

CLAIMS

1. A fusion polypeptide comprising or consisting of an amino acid sequence of any one of SEQ ID NOs: 82-83, 86-87, and 98-101, or an amino acid sequence that is at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 82-83, 86-87, and 98-101.

2. The fusion polypeptide claim 1, further comprising an N-terminal signal peptide or leader sequence.

3. The fusion polypeptide of claim 1 or 2, wherein the fusion polypeptide is capable of inducing, promoting or stimulating an immune response against HIV-1 in a human.

4. The fusion polypeptide of any one of claims 1 to 3, wherein fusion polypeptide is capable of inducing, promoting or stimulating proliferation and/or activation of one or more cell types selected from monocyte-derived dendritic cells (DCs), CD8+ T cells and CD4+ T cells.

5. A polynucleotide comprising a nucleic acid sequence encoding one or more fusion polypeptides of any one of claims 1 to 4.

6. The polynucleotide of claim 5, comprising a nucleic acid sequence of any one of SEQ ID NOs: 139, 140, 142, 143, 145, 146, 148, 149, 150, 152, 155, and 158, or that is at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 139, 140, 142, 143, 145, 146, 148, 149, 150, 152, 155, and 158.

7. An expression cassette, comprising a polynucleotide of claim 5 or 6 operably linked to one or more regulatory sequences.

8. A vector comprising one or more polynucleotides of claim 5 or 6, or an expression cassette of claim 7.

9. The vector of claim 8, comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide: SEQ ID

NOs: 82 and 86, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 82 and 86, respectively.

10. The vector of claim 8, comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide: SEQ ID NOs: 83 and 87, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 83 and 87, respectively.

11. The vector of claim 8 comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide: SEQ ID NOs: 98 and 100, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 98 and 100, respectively.

12. The vector of claim 8, comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide: SEQ ID NOs: 99 and 101, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 99 and 101, respectively.

13. The vector of any one of claims 8 to 12, comprising the following first polynucleotide and second polynucleotide:

- a) a first polynucleotide comprising SEQ ID NO: 140, or a polynucleotide that is at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to SEQ ID NO: 140, respectively, and
- b) a second polynucleotide comprising SEQ ID NO: 146, or a polynucleotide that is at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to SEQ ID NO: 146.

14. The vector of any one of claims 8 to 12, comprising the following first polynucleotide and second polynucleotide:

- a) a first polynucleotide comprising SEQ ID NO: 143, or a polynucleotide that is at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to SEQ ID NO: 143, respectively, and
- b) a second polynucleotide comprising SEQ ID NO: 149, or a polynucleotide that is at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to SEQ ID NO: 149.

15. The vector of any one of claims 8 to 12, comprising the following first polynucleotide and second polynucleotide:

- a) a first polynucleotide comprising SEQ ID NO: 150, or a polynucleotide that is at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to SEQ ID NO: 150, respectively, and
- b) a second polynucleotide comprising SEQ ID NO: 152, or a polynucleotide that is at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to SEQ ID NO: 152.

16. The vector of any one of claims 8 to 12, comprising the following first polynucleotide and second polynucleotide:

- a) a first polynucleotide comprising SEQ ID NO: 154, or a polynucleotide that is at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to SEQ ID NO: 154, respectively, and
- b) a second polynucleotide comprising SEQ ID NO: 157, or a polynucleotide that is at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to SEQ ID NO: 157.

17. The vector of any one of claims 8 to 16, wherein the vector is a viral vector.

18. The vector of claim 17, wherein the viral vector is replication defective, replication deficient, replication attenuated or replication competent.

19. The vector of claim 17 or 18, wherein the viral vector is an arenavirus vector selected from Lymphocytic choriomeningitis mammarenavirus (LCMV), Cali mammarenavirus (*a.k.a.*, Pichinde mammarenavirus or Pichinde arenavirus), Guanarito virus (GTOV), Junin virus (JUNV), Lassa virus (LASV), Lujo virus (LUJV), Machupo virus (MACV), Sabia virus (SABV), and Whitewater Arroyo virus (WWAV).

20. The vector of claim 19, wherein the viral vector is an arenavirus vector selected from Lymphocytic choriomeningitis mammarenavirus (LCMV) or Cali mammarenavirus (*a.k.a.* Pichinde mammarenavirus or Pichinde arenavirus).

21. The vector of claim 19 or 20, wherein the arenavirus vector comprises a tri-segmented genome.

22. A host cell comprising one or more polynucleotides of claim 5, or one or more vectors of any one of claims 8 to 21.

23. An immunogenic composition comprising two or more of the fusion polypeptides of any one of claims 1 to 4, or two or more polynucleotides of claim 5, or two or more vectors of any one of claims 8 to 18, and a pharmaceutically acceptable carrier.

24. The immunogenic composition of claim 23, comprising first and second viral vectors comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide:

a) a first polynucleotide or first viral vector comprising one or more polynucleotides encoding a first fusion polypeptide and a second fusion polypeptide comprising SEQ ID NOs: 82 and 86, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 82 and 86, respectively, and

b) a second polynucleotide or second viral vector comprising one or more polynucleotides encoding a first fusion polypeptide and a second fusion polypeptide comprising SEQ ID NOs: 83 and 87, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 83 and 87, respectively.

25. The immunogenic composition of claim 23, comprising first and second viral vectors comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide:

a) a first polynucleotide or first viral vector comprising one or more polynucleotides encoding a first fusion polypeptide and a second fusion polypeptide comprising SEQ ID NOs: 98 and 100, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 98 and 100, respectively, and

b) a second polynucleotide or second viral vector comprising one or more polynucleotides encoding a first fusion polypeptide and a second fusion polypeptide comprising SEQ ID NOs: 99 and 101, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 99 and 101, respectively.

26. The immunogenic composition of claim 24 or 25, wherein the first and second viral vectors are Lymphocytic choriomeningitis mammarenavirus (LCMV) viral vectors.

27. The immunogenic composition of claim 24 or 25, wherein the first and second viral vectors are Cali mammarenavirus (*a.k.a.* Pichinde mammarenavirus or Pichinde arenavirus) viral vectors.

28. The immunogenic composition of any one of claims 23 to 27, comprising first and second viral vectors comprising the following first polynucleotide and second polynucleotide:

a) a first vector comprising first and second polynucleotides comprising SEQ ID NOs: 140 and 146, or polynucleotides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 140 and 146, respectively, and

b) a second vector comprising first and second polynucleotides comprising SEQ ID NOs: 143 and 149, or polynucleotides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 143 and 149, respectively.

29. The immunogenic composition of claim 28, wherein the first and second viral vectors are Lymphocytic choriomeningitis mammarenavirus (LCMV) viral vectors.

30. The immunogenic composition of any one of claims 23 to 27, comprising first and second viral vectors comprising the following first polynucleotide and second polynucleotide:

a) a first vector comprising first and second polynucleotides comprising SEQ ID NOs: 150 and 152, or polynucleotides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 150 and 152, respectively, and

b) a second vector comprising first and second polynucleotides comprising SEQ ID NOs: 154 and 157 or SEQ ID NOs: 155 and 158, or polynucleotides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 154 and 157 or SEQ ID NOs: 155 and 158, respectively.

31. The immunogenic composition of claim 30, wherein the first and second viral vectors are Cali mammarenavirus (*a.k.a.* Pichinde mammarenavirus or Pichinde arenavirus) viral vectors.

32. The immunogenic composition of any one of claims 23 to 31, formulated for administration via a route selected from intravenous, intramuscular, intradermal, subcutaneous, intranodal and mucosal (*e.g.* buccal, intranasal, intrarectal, intravaginal).

33. The immunogenic composition of any one of claims 23 to 32, formulated as a liquid, a suspension or an emulsion.

34. The immunogenic composition of any one of claims 23 to 32, wherein the composition is lyophilized.

35. A kit comprising one or more unitary doses of one or more of the fusion polypeptides of any one of claims 1 to 4, or one or more polynucleotides of claim 5, or one or more vectors of any one of claims 8 to 18, or one or more immunogenic compositions of any one of claims 23 to 34.

36. Use of the immunogenic composition of any one of claims 23 to 34 in the manufacture of a medicament for treating or preventing human immunodeficiency virus (HIV).

37. The use of claim 36, wherein the medicament comprises first and second viral vectors comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide:

a) a first polynucleotide or first viral vector comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide comprising SEQ ID NOs: 82 and 86, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 82 and 86, respectively, and

b) a second polynucleotide or second viral vector comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide comprising SEQ ID NOs: 83 and 87, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 83 and 87, respectively.

38. The use of claim 36, wherein the medicament comprises first and second viral vectors comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide:

a) a first polynucleotide or first viral vector comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide comprising SEQ ID NOs: 98 and 100, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 98 and 100, respectively, and

b) a second polynucleotide or second viral vector comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide comprising SEQ ID NOs: 85 and 101, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 85 and 101, respectively.

39. The use of claim 37 or 38, wherein the first and second viral vectors are Lymphocytic choriomeningitis mammarenavirus (LCMV) viral vectors.

40. The use of claim 37 or 38, wherein the first and second viral vectors are Cali mammarenavirus (*a.k.a.* Pichinde mammarenavirus or Pichinde arenavirus) viral vectors.

41. The use of any one of claims 36 to 40, wherein the medicament comprises first and second viral vectors, comprising the following first polynucleotide and second polynucleotide:

- a) a first vector comprising first and second polynucleotides comprising SEQ ID NOs: 140 and 146, or polynucleotides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 140 and 146, respectively, and
- b) a second vector comprising first and second polynucleotides comprising SEQ ID NOs: 143 and 149, or polynucleotides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 143 and 149, respectively, wherein the first and second viral vectors are Lymphocytic choriomeningitis mammarenavirus (LCMV) viral vectors.

42. The use of any one of claims 36 to 41, wherein the medicament comprises first and second viral vectors, comprising the following first polynucleotide and second polynucleotide:

- a) a first vector comprising first and second polynucleotides comprising SEQ ID NOs: 150 and 152, or polynucleotides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 150 and 152, respectively, and
- b) a second vector comprising first and second polynucleotides comprising SEQ ID NOs: 154 and 157 or SEQ ID NOs: 155 and 158, or polynucleotides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 154 and 157 or SEQ ID NOs: 155 and 158, respectively, wherein the first and second viral vectors are Cali mammarenavirus (*a.k.a.* Pichinde mammarenavirus or Pichinde arenavirus) viral vectors.

43. The use of any one of claims 36 to 42, wherein the subject is infected with HIV-1, is suspected of being infected with HIV-1, or is at risk of being infected with HIV-1.

44. The use of any one of claims 36 to 43, wherein the immunogenic composition is to be administered via a route selected from intravenous, intramuscular, intradermal, subcutaneous, intranodal and mucosal (*e.g.* buccal, intranasal, intrarectal, intravaginal).

45. The use of any one of claims 36 to 44, wherein the treating or preventing HIV comprises administering from about 10^3 to about 10^{12} viral focus forming units (FFU) or plaque forming units (PFU) or infectious units (IU) or viral particles (vp), *e.g.* from about 10^4 to about 10^7 viral FFU or PFU or IU or vp, *e.g.* from about 10^3 to about 10^4 , 10^5 , 10^6 , 10^7 , 10^8 , 10^9 , 10^{10} , 10^{11} , 10^{12} , 10^{13} , 10^{14} or 10^{15} viral FFU or PFU or IU or vp, per administration.

46. The use of any one of claims 36 to 45, wherein the treating or preventing HIV comprises a prime-boost regimen comprising administering a priming composition at a first time point and administering one or more boosting compositions at one or more subsequent time points.

47. The use of claim 46, wherein the prime-boost regimen comprises:
- 1) Priming with an immunogenic composition comprising first and second viral vectors, comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide, optionally joined or connected by one or more linkers:
 - a) a first viral vector comprising one or more polynucleotides encoding first fusion polypeptide and second fusion polypeptides comprising SEQ ID NOs: 82 and 86, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 82 and 86, respectively; and
 - b) a second viral vector comprising one or more polynucleotides encoding first fusion polypeptide and second fusion polypeptides comprising SEQ ID NOs: 83 and 87, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%,

97%, 98% or 99% identical to any one of SEQ ID NOs: 83 and 87,
respectively; and

- 2) Boosting with an immunogenic composition comprising first and second viral vectors, comprising one or more polynucleotides encoding the following first fusion polypeptide and second fusion polypeptide, optionally joined or connected by one or more linkers:
 - a) a first viral vector comprising one or more polynucleotides encoding first fusion polypeptide and second fusion polypeptides comprising SEQ ID NOs: 98 and 100, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 98 and 100, respectively; and
 - b) a second viral vector comprising one or more polynucleotides encoding first fusion polypeptide and second fusion polypeptides comprising SEQ ID NOs: 99 and 101, or fusion polypeptides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 99 and 101, respectively.

48. The use of claim 46, wherein the prime-boost regimen comprises:

- 1) Priming with an immunogenic composition comprising first and second viral vectors, comprising the following polynucleotides:
 - a) a first viral vector comprising first and second polynucleotides comprising SEQ ID NOs: 150 and 152, or polynucleotides that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 150 and 152, respectively; and
 - b) a second viral vector comprising first and second polynucleotides comprising SEQ ID NOs: 154 and 157 or SEQ ID NOs: 155 and 158, or that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 154 and 157 or SEQ ID NOs: 155 and 158, respectively; and
- 2) Boosting with an immunogenic composition comprising first and second viral vectors, comprising the following polynucleotides:

- a) a first viral vector comprising first and second polynucleotides comprising SEQ ID NOs: 140 and 146, or that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 140 and 146, respectively; and
- b) a second viral vector comprising first and second polynucleotides comprising SEQ ID NOs: 143 and 149, or that are at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% identical to any one of SEQ ID NOs: 143 and 149, respectively.

49. The use of claim 47 or 48, wherein the viral vectors in the priming composition are Cali mammarenavirus (*a.k.a.* Pichinde mammarenavirus or Pichinde arenavirus) viral vectors and the viral vectors in the boosting composition are Lymphocytic choriomeningitis mammarenavirus (LCMV) viral vectors.

50. The use of any one of claims 47 to 49, wherein the viral vectors in the priming composition and the viral vectors in the boosting composition are replication attenuated.