Claims

1. A recombinant modified Vaccinia virus Ankara (MVA) comprising:

(a) a first nucleic acid encoding an endogenous retroviral (ERV) protein;

(b) a second nucleic acid encoding a 4-1BB ligand (4-1BBL); and

(c) at least one further nucleic acid encoding a TAA.

2. The recombinant MVA according to claim 1, further comprising:

(d) a nucleic acid encoding a CD40 ligand (CD40L).

3. The recombinant MVA according to claim 1, comprising two, three, four, five, six, or more nucleic acids each encoding a different TAA.

4. The recombinant MVA according to any of claims 1 to 3, wherein the TAA is selected from the group consisting of another endogenous retroviral (ERV) protein, an endogenous retroviral (ERV) peptide, carcinoembryonic antigen (CEA), mucin 1 cell surface associated (MUC-1), prostatic acid phosphatase (PAP), prostate specific antigen (PSA), human epidermal growth factor receptor 2 (HER-2), survivin, tyrosine related protein 1 (TRP1), tyrosine related protein 1 (TRP2), Brachyury, p15, AH1A5, folate receptor alpha (FOLR1), preferentially expressed antigen of melanoma (PRAME), and MEL; and combinations thereof.

5. The recombinant MVA according to claim 4, wherein the ERV protein is from the human endogenous retroviral K (HERV-K) family, preferably is selected from a HERV-K envelope (HERV-K-env) protein and a HERV-K gag protein.

6. The recombinant MVA according to claim 5, wherein the ERV peptide is from the human endogenous retroviral K (HERV-K) family, preferably is selected from a pseudogene of a HERV-K envelope protein (HERV-K-env/MEL).

7. A recombinant modified Vaccinia virus Ankara (MVA) comprising:

(i) a nucleic acid encoding HERV-K-env/MEL;

(ii) a nucleic acid encoding HERV-K gag;

(iii) a nucleic acid encoding FOLR1 and PRAME, preferably expressed as a fusion protein; and

(iv) a nucleic acid encoding 4-1BBL.

8. The recombinant MVA according to claim 7 further comprising:

(v) a nucleic acid encoding CD40L.

9. The recombinant MVA according to any of claims 1 to 3, 7, or 8, wherein the recombinant MVA is derived from MVA-BN.

10. A pharmaceutical preparation or composition comprising a recombinant MVA according to claim 9.

11. The pharmaceutical preparation or composition according to claim 10 which is adapted to intratumoral and/or intravenous administration, preferably intratumoral administration.

12. A recombinant MVA according to any of claims 1 to 3, 7 or 8 for use as a medicament or a vaccine for use in the treatment of cancer.

13. A recombinant MVA according to any of claims 1 to 3, 7 or 8 for use in the treatment of cancer, preferably melanoma, breast cancer, colon cancer, or ovarian cancer.

14. A recombinant MVA according to any of claims 1 to 3, 7 or 8 for use in enhancing an inflammatory response in a cancerous tumor, reducing the size of a cancerous tumor, retarding or arresting the growth of a cancerous tumor and/or increasing the overall survival of a subject, preferably a human.

15. The recombinant MVA for use according to claim 12, wherein the recombinant MVA is administered intratumorally and/or intravenously, preferably intratumorally.

16. The recombinant MVA for use according to claim 12, wherein the recombinant MVA is used in combination with a TAA specific antibody.

17. The recombinant MVA for use according to claim 12, wherein the recombinant MVA is used in combination with either an immune checkpoint molecule antagonist or agonist.