherein the promoter is selected from the group consisting of an MND promoter, a T-cell specific promoter, a CD4 T-cell specific promoter, a CD8 T-cell specific promoter, an NK-cell specific promoter, a T-cell and NK-cell specific promoter, a CD4 T-cell and NK-cell specific promoter, and a CD8 T-cell and NK-cell specific promoter.

50. The nucleic acid vector of any one of claims 47-49, wherein the sequence of the promoter is at least 90% identical to a sequence selected from the group consisting of SEQ ID NOs: 1-4.

51. The nucleic acid vector of any one of claims 47-50, wherein the T-cell/NK-cell activation receptor comprises a signaling domain selected from the group consisting of a cytokine receptor signaling domain, a co-stimulatory receptor signaling domain, a T-cell receptor subunit signaling domain, an NK-cell receptor subunit signaling domain, and a growth factor receptor signaling domain.

52. The nucleic acid vector of claim 51, wherein the signaling domain comprises a cytokine receptor signaling domain of a common cytokine receptor gamma chain.

53. The nucleic acid vector of claim 51 or claim 52, wherein the signaling domain comprises a cytokine receptor signaling domain of a common cytokine receptor beta chain.

54. The nucleic acid vector of any one of claims 51-53, wherein the signaling domain comprises an ITAM.

55. The nucleic acid vector of any one of claims 51-54, wherein the signaling domain comprises a tyrosine capable of binding an SH2-domain when the tyrosine is phosphorylated.

56. The nucleic acid vector of any one of claims 47-55, further comprising a nucleic acid sequence encoding a checkpoint-inhibiting ligand.

57. The nucleic acid vector of claim 56, wherein the checkpoint-inhibiting ligand is capable of blocking the PD-1/PD-L1 checkpoint.

58. The nucleic acid vector of claims 56, wherein the checkpoint-inhibiting ligand is capable of blocking the Tim-3 checkpoint.

59. The nucleic acid vector of any one of claims 47-58, further comprising a nucleic acid sequence encoding a protein that provides resistance to an immunosuppressive drug.

60. The nucleic acid vector of claims 59, wherein the immunosuppressive drug is selected from the group consisting of methotrexate, rapamycin, a rapalog, tacrolimus, and cyclosporine.

61. The nucleic acid vector of any one of claims 47-60, further comprising one or more nucleic acid sequences encoding either or both of FK506 binding protein (FKPB) or a functional homolog thereof, and FKBP12-rapamycin binding (FRB) protein or a functional homolog thereof.

62. The nucleic acid vector of any one of claims 47-61, further comprising a nucleic acid sequence encoding a 2A peptide.

63. The nucleic acid vector of any one of claims 47-62, further comprising a wPRE nucleic acid sequence.

64. The nucleic acid vector of any one of claims 47-62, further comprising a nucleic acid sequence encoding a TGFbeta dominant-negative inhibiting receptor.

65. The nucleic acid vector of any one of claims 47-63, wherein the nucleic acid vector is a lentiviral vector.

66. The nucleic acid vector of any one of claims 47-64, wherein the nucleic acid vector is an adeno-associated virus (AAV) vector.

67. The nucleic acid vector of any one of claims 47-64, wherein the nucleic acid vector is an adenovirus vector.

68. A nucleic acid vector comprising a sequence at least 70%, 80%, 90%, 95%, or 99% identical to a sequence selected from SEQ ID NOs: 6-11.

69. A lentiviral particle produced by transfecting a packaging cell line with the nucleic acid vector of claim 67.

70. The lentiviral particle of claim 68, further comprising a T-cell activation or co-stimulation molecule.

71. The lentiviral particle of claim 69, wherein the T-cell activation or co-stimulation molecule is selected from the group consisting of an anti-CD3 antibody, CD28 ligand, and 41bb ligand.

72. The lentiviral particle of any one of claims 1-20 or 68-70, the method of any one of claims 21-38, or the nucleic acid vector of any one of claims 47-67, wherein the T-cell/NK-cell activation receptor comprises:

(a) a first chain comprising either or both of: (i) a functional FKPB domain that shares at least 95%, 99%, or 100% sequence identity with SEQ ID NO: 13, and (ii) a functional IL2Rb domain that shares at least 95%, 99%, or 100% sequence identity with SEQ ID NO: 14; and/or

(b) a second chain comprising either or both of: (i) a functional FRB domain that shares at least 95%, 99%, or 100% sequence identity with SEQ ID NO: 16, and (ii) a functional IL2Rg domain that shares at least 95%, 99%, or 100% sequence identity with SEQ ID NO: 17.

73. The lentiviral particle of any one of claims 1-20 or 68-70, the method of any one of claims 21-38, or the nucleic acid vector of any one of claims 47-67, wherein T-cell/NK-cell activation receptor comprises:

(a) a first chain comprising a functional FKPB domain and a functional IL2Rb domain, wherein the first chain shares at least 95%, 99%, or 100% sequence identity with SEQ ID NO: 12; and/or

(b) a second chain comprising a functional FRB domain and a functional IL2Rg domain, wherein the second chain shares at least 95%, 99%, or 100% sequence identity with SEQ ID NO: 15.