A launchpad for stem cell research

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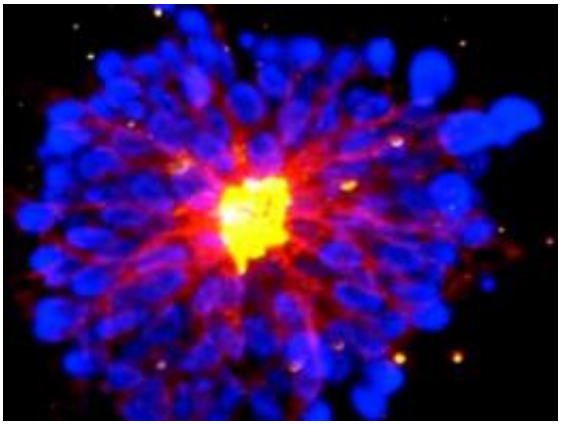

Neural stem cells organize radially towards a center to form a rosette. Credit: AFTAU

Stem cell research holds promise for improving the quality of human life -- especially embryonic stem cells, which can potentially develop into any tissue in the human body. However, basic scientific problems still remain unresolved -- but Tel Aviv University researchers are leading the way to inventive solutions.

"In order to use embryonic stem cells as a reliable and safe therapeutic tool, we have to find strategies to control their differentiation so we get exactly the type of cells we desire," says Dr. Yechiel Elkabetz of Tel Aviv University's Department of Cell and Developmental Biology, Sackler Faculty of Medicine. To do that, Dr. Elkabetz is building tools based on genetic engineering of human embryonic stem cells, which will

enable his research group to mark, isolate and track the growth of the very early nervous system stem cells (or neural stem cells) he recently identified. His current research is based on a series of articles he published in Genes *& Development* and *Nature Biotechnology*, while still at Sloan-Kettering Institute in the U.S.

Ideally, researchers would like to grow stem cells in order to replace those that are missing in patients, such as motor neurons in the spinal cord of victims of ALS, or dopamine neurons in the brains of Parkinson's disease sufferers. But because our understanding of how embryonic stem cells evolve in the Petri dish is only beginning to become clear, such cells may often "take on a life of their own" in the laboratory -- turning into tumors or cells they weren't expected to become.

Avoiding cellular "Jekylls and Hydes"

"We need to create a common platform -- or language -- of neural stem cells that researchers around the world can use," says Dr. Elkabetz. "Our new approach could set the stage for generating better defined neural stem cells, minimizing risks, and giving scientists the ultimate tool for developing new hypotheses and experiments."

While numerous kinds of neural stem cells potentially exist, Dr. Elkabetz has identified a specific neural stem cell type with the capacity to generate a broad range of nervous system cell types in response to appropriate developmental signals he defines.

The cells he identified — called rosette-stage NSCs (R-NSCs) — are different from other neural stem cells in the way they look, express genes, and in their special needs for growth. Based on his initial investigation and preliminary results, Dr. Elkabetz has been able to track their behavior, development and gene expression. With this information,

he is now developing tools to cultivate a range of optimal neural stem cells that can be instructed to become exactly what he wants them to, eliminating the risk of the "wild" runaway stem cells that can cause undesired effects.

A standard for the world

Dr. Elkabetz's research has allowed him to begin creating a protocol which may result in "freezing" the natural development of these cells for the first time ever, subsequently making them reproduce or self-propagate in large numbers, he says. This should allow the cells to develop into much more specific neural cell types, which in turn can be used to better understand the progression of nervous system disorders, discover new drugs, and replace defective cells in the brains of Parkinson's patients.

The implications of this research can provide the basis for a new kind of research tool, one that biologists around the world could use to define and grow the specific kinds of neural stem cells they require. Dr. Elkabetz hopes that it will become an international standard against which scientists can test new hypotheses and compare findings.

Provided by Tel Aviv University