

Research Progress Report

JDRF Key Advances Fall 2009

Thanks to the generous support you and other donors have given, JDRF's research program has made significant advances in recent months toward our goal: to find a cure for type 1 diabetes and its complications. We rely on people like you to help move science along as rapidly as possible. Below are highlights of the recent accomplishments you helped make possible.

Regeneration

Researchers Discover How Beta Cell Regeneration Slows With Age

Two groups of researchers have identified two proteins that promote beta cell regeneration but whose levels decline with age. The findings shed light on the mechanisms that regulate normal beta cell expansion and decline. The insights they provide could lead researchers to new targets and drugs for releasing or reversing the "brakes" that limit beta cell regeneration as a treatment – and potential cure – for type 1 diabetes.

New Insulin-Producing Beta Cells Produced from Pancreatic Alpha Cells

In findings that further increase the prospects of using regeneration therapies to treat – or cure – type 1 diabetes, scientists have shown that new insulin-producing beta cells can be generated from non-insulin-producing alpha cells in the mouse pancreas. The findings are important in advancing the prospects for beta cell regeneration-related treatments for type 1 diabetes. They reinforce the concept that it may become possible to reprogram or convert non-insulin-producing cells in the body to become beta cells to achieve insulin independence.

Replacement

Scientists Advance Toward Identifying Pancreatic Stem Cells

In a study in mice, researchers showed that certain cells in the pancreas act as progenitors that give rise to new islet cells after birth and injury. Identifying and isolating pancreatic stem cells is important because of its implications for treating – and curing – type 1 diabetes. Pancreatic stem cells could be used to create an unlimited source of insulin-producing beta cells for use in islet transplantation and other beta cell replacement therapies.

A More Efficient Way to Produce Beta Cell Precursors from Human Embryonic Stem Cells Found

Scientists have made an important advance in the efforts to transform stem cells into insulin-producing beta cells. Using a novel screening method, they identified a small molecule that can help drive human embryonic stem cells along the path to becoming beta cells. By uncovering a more efficient way to generate precursor cells from human embryonic stem cells, this research could lead to less costly and faster ways of generating the large, unlimited supply of beta cells that would be needed to make islet transplantation a viable treatment option for many more people with type 1 diabetes.

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Metabolic Control

CGMs Benefit People Who Have Already Achieved Good Blood Glucose Control

A major JDRF study has shown that people who have already achieved excellent blood-sugar control (HbA1c levels below seven percent) can further benefit from using the devices. The study showed that CGM use allowed people in this group to continue to tightly manage their diabetes while reducing episodes of hypoglycemia, or low blood sugar. This study has important implications for the management of type 1 diabetes: it shows that CGM devices not only help people achieve good glucose control, which can have a significant positive impact on lowering their risk of complications, but also enable people to achieve tight blood sugar control without increasing the near-term risk of hypoglycemia.

Artificial Pancreas Researcher Named “Medical Pioneer”

One of the JDRF-funded scientists working to create an artificial pancreas has been named a "Medical Pioneer" by U.S News & World Report. Boris Kovatchev, Ph.D., of the University of Virginia, is working to develop the algorithms that will link insulin pumps with CGMs to control blood sugar levels. Dr. Kovatchev's innovative work was recognized last year when the Food and Drug Administration approved a computer model of diabetes that he and his colleagues developed as a pre-clinical testing tool. The model is facilitating the development of new algorithms that are essential to achieving an artificial pancreas.

Complications

Understanding the Role of Lipids in Complications

Several recent studies suggest a role for lipids in the development and progression of complications of diabetes. A JDRF-funded study showed that a significant number of people ages 10-16 had lipid abnormalities and that HDL cholesterol levels were higher in those with microalbuminuria, a sign of nephropathy (kidney disease), suggesting that dyslipidemia may play a role in its development. The study raises questions about the potential need for lipid monitoring and management in type 1 diabetes as a strategy to prevent complications beyond cardiovascular disease.

Neuropathy Drug Shows Promise

A study co-sponsored by JDRF and Sangamo BioSciences suggests that a new drug, SB509, may be beneficial in treating people with moderate to severe neuropathy. If SB-509 continues to prove effective in future clinical trials, it would be an important step forward in the treatment of neuropathy in type 1 diabetes.

JDRF Investment in GoKinD Study Yields Multiple Discoveries on Kidney Disease

The JDRF-funded GoKinD (Genetics of Kidneys in Diabetes) study has yielded a treasure trove of information about nephropathy, with 18 papers published in scientific journals to date. The studies have greatly advanced our understanding of kidney disease and have identified potential new avenues for treatment.

Autoimmunity

Potential T Cell Therapy Clears Laboratory Hurdles

Researchers have discovered further evidence that the immune system's regulatory T cells are a promising cell-based therapy for type 1 diabetes. In a study, scientists showed that the cells – which suppress the actions of the immune cells that cause type 1 diabetes – can be isolated from people with type 1 and then expanded in the laboratory to levels that could be therapeutically useful, with no loss in function or stability.

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Previous research has shown that regulatory T cells can prevent and even reverse type 1 diabetes in mice when administered in large quantities. This study confirms the feasibility of that approach—isolating, expanding, and ultimately reintroducing the regulatory T cells—as a potential treatment for people, and outlines important tools and principles for translating the therapy into clinical treatments.

Study Shows Gene Contributes to the Development of Autoimmunity

Researchers have identified a gene in mice that helps to explain the autoimmune changes that lead to the development of type 1 diabetes. The gene, called MerTK, appears to block the immune system's early attempts to control the autoimmune response that results in type 1 diabetes. The gene was specifically shown to prevent the removal of T cells that are primed to attack the insulin-producing beta cells. The importance of MerTK in human type 1 diabetes remains to be determined, but if it is found to play a similar role in people, it could become a new drug target for treating or even preventing type 1 diabetes.

Scientists Gain Evidence for How mATG Reverses Diabetes in Mice

After previously showing that the immunosuppressive drug antithymocyte globulin (mATG) prevents, as well as reverses, type 1 diabetes in mice, scientists have now provided an explanation for how that happens. They found that mATG altered the traits and function of dendritic cells, which in turn affected T cell response in a way that delayed the onset of diabetes. These findings have the potential to lead to new treatments for type 1 diabetes. Because abnormalities in the function of dendritic cells may play an important role in the autoimmune destruction underlying type 1 diabetes, it may be possible to treat the disease by manipulating these cells.