CLAIMS

WHAT IS CLAIMED IS:

1. A composition comprising a replication-defective vector, wherein the replication-defective vector comprises:

a nucleic acid sequence encoding for a tumor neo-antigen; and
a nucleic acid sequence encoding for an immunological fusion partner.

2. The composition of claim 1, wherein the replication-defective vector is an adenovirus vector.

3. The composition of any one of claims 1 or 2, wherein the replication defective vector comprises a deletion in an E2b region, an E1 region, an E3 region, and E4 region, or any combination thereof.

4. The composition of any one of claims 1-3, wherein the replication-defective vector is not a gutted vector.

5. The composition of any one of claims 1-4, wherein the immunological fusion partner comprises *Mycobacterium sp.*, *Mycobacterium tuberculosis*-derived Ra12 fragment, protein D derived from a surface protein of gram-negative bacterium *Haemophilus influenzae* B, LYTA, IFN-γ, TNFα, IL-2, IL-8, IL-12, IL-18, IL-7, IL-3, IL-4, IL-5, IL-6, IL-9, IL-10, IL-13, IL-15, IL-16, IL-17, IL-23, IL-32, CpG-ODN, truncated A subunit coding region derived from bacterial ADP-ribosylating exotoxin, truncated B subunit coding region derived from bacterial ADP-ribosylating exotoxin, Hp91, CCL20, CCL3, GM-CSF, G-CSF, LPS peptide mimic, shiga toxin, diphtheria toxin, IL-15 super agonist, ALT-803, CRM_{197}, or any combination thereof.

6. The composition of any one of claims 1-5, wherein the immunological fusion partner is at least 80%, at least 85%, at least 90%, at least 95%, or at least 90% identical to a sequence of any one of SEQ ID NO: 39 – SEQ ID NO: 90 or SEQ ID NO: 109 – SEQ ID NO: 112.

7. The composition of any one of claims 1-6, wherein the replication-defective vector further comprises a nucleic acid sequence encoding for a linker, a nucleic acid sequence encoding a costimulatory molecule, a nucleic acid sequence encoding a reporter, an engineered natural killer (NK) cell, an immunostimulant, a cancer therapy, and immune pathway checkpoint inhibitor or a combination thereof.

8. The composition of claim 7, wherein the linker is a polyalanine linker, or a polyglycine linker or comprises a mixture of alanines and glycines.

9. The composition of claim 7, wherein the linker is any one of SEQ ID NO: 91 – SEQ ID NO: 105.

10. The composition of any one of claims 1-9, wherein the composition comprises at least ten adenovirus vectors.

11. The composition of any one of claims 1-10, wherein the tumor neo-antigen comprises a tumor neo-epitope, WT1, HPV-E6, HPV-E7, p53, MAGE-A1, MAGE-A2, MAGE-A3, MAGE-A4, MAGE-A6, MAGE-A10, MAGE-A12, BAGE, DAM-6, DAM-10, Folate receptor alpha, GAGE-1, GAGE-2, GAGE-8, GAGE-3, GAGE-4, GAGE-5, GAGE-6, GAGE-7B, NA88-A, NY-ESO-1, MART-1, MC1R, Gp100, PSA, PSM, Tyrosinase, TRP-1, TRP-2, ART-4, CAMEL, CEA, Cyp-B, Her1, Her2/neu, Her3, Her 4, BRCA1, Brachyury, Brachyury (TIVS7-2, polymorphism), Brachyury (IVS7 T/C polymorphism), T Brachyury, T, hTERT, hTRT, iCE, MUC1, MUC1 (VNTR polymorphism), MUC1c, MUC1n, MUC2, PRAME, P15, PSCA, PSMA, RU1, RU2, SART-1, SART-3, AFP, β-catenin/m, Caspase-8/m, CDK-4/m, ELF2M, GnT-V, G250, HSP70-2M, HST-2, KIAA0205, MUM-1, MUM-2, MUM-3, Myosin/m, RAGE, SART-2, TRP-2/INT2, 707-AP, Annexin II, CDC27/m, TPl/mbcr-abl, ETV6/AML, LDLR/FUT, Pml/RARα, TEL/AML1, or any combination thereof.

12. The composition of any one of claims 1-11, wherein the tumor neo-antigen is a tumor neo-epitope with an amino acid sequence of any one of SEQ ID NO: 1 – SEQ ID NO: 22, a nucleotide sequence of any one of SEQ ID NO: 23 – SEQ ID NO: 30, or has one of the following mutation: Q678P mutation of gene SLC4A11, D1143N mutation of gene SIGLEC1, A292T mutation of gene SIGLEC14, T2356M mutation of PIEZO2, S1613L mutation of gene FAT4, R268C mutation of gene FCRL1, or V73M mutation of gene VIPR2, or R346W mutation of gene FLRT2.

13. A composition comprising a cell comprising the composition of any one of claims 1-12.

14. The composition of any one of claims 1-13 for use in therapy.

15. The composition of any one of claims 1-13 for use in treating a cancer.

16. Use of the composition of any one of claims 1-13 in the manufacture of a pharmaceutical composition for treating a cancer.

17. A pharmaceutical composition for use in treating a cancer, the pharmaceutical composition comprising a replication-defective vector, wherein the replication-defective vector comprises

a nucleic acid sequence encoding for a tumor neo-antigen; and
a nucleic acid sequence encoding for an immunological fusion partner.

18. Use of a pharmaceutical composition in the manufacture of a medicament for the treatment of a cancer, the pharmaceutical composition comprising a replication-defective vector, wherein the replication-defective vector comprises

a nucleic acid sequence encoding for a tumor neo-antigen; and

a nucleic acid sequence encoding for an immunological fusion partner.

19. The pharmaceutical composition for use of claim 17, or the use of claim 18, wherein the replication-defective vector is an adenovirus vector.

20. The pharmaceutical composition for use of claim 17 or 19, or the use of claim 18 or 19, wherein the replication defective vector comprises a deletion in an E2b region, an E1 region, an E3 region, and E4 region, or any combination thereof.

21. The pharmaceutical composition for use of any one of claims 17, 19 or 20, or the use of any one of claims 18-20, wherein the replication-defective vector is not a gutted vector.

22. The pharmaceutical composition for use of any one of claims 17 or 19-21, or the use of any one of claims 18-21, wherein the immunological fusion partner comprises *Mycobacterium sp.*, *Mycobacterium tuberculosis*-derived Ra12 fragment, protein D derived from a surface protein of gram-negative bacterium *Haemophilus influenzae* B, LYTA, IFN-γ, TNFα, IL-2, IL-8, IL-12, IL-18, IL-7, IL-3, IL-4, IL-5, IL-6, IL-9, IL-10, IL-13, IL-15, IL-16, IL-17, IL-23, IL-32, CpG-ODN, truncated A subunit coding region derived from bacterial ADP-ribosylating exotoxin, truncated B subunit coding region derived from bacterial ADP-ribosylating exotoxin, Hp91, CCL20, CCL3, GM-CSF, G-CSF, LPS peptide mimic, shiga toxin, diphtheria toxin, IL-15 super agonist, ALT-803, CRM_{197}, or any combination thereof.

23. The pharmceutical composition for use of any one of claims 17 or 19-22, or the use of any one of claims 18-22, wherein the immunological fusion partner is at least 80%, at least 85%, at least 90%,

at least 95%, or at least 90% identical to a sequence of any one of SEQ ID NO: 39 – SEQ ID NO: 90 or SEQ ID NO: 109 – SEQ ID NO: 112.

24. The pharmaceutical composition for use of any one of claims 17 or 19-23, or the use of any one of claims 18-23, wherein the replication-defective vector further comprises a nucleic acid sequence encoding for a linker, a nucleic acid sequence encoding a costimulatory molecule, a nucleic acid sequence encoding a reporter, an engineered natural killer (NK) cell, an immunostimulant, an immune pathway checkpoint inhibitor or a combination thereof.

25. The pharmaceutical composition for use of any one of claims 17 or 19-24, or the use of any one of claims 18-24, wherein the linker is a polyalanine linker, a polyglycine linker or comprises a mixture of alanines and glycines.

26. The pharmaceutical composition for use of any one of claims 17 or 19-25, or the use of any one of claims 18-25, wherein the linker is any one of SEQ ID NO: 91 – SEQ ID NO: 105.

27. The pharmaceutical composition for use of any one of claims 17 or 19-26, or the use of any one of claims 18-26, wherein the tumor neo-antigen comprises a tumor neo-epitope, WT1, HPV-E6, HPV-E7, p53, MAGE-A1, MAGE-A2, MAGE-A3, MAGE-A4, MAGE-A6, MAGE-A10, MAGE-A12, BAGE, DAM-6, DAM-10, Folate receptor alpha, GAGE-1, GAGE-2, GAGE-8, GAGE-3, GAGE-4, GAGE-5, GAGE-6, GAGE-7B, NA88-A, NY-ESO-1, MART-1, MC1R, Gp100, PSA, PSM, Tyrosinase, TRP-1, TRP-2, ART-4, CAMEL, CEA, Cyp-B, Her1, Her2/neu, Her3, Her 4, BRCA1, Brachyury, Brachyury (TIVS7-2, polymorphism), Brachyury (IVS7 T/C polymorphism), T Brachyury, T, hTERT, hTRT, iCE, MUC1, MUC1 (VNTR polymorphism), MUC1c, MUC1n, MUC2, PRAME, P15, PSCA, PSMA, RU1, RU2, SART-1, SART-3, AFP, β-catenin/m, Caspase-8/m, CDK-4/m, ELF2M, GnT-V, G250, HSP70-2M, HST-2, KIAA0205, MUM-1, MUM-2, MUM-3, Myosin/m, RAGE, SART-2, TRP-2/INT2, 707-AP, Annexin II, CDC27/m, TPl/mbcr-abl, ETV6/AML, LDLR/FUT, Pml/RARα, TEL/AML1, or any combination thereof.

28. The pharmaceutical composition for use of any one of claims 17 or 19-27, or the use of any one of claims 18-27, wherein the tumor neo-antigen is a tumor neo-epitope with an amino acid sequence of any one of SEQ ID NO: 1 – SEQ ID NO: 22, a nucleotide sequence of any one of SEQ ID NO: 23 – SEQ ID NO: 30, or has one of the following mutation: Q678P mutation of gene SLC4A11, D1143N mutation of gene SIGLEC1, A292T mutation of gene SIGLEC14, T2356M mutation of PIEZO2,

S1613L mutation of gene FAT4, R268C mutation of gene FCRL1, or V73M mutation of gene VIPR2, or R346W mutation of gene FLRT2.