CLAIMS

1. A pharmaceutical composition comprising a plurality of neoantigenic peptides and a pharmaceutically acceptable carrier, each neoantigenic peptide comprising a tumor-specific neoepitope capable of binding to an HLA protein in a subject, each tumor-specific neoepitope comprising a tumor-specific mutation present in a tumor, in which the plurality of neoantigenic peptides has affinity to a plurality of HLA proteins, in which:

(a) the composition comprises a plurality of neoantigenic peptides comprising a tumor-specific mutation present in a tumor in at least 1% of subjects in a population of subjects suffering from cancer; and

(b) the composition comprises a plurality of neoantigenic peptides, each of which comprises a tumor-specific neoepitope which binds to an HLA protein present in at least 5% of subjects in the population of subjects suffering from cancer with a binding affinity of less than 500nM,

in which the pharmaceutical composition is an immunogenic composition or a vaccine composition.

2. A pharmaceutical composition according to Claim 1, in which each tumor-specific mutation is present in one or more genes encoding an GATA binding protein 3 (GATA3).

3. A pharmaceutical composition according to Claim 1, in which each tumor-specific mutation is present in one or more genes encoding an epidermal growth factor receptor (EGFR).

4. A pharmaceutical composition according to Claim 1, in which each tumor-specific mutation is present in one or more genes encoding an KRAS.

5. A pharmaceutical composition according to Claim 1, in which each tumor-specific mutation is present in one or more genes encoding an NRAS.

6. A pharmaceutical composition according to any preceding claim, in which the population of subjects is suffering from adrenocortical carcinoma (ACC), bladder urothelial carcinoma (BLCA), breast cancer, breast invasive carcinoma (BRCA), cervical squamous cell carcinoma and endocervical adenocarcinoma (CESC), colon adenocarcinoma (COAD), Chronic lymphocytic Leukaemia (CLL), colorectal cancer (CRC), Diffuse large B-cell

lymphoma (DLBCL), glioblastoma multiforme (GBM), head and neck squamous cell carcinoma (HNSC), kidney chromophobe (KICH), kidney renal clear cell carcinoma (KIRC), kidney renal papillary cell carcinoma (KIRP), acute myeloid leukemia (LAML), liver hepatocellular carcinoma (LIHC), lung adenocarcinoma (LUAD), lung squamous cell carcinoma (LUSC), multiple myeloma (MM), ovarian serous cystadenocarcinoma (OV), pancreatic adenocarcinoma (PAAD), prostate adenocarcinoma (PRAD), rectum adenocarcinoma (READ), skin cutaneous melanoma (SKCM), stomach adenocarcinoma (STAD), testicular germ cell tumors (TGCT), thyroid adenocarcinoma (THCA), uterine corpus endometrioid carcinoma (UCEC), or uterine carcinosarcoma (UCS).

7. A pharmaceutical composition according to Claim 1 or 2, in which the population of subjects is suffering from breast cancer.

8. A pharmaceutical composition according to any preceding claim, in which the population suffering from cancer was treated with, is being treated with, or is selected to be treated with ibrutinib, erlotinib, imatinib, gefitinib, crizotinib, trastuzumab, vemurafenib, a RAF/MEK inhibitor, or an antiestrogen therapy.

9. A pharmaceutical composition according to Claim 1, in which the tumor-specific mutations comprise splice-variant mutations, point mutations, and/or frameshift mutations; or in which the tumor-specific mutations comprise drug resistance mutations.

10. A pharmaceutical composition according to any preceding claim, in which the plurality of neoantigenic peptides comprises at least one neoantigenic peptide derived from a long peptide region flanking and including the tumor specific mutation, and in which all contiguous segments within the long peptide are included.

11. A pharmaceutical composition according to Claim 2, in which at least one tumor-specific mutation is present in a gene encoding an GATA3, in which the at least one tumor-specific mutation is selected from the group consisting of N334, H400, S408, S430, H434, H435, and L328.

12. A pharmaceutical composition according to Claim 3, in which at least one tumor-specific mutation is present in a gene encoding an EGFR, and in which the at least one tumor-specific mutation is selected from the group consisting of P596S, P596L, G598A, G598V,

L62R, E709K, G719A, ELREA746del, S768I, L838M, L858R, L861Q, R108K, R252C, A289T, A289D, A289V, and H304Y.

13. A pharmaceutical composition according to Claim 4, in which at least one tumor-specific mutation is present in a gene encoding an KRAS, and in which the at least one tumor-specific mutation is selected from the group consisting of A59G, Q61K, Q61R, Q61L, Q61H, G12S, G12R, G12C, G12D, G12A, G12V, G13C, G13D, and A146T.

14. A pharmaceutical composition according to Claim 5, in which at least one tumor-specific mutation is present in a gene encoding an NRAS, and in which the at least one tumor-specific mutation is selected from the group consisting of Q61K, Q61R, Q61L, Q61H, G12C, G12D, G13R, and G13D.

15. A pharmaceutical composition according to any preceding claim, in which the at least one tumor-specific mutation has an incidence of at least 500 patients a year in the population of subjects suffering from cancer.

16. A pharmaceutical composition according to any preceding claim, in which the at least one neoantigenic peptide comprises a sequence selected from SEQ ID NOS 1-80, 3799-33502 and 33503-33732.

17. A pharmaceutical composition according to any preceding claim, in which the composition comprises at least 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 or 20 neoantigenic peptides.

18. A pharmaceutical composition according to Claim 17, in which the composition comprises at most 20 neoantigenic peptides.

19. A pharmaceutical composition according to any preceding claim, in which each neoantigenic peptide is from 8 to 50 amino acids in length.

20. A pharmaceutical composition according to any preceding claim, in which each tumor-specific neoepitope binds to a protein expressed by an HLA-A, -B or –C allele of a human subject suffering from the cancer.

21. A pharmaceutical composition according to any preceding claim, further comprising an immunomodulator or adjuvant.

22. A pharmaceutical composition according to Claim 21, in which the immunodulator or adjuvant is selected from the group consisting of 1018 ISS, aluminum salts, Amplivax, AS15, BCG, CP-870,893, CpG7909, CyaA, dSLIM, GM-CSF, IC30, IC31, Imiquimod, ImuFact IMP321, IS Patch, ISS, ISCOMATRIX, Juvlmmune, LipoVac, MF59, monophosphoryllipid A, Montanide IMS 1312, Montanide ISA 206, Montanide ISA 50V, Montanide ISA-51, OK-432, OM-174, OM-197-MP-EC, ONTAK, PepTel®, vector system, PLGA microparticles, resiquimod, SRL172, Virosomes and other Virus-like particles, YF-17D, VEGF trap, R848, beta-glucan, Pam3Cys, and Aquila's QS21 stimulon.

23. A pharmaceutical composition according to any preceding claim for use in a method of treating or preventing a tumor in a subject in need thereof.

24. A pharmaceutical composition for use according to Claim 23, in which the pharmaceutical composition is to be administered as a combination therapy with an additional cancer therapy.

25. A pharmaceutical composition for use according to Claim 24, in which the additional therapy comprises a check point inhibitor; or in which the additional therapy is surgery, chemotherapy, a targeted therapy, or a combination thereof.

26. A pharmaceutical composition according to any preceding claim for use in a method of prophylactic cancer treatment, the method comprising selecting a cancer drug for a patient in need thereof, in which the drug is selected from the group consisting of ibrutinib, erlotinib, imatinib, gefitinib, crizotinib, trastuzumab, vemurafenib, RAF/MEK inhibitors, and antiestrogen therapy, in which the pharmaceutical composition is to be administered prophylactically to the subject, in which the at least one neoantigenic peptide is derived from drug resistant mutations associated with the selected cancer drug.

27. An agent comprising an extracellular ligand-binding domain recognizing a tumor-specific neoepitope comprising a tumor-specific mutation having an incidence of at least 1% of subjects in a population for use in a method of treating or preventing a tumor in a population of subjects in need thereof, in which the tumor-specific mutation is present in a gene encoding an epidermal growth factor receptor (EGFR), and in which the agent has been obtained by using peptides comprising the tumor-specific neoepitope.

28. An agent for use according to Claim 27, in which the agent comprises an antibody, antibody fragment, antibody drug conjugate, aptamer, CAR, or T cell receptor.

29. An agent for use according to Claim 28, in which the antibody or antibody fragment is humanized, fully humanized, or chimeric; or in which the antibody fragment comprises a nanobody, Fab, Fab', (Fab')2, Fv, ScFv, diabody, triabody, tetrabody, Bis-scFv, minibody, Fab2, or Fab3 fragment.