New cells may help treat diabetes

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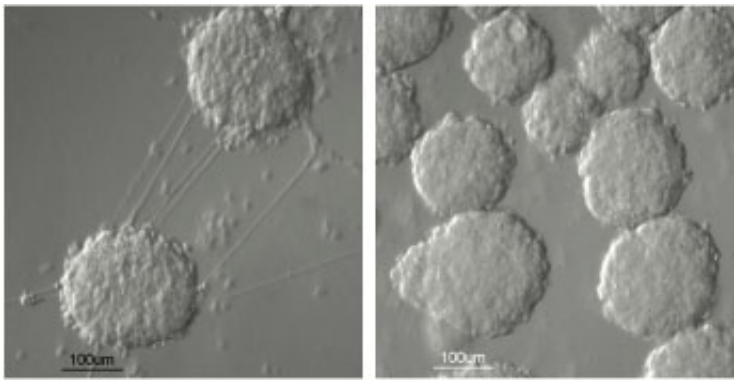

University of Iowa researchers reprogrammed human skin cells to create induced pluripotent stem cells, which were then differentiated in a stepwise fashion to create insulin-producing cells. When these cells were transplanted into diabetic mice, the cells secreted insulin and reduced the blood sugar levels of the mice to normal or near-normal levels. The image shows the insulin-producing cells (right) and precursor cells (left). Credit: University of Iowa

Starting from human skin cells, researchers at the University of Iowa have created human insulin-producing cells that respond to glucose and correct blood-sugar levels in diabetic mice. The findings may represent a first step toward developing patient-specific cell replacement therapy for type 1 diabetes.

In the new study, published Jan. 28 in the journal *PLOS ONE*, the UI team led by Nicholas Zavazava, MD, PhD, UI professor of internal medicine, reprogrammed human skin cells to create induced pluripotent stem (iPS) cells, which were then coaxed into forming insulin-producing

cells. When these cells were transplanted into diabetic mice, the cells secreted insulin and reduced the blood sugar levels of the mice to normal or near-normal levels.

Although the cells were not as effective as pancreatic cells in controlling blood sugar levels, Zavazava says that the results are an "encouraging first step" toward the goal of generating effective insulin-producing cells that can be used to potentially cure type 1 diabetes.

"This raises the possibility that we could treat patients with diabetes with their own cells," says Zavazava, who also is a member of the Fraternal Order of Eagles Diabetes Research Center at the UI. "That would be a major advance, which will accelerate treatment of diabetes."

In type 1 diabetes, a person's immune system attacks and destroys the pancreatic beta cells that produce insulin. Although it is possible to treat type 1 diabetes with pancreas transplants from deceased donors, the demand for transplants far exceeds the availability of donated organs.

Zavazava's team is among several groups aiming to create an alternative source of insulin-producing pancreatic cells that can be transplanted into patients with type 1 diabetes. However, the UI study is the first to use human iPS cells to create the insulin-producing cells. Creating these cells from a patient's own cells would not only eliminate the need to wait for a donor pancreas, but would also mean patients could receive transplants without needing to take immunosuppressive drugs. Using iPS cells rather than embryonic stem cells as a starting point also avoids the ethical concerns some people have with using embryonic stem cells.

In the mouse study, the insulin-producing cells were placed under the kidney capsule - a thin membrane layer that surrounds the kidney - where they developed into an organ-like structure with its own blood supply. This new "organ" secreted insulin and gradually corrected the

blood sugar levels in the diabetic mice over a period of several months. In addition, after the mice became normoglycemic, the glucose levels stayed steady.

By developing the cells in a stepwise fashion, the UI team was able to collect and use only those cells that would develop into pancreatic cells. This meant they were able to remove very immature (undifferentiated) cells that could form tumors. None of the mice developed tumors from the transplanted cells.

More information: *PLOS ONE*, dx.plos.org/10.1371/journal.pone.0116582

Provided by University of Iowa