Stem cells in plants and animals behave surprisingly similarly

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A new study from Lund University in Sweden shows that the behaviour of stem cells in plants and animals is surprisingly similar. The researchers were able to produce mathematical equations that reveal very small differences in the behaviour of the proteins. The results can hopefully be used in stem cell research involving humans.

"The plant and animal kingdoms were separated through evolution more than 1.6 billion years ago. It is surprising that the interactions between the handful of key genes that control the fate of each stem cell are so similar in both cases", says Carsten Peterson, professor at the Faculty of Science at Lund University.

Carsten Peterson is one of the researchers behind the recent study on differences and similarities between animal and plant stem cells. With a background in theoretical physics, he and his colleagues have tackled the stem cells from a different perspective, which proved successful.

By formulating mathematical equations, the researchers have performed a detailed study of the proteins that are central to the stem cells in mammals and plants. The proteins are linked to the genes that control the stem cells. In particular, the researchers have studied how these proteins mutually affect one another through interaction as the cells evolve.

"Although the proteins in mammalian and plant stem cells are very different when studied separately, there are major similarities in the ways in which they interact, that is, how they strengthen or weaken each

other", says Carsten Peterson.

Stem cells are a hot topic in medical contexts, especially when it comes to cancer and autoimmune diseases. A stem cell is capable of evolving into several different types of cells and is thus a sort of mother cell to all of the body's specialised cell types. In animals, these specialised cells can never return to a stem cell state on their own. In plants, however, they can.

"Specialised cells of plants can return to being stem cells without external manipulation. In the plant world, there is a natural reprogramming process", says Carsten Peterson.

The mathematical equations show that very small differences are sufficient to explain why plant cells are so flexible while cells of mammals require artificial reprogramming to return to a stem cell state.

"When cells are influenced externally – artificially for animals or naturally for plants – the minor differences in interaction play a greater role, and the differences appear to be of greater significance", says Carsten Peterson.

He believes that a lot of work remains with regard to the efficiency of reprogramming of animal cells and therefore hopes that insights from the plant world can contribute. The current study provides clues about why it is so much easier to make a cell go back to being a stem cell in plants compared to mammals.

Reprogramming is a frequently used word in stem cell contexts today, ever since the Nobel Prize in Medicine and Physiology in 2012. One of the prize winners, Shinya Yamanaka, had demonstrated how to externally manipulate cells to return to an embryonic stem cell state by increasing the concentration of certain proteins. Turning back the clock

this way has enormous potential in clinical contexts. For example, on an individual basis, skin cells can be reprogrammed into embryonic stem cells, and be made into desired cell types by manipulating certain proteins. This process is known as regenerative medicine.

The study was recently published in the scientific journal *PLoS ONE*.

More information: Victor Olariu et al. Different reprogramming propensities in plants and mammals: Are small variations in the core network wirings responsible?, *PLOS ONE* (2017). DOI: 10.1371/journal.pone.0175251

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