Stem cell 'memory' can boost insulin levels

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Stem cells from early embryos can be coaxed into becoming a diverse array of specialized cells to revive and repair different areas of the body. Therapies based on these stem cells have long been contemplated for the treatment of diabetes, but have been held back by medical and ethical drawbacks.

Now researchers at Tel Aviv University are capitalizing on the "memories" of stem cells generated from adult cells to bring new hope to sufferers of juvenile or type 1 diabetes, which affects three million people in the United States.

Prof. Shimon Efrat of TAU's Department of Human Molecular Genetics and Biochemistry at the Sackler Faculty of Medicine, says these "induced pluripotent stem cells," derived from adult cells, represent an embryonic-like state. To some degree, he found, the cells retain a "memory" of what they once were – when created from pancreatic beta cells, the cells responsible for the production of insulin, these pluripotent cells prove more efficient than their embryonic counterparts in creating insulin-producing cells. Prof. Efrat says that this discovery promises to advance the development of cell replacement therapy for diabetics, possibly leading to an effective alternative to organ transplants.

His research, pursued with his PhD student Holger Russ and in collaboration with Prof. Nissim Benvenisty and Ori Bar-Nur from the Hebrew University, was recently published in the journal *Cell Stem Cell*.

Choosing adult over embryo

Diabetes is caused by the destruction of pancreatic beta cells, and the idea of using stem cells as a method of correcting this deficiency in diabetic patients is nothing new. Embryonic stem cells have been the preferred choice, since they can be easily grown in the lab in almost unlimited numbers, and can form any cell type in the body.

"But turning them into pancreatic beta cells is not an easy task," says Prof. Efrat, who notes that the process has remained inefficient despite a long struggle for improvement. Instead, he was inspired to test the efficiency of pluripotent stem cells that were derived from adult insulin-producing cells themselves.

"When generated from human beta cells, pluriponent stem cells maintain a 'memory' of their origins, in the proteins bound to their genes," says Prof. Efrat. As though receiving a prompt from their past life, the cells already have some understanding of their purpose, making them more efficient in generating beta cells.

Avoiding the transplant list

Today, diabetics can opt for an organ transplant to replace damaged pancreatic beta cells, but that is a long and arduous road, limited by a shortage of organ donors, and patients can wait years. Currently, Prof. Efrat notes, the ratio of donors to potential recipients is about one to 1,000. A better option is sorely needed, and stem cells present a viable hope for the future.

The discovery made by Prof. Efrat and his fellow researchers was licensed to a start-up company that promotes the research and development of technology of innovative treatments for diabetes.

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