Claims

1. A nucleic acid encoding a synthetic HIV envelope protein comprising the amino acid sequence of SEQ ID NO: 8, or SEQ ID NO:8 having one or more mutations selected from the group consisting of (i) I529P, (ii) K480E, and (iii) a combination of EK479-480RRRR, I529P, A471C and T575C.

2. The nucleic acid of claim 1, wherein the synthetic HIV envelope protein further comprises a signal sequence, for instance, a signal sequence comprising the amino acid sequence selected from the group consisting of SEQ ID NO:9 to SEQ ID NO: 12.

3. The nucleic acid of claim 1 or 2, wherein the synthetic HIV envelope protein further comprises a transmembrane domain, for instance, a transmembrane domain comprising SEQ ID NO:13, preferably the synthetic HIV envelope protein further comprises SEQ ID NO:37 fused to the C-terminus of SEQ ID NO:8 and the N-terminus of the transmembrane domain.

4. The nucleic acid of claim 3, wherein the synthetic HIV envelope protein further comprises a fragment of a cytoplasmic domain, preferably a fragment of a cytoplasmic domain comprising the amino acid sequence of SEQ ID NO:14 or residues 1-4 thereof.

5. The nucleic acid of any one of the preceding claims 1-4, wherein the synthetic HIV envelope protein comprises the amino acid sequence of SEQ ID NO: 18.

6. The nucleic acid of claim 1 or 2, wherein the synthetic HIV envelope protein either: (a) further comprises a trimerization domain, for instance a trimerization domain having the amino acid sequence of SEQ ID NO: 15 or SEQ ID NO:16; or (b) comprises SEQ ID NO:8 having a combination of mutations EK479-480RRRR, I529P, A471C and T575C.

7. The nucleic acid of claim 6, wherein the synthetic HIV envelope protein comprises the amino acid sequence of residues 1-686 of SEQ ID NO: 19.

8. A vector comprising the nucleic acid of any one of claims 1-7, wherein the nucleic acid is operably linked to a promoter sequence.

9. The vector of claim 8, being a viral vector, preferably an adenovirus vector.

10. The vector of claim 9, wherein the adenovirus vector is a human adenovirus serotype 26 (Ad26) vector.

11. An isolated cell comprising the vector of any one of claims 8-10.

12. A composition comprising an immunogenically effective amount of the vector of any one of claims 8-10, and a carrier.

13. A vaccine combination, comprising:

(i) a first composition comprising an immunogenically effective amount of an adenovirus vector, preferably an adenovirus 26 vector, encoding a synthetic HIV envelope protein having the amino acid sequence of SEQ ID NO: 8, preferably SEQ ID NO: 18;
(ii) a second composition comprising an immunogenically effective amount of a second adenovirus vector, preferably a second adenovirus 26 vector, encoding an HIV antigenic polypeptide comprising the amino acid sequence of SEQ ID NO: 5; and optionally

(iii) at least one additional composition comprising an immunogenically effective amount of at least one selected from the group consisting of
(iiia) a vector encoding at least one antigenic polypeptide having the amino acid sequence selected from the group consisting of SEQ ID NOs: 1-4, 28 and 29, and
(iiib) a polypeptide comprising an immunogenically effective amount of an isolated HIV antigenic polypeptide having residues 30-708 of the amino acid sequence of SEQ ID NO: 7, or residues 30-724 of SEQ ID NO: 36,

wherein the first composition, second composition and additional composition are present in the same composition or in one or more different compositions.

14. The composition of claim 12 or the vaccine combination of claim 13 for use in inducing an immune response against a human immunodeficiency virus (HIV) in a subject in need thereof.

15. A synthetic HIV envelope protein comprising the amino acid sequence of SEQ ID NO:8 or SEQ ID NO:8 having one or more mutations selected from the group consisting of (i) I529P, (ii) K480E, and (iii) a combination of EK479-480RRRR, I529P, A471C and T575C, preferably, comprising (i) SEQ ID NO:8 having a combination of mutations EK479-480RRRR, I529P, A471C and T575C; (ii) amino acid residues 30-704 of SEQ ID NO: 18, or (iii) amino acid residues 30-686 of SEQ ID NO: 19.