[0005] As such, there is a need to identify a marker of totipotency that allows a maximum degree of cellular plasticity to be achieved and maintained, thereby providing more options for efficient reprogramming and potential therapeutic avenues.

SUMMARY

[0006] In one aspect, there is provided a method of determining a potency state of an embryonic stem cell (ESC) in culture comprising:

a) detecting the expression level of Nelfa in said embryonic stem cell;

b) correlating the expression level of Nelfa in said embryonic stem cell with that of a reference sample to determine the potency state of said embryonic stem cell.

[0006a] In one aspect, there is provided a method of selecting totipotent-like embryonic stem cells (ESCs) from a population of embryonic stem cells in culture, comprising:

a) providing a population of ESCs that displays a predetermined phenotype when Nelfa is expressed;

b) identifying the ESCs that express the predetermined phenotype; and

c) selecting the ESCs that express the predetermined phenotype.

[0007] In one aspect, there is provided a method of selecting totipotent-like embryonic stem cells (ESCs) from a population of embryonic stem cells in culture, comprising:

a) contacting said population of ESCs with an anti-Nelfa antigen binding protein;

b) selecting the ESCs binding to said anti-Nelfa antigen binding protein; and

c) optionally isolating the ESCs from said anti-Nelfa antigen binding protein

[0008] In one aspect, there is provided a method of inducing totipotency in an embryonic stem cell (ESC) in culture, comprising contacting and incubating said ESC with one or more of a metabolic regulator, a small molecule compound, a chemical, a virus, a nucleic acid or a polypeptide, to induce expression of Nelfa.

[0009] In one aspect, there is provided a use of a metabolic regulator, a nucleic acid, a small molecule, a chemical, a virus or a polypeptide for inducing totipotency in an embryonic stem cell.

[0010] In one aspect, there is provided a cell comprising an expression vector encoding Nelfa operably linked to a promoter.

[0011] In one aspect, there is provided a kit comprising at least one of a metabolic regulator, a nucleic acid, a polypeptide, a small molecule, a virus or a chemical when used in the method as described herein.

[0012] In one aspect, there is provided a method of improving the reprogramming efficiency of a somatic cell into an induced pluripotent stem cell (iPSC), comprising contacting and incubating said somatic cell with one or more of a metabolic regulator, a small molecule compound, a chemical, a nucleic acid, a virus or a polypeptide to induce expression of Nelfa.