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(54) Title: MARKERS OF TOTIPOTENCY AND METHODS OF USE

(57) Abstract: The present invention relates to methods of determining a potency state of an embryonic stem cell (ESC) in culture, comprising detecting the expression level of Negative Elongation Factor Complex Member A (Nelfa) in the embryonic stem cell, and 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. The present invention also provides methods of selecting totipotent-like embryonic stem cells (ESCs) from a population of embryonic stem cells in culture using an anti-Nelfa antigen binding protein. Methods of inducing totipotency in an embryonic stem cell in culture, methods of improving the reprogramming efficiency of a somatic cell into an induced pluripotent stem cell (iPSC) and methods of reprogramming a somatic cell into a totipotent stem cell by inducing Nelfa expression are also provided. Cells comprising an expression vector encoding Nelfa as well as kits to be used in the methods of the invention are also provided.