Discovery of insulin production from stem cells showing hope to diabetes

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There is currently no cure for diabetes. People with type 1 diabetes must take insulin several times a day and test their blood glucose concentration three to four times a day throughout their entire lives. Frequent monitoring is important because patients who keep their blood glucose concentrations as close to normal as possible can significantly reduce many of the complications of diabetes, such as retinopathy (a disease of the small blood vessels of the eye which can lead to blindness) and heart disease, that tend to develop over time.

People with type 2 diabetes can often control their blood glucose concentrations through a combination of diet, exercise, and oral medication. Type 2 diabetes often progresses to the point where only insulin therapy will control blood glucose concentrations.

A polypeptide hormone secreted by the islets of Langerhans and functioning in the regulation of the metabolism of carbohydrates and fats, especially the conversion of glucose to glycogen, which lowers the blood glucose level. The liver acts as the energy center of the body, metabolizing food into glucose. The majority of nutrients and glucose are absorbed into the body while in the small intestine. The pancreas produces the hormone insulin which acts like a key to unlock cells and allow glucose (energy) absorption.

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Further research and development of this technique could lead to a renewable source of cells for treatment of people with diabetes, according to Emmanuel Baetge, of Novocell Inc., in San Diego, and colleagues, who published their work online in the current issue of Nature Biotechnology.

Type 1 and some forms of type 2 diabetes involve the loss of pancreatic beta cells, which regulate blood glucose (sugar) levels by releasing insulin, according to background information in a news release about the study.

In previous work, Baetge and the team were able to coax human ES cells part of the way toward becoming beta cells, but not far enough for them to carry out the key function of mature beta cells, which is the release of insulin in response to glucose.

In this new study, the researchers transplanted immature beta cells derived from human ES cells into mice whose beta cells had been destroyed by chemical treatment. After one to three months, the transplanted cells developed into glucose-responsive, insulin-secreting cells and helped control blood glucose levels in the mice.

Previous research demonstrated that transplantation of pancreatic beta cells (within islets) can help control diabetes in humans. But the therapy relies on cells from donor pancreases, meaning that the supply of such cells is limited. That's why scientists are trying to develop alternative sources of beta cells, such as those derived from human ES cells.

In the early 1970s, biochemists at Stanford University showed that genetic traits could indeed be transferred from one organism to another. The methods used in rDNA technology are fairly simple. He told; "We take, for example, the sentence (gene) for insulin production in humans and paste it into the DNA of Escherichia coli, a bacterium that inhabits the human digestive tract. The bacterial cells divide very rapidly making billions of copies of themselves, and each bacterium carries in its DNA a faithful replica of the gene for insulin production. Each new E. coli cell has inherited the human insulin gene sentence".

Biotechnology and genetic engineering will not eliminate much of medicine as we know it, but will revolutionize the treatment of many diseases and offer the potential for changing human beings in ways only contemplated previously in science fiction. In 1990, the first government-sanctioned human gene therapy began with a child receiving modified cells for severe combined immune deficiency (SCID).

Scientists and biotechnologists alike were very optimistic about the potential success of this new means of treating genetic diseases. By early 1998, the National Institutes of Health had approved 222 experimental procedures, 190 for testing therapeutic approaches (Henig, 1998). However, Friedman noted in 1997 that "no approach has definitively improved the health of a single one of the more than 2,000 patients who have enrolled in gene therapy trials worldwide".