## CLAIMS

1. A polynucleotide molecule, comprising at least a coding sequence of an HPV antigen polypeptide, the antigen polypeptide sequentially from the N-terminus to the C-terminus comprises at least:
1) an amino acid sequence B and an amino acid sequence A; or
2) an amino acid sequence C, an amino acid sequence B, and an amino acid sequence A;
wherein,
the amino acid sequence A sequentially from the N-terminus to the C-terminus comprises at least SEQ ID NOs: 1-4, and each of the amino acid sequences represented by the SEQ ID NOs is connected directly and sequentially or by a linker sequentially;
the amino acid sequence B sequentially from the N-terminus to the C-terminus comprises at least SEQ ID NOs: 5-8, and each of the amino acid sequences represented by the SEQ ID NOs is connected directly and sequentially or by a linker sequentially; and
the amino acid sequence C comprises an HPV E2 antigen sequence;
wherein optionally, the HPV E2 antigen sequence is SEQ ID NO: 9.

2. The polynucleotide molecule according to claim 1, wherein the HPV antigen polypeptide comprises SEQ ID NO: 13 or SEQ ID NO: 16, or an amino acid sequence having at least 99%, 98%, 97%, 96%, 95%, 90%, 85%, or 80% sequence identity with SEQ ID NO: 13 or SEQ ID NO: 16.

3. The polynucleotide molecule according to any one of claims 1-2, further comprising an encoding sequence of an immune stimulating factor Flt3L or a functional domain thereof at the 5’ end of the coding sequence of the HPV antigen polypeptide; wherein optionally, the polypeptide sequence of the immune stimulating factor Flt3L comprises at least an amino acid sequence represented by SEQ ID NO: 10, or an amino acid sequence having at least 99%, 98%, 97%, 96%, 95%, 90%, 85%, or 80% sequence identity with SEQ ID NO: 10.

4. The polynucleotide molecule according to any one of claims 1-3, further comprising a coding sequence of a secretory signal peptide tPA-SP; wherein optionally, the secretory signal

peptide comprises the amino acid sequence represented by SEQ ID NO: 11, or an amino acid sequence having at least 99%, 98%, 97%, 96%, 95%, 90%, 85%, or 80% sequence identity with SEQ ID NO: 11.

5. The polynucleotide molecule according to claim 4, comprising the coding sequences of the secretory signal peptide, immune stimulating factor, and HPV antigen polypeptide which are sequentially connected from the 5’ end to the 3' end.

6. The polynucleotide molecule according to claim 5, wherein the amino acid sequence of the sequentially connected secretory signal peptide, immune stimulating factor, and HPV antigen polypeptide comprises SEQ ID NO: 18 or SEQ ID NO: 21, or comprises an amino acid sequence having at least 99%, 98%, 97%, 96%, 95%, 90%, 85%, or 80% sequence identity with SEQ ID NO: 18 or SEQ ID NO: 21.

7. The polynucleotide molecule according to any one of claims 1-6, comprising any one polynucleotide sequence selected from SEQ ID NO: 40-42, 46, 48-50, and 54, or consisting of any one polynucleotide sequence selected from SEQ ID NO: 40-42, 46, 48-50, and 54, or encoded by any one polynucleotide sequence selected from SEQ ID NO: 40-42, 46, 48-50, and 54.

8. The polynucleotide molecule according to any one of claims 1-7, wherein the polynucleotide molecule is an mRNA comprising a 5’ cap structure, a 5'UTR structure, a 3'UTR structure and/or a poly(A) tail;
wherein optionally, the 5'UTR structure comprises at least a polynucleotide sequence represented by SEQ ID NO: 22 or SEQ ID NO: 25, or a polynucleotide sequence having at least 99%, 98%, 97%, 96%, 95%, 90%, 85%, or 80% sequence identity with SEQ ID NO: 22 or SEQ ID NO: 25;
the 3'UTR structure comprises at least a polynucleotide sequence represented by SEQ ID NO: 23 or SEQ ID NO: 26, or a polynucleotide sequence having at least 99%, 98%, 97%, 96%, 95%, 90%, 85%, or 80% sequence identity with SEQ ID NO: 23 or SEQ ID NO: 26;
the 5’ cap structure is m7G(5’)ppp(5’)(2’-OMeA)pG;

the poly(A) tail sequence comprises at least 50, at least 60, or at least 100 of A nucleotides; preferably the poly(A) tail comprises at least a polynucleotide sequence shown as SEQ ID NO: 24 or SEQ ID NO: 27, or a polynucleotide sequence having at least 99%, 98%, 97%, 96%, 95%, 90%, 85%, or 80% sequence identity with SEQ ID NO: 24 or SEQ ID NO: 27.

9. The polynucleotide molecule according to claim 8, wherein part or all of the uridines in the mRNA molecule are chemically modified uridines; wherein optionally, the chemically modified uridines are pseudouridines or N1-methyl-pseudouridines.

10. A fusion polypeptide, which is encoded by the polynucleotide molecule according to any one of claims 1-9, wherein optionally the fusion polypeptide comprises an amino acid sequence shown as SEQ ID NO: 13, SEQ ID NO: 16, SEQ ID NO: 18, or SEQ ID NO: 21, or an amino acid sequence having at least 99%, 98%, 97%, 96%, 95%, 90%, 85%, or 80% sequence identity with the amino acid sequence represented by SEQ ID NO: 13, SEQ ID NO: 16, SEQ ID NO: 18, or SEQ ID NO: 21.

11. A delivery system, comprising the polynucleotide molecule according to any one of claims 1-9, wherein optionally the delivery system is a lipid nanoparticle (LNP), and the LNP comprises ionizable lipid, phospholipid, cholesterol, and polyethylene glycol (PEG)-lipid.

12. A cell, comprising the polynucleotide molecule according to any one of claims 1-9 or the fusion polypeptide according to claim 10.

13. A pharmaceutical composition, comprising the polynucleotide molecule according to any one of claims 1-9, the fusion polypeptide according to claim 10, the delivery system according to claim 11, or the cell according to claim 12.

14. The pharmaceutical composition according to claim 13, further comprising an immune stimulating factor and/or an adjuvant, or an nucleic acid molecule encoding the immune stimulating factor and/or adjuvant; wherein the immune stimulating factor is any one or more selected from the group consisting of: IL-3, IL-7, IL-2, IL-4, IL-5, IL-12, IL-13, Flt3L, G-CSF,

M-CSF, GM-CSF, EPO, TPO, SCF, IFNα-2α, IFNα-2β, Pre IFNα-2β, MIP-α, STING, HSP70, and an immune checkpoint inhibitor; wherein optionally, the immune checkpoint inhibitor is a PD-1 inhibitor or a PD-L1 inhibitor.

15. The polynucleotide molecule according to any one of claims 1-9, the fusion polypeptide according to claim 10, the delivery system according to claim 11, the cell according to claim 12, or the pharmaceutical composition according to any one of claims 13-14, for use in the treatment or prevention of HPV infection or a HPV infection related disease.

16. Use of the polynucleotide molecule according to any one of claims 1-9, the fusion polypeptide according to claim 10, the delivery system according to claim 11, the cell according to claim 12, or the pharmaceutical composition according to any one of claims 13-14 in the preparation of a medicament for the treatment or prevention of a HPV infection or a HPV infection related disease.

17. The use according to claim 16, wherein the HPV infection related disease is cervical cancer.

18. The use according to claim 17, wherein the medicament is to be administered by intratumoral injection, peri-lymph nodes injection, or intramuscular injection.

19. The use according to any one of claims 16 to 18, wherein an immune stimulating factor or a nucleic acid molecule encoding the immune stimulating factor, chemotherapy, radiation therapy, and/or targeted therapy is to be further administered to an individual;
wherein the immune stimulating factor is one or more selected from the group consisting of: IL-3, IL-7, IL-2, IL-4, IL-5, IL-12, IL-13, Fl3L, G-CSF, M-CSF, GM-CSF, EPO, TPO, SCF, IFNα-2α, IFNα-2β, Pre IFNα-2β, MIP-α, STING, HSP70, and an immune checkpoint inhibitor;
wherein optionally, the immune checkpoint inhibitor is a PD-1 inhibitor, or a PD-L1 inhibitor.