CLAIMS

1. A polypeptide comprising at least two or more epitope sequences selected from the group consisting of:

MKDKQDEEQRTRRMMRTKMRMRRMRRTRRKMRRKMSPARPRTSCREACL QGWTE (SEQ ID NO: 1) or at least 90% sequence identity to SEQ ID NO: 1;

EEAEDNCRRMMRTK (SEQ ID NO: 2) or at least 90% sequence identity to SEQ ID NO: 2;

KLSHKHLVLNYGVCFCGDENILVQEFVKFG (SEQ ID NO: 4) or at least 90% sequence identity to SEQ ID NO: 4;

VLNYGVCFC (SEQ ID NO: 5) or at least 90% sequence identity to SEQ ID NO: 5;

FCGDENILV (SEQ ID NO: 6) or at least 90% sequence identity to SEQ ID NO: 6; and combinations thereof.

2. The polypeptide of claim 1, wherein the polypeptide comprises the epitope sequences:

MKDKQDEEQRTRRMMRTKMRMRRMRRTRRKMRRKMSPARPRTSCREACL QGWTE (SEQ ID NO: 1) or at least 90% sequence identity to SEQ ID NO: 1;

EEAEDNCRRMMRTK (SEQ ID NO: 2) or at least 90% sequence identity to SEQ ID NO: 2;

VLNYGVCFC (SEQ ID NO: 5) or at least 90% sequence identity to SEQ ID NO: 5; and

FCGDENILV (SEQ ID NO: 6) or at least 90% sequence identity to SEQ ID NO: 6.

3. The polypeptide of claim 1, wherein the polypeptide comprises the epitope sequences:

MKDKQDEEQRTRRMMRTKMRMRRMRRTRRKMRRKMSPARPRTSCREACL QGWTE (SEQ ID NO: 1) or at least 90% sequence identity to SEQ ID NO: 1;

EEAEDNCRRMMRTK (SEQ ID NO: 2) or at least 90% sequence identity to SEQ ID NO: 2; and

KLSHKHLVLNYGVCFCGDENILVQEFVKFG (SEQ ID NO: 4) or at least 90% sequence identity to SEQ ID NO: 4.

4. The polypeptide of claim 1, wherein the polypeptide comprises the epitope sequences:

MKDKQDEEQRTRRMMRTKMRMRRMRRTRRKMRRKMSPARPRTSCREACL QGWTE (SEQ ID NO: 1) or at least 90% sequence identity to SEQ ID NO: 1; and

EEAEDNCRRMMRTK (SEQ ID NO: 2) or at least 90% sequence identity to SEQ ID NO: 2.

5. The polypeptide of any one of claims 1-4, further comprising a leader sequence at N terminus selected from:

MACPGFLWALVISTCLEFSMA (SEQ ID NO: 8);

MQIFVKTLTGKTITLEVEPSDTIENVKAKIQDKEGIPPDQQRLIFAGKQLEDGR TLSDYNIQKESTLHLVLRLRGV (SEQ ID NO: 54); and

MGQKEQIHTLQKNSERMSKQLTRSSQAV (SEQ ID NO: 29).

6. The polypeptide of any one of claims 1-4, wherein the epitope sequences are connected to each other by a linker sequence.

7. The polypeptide of claim 6, wherein the linker sequence is selected from AAY, RR, DPP, HHAA (SEQ ID NO: 56), HHA, HHL, RKSYL (SEQ ID NO: 57), RKSY (SEQ ID NO: 58), SSL, or REKR (SEQ ID NO: 59).

8. The polypeptide of claim 6, wherein the linker sequence comprises a protease cleavage site.

9. The polypeptide of claim 1, wherein the polypeptide is selected from:

an amino acid sequence of SEQ ID NO: 3 or having at least 90% sequence identity to SEQ ID NO: 3;

an amino acid sequence of SEQ ID NO: 7 or having at least 90% sequence identity to SEQ ID NO: 7;

an amino acid sequence of SEQ ID NO: 9 or having at least 90% sequence identity to SEQ ID NO: 9;

an amino acid sequence of SEQ ID NO: 10 or having at least 90% sequence identity to SEQ ID NO: 10;

an amino acid sequence of SEQ ID NO: 11 or having at least 90% sequence identity to SEQ ID NO: 11;

an amino acid sequence of SEQ ID NO: 12 or having at least 90% sequence identity to SEQ ID NO: 12;

an amino acid sequence of SEQ ID NO: 13 or having at least 90% sequence identity to SEQ ID NO: 13;

an amino acid sequence of SEQ ID NO:14 or having at least 90% sequence identity to SEQ ID NO: 14;

an amino acid sequence of SEQ ID NO: 15 or having at least 90% sequence identity to SEQ ID NO: 15; and

an amino acid sequence of SEQ ID NO: 31 or having at least 90% sequence identity to SEQ ID NO: 31.

10. A polynucleotide encoding a polypeptide of any one of claims 1-9.

11. The polynucleotide of claim 10, wherein the polynucleotide is selected from the group consisting of:

a nucleic acid sequence of SEQ ID NO: 16 or having at least 90% sequence identity to SEQ ID NO: 16;

a nucleic acid sequence of SEQ ID NO: 17 or having at least 90% sequence identity to SEQ ID NO: 17;

a nucleic acid sequence of SEQ ID NO: 18 or having at least 90% sequence identity to SEQ ID NO: 18;

a nucleic acid sequence of SEQ ID NO: 19 or having at least 90% sequence identity to SEQ ID NO: 19;

a nucleic acid sequence of SEQ ID NO: 20 or having at least 90% sequence identity to SEQ ID NO: 20;

a nucleic acid sequence of SEQ ID NO: 21 or having at least 90% sequence identity to SEQ ID NO: 21;

a nucleic acid sequence of SEQ ID NO: 22 or having at least 90% sequence identity to SEQ ID NO: 22;

a nucleic acid sequence of SEQ ID NO: 26 or having at least 90% sequence identity to SEQ ID NO: 26; and

a nucleic acid sequence of SEQ ID NO: 27 or having at least 90% sequence identity to SEQ ID NO: 27.

12. A vector comprising a polynucleotide of claim 10 or claim 11.

13. The vector of claim 12, wherein the vector is selected from an adenovirus vector, an alphaviral vector, a poxvirus vector, an adeno-associated virus vector, a retrovirus vector, a self-replicating RNA molecule, and a combination thereof.

14. The vector of claim 13, wherein the adenovirus vector is selected from hAd5, hAd7, hAd11, hAd26, hAd34, hAd35, hAd48, hAd49, hAd50, GAd20, Gad19, GAd21, GAd25, GAd26, GAd27, GAd28, GAd29, GAd30, GAd31, ChAd3, ChAd4, ChAd5, ChAd6, ChAd7, ChAd8, ChAd9, ChAd10, ChAd11, ChAd16, ChAdI7, ChAd19, ChAd20, ChAd22, ChAd24, ChAd26, ChAd30, ChAd31, ChAd37, ChAd38, ChAd44, ChAd55, ChAd63, ChAd73, ChAd82, ChAd83, ChAd146, ChAd147, PanAd1, PanAd2, and PanAd3.

15. The vector of claim 13, wherein the poxvirus vector is selected from smallpox virus vector, vaccinia virus vector, cowpox virus vector, monkeypox virus vector, Copenhagen vaccinia virus (W) vector, New York Attenuated Vaccinia Virus (NYVAC) vector, and Modified Vaccinia Ankara (MVA) vector.

16. The vector of claim 12, wherein the vector is the adenovirus vector comprising a polynucleotide encoding any one of the polypeptides of any one of claims 1-9.

17. The vector of claim 12, wherein the vector is the self-replicating RNA molecule comprising a polynucleotide encoding any one of the polypeptides of any one of claims 1-9.

18. The vector of claim 12, wherein the vector is Ad26 comprising a polynucleotide encoding a polypeptide of SEQ ID NO: 10 or having at least 90% sequence identity to SEQ ID NO: 10.

19. The vector of claim 12, wherein the vector is MVA vector comprising a polynucleotide encoding a polypeptide of SEQ ID NO: 31 or having at least 90% sequence identity to SEQ ID NO: 31.

20. The vector of claim 12, wherein the vector is GAd20 comprising a polynucleotide encoding a polypeptide of SEQ ID NO: 31 or having at least 90% sequence identity to SEQ ID NO: 31.

21. The vector of claim 12, wherein the vector is a self-replicating RNA molecule comprising a polynucleotide encoding a polypeptide of SEQ ID NO: 12 or having at least 90% sequence identity to SEQ ID NO: 12.

22. A pharmaceutical composition comprising a polypeptide of any one of claims 1-9.

23. A pharmaceutical composition comprising a polynucleotide any one of claims 10 and 11.

24. A pharmaceutical composition comprising a vector of any one of claims 12-21.

25. The pharmaceutical composition of claim 24, wherein the vector is selected from an Ad26 vector, a MVA vector, a GAd20 vector, a self-replicating RNA molecule, and combinations thereof.

26. The pharmaceutical composition of any one of claims 22-25 for use in therapy~~A method of treating, preventing, reducing a risk of onset or delaying the onset of a clinical condition characterized by an expression of JAK2V617F and/or CALR exon 9 mutant in a subject~~, wherein the pharmaceutical composition is to be administered to ~~comprising administering to the~~a subject in need thereof~~ a pharmaceutical composition of any one of claims 22-25~~.

27. Use of the pharmaceutical composition of any one of claims 22-25 in the manufacture of a medicament for the treatment, prevention or reduction of a risk of onset or delay of the onset of a clinical condition characterized by an expression of JAK2V617F and/or CALR exon 9 mutant in a subject, wherein the pharmaceutical composition is to be administered to the subject in need thereof.~~A method of inducing an immune response in a subject carrying JAK2V617F and/or CALR exon 9 mutation comprising administering to the subject in need thereof a pharmaceutical composition of any one of claims 22-25.~~

28. Use of the pharmaceutical composition of any one of claims 22-25 in the manufacture of a medicament for the treatment or prevention of ~~A method of treating or preventing~~ a myeloproliferative disease in a subject, wherein the pharmaceutical composition is to be

administered ~~comprising administering~~ to the subject in need thereof ~~a pharmaceutical composition of any one of claims 22-25~~.

29. Use of the pharmaceutical composition of any one of claims 22-25 in the manufacture of a medicament for the treatment of ~~A method of treating~~ cancer in a subject, wherein the pharmaceutical composition is to be administered ~~comprising administering~~ to the subject in need thereof ~~a pharmaceutical composition of any one of claims 22-25~~.

30. Use of the pharmaceutical composition of any one of claims 22-25 in the manufacture of a medicament for the treatment of ~~A method of treating~~ a cardiovascular disease in a subject, wherein the pharmaceutical composition is to be administered ~~comprising administering~~ to the subject in need thereof ~~a pharmaceutical composition of any one of claims 22-25~~.

31. A ~~method of treating, preventing, reducing a risk of onset or delaying the onset of a clinical condition characterized by an expression of JAK2V617F and/or CALR exon 9 mutant in a subject comprising administering to the subject in need thereof a~~ composition comprising a vector comprising a polynucleotide encoding at least two or more epitope sequences selected from the group consisting of:

- CALR epitope of SEQ ID NO: 1 or having at least 90% sequence identity to SEQ ID NO: 1;
- CALR epitope of SEQ ID NO: 2 or having at least 90% sequence identity to SEQ ID NO: 2;
- JAK2 epitope of SEQ ID NO: 4 or having at least 90% sequence identity to SEQ ID NO: 4;
- JAK2 epitope of SEQ ID NO: 5 or at least 90% sequence identity to SEQ ID NO: 5;
- JAK2 epitope of SEQ ID NO: 6 or having at least 90% sequence identity to SEQ ID NO: 6; and combinations thereof, ~~and~~for use in therapy, wherein the composition is to be administered to a subject in need thereof once or more.
  ~~wherein the administration comprises one or more administrations of the composition.~~

32. ~~A method of inducing an immune response in a subject carrying JAK2V617F and/or CALR exon 9 mutation comprising administering to the subject in need thereof a~~ Use of

composition comprising a vector comprising a polynucleotide encoding at least two or more epitope sequences selected from the group consisting of:

- CALR epitope of SEQ ID NO: 1 or having at least 90% sequence identity to SEQ ID NO: 1;
- CALR epitope of SEQ ID NO: 2 or having at least 90% sequence identity to SEQ ID NO: 2;
- JAK2 epitope of SEQ ID NO: 4 or having at least 90% sequence identity to SEQ ID NO: 4;
- JAK2 epitope of SEQ ID NO: 5 or at least 90% sequence identity to SEQ ID NO: 5;
- JAK2 epitope of SEQ ID NO: 6 or having at least 90% sequence identity to SEQ ID NO: 6; and combinations thereof, ~~and~~ in the manufacture of a medicament for the treatment, prevention or reduction of a risk of onset or delay of a clinical condition characterized by an expression of JAK2V617F and/or CALR exon 9 mutant in a subject, wherein the composition is to be administered to the subject in need thereof once or more.

~~wherein the administration comprises one or more administrations of the composition.~~

33. ~~A method of treating or preventing a myeloproliferative disease in a subject comprising administering to the subject in need thereof~~ Use of a composition comprising a vector comprising a polynucleotide encoding at least two or more epitope sequences selected from the group consisting of:

- CALR epitope of SEQ ID NO: 1 or having at least 90% sequence identity to SEQ ID NO: 1;
- CALR epitope of SEQ ID NO: 2 or having at least 90% sequence identity to SEQ ID NO: 2;
- JAK2 epitope of SEQ ID NO: 4 or having at least 90% sequence identity to SEQ ID NO: 4;
- JAK2 epitope of SEQ ID NO: 5 or at least 90% sequence identity to SEQ ID NO: 5;
- JAK2 epitope of SEQ ID NO: 6 or having at least 90% sequence identity to SEQ ID NO: 6; and combinations thereof, ~~and~~in the manufacture of a medicament for the treatment or prevention of preventing a myeloproliferative disease in a subject, wherein the composition is to be administered to the subject once or more.

~~wherein the administration comprises one or more administrations of the composition.~~

34. The ~~method~~ use of claim 33, wherein the myeloproliferative disease is selected from primary myelofibrosis (MPN), polycythemia vera (PV), essential thrombocythemia (ET), primary myelofibrosis (PFM), secondary myelofibrosis, acute myeloid leukemia (AML), secondary AML, chronic myelogenous leukemia (CML), clonal hematopoiesis of indeterminate potential (CHIP), and chronic myelomonocytic leukemia (CMML).

35. ~~A method of treating cancer in a subject comprising administering to the subject in need thereof~~ Use of a composition comprising a vector comprising a polynucleotide encoding at least two or more epitope sequences selected from the group consisting of:

- CALR epitope of SEQ ID NO: 1 or having at least 90% sequence identity to SEQ ID NO: 1;
- CALR epitope of SEQ ID NO: 2 or having at least 90% sequence identity to SEQ ID NO: 2;
- JAK2 epitope of SEQ ID NO: 4 or having at least 90% sequence identity to SEQ ID NO: 4;
- JAK2 epitope of SEQ ID NO: 5 or at least 90% sequence identity to SEQ ID NO: 5;
- JAK2 epitope of SEQ ID NO: 6 or having at least 90% sequence identity to SEQ ID NO: 6; and combinations thereof, in the manufacture of a medicament for the treatment of cancer, wherein the composition is to be administered to a subject in need thereof once or more.~~and~~

~~wherein the administration comprises one or more administrations of the composition.~~

36. The ~~method~~ use of claim 35, wherein the cancer is selected from lung cancer, lymphoid cancer, acute lymphoid leukemia, acute myeloid leukemia, chronic myelogenous leukemia, Burkitt's lymphoma, Hodgkin's lymphoma, plasma cell myeloma, biliary tract cancer, bladder cancer, liver cancer, pancreatic cancer, prostate cancer, skin cancer, thyroid cancer, stomach cancer, large intestine cancer, colon cancer, urinary tract cancer, central nervous system cancer, neuroblastoma, kidney cancer, breast cancer, cervical cancer, testicular cancer, and soft tissue cancer.

37. ~~A method of treating a cardiovascular disease in a subject comprising administering to the subject in need thereof~~ Use of a composition comprising a vector comprising a

polynucleotide encoding at least two or more epitope sequences selected from the group consisting of:

- CALR epitope of SEQ ID NO: 1 or having at least 90% sequence identity to SEQ ID NO: 1;
- CALR epitope of SEQ ID NO: 2 or having at least 90% sequence identity to SEQ ID NO: 2;
- JAK2 epitope of SEQ ID NO: 4 or having at least 90% sequence identity to SEQ ID NO: 4;
- JAK2 epitope of SEQ ID NO: 5 or at least 90% sequence identity to SEQ ID NO: 5;
- JAK2 epitope of SEQ ID NO: 6 or having at least 90% sequence identity to SEQ ID NO: 6; and combinations thereof, in the manufacture of a medicament for the treatment of a cardiovascular disease in a subject, wherein the composition is to be administered to the subject in need thereof once or more.~~and~~

~~wherein the administration comprises one or more administrations of the composition.~~

38. The ~~method~~ use of claim 37, wherein the cardiovascular disease is selected from an acute coronary syndrome, an ischemic cerebrovascular disease, an ischemic heart disease, a thrombosis, a venous thromboembolism, a deep vein thrombosis, a pulmonary embolism, a catastrophic intra-abdominal thromboses, a peripheral arterial disease, a hypertension, a heart failure, an atrial fibrillation, a coronary heart disease, an atherosclerosis, and a clonal hematopoiesis.

39. The ~~method~~ use of any one of claims ~~31~~32-38, wherein the vector is selected from an adenovirus vector, an alphaviral vector, a poxvirus vector, an adeno-associated virus vector, a retrovirus vector, a self-replicating RNA molecule, and a combination thereof.

40. The ~~method~~ use of any one of claims ~~31~~32-39, wherein the vector is selected from Ad26 vector, MVA vector, GAd20 vector, a self-replicating RNA molecule, and combinations thereof.

41. The method of any one of claims ~~31~~32-39, wherein the vector is an Ad26 vector comprising a polynucleotide encoding a polypeptide comprising epitope sequences of

calreticulin (CALR) epitope of SEQ ID NO: 1, CALR epitope of SEQ ID NO: 2, JAK2 epitope of SEQ ID NO: 5, and JAK2 epitope of SEQ ID NO: 6,

42. The ~~method~~ use of any one of claims ~~31~~32-39, wherein the vector is a GAd20 vector comprising a polynucleotide encoding a polypeptide comprising epitope sequences of calreticulin (CALR) epitope of SEQ ID NO: 1, CALR epitope of SEQ ID NO: 2, JAK2 epitope of SEQ ID NO: 5, and JAK2 epitope of SEQ ID NO: 6,

43. The ~~method~~ use of any one of claims ~~31~~32-39, wherein the vector is a MVA vector comprising a polynucleotide encoding a polypeptide comprising epitope sequences of calreticulin (CALR) epitope of SEQ ID NO: 1, CALR epitope of SEQ ID NO: 2, JAK2 epitope of SEQ ID NO: 5, and JAK2 epitope of SEQ ID NO: 6,

44. The ~~method~~ use of any one of claims ~~31~~32-39, wherein the vector is a self-replicating RNA molecule comprising a polynucleotide encoding a polypeptide comprising epitope sequences of calreticulin (CALR) epitope of SEQ ID NO: 1, CALR epitope of SEQ ID NO: 2, JAK2 epitope of SEQ ID NO: 5, and JAK2 epitope of SEQ ID NO: 6,

45. The ~~method~~ use of any one of claims ~~31~~32-44, further comprising ~~administering~~ a second therapeutic agent to be administered, wherein the second therapeutic agent is selected from a CTLA-4 antibody, a PD-1 antibody, a PD-L1 antibody, a TLR agonist, a CD40 agonist, an OX40 agonist, hydroxyurea, ruxolitinib, fedratinib, a 41BB agonist, a CD28 agonist, FLT3 ligand, aluminum sulfate, a BTK inhibitor, a JAK inhibitor, a CD38 antibody, a CDK inhibitor, a CD33 antibody, a CD37 antibody, a CD25 antibody, a GM-CSF inhibitor, IL-2, IL-15, IL-7, IFNγ, IFNα, TNFα, a VEGF antibody, a CD70 antibody, a CD27 antibody, a BCMA antibody, a GPRC5D antibody, and combinations thereof.