



Oklahoma Center for Adult Stem Cell Research

Stem Cell Cures for Diabetes

Nearly 16 million people in the United States have diabetes, and currently there is no cure. However, stem cell research offers hope for those with the type I or juvenile form of the disease. As with all areas of medical research, there are many problems to solve. Fortunately, there are a lot of scientists trying to solve them.

People with diabetes have trouble keeping sugar glucose at the correct level in blood. Blindness, kidney failure, heart disease, strokes and other problems occur if it is too high. After we eat, our blood sugar increases, the pancreas produces insulin, and that causes sugar to be used up. However, the “beta” cells that normally make insulin are damaged in type I diabetics, so levels of sugar remain high unless they get insulin injections. They spend a lot of time determining the right things to eat, the timing of their insulin injections, and planning their activities.

In type I diabetes, the person’s immune system gets confused and sees the insulin producing pancreas cells as foreign, like an infection and destroys them. All cures for this kind of diabetes will require suppression of the immune system, as is being done right now in many patients. One type of suppression is so damaging to bone marrow that the patients have to be given back their own stem cells. The idea is that the immune system can be completely rebuilt and rebalanced in the process. However, advances in immunology suggest it should be possible to do the same thing more selectively and with less risk. After treatment, patients will be able to respond normally to infections, but not keep attacking and killing their beta cells.

As progress is made in immunology, workers are trying hard to learn how to restore insulin producing beta cells. All current approaches depend on gaining a better understanding of stem cells. If the disease is caught early, and some beta cells remain, it may be possible to make the good ones multiply to normal numbers. Here we need to learn what makes a cell divide to make two exact copies, as stem cells do. Beta cells in normal adults have a limited ability to do this, but large scale chemical screens are underway to find drugs that stimulate their growth.

Others believe that iPSC (explained elsewhere on this web site) can be used to make new beta cells. For that approach, skin cells from a person with diabetes would be placed in culture and engineered to become stem cells. The stem cells (now called iPSC) would then be used to produce beta cells that could be returned to the patient. A related line of work aims to convert another kind of cells in the diabetic’s pancreas to become beta cells. Studies done with mice and cell cultures show that both of these approaches can work.

One treatment for type I diabetes involves collection of islet cells from cadavers and then injecting them into the liver. This so-called Edmonton Protocol has had some success and has shown scientists some of the practical hurdles that need to be overcome. For example, a large number of beta cell containing islets must be available and they should be compatible so that the diabetic patient will not reject them. Also, a better way for placing them in the body needs to be developed. These are the kinds of problems that need to be solved in order for beta cells made in test tubes to be good diabetes cures.

Diabetes is an example of how a good platform of basic knowledge can lead to treatments. Scientists trained in developmental, molecular and stem cell biology are working together to learn how our bodies are made in the first place. Knowing exactly how the more than 200 cell types keep their identities suggests ways to make them more “plastic”. That in turn is driving the exciting new field of regenerative medicine.

OCASCR is already encouraging diabetes research in several ways. For example, one funded investigator is learning how to improve production of iPSC. Also, a highly trained developmental biologist has recently been recruited to the state. It is hoped that more will follow, strengthening our community and work that is already underway on multiple campuses.