CLAIMS

1. A gene expression system comprising
(a) an alphavirus vector that comprises in a 5' to 3' orientation a bacteriophage promoter, a first capping sequence, an alphavirus replicon operatively linked to the bacteriophage promoter, a subgenomic promoter, a second capping sequence, and a gene of interest, and
(b) a protein that comprises an exogenous T7 RNA polymerase which transcribes the alphavirus replicon, wherein the exogenous T7 RNA polymerase is pre-bound to the alphavirus vector and co-delivered with the alphavirus vector into a cell, and wherein the gene of interest is expressed in the cytoplasm of the cell.

2. The gene expression system of claim 1, wherein the alphavirus replicon is from an alphavirus selected from the group consisting of Sindbis virus (SIN), Semliki Forest virus (SFV), and Venezuelan equine encephalitis virus (VEE).

3. The gene expression system of claim 1, wherein the alphavirus replicon is noncytopathic.

4. The gene expression system of claim 3, wherein the alphavirus replicon has one or more mutations in the nsp2 subunit.

5. The gene expression system of claim 1, wherein both the first and second capping sequences are the internal ribosome entry site sequence from encephalomyocarditis virus.

6. The gene expression system of claim 1, wherein the gene of interest encodes for an antigen.

7. The gene expression system of claim 6, wherein the antigen is selected from the group consisting of a viral antigen, a bacterial antigen, and a cancer antigen.

8. The gene expression system of claim 1, wherein the subgenomic promoter is from analphavirus.

9. The gene expression system of claim 1, wherein the bacteriophage promoter is T7 promoter.

10. A method for producing an induced pluripotent stem cell, comprising:
(a) introducing into a mammalian somatic cell a gene expression system to produce a transduced somatic cell, wherein the gene expression system comprises

(i) a vector that comprises in a 5' to 3' orientation a bacteriophage promoter, a first capping sequence, an alphavirus replicon operatively linked to the bacteriophage promoter, a subgenomic promoter, a second capping sequence, and a sequence that encodes one or more mammalian reprogramming factor, and

(ii) a protein that comprises an exogenous T7 RNA polymerase pre-bound to the alphavirus vector and co-delivered with the alphavirus vector, and

(b) culturing the transduced somatic cell in the presence of a cytokine selected from a basic fibroblast growth factor (bFGF) or a stem cell factor (SCF) on a fibroblast feeder layer or an extracellular matrix under a condition for maintaining pluripotency and self-renewal.

11. The method of claim 10, wherein the sequence encodes reprogramming factors Oct 3/4, Sox2, Klf4, and c-Myc, wherein the four reprogramming factors are expressed simultaneously.

12. The method of claim 10 or 11, wherein culturing the transduced somatic cell is carried out in the presence of a substance for improving the efficiency of establishing the pluripotent stem cell.

13. The method of claim 12, wherein the substance for improving the efficiency of establishing the pluripotent stem cell is selected from the group consisting of a histone deacetylase (HDAC) inhibitor, a histone methyltransferase (G9a) inhibitor, and a DNA methylase (Dnmt) inhibitor.

14. A vaccine comprising the gene expression system of any one of claims 1-9, wherein the gene of interest encodes an antigen.

15. The vaccine of claim 14, wherein the antigen is selected from the group consisting of a viral antigen, a bacterial antigen, and a cancer antigen.

16. The vaccine of claim 15, wherein the antigen is influenza hemagglutinin (HA).

17. A therapeutic composition, comprising a dendritic cell transfected with the gene expression system of any one of claims 1-9, wherein the gene of interest encodes an antigen capable of being displayed on the surface of the dendritic cell, wherein the therapeutic composition is capable of producing an immune response in a subject.

18. The therapeutic composition of claim 17, wherein the antigen is a tumor antigen.

19. The therapeutic composition of claim 18, wherein the tumor antigen is one or more proteins selected from the group consisting of tyrosinase, tyrosine-related protein 1 (TRP-1), and tyrosine-related protein 2 (TRP-2).

20. Use of a therapeutic composition comprising a dendritic cell transfected with the gene expression system of any one of claims 1-9 in the manufacture of a medicament for the treatment of cancer, wherein the gene of interest encodes an antigen capable of being displayed on the surface of the dendritic cell, wherein the antigen is a tumor antigen.

21. The use of claim 20, wherein the cancer is melanoma, and the antigen is tyrosinase.

22. The use of claim 20, wherein the cancer is melanoma, and the antigen is tyrosine-relatedprotein 1 (TRP-1).

23. The use of claim 20, wherein the cancer is melanoma, and the antigen is tyrosine-relatedprotein 2 (TRP-2).

24. A therapeutic composition, for use in the treatment of cancer wherein the therapeutic composition comprises a dendritic cell transfected with the gene expression system of any one of claims 1-9, wherein the gene of interest encodes an antigen capable of being displayed on the surface of the dendritic cell, and wherein the antigen is a tumor antigen, and the composition is capable of producing an immune response in a subject.

25. The therapeutic composition of claim 24, wherein the cancer is melanoma, and the antigen is tyrosinase.

26. The therapeutic composition of claim 24, wherein the cancer is melanoma, and theantigen is tyrosine-related protein 1 (TRP-1).

27. The therapeutic composition of claim 24, wherein the cancer is melanoma, and

the antigen is tyrosine-related protein 2 (TRP-2).