

Researchers identify a new gene that is essential for nuclear reprogramming

June 5 2013

Researchers are still fascinated by the idea of the possibility of reprogramming the cells of any tissue, turning them into cells with the capacity to differentiate into cells of a completely different type—pluripotent cells—and they are still striving to understand how it happens.

A group from the Spanish National Cancer Research Centre (CNIO), headed by researcher Ralph P. Schneider, from the Telomeres and Telomerase Group led by María A. Blasco, publishes this week an article in *Nature Communications* on the discovery of a new gene called TRF1 that is essential for nuclear reprogramming.

It is also known that TRF1 is indispensable for protecting telomeres, the ends of chromosomes. Existing evidence suggests that the length of telomeres and pluripotency—the capacity of a cell to differentiate into multiple cell types—are related. Pluripotent cells, for example, have very long telomeres—a previous finding at CNIO—but until now no [protective protein](#) for the telomeres had been found that was essential for pluripotency.

To investigate the connection between telomeres and pluripotency, researchers generated a 'reporter' mouse: they linked together the TRF1 gene and the gene coding for a [green fluorescent protein](#) and created a lineage of mice carrying this new genetic baggage. In these animals, the green fluorescent protein acts as a label to show expression of TRF1.

They discovered that TRF1 is an excellent marker for stem cells, both in [adult stem cells](#)—those that are found in tissues and the different organs of the body—and [embryonic stem cells](#). It is also the case with 'induced pluripotent' stem cells (iPS cells), which are [pluripotent cells](#) that come from artificially reprogrammed [specialised cells](#).

In the case of tissues, the authors write: "TRF1 distinguishes adult stem cells and is indispensable for their functioning". The discovery is useful for both identifying and eventually isolating the stem cell population in tissues, something that is important for the development of regenerative medicine. The cells in which TRF1 is expressed are also the most pluripotent.

In iPS cells, the same thing happens. The authors explain that: "The expression of TRF1 is an indicator of pluripotency. Those iPS cells that express the highest levels of TRF1 are also the most pluripotent. Furthermore, we demonstrate that [TRF1](#) is necessary for the induction and maintenance of pluripotency, inhibiting the triggering of DNA damage responses and apoptosis ('cell suicide')".

More information: TRF1 is a stem cell marker and is essential for the generation of induced pluripotent stem cells. Ralph P. Schneider, Ianire Garrobo, Miguel Foronda, Jose A. Palacios, Rosa M. Marión, Ignacio Flores, Sagrario Ortega, Maria A. Blasco. [doi: 10.1038/ncomms2946](https://doi.org/10.1038/ncomms2946)

Provided by Centro Nacional de Investigaciones Oncológicas (CNIO)

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