Stem cells make similar decisions to humans

March 25 2015

Scientists at the University of Copenhagen have captured thousands of progenitor cells of the pancreas on video as they made decisions to divide and expand the organ or to specialize into the endocrine cells that regulate our blood sugar levels.

The study reveals that stem cells behave as people in a society, making individual choices but with enough interactions to bring them to their end-goal. The results could eventually lead to a better control over the production of insulin-producing endocrine cells for diabetes therapy.

The research is published in the scientific journal *PLOS Biology*.

Why one cell matters

In a joint collaboration between the University of Copenhagen and University of Cambridge, Professor Anne Grapin- Botton and a team of researchers including Assistant Professor Yung Hae Kim from DanStem Center focused on marking the progenitor cells of the embryonic pancreas, commonly referred to as 'mothers', and their 'daughters' in different fluorescent colours and then captured them on video to analyse how they make decisions.

Prior to this work, there were methods to predict how specific types of pancreas cells would evolve as the embryo develops. However, by looking at individual cells, the scientists found that even within one group of cells presumed to be of the same type, some will divide many times to make the organ bigger while others will become specialized and

will stop dividing.

The scientists witnessed interesting occurrences where the 'mother' of two 'daughters' made a decision and passed it on to the two 'daughters' who then acquired their specialization in synchrony. By observing enough cells, they were able to extract logic rules of decision-making, and with the help of Pau Rué, a mathematician from the University of Cambridge, they developed a mathematical model to make long-term predictions over multiple generations of cells.

Stem cell movies

'It is the first time we have made movies of a quality that is high enough to follow thousands of individual cells in this organ, for periods of time that are long enough for us to follow the slow decision process. The task seemed daunting and technically challenging, but fascinating", says Professor Grapin-Botton.

'With these movies we can see and quantify the dynamics of decisions in each cell in the context of the organ, in a way that will inspire the study of many other organs' says Assistant Professor Yung Hae Kim.

"To complement the movies, which are done on isolated pancreas, we developed a method to visualize the family tree of cells in the untouched organ. We initially focused on one generation but now we are also observing their descendants over multiple generations", Kim elaborates.

Next steps in diabetes therapy

The project has been focused on basic research and is highly theoretical, but it now provides tools to control whether a cell should expand or specialize into an endocrine cell on its way to producing insulin.

"It is a worldwide quest to produce such insulin-producing cells from stem cells, for their transplantation in diabetic patients. In the future, this could be done by increasing the probability of specialization or by pushing 'mother' cells to pass on the decision to specialize to their two daughters", Grapin-Botton concludes.

Provided by University of Copenhagen