WHAT IS CLAIMED IS:

1. A self-replicating RNA vector based on an alphavirus in which sequence encoding viral structural proteins is deleted and replaced with sequence encoding at least one immortalization protein, wherein the at least one immortalization protein comprises human telomerase (hTert).

2. The self-replicating RNA vector of claim 1, wherein the at least one immortalization protein further comprises human papillomavirus type 16 E6 protein (HPV16 E6), human papillomavirus type 16 E7 protein (HPV16 E7), simian vacuolating virus 40 large T antigen (SV40 LT), cMyc-T58A protein, homeobox HoxB8 protein, homeobox HoxA9 protein, homeobox HoxA10 protein, adenovirus E1A protein, adenovirus E1B protein, cyclin-dependent kinase 4 (CDK4), Ras V12 protein, polycomb complex protein Bmi1, hsp70 member 9 (HSPA9), or combination thereof.

3. The self-replicating RNA vector of claim 1, wherein the at least one immortalization protein further comprises HPV16 E6 and HPV16 E7 (HPV16 E6-E7), SV40 LT, cMyc-T58A, or combination thereof.

4. The self-replicating RNA vector of any one of claims 1 to 3, wherein the alphavirus is Aura virus, Babanki virus, Barmah Forest virus, Bebaru virus, Buggy Creek virus, Chikungunya virus, Eastern equine encephalitis virus, Everglades virus, Fort Morgan virus, Getah virus, Highlands J virus, Kyzylagach virus, Mayaro virus, Middelburg virus, Mucambo virus, Ndumu virus Pixuna virus, O'nyong-nyong virus, Ross River virus, Sagiyama virus, Semliki Forest virus, Sindbis virus, Una virus, Venezuelan equine encephalitis (VEE) virus, Western equine encephalitis virus, or Whataroa virus.

5. The self-replicating RNA vector of claim 4, wherein the alphavirus is Semliki Forest virus, Sindbis virus, or VEE.

6. The self-replicating RNA vector of claims 4 or 5, wherein the alphavirus is VEE.

7. The self-replicating RNA vector of any one of claims 1 to 6, wherein sequence encoding non-structural replication complex proteins of the alphavirus comprises at least one nucleotide change relative to wild-type alphavirus.

8. The self-replicating RNA vector of any one of claims 1 to 7, wherein the vector further comprises sequence encoding at least one fluorescent protein.

9. The self-replicating RNA vector of any one of claims 1 to 8, wherein the vector further comprises sequence encoding at least one selectable marker.

10. The self-replicating RNA vector of any one of claims 1 to 9, wherein the vector further comprises sequence encoding vaccinia virus E3L protein.

11. The self-replicating RNA vector of any one of claims 1 to 10, wherein the RNA vector is based on VEE virus and comprises sequence encoding hTert and optionally HPV16 E6-E7, SV40 LT, and/or cMyc-T58A.

12. The self-replicating RNA vector of any one of claims 1 to 10, wherein the RNA vector is based on VEE virus and comprises sequence encoding hTert and HPV16 E6-E7.

13. The self-replicating RNA vector of any one of claims 1 to 10, wherein the RNA vector is based on VEE virus and comprises sequence encoding hTert and SV40 LT.

14. The self-replicating RNA vector of any one of claims 1 to 10, wherein the RNA vector is based on VEE virus and comprises sequence encoding hTert and cMyc-T58A.

15. A primary cell comprising the self-replicating RNA vector of any one of claims 1 to 14.

16. The primary cell of claim 15, further comprising p53 siRNA and/or RB siRNA.

17. The primary cell of claims 15 or 16, further comprising vaccinia virus E3L protein, vaccina virus B18R protein, or a combination thereof.

18. The primary cell of any one of claims 15 to 17, which is of human origin.

19. The primary cell of any one of claims 15 to 18, which is chosen from adipocytes, astrocytes, blood cells, chondrocytes, endothelial cells, epithelial cells, fibroblasts, hair cells, hepatocytes, keratinocytes, melanocyte, myocytes, neurons, osteoblasts, skeletal muscle cells, smooth muscle cells, stem cells, or synoviocytes.

20. A plasmid vector encoding the self-replicating RNA vector as specified in any one of claims 1 to 14.

21. The plasmid vector of claim 20, further comprising a T7 or SP6 promoter for *in vitro* transcription.

22. A method for extending lifespan in a population of primary cells, the method comprising introducing into the population of primary cells the self-replicating RNA vector as specified in any one of claims 1 to 14, wherein upon expression of the at least one immortalization protein the population of primary cells has an increased lifespan as compared to a population of control primary cells not transfected with the self-replicating RNA vector and/or not exposed to the at least one immortalization protein.

23. The method of claim 22, wherein the population of primary cells undergoes additional cell divisions as compared to the population of control primary cells.

24. The method of claims 22 or 23, further comprising introducing vaccinia virus E3L protein, vaccinia virus B18R protein, or a combination thereof into the population of primary cells.

25. The method of any one of claims 22 to 24, further comprising introducing p53 siRNA and/or RB siRNA into the population of primary cells.

26. The method of any one of claims 22 to 25, wherein the population of primary cells is of human origin.

27. The method of any one of claims 22 to 26, wherein the population of primary cells is chosen from adipocytes, astrocytes, blood cells, chondrocytes, endothelial cells, epithelial cells, fibroblasts, hair cells, hepatocytes, keratinocytes, melanocyte, myocytes, neurons, osteoblasts, skeletal muscle cells, smooth muscle cells, stem cells, or synoviocytes.

28. A method for expanding a population of primary cells, the method comprising:

    (a) introducing into the population of primary cells the self-replicating RNA vector as specified in any one of claims 1 to 14, wherein upon expression of the at least one immortalization protein the population of primary cells has an increased lifespan as compared to a population of control primary cells not transfected with the self-replicating RNA vector and/or not exposed to the at least one immortalization protein; and

    (b) removing the self-replicating RNA vector from the population of primary cells by dilution and/or via an interferon innate immune response once the population of primary cells reaches an appropriate cell quantity.

29. The method of claim 28, wherein at step (a) the population of primary cells undergoes additional cell divisions as compared to the population of control primary cells.

30. The method of claims 28 or 29, wherein step (a) further comprises introducing vaccinia virus E3L protein, vaccinia virus B18R protein, or a combination thereof into the population of primary cells.

31. The method of any one of claims 28 to 30, wherein step (a) further comprises introducing p53 siRNA and/or RB siRNA into the population of primary cells.

32. The method of any one of claims 28 to 31, wherein step (b) comprises removing the self-replicating RNA vector by dilution.

33. The method of any one of claims 28 to 32, wherein step (b) comprises removing the self-replicating RNA vector via an interferon immune response.

34. The method of any one of claims 28 to 33, wherein the population of primary cells is of human origin.

35. The method of any one of claims 28 to 34, wherein the population of primary cells is chosen from adipocytes, astrocytes, blood cells, chondrocytes, endothelial cells, epithelial cells, fibroblasts, hair cells, hepatocytes, keratinocytes, melanocyte, myocytes, neurons, osteoblasts, skeletal muscle cells, smooth muscle cells, stem cells, or synoviocytes.