Working Toward a Cure

Promising advances in diabetes care

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Dr. James Shapiro is best known for his ground-breaking research that led to the internationally acclaimed Edmonton Protocol. His research team has successfully transplanted islet cells from donated human pancreases into the liver of patients with type 1 diabetes. These transplanted islet cells, which make insulin, allow patients to be free from insulin injections. For some patients, the results have lasted for years.

The Edmonton Protocol is now an accepted treatment for people with type 1 diabetes who have very serious problems controlling their blood glucose levels. These people may have frequent or severe hypoglycemia (low blood glucose). They may be unable to sense that their blood glucose is getting very low. This can be dangerous.

This treatment does have risk. Patients must stay on anti-rejection drugs for life. The drugs keep a patient's immune (defence) system from attacking the transplanted cells. Anti-rejection drugs increase the risk of cancer and infection, and have other side effects.

For this reason, Dr. Shapiro and his team continue to work on new treatments that will hopefully have fewer risks for patients. The hope is to free more people with type 1 diabetes from insulin injections.

Dr. Shapiro currently holds the Canada Research Chair in Transplantation Surgery and Regenerative Medicine at the University of Alberta. His busy research lab is currently working on more than 30 projects involving mice, and 15 human clinical trials. One is an immune reset trial. In this study, people newly diagnosed with type 1 diabetes are given a combination of targeted medications designed to reset their immune system and repair the pancreas. So far, early results are promising. Two of the first patients in this trial currently do not need insulin injections.

Dr. Shapiro is most excited about his research that places human pancreas progenitor cells (stem cells) into a semi-porous plastic implant that is put under the skin. These sacs (called the Encaptra cell delivery

system) are designed to protect the implanted cells from attack by the body's immune system. This means that patients do not require anti-rejection drugs. As well, since the stem cells are made in the laboratory rather than being from a donor pancreas, there is an unending supply. As a result, more people can be treated. Another benefit is that the implant is placed under the skin – a much easier procedure than transplanting cells into the liver, as in the Edmonton Protocol.

Once the cells are placed under the skin in the Encaptra device, they take a few months to mature into cells that can make insulin. The first study done by Dr. Shapiro's team looked at how long these implanted cells could survive. The team discovered that in order for the cells to survive, they needed a good blood supply. Then, they found that making small laser holes in the Encaptra device allowed blood vessels to grow into the unit to supply the implanted cells with blood. This helped the cells to last longer. Unfortunately, the laser holes also allowed the cells to be attacked by the patient's immune system. The patient would still need to take anti-rejection drugs.

Dr. Shapiro does not look at this discovery as a setback. Instead, he explains that any approach that is going to be successful must alter what is done next based on what is learned from each change made in the procedure. The next step with this study will be to increase the number of stem cells being implanted to see if this will improve diabetes control.

Changing the material that the sac is made of is also being explored. The hope is to improve the length of time that the cells can survive, and better protect the cells from attack from the immune system. Gore-Tex is one of the materials being researched.

Stealth technology may also be a solution. Research is being done to see if stem cells can be developed that can hide from the immune system. This would be done by removing markers on the cell membranes that can trigger the immune system to attack.

Dr. Shapiro's ultimate hope is that a patient's own cells, such as skin, cheek lining or blood stem cells, can be reprogrammed into pancreas type cells that make insulin. In type 1 diabetes, the person's own immune system attacks pancreas cells. These cells would still need to be changed in some way to protect them from this attack. If this is possible, anti-rejection drugs would not be needed. Since the patient's own cells are being used, every person could be treated.

"I am very optimistic that we can develop a treatment for patients who have diabetes that is more effective than what we have today," says Dr. Shapiro. "Patients struggle with glucose monitoring and insulin injections. Even with all the brand new technologies, we still cannot get blood glucose control anything like we can with a cell transplant. I am very optimistic that the areas that we and others globally are working on to cure diabetes are making huge progress."

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How can I get involved?

- **Volunteer for a study**. Dr. Shapiro's lab is always looking for patients for all of his lab's clinical trials. If you are an adult with type 1 diabetes who is interested, please visit ☛ *islet.ca* for more information.
- **Donate to fund the cure.** The mission of the Diabetes Research Institute Foundation Canada (DRIFCan) is to end type 1 diabetes by directly funding cure-based diabetes researcher Dr. James Shapiro and his team at the University of Alberta in Edmonton, Alberta. All funds raised stay at the University of Alberta. Ongoing, sustainable funding is critical to keep DRIFCan's exciting and promising research projects moving forward. For more information or to donate, please visit ☛ *drifcan.com*.