CLAIMS

1. A method of reprogramming a non-pluripotent cell comprising:

introducing into the non-pluripotent cell (i) one or more polypeptides, or polynucleotides encoding the polypeptides, in which the one or more polypeptides is selected from the group consisting of OCT4, SOX2, NANOG, KLF, LIN28, C-MYC, ECAT1, UTF1, ESRRB, SV40LT; and (ii) one or more polypeptides, or polynucleotides encoding the polypeptides, in which the one or more polypeptides is selected from the group consisting of (ii) HESRG, CDH1, TDGF1, DPPA4, DNMT3B, ZIC3, and L1TD1, thereby reprogramming the non-pluripotent cell to produce a pluripotent cell.

2. A method according to Claim 1, in which the one or more polynucleotides are comprised in one or more constructs; in which each of the constructs comprises same or different number of a same polynucleotide and/or combination of polynucleotides; and in which the one of more constructs are introduced to the non-pluripotent cell by a vector.

3. A method according to Claim 2, in which the construct comprises at least one of the following:

(i) at least two OCT4 encoding polynucleotides;

(ii) at least one OCT4 encoding polynucleotide and at least one NANOG encoding polynucleotide;

(iii) at least one OCT4 encoding polynucleotide and at least one ESRRB encoding polynucleotide;

(iv) at least one ECAT1 encoding polynucleotide and at least one UTF1 encoding polynucleotide;

(v) at least one OCT4 encoding polynucleotide, at least one ESRRB encoding polynucleotide, and at least one NANOG encoding polynucleotide;

(vi) at least one of CDH1, ZIC3, and HESRG encoding polynucleotide;

(vii) at least one of L1TD1, DPPA4, and TDGF1 encoding polynucleotide; and

(viii) at least one DNMT3B encoding polynucleotide.

4. A method according to Claim 3, in which introducing into the non-pluripotent cell one or more polypeptides comprises:

(a) introducing at least one construct comprising at least one of the following:

(i) at least two OCT4 encoding polynucleotides;

(ii) at least one OCT4 encoding polynucleotide and at least one NANOG encoding polynucleotide;

(iii) at least one OCT4 encoding polynucleotide and at least one ESRRB encoding polynucleotide;

(iv) at least one ECAT1 encoding polynucleotide and at least one UTF1 encoding polynucleotide; or

(v) at least one OCT4 encoding polynucleotide, at least one ESRRB encoding polynucleotide, and at least one NANOG encoding polynucleotide; and

(b) introducing one or more additional construct comprising at least one of the following:

(i) at least one CDH1 encoding polynucleotide, at least one ZIC3 encoding polynucleotide, and at least one HESRG encoding polynucleotide;

(ii) at least one L1TD1 encoding polynucleotide, at least one DPPA4 encoding polynucleotide, and at least one TDGF1 encoding polynucleotide; or

(iii) at least one DNMT3B encoding polynucleotide.

5. A method according to Claim 4, in which the construct comprises at least one of the following:

(a) one or more polynucleotides encoding one or more of Nanog, ESRRB and OCT4;

(b) one or more polynucleotides encoding one or both of ECAT1 and UTF1;

(c) one or more polynucleotides encoding one or more of L1TD1, DPPA4 and TDGF1; or

(d) one or more polynucleotides encoding one or more of CDH1, ZIC3, and HESRG.

6. A method according to Claim 4, in which at least one construct comprises one or more polynucleotides encoding OCT4, and at least another construct comprises at least one of the following:

(a) polynucleotides encoding L1TD1, DPPA4 and TDGF1; and

(b) polynucleotides encoding CDH1, ZIC3, and HESRG.

7. A method according to Claim 2, in which the vector is a retrovirus, a Sendai virus, an adenovirus, an episome, a plasmid, a mini-circle, a vector system with expression cassette, or an mRNA.

8. A method according to Claim 7, in which the vector is a Sendai virus.

9. A method according to Claim 2, in which the one or more polynucleotides comprised in a construct are linked by at least one self-cleaving polypeptide.

10. A method according to Claim 1, in which the method has at least one of the following characteristics: (i) the non-pluripotent cell is reprogrammed to a pluripotent cell; (ii) the non-pluripotent cell is a somatic cell; or (iii) the one or more polypeptides excludes at least one of SOX2, KLF4 and c-Myc.

11. A composition for reprogramming a non-pluripotent cell to a pluripotent cell comprises (i) one or more polypeptides, or exogenous polynucleotides encoding the polypeptides, selected from the group consisting of OCT4, SOX2, NANOG, KLF, LIN28, C-MYC, ECAT1, UTF1, ESRRB, SV40LT; and (ii) one or more polypeptides, or exogenous polynucleotides encoding the polypeptides, selected from the group consisting of HESRG, CDH1, TDGF1, DPPA4, DNMT3B, ZIC3, and L1TD1.

12. A composition according to Claim 11, further comprising a population of non-pluripotent cells.

13. A composition according to Claim 11, in which the one or more exogenous polynucleotides are comprised in one or more constructs, and in which each of the construct comprises same or different number of a same polynucleotide and/or combination of polynucleotides.

14. A composition according to Claim 13, in which the one or more constructs comprise at least one of the following:

(i) one or more polynucleotides encoding one or more polypeptides selected from the group consisting of OCT4, ESRRB, ECAT1, UTF1, and NANOG; and one or more additional polynucleotides encoding one or more polypeptides selected from the group consisting of CDH1, ZIC3, HESRG, L1TD1, DPPA4, TDGF1, and DNMT3B;

(ii) at least two polynucleotides encoding OCT4;

(iii) at least one OCT4 encoding polynucleotide and at least one NANOG encoding polynucleotide;

(iv) at least one OCT4 encoding polynucleotide and at least one ESRRB encoding polynucleotide;

(v) at least one ECAT1 encoding polynucleotide and at least one UTF1 encoding polynucleotide; and/or

(vi) at least one OCT4 encoding polynucleotide, at least one ESRRB encoding polynucleotide, and at least one NANOG encoding polynucleotide,

in which the one or more constructs optionally do not comprise one or more of SOX2, KLF and c-Myc.

15. A composition according to Claim 13, in which the one or more constructs comprise at least one of the following:

(i) at least one CDH1 encoding polynucleotide, at least one ZIC3 encoding polynucleotide, and at least one HESRG encoding polynucleotide;

(ii) at least one L1TD1 encoding polynucleotide, at least one DPPA4 encoding polynucleotide, and at least one TDGF1 encoding polynucleotide; and/or

(iii) at least one DNMT3B encoding polynucleotide.

16. A composition according to Claim 13, in which the one or more constructs comprise at least one of the following :

(i) at least two OCT4 encoding polynucleotides;

(ii) at least one OCT4 encoding polynucleotide and at least one NANOG encoding polynucleotide;

(iii) at least one OCT4 encoding polynucleotide and at least one ESRRB encoding polynucleotide;

(iv) at least one ECAT1 encoding polynucleotide and at least one UTF1 encoding polynucleotide;

(v) at least one OCT4 encoding polynucleotide, at least one ESRRB encoding polynucleotide, and at least one NANOG encoding polynucleotide;

(vi) at least one of CDH1, ZIC3, and HESRG encoding polynucleotide;

(vii) at least one of L1TD1, DPPA4, and TDGF1 encoding polynucleotide; or

(viii) at least one DNMT3B encoding polynucleotide.

17. A composition according to Claim 13, in which the one or more constructs comprise at least one combination from group (a) and at least one combination from group (b):

(a):

(i) at least two OCT4 encoding polynucleotides;

(ii) at least one OCT4 encoding polynucleotide and at least one NANOG encoding polynucleotide;

(iii) at least one OCT4 encoding polynucleotide and at least one ESRRB encoding polynucleotide;

(iv) at least one ECAT1 encoding polynucleotide and at least one UTF1 encoding polynucleotide; or

(v) at least one OCT4 encoding polynucleotide, at least one ESRRB encoding polynucleotide, and at least one NANOG encoding polynucleotide; and,

(b):

(i) at least one CDH1 encoding polynucleotide, at least one ZIC3 encoding polynucleotide, and at least one HESRG encoding polynucleotide;

(ii) at least one L1TD1 encoding polynucleotide, at least one DPPA4 encoding polynucleotide, and at least one TDGF1 encoding polynucleotide; or

(iii) at least one DNMT3B encoding polynucleotide.

18. A composition according to Claim 12, in which the non-pluripotent cell comprises at least one of the following combinations:

(a) one or more Nanog, ESRRB and OCT4 encoding polynucleotides;

(b) one or more ECAT1 and UTF1 encoding polynucleotides;

(c) one or more L1TD1, DPPA4 and TDGF1 encoding polynucleotides; or

(d) one or more CDH1, ZIC3, and HESRG encoding polynucleotides.

19. A composition according to Claim 13, in which the one or more constructs are capable of being introduced to the non-pluripotent cell by retrovirus, Sendai virus, adenovirus, episome, plasmid, mini-circle, or mRNA.

20. A method of reprogramming a non-pluripotent cell comprising:

(a) introducing into the non-pluripotent cell one or more polynucleotides encoding OCT4, and optionally one or more of KLF, Sox2, Myc, Nanog, and ESRRB; and

(b) introducing into the non-pluripotent cell one or more polynucleotide encoding at least one of ECAT1, UTF1, L1TD1, DPPA4, TDGF1, CDH1, ZIC3, and HESRG;

thereby obtaining a pluripotent cell.

21. A method according to Claim 20, in which the one or more polynucleotides of (a) and (b) are comprised in one or more constructs; and in which the constructs comprise same or different number of a same polynucleotide and/or combination of polynucleotides.

22. A method according to Claim 21, in which one or more constructs comprise at least one of the following:

(a) one or more Nanog, ESRRB and OCT4 encoding polynucleotides;

(b) one or more ECAT1 and UTF1 encoding polynucleotides;

(c) one or more L1TD1, DPPA4 and TDGF1 encoding polynucleotides; or

(d) one or more CDH1, ZIC3, and HESRG encoding polynucleotides.

23. A method according to Claim 21, in which at least one construct comprises at least two polynucleotides encoding OCT4.

24. A method according to Claim 21, in which the one or more constructs are introduced to the non-pluripotent cells by retrovirus, Sendai virus, adenovirus, episome, plasmid, mini-circle, or mRNA.

25. A method according to Claim 24, in which the vector construct is carried by a Sendai virus.

26. A method of reprogramming a non-pluripotent cell using Sendai virus comprising:

(a) introducing into the non-pluripotent cell one or more polynucleotides encoding OCT4, and optionally one or more of KLF, Sox2, Myc, Nanog, and ESRRB; and

(b) introducing into the non-pluripotent cell one or more polynucleotide encoding at least one of ECAT1, UTF1, L1TD1, DPPA4, TDGF1, CDH1, ZIC3, and HESRG;

thereby obtaining a pluripotent cell.

27. A method according to Claim 26, in which the one or more polynucleotides of (a) and (b) are introduced by one or more vectors; and in which the one or more polynucleotides encode same or different polypeptides.

28. A method according to Claim 27, in which one or more of the vectors comprises a construct comprising:

(a) one or more Nanog, ESRRB and OCT4 encoding polynucleotides;

(b) one or more ECAT1 and UTF1 encoding polynucleotides;

(c) one or more L1TD1, DPPA4 and TDGF1 encoding polynucleotides; or

(d) one or more of CDH1, ZIC3, and HESRG encoding polynucleotides.

29. A method according to Claim 26, in which the one or more polynucleotides are introduced via a vector comprising one or more polynucleotides encoding OCT4, and at least one of:

(a) a vector comprising polynucleotides encoding Nanog, ESRRB and OCT4;

(b) a vector comprising polynucleotides encoding ECAT1 and UTF1;

(c) a vector comprising polynucleotides encoding L1TD1, DPPA4 and TDGF1; and

(d) a vector comprising polynucleotides encoding CDH1, ZIC3, and HESRG;

in which the vectors are carried by Sendai virus.

30. A method of reprogramming a non-pluripotent cell using Sendai virus comprising:

(a) introducing into the non-pluripotent cell a polynucleotide encoding OCT4, and optionally one or more of KLF, Sox2, Myc, Nanog, and ESRRB; and

(b) introducing into the non-pluripotent cell one of the constructs comprising

(i) polynucleotides encoding one or both of ECAT1 and UTF1;

(ii) polynucleotides encoding one or more of L1TD1, DPPA4 and TDGF1; or

(iii) polynucleotides encoding one or more of CDH1, ZIC3, and HESRG.

thereby obtaining a pluripotent cell.

31. A method according to Claim 30, in which the one or more polynucleotides are introduced via a vector comprising one or more polynucleotides encoding OCT4, and at least one of:

(a) a vector comprising polynucleotides encoding Nanog, ESRRB and OCT4;

(b) a vector comprising polynucleotides encoding ECAT1 and UTF1;

(c) a vector comprising polynucleotides encoding L1TD1, DPPA4 and TDGF1; and

(d) a vector comprising polynucleotides encoding CDH1, ZIC3, and HESRG;

in which the vectors are carried by Sendai virus.