Testimony
Before the
Special Committee on Aging
United States Senate

Diabetes Research: Improving Lives on the Path to a Cure

Statement of

Griffin P. Rodgers, M.D., M.A.C.P.

Director
National Institute of Diabetes and Digestive and Kidney Diseases
National Institutes of Health
U.S. Department of Health and Human Services

National Institutes of Health

For Release on Delivery
Expected at 2:00 p.m.
Wednesday, July 15, 2015

Chairman Collins, Senator McCaskill, and Members of the Committee, as Director of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), I thank you for your invitation to testify at this hearing on type 1 diabetes. On behalf of the NIDDK and the other Institutes and Centers of the National Institutes of Health (NIH) within the U.S. Department of Health and Human Services (HHS), I am pleased to report on significant recent scientific advances and future research opportunities in type 1 diabetes and its complications.

Long recognizing the importance of diabetes research toward improving the health of people affected by the disease, the NIH has invested over $1 billion a year in diabetes research in each of the last several years. This investment has been complemented by the support and efforts of our research partners—academic institutions, the U.S. Food and Drug Administration (FDA), the Centers for Disease Control and Prevention (CDC), and charitable and patient advocacy groups such as JDRF (formerly the Juvenile Diabetes Research Foundation), the Leona M. and Harry B. Helmsley Charitable Trust, and the American Diabetes Association (ADA). These partners share our goals of preventing, treating, and ultimately curing type 1 diabetes. Through the invaluable support of the Congress and the Administration, through collaborative and coordinated research efforts, through the hard work of our researchers, and through the dedication and generosity of our clinical trial volunteers, we have made important strides toward these goals. I am pleased to be here today to describe recent scientific advances and future opportunities in type 1 diabetes research, including research supported by the recently renewed Special Statutory Funding Program for Type 1 Diabetes Research (Special Diabetes Program). With the Special Program now funded through Fiscal Year 2017, we look forward to taking advantage of the opportunities I'll describe to you today.

Type 1 diabetes primarily strikes children and adolescents, but it can begin at any age. It is a lifelong disease that affects Americans of all ages, including seniors. Type 1 diabetes is an autoimmune disease, in which the body's immune system launches a misguided attack and destroys the insulin-producing beta cells found in clusters called islets within the pancreas. Insulin is a hormone that helps the body regulate glucose levels in the blood. Because their body no longer produces insulin, people with type 1 diabetes—or the parents of young children with the disease—must do the work of the lost beta cells. Thus, the children here today and people of all ages with the disease must closely monitor food intake and physical activity levels, monitor blood glucose levels many times each day and night, and administer insulin through injections or an insulin pump. This is an enormous and constant burden on them and their families, and greatly affects quality of life. Despite their vigilance, they remain susceptible to dangerous and frightening episodes of hypoglycemia (low blood glucose) and to developing long-term complications affecting their eyes, kidneys, nerves, heart, and other organs. Thus, it is imperative to pursue research to identify prevention strategies and improved treatments, while striving for a cure.

IMPROVING THE OUTLOOK FOR PEOPLE WITH TYPE 1 DIABETES

Research has had a dramatic and beneficial impact on the health and quality of life of people with type 1 diabetes. A major contributor to this success is information that has been garnered by the NIDDK's landmark Diabetes Control and Complications Trial (DCCT) and its follow-up study, the Epidemiology of Diabetes Interventions and Complications (EDIC). DCCT, which began in 1983, compared the effect of intensive blood glucose control versus what was conventional care at that time on the long-term health of people with type 1 diabetes. DCCT

demonstrated that intensive blood glucose control, beginning as soon as possible after diagnosis, prevented or delayed the development of complications of the eyes, kidneys, and nerves. After DCCT ended, the EDIC study—which began in 1994 and is still ongoing—followed the original DCCT participants and demonstrated enduring protective effects of intensive glucose control on eye, kidney, nerve, and heart complications. These results have transformed clinical care for people with type 1 diabetes, with doctors now recommending that people with the disease practice intensive control as early in the course of the disease as safely possible.

However, despite unequivocal evidence of the benefit of intensive glucose control, many people—especially teens—are not able to achieve the intensive control that researchers helped DCCT participants achieve. Even DCCT participants themselves could not maintain this control after the trial ended and they were not receiving diabetes treatment from the research staff. Data from children participating in the SEARCH for Diabetes in Youth study (SEARCH), which is funded by the NIDDK and CDC's Division of Diabetes Translation, show that one out of five teenagers with type 1 diabetes have hemoglobin A1c (HbA1c) levels—a measurement of blood glucose levels over time—above 9.5 percent, which is higher than the recommended level of less than 7.5 percent. Teenagers' mean HbA1c level is also closer to that achieved by the conventional than the intensive control group in DCCT, indicating that achieving the recommended intensive glucose control and attaining its long-term protective effects is particularly challenging in this age group. Thus, new approaches to improve glucose control are urgently needed.

Even though it has been over 30 years since DCCT began, critical insights continue to emerge. Recent results from DCCT/EDIC show that people with type 1 diabetes who intensively control their blood glucose levels early in the disease are likely to live longer than those who do

not. Higher average blood glucose levels and increased protein in the urine—a marker of diabetic kidney disease—were the major risk factors for death.[1] These results emphasize the importance of early and intensive blood glucose control. They also demonstrate the fruits of a long-term research investment—the NIDDK has supported DCCT/EDIC for over 30 years, and translation of these insights into long term outcomes would not have been available without sustained support. Additionally, many current studies supported by the NIDDK, such as development of artificial pancreas technologies and clinical trials of agents to preserve beta cell function, stem from DCCT/EDIC research showing that controlling blood glucose levels is key to maintaining long-term health. Thus, results from DCCT/EDIC have been transformative and far-reaching.

Because type 1 diabetes is a complex disease involving many different organ systems, propelling research progress involves partnerships among scientists with diverse backgrounds and expertise. NIH has also valued its partnerships with academic institutions, with other HHS agencies, and with patient advocacy groups such as JDRF and ADA. These partnerships have allowed us to work together toward common goals and reduce duplication. Our most important research partners are people with or at risk for type 1 diabetes who participate in clinical research studies. We are inspired by their commitment, not only for themselves and their families, but for future generations who may benefit from findings stemming from these research studies.

Toward the goals of preventing, treating, and curing type 1 diabetes and its complications, the NIH vigorously supports research focusing on all stages of the disease: to prevent the autoimmune attack before it starts; to stop the autoimmune attack early in the course of disease to protect remaining beta cells; to improve blood glucose control in people with established disease; to restore beta cell function in people with significant beta cell loss; and to

[1] http://www.ncbi.nlm.nih.gov/pubmed/25562265

prevent, treat, and reverse complications. I am pleased to share with you some of the exciting recent advances in type 1 diabetes research, many of which were reported in just the last year.

UNDERSTANDING THE CAUSES OF TYPE 1 DIABETES TOWARD DISEASE PREVENTION

To achieve our goal of preventing type 1 diabetes, it is imperative to understand the underlying causes of the disease. A person's risk for developing type 1 diabetes involves both genetic and environmental factors, and many genes contribute to disease risk. Thus, research on genetic and environmental contributors is critical toward developing prevention strategies.

In recent years, we have made significant progress in understanding genetic contributors to type 1 diabetes. About a decade ago, only a few culprit genes had been identified. Now, because of the NIDDK's Type 1 Diabetes Genetics Consortium and other groups, we know over 50 genes or genetic regions that contribute to disease risk. This represents about 80 percent of the genetic contributions to disease, making type 1 diabetes one of the few polygenic diseases (in which many genes are involved) for which most of the genetic susceptibility has been identified**.**

The NIDDK is building on this progress by supporting research to pinpoint the genes within these regions that could be influencing disease. We also support research to understand the function of identified genes to determine how they may be involved in disease, which could point to new targets for prevention or treatment. For example, NIDDK-supported researchers studied one of these genes, called *Clec16a*, whose function was previously unknown. They found that it encodes a protein involved in quality control of mitochondria, the cell's "power plants." Over time, mitochondria may develop problems, requiring recycling and replacement. Using mice, researchers found that reducing the amount of Clec16a protein caused too-frequent

mitochondrial recycling. Moreover, beta cells that lack Clec16a are less able to process energy and produce less insulin in response to rising blood glucose than normal beta cells do. Notably, people with a common mutation of *CLEC16a* that is linked to type 1 diabetes also have lower levels of Clec16a protein and poorer insulin response than people with other variants of the gene, suggesting the protein's role in humans is similar to its role in mice. Further research could determine whether modulating the mitochondrial recycling program helps prevent the disease.[2]

However, genetics does not represent the full picture. The CDC and NIDDK co-led SEARCH for Diabetes in Youth study reported the first national surveillance data on childhood diabetes and found that the prevalence of type 1 diabetes in people under age 20 rose by 21 percent between 2001 and 2009, and that the disease is also an increasing burden in minority youth.[3] Rising rates of type 1 diabetes suggest that there is an unknown factor—or factors—in the environment that interacts with genetic risk to trigger disease onset or protect against it. Identifying these factors—such as infectious agents, dietary factors, or some other agent—is critical to understanding the disease process and to developing prevention strategies. Toward these goals, the NIDDK supports an ambitious, long-term clinical research study called The Environmental Determinants of Diabetes in the Young, or TEDDY. After screening over 425,000 newborns, TEDDY is currently following over 6,000 of them at high genetic risk of type 1 diabetes until they are 15 years old. During that time, researchers and devoted parents regularly collect information about the children's diet, allergies, illnesses, and other environmental exposures. Over 2.7 million biological samples have been collected to date. These samples are a treasure trove of information that is now being analyzed with state-of-the-art genomic, metabolomic, and proteomic technologies to uncover possible environmental triggers

[2] http://www.ncbi.nlm.nih.gov/pubmed/24949970
[3] http://www.ncbi.nlm.nih.gov/pubmed/24794371

and protective factors. The TEDDY study represents an unparalleled resource that can give unique insight into type 1 diabetes and children's health.

TEDDY is also giving us knowledge about other autoimmune diseases, such as celiac disease (gluten intolerance), which shares some genetic risk factors with type 1 diabetes and often occurs in the same individuals. TEDDY recently found that more than one quarter of children with two copies of a high-risk variant in a specific group of genes develop an early sign of celiac disease by age 5—results that could have future implications for celiac disease screening in young children.[4]

TESTING STRATEGIES TO STOP THE AUTOIMMUNE ATTACK AND PRESERVE BETA CELLS

After a person is diagnosed with type 1 diabetes, it is critical to preserve remaining beta cells to maintain some insulin production and achieve good blood glucose control, which research has shown could improve long-term health. NIDDK's Type 1 Diabetes TrialNet and the National Institute of Allergy and Infectious Diseases' (NIAID's) Immune Tolerance Network have both tested agents in people with newly diagnosed type 1 diabetes to determine if they could halt or slow the autoimmune attack and protect remaining beta cells. Some agents have shown promise, including the drug abatacept and the anti-CD3 monoclonal antibody teplizumab. TrialNet is building on these results in newly diagnosed patients and now supports clinical trials testing whether these agents could prevent type 1 diabetes in relatives of people with the disease. The ability to conduct such prevention trials is based on research showing that blood tests can accurately identify relatives of people with type 1 diabetes who are at high or moderate risk of developing the disease within five years.

[4] http://www.ncbi.nlm.nih.gov/pubmed/24988556

Looking forward, TrialNet is uniquely positioned to test new and emerging prevention approaches that may stem from studies such as TEDDY. Additionally, the ability to screen people for risk of type 1 diabetes with a blood test allows us to identify those who could benefit from a prevention strategy if one emerges; the NIDDK also supports research by small businesses to improve predictive tests to be used in clinical trials, as well as for use in a public health setting once prevention approaches are identified. Thus, the Special Diabetes Program has enabled the creation of a unique research pipeline with goals of discovering strategies to protect beta cells, testing those strategies in people, and identifying those who could benefit from effective strategies on a larger public health scale.

DEVELOPING TECHNOLOGIES TO IMPROVE GLUCOSE CONTROL

The results of the DCCT/EDIC studies that I described earlier show the importance of early and intensive blood glucose control to patients' long-term health. However, type 1 diabetes is an extremely burdensome disease to manage for even the most vigilant of patients, and intensive therapy brings with it the potential for acute episodes of hypoglycemia. Nocturnal hypoglycemia, an imbalance of glucose supply and relative oversupply of insulin during the night, can be a worrisome side effect in children on intensive insulin therapy. Thus, it is difficult for people to achieve recommended levels of blood glucose control using current management approaches. Recent research has shown other alarming effects of elevated blood glucose levels: scientists in the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development-led Diabetes Research in Children Network (DirecNet) found that young children with long-term high blood glucose levels are more likely to have slower brain growth. Researchers did not find significant cognitive differences between healthy children and those

with type 1 diabetes, but longer-term studies could shed light on whether differences exist.[5] Thus, research findings continue to emphasize the need to develop improved technologies to help people with type 1 diabetes and their families manage their disease and keep blood glucose levels in a healthy range, while reducing the risk of hypoglycemia.

One extremely promising technology to achieve these goals is an "artificial pancreas," which is a device that fully automates blood glucose sensing and insulin administration. Such a device has three components: a glucose-sensing component that measures blood glucose levels and sends information to a computer; an insulin delivery device; and a computer that calculates the amount of insulin needed and thereby "closes the loop" between glucose sensing and insulin delivery. In other words, this technology is designed to do the work of the pancreas with minimal human input.

The NIDDK is working closely with our partners, including the FDA and JDRF, to develop artificial pancreas technology, and I am pleased to report that there has been significant recent progress. Until recently, artificial pancreas clinical trials took place in hospital settings and used laptop computers to run the technology, restricting the activities of participants. Recent trials have built on the success of the inpatient trials, testing ambulatory devices in real-world settings. For example, NIDDK-supported researchers tested a wearable, automated, bihormonal "bionic" pancreas—one that releases both insulin and its counteracting hormone, glucagon—in adults and adolescents with type 1 diabetes. The adults wore this cell-phone controlled device for five days and nights and were unrestricted in their activities—they ate in restaurants, exercised at gyms, and stayed in a hotel, while being accompanied by study staff for their safety. The adolescents wore the same device at diabetes summer camp, also being closely monitored while participating freely in all camp activities. In both trials, compared to usual care of insulin

[5] http://www.ncbi.nlm.nih.gov/pubmed/25488901

pump therapy, participants had lower mean glucose levels and reduced episodes of hypoglycemia. In fact, the bionic pancreas allowed nearly all participants to achieve recommended levels of blood glucose control.[6]

In another study, researchers tested unsupervised overnight home use of a closed-loop system in adolescents with type 1 diabetes for 21 nights. During the day, participants used standard glucose sensor and pump therapy and did normal activities. At night, they used the closed-loop system, controlling it on their own, with minimal supervision on only the first night. Results showed that closed-loop control at night improved participants' glucose control during the day and night and reduced the number of episodes of nighttime hypoglycemia.[7]

Progress is also being made testing the next generation of low-glucose suspend devices—an important component of artificial pancreas technologies. The first-generation device, approved by the FDA in September 2013, suspends the delivery of insulin when glucose levels reach a preset threshold. The next generation device predicts when this level will be reached and preemptively suspends insulin delivery. A recent NIDDK-supported study tested a predictive device over 42 nights in people with type 1 diabetes in their homes. The results showed that, compared to control nights, nighttime hypoglycemia was reduced by over 70 percent when participants used the predictive device.[8] Nighttime hours are particularly worrisome for people with type 1 diabetes and their parents. Thus, the reductions in nocturnal hypoglycemia seen in recent studies suggest that new devices have the promise to lead to real and immediate benefits.

To build on these and other advances, the NIDDK plans to support advanced clinical trials on artificial pancreas technology that are expected to generate data able to address safety and efficacy requirements by regulatory agencies regarding the clinical testing of these systems.

[6] http://www.ncbi.nlm.nih.gov/pubmed/24931572
[7] http://www.ncbi.nlm.nih.gov/pubmed/24757227
[8] http://www.ncbi.nlm.nih.gov/pubmed/24804697

We also support research being conducted by small businesses to develop innovative technologies that may improve key components of and thus advance progress toward an artificial pancreas, as well as research conducted by academic medical centers studying physiological and behavioral factors. Partnerships between bioengineers designing these devices, clinicians, and behavioral scientists are key to make artificial pancreas use easier, so that as new technologies become available, patients and families can use them. With continued research, artificial pancreas technology can become a reality for people with type 1 diabetes.

RESTORING BETA CELL FUNCTION

Although the development of artificial pancreas technology represents an important and near-term approach to reduce the burden of managing type 1 diabetes while improving patients' health, it is not a cure. Thus, another major goal of NIH-supported type 1 diabetes research is to identify ways to replace lost beta cells and restore insulin production, which would represent a biological cure for the disease. One way to restore the ability to produce insulin is to replace beta cells through islet transplantation. The current procedure involves purifying islets from a donor pancreas and transplanting them into a person with type 1 diabetes. Research has shown that islet transplantation is highly successful in reversing hypoglycemia unawareness, a devastating complication of type 1 diabetes in which people do not recognize dangerously low blood glucose levels, making everyday tasks, like driving, a danger.

The NIDDK and NIAID co-led Clinical Islet Transplantation Consortium (CITC) has been conducting clinical and mechanistic studies in islet transplantation, with or without accompanying kidney transplantation, to make islet transplantation safer and more effective. The islet alone pivotal, Phase III islet transplantation trial has been completed and the islet after

kidney phase III trial has reached its primary endpoint. The Collaborative Islet Transplant Registry (CITR) has shown that both efficacy and safety outcome measures have improved in the 2007-2010 period compared to those from 1999-2006. Both the CITC and CITR's results showed that islet transplantation continues to show improved long-term benefits including insulin independence, improved indications of normal or near-normal blood glucose levels over time, and sustained marked decrease in severe hypoglycemic episodes. I'm pleased to report that the CITC will be submitting a report to the FDA based on these exciting results, toward licensing a pancreatic islet product for transplantation.

One barrier to islet transplantation is the scarcity of donor islets for transplant. A major advance from researchers in the NIDDK's Beta Cell Biology Consortium (BCBC) could help overcome that barrier. The scientists discovered a method to produce, or differentiate, beta cells in the laboratory. Previous attempts resulted in cells that produce insulin, but that do not respond to changing glucose levels. Recently, scientists developed a multistep differentiation process in which they coaxed large numbers of human stem cells into a state that closely resembles beta cells. Importantly, this process can use induced pluripotent stem cells that can be made from adult skin cells obtained from patients with type 1 diabetes. Importantly, these new cells respond to fluctuating glucose levels by increasing or decreasing secretion of insulin, as appropriate. This dramatically improved process for making large amounts of beta cells is a promising step toward developing donor-derived stem cell therapies to replace beta cells lost in type 1 diabetes.[9]

Another barrier to islet transplantation is the need for transplant recipients to take lifelong immunosuppressive medicines, which often have serious side effects, to prevent their body from rejecting the transplanted islets. One approach to protect the transplanted islets is to encapsulate them in a material that would protect them from an immune attack but still allow them to

[9] http://www.ncbi.nlm.nih.gov/pubmed/25303535

function. Thus, the ability to make large amounts of beta cells for transplantation which I just described makes developing new approaches to immunomodulation and encapsulation even more urgent.

Another group of BCBC researchers discovered that delta cells in the pancreas, which produce a hormone called somatostatin, could be reprogrammed into beta cells, representing another potential way to restore lost beta cells in type 1 diabetes.[10] Building on these and other ground-breaking successes of the BCBC, the NIDDK recently transitioned to a new effort, the Human Islet Research Network (HIRN). HIRN is supporting collaborative, translational beta cell research that can further our understanding of the human disease process and lead to innovative treatment strategies.

PREVENTING, TREATING, AND REVERSING DIABETIC COMPLICATIONS

Chronic elevation of blood glucose levels slowly damages organs and can result in life-threatening diabetes complications. Until prevention or cure of type 1 diabetes is possible, it is critical to pursue research toward preventing, treating, and reversing diabetes complications.

Diabetic eye disease is a debilitating complication of type 1 diabetes and is a cause of vision loss in working age adults. This vision loss is often due to diabetic macular edema (DME), a condition in which fluid leaks from blood vessels and causes swelling and damage to the central retina.

The development of intravitreal anti-vascular endothelial growth factor (VEGF), drug and biologic products has more recently led to improved treatment. Previously, patients might have had to resort to laser treatment procedures in an attempt to preserve some measure of vision. The National Eye Institute-led Diabetic Retinopathy Clinical Research Network

[10] http://www.ncbi.nlm.nih.gov/pubmed/25141178

(DRCR.net) showed that the anti-VEGF drug, ranibizumab, often in conjunction with laser treatment, is a more effective treatment for DME than laser treatment alone.[11] Ranibizumab blocks the function of VEGF, a protein that promotes blood vessel growth. Clinical practice has now changed dramatically—anti-VEGF therapy, where the drug is injected directly into the eye's vitreous, is one of the standard treatments for people with vision loss from diabetic macular edema.

Building on this result, another recent DRCR.net comparative effectiveness trial compared safety and efficacy of three anti-VEGF drugs commonly used to treat DME: Eylea® (aflibercept), Avastin® (bevacizumab), and Lucentis® (ranibizumab). The trial showed that, in people with DME and mild visual impairment, any of the three drugs, on average, improved visual acuity and that the drugs were equally effective. Researchers found no major differences in the safety of the three drugs.[12] The costs of these drugs differ widely: based on Medicare allowable charges, the per-injection costs of each drug at the doses used in this study were about $1,960 for Eylea®, about $1,200 for Lucentis®, and about $70 for Avastin®. Many patients required 10-12 injections. Thus, these results offer important data for informing clinical decisions for DME, while having significant cost implications. The study reinforced the previously reported finding that anti-VEGF therapy actually improves vision, as compared to laser treatment that is effective in preventing blindness but does not improve and often somewhat worsens vision in the short term. Improving vision with anti-VEGF therapy can make the difference between people being able to drive or not, which greatly affects quality of life.

Because the study compared drugs from different companies and the results of the recent DRCR.net trial had large cost implications, the Government was in a unique position to support

[11] http://www.ncbi.nlm.nih.gov/pubmed/20427088
[12] http://www.ncbi.nlm.nih.gov/pubmed/25692915

it, as it would not have been conducted by the private sector. Another new clinical trial that would also not be supported by the private sector is the NIDDK's Preventing Early Renal Loss in Diabetes (PERL). PERL is testing whether the inexpensive, generic medication allopurinol, currently used for the treatment of gout, could preserve kidney function in people with type 1 diabetes who are at high risk of kidney disease. If this inexpensive drug proves effective, it has the potential to be the first new therapy to reduce risk for diabetic kidney disease in over two decades. Diabetic kidney disease is a major risk factor for cardiovascular disease (CVD) in people with type 1 diabetes, underscoring the importance of studying new strategies to prevent kidney disease.

Although blindness, amputation, and kidney disease are what people with the disease fear most, CVD is the leading cause of death. It is important to determine when to start prevention efforts in people with type 1 diabetes to reduce their risk of CVD and lengthen their life. The SEARCH for Diabetes in Youth Study is shedding light on this by studying the natural history of CVD and examining CVD risk factors in youth with type 1 diabetes. SEARCH researchers found that youth with the disease, particularly those with suboptimal blood glucose control, had reduced overall heart rate variability compared to youth without type 1 diabetes.[13] Reduced heart rate variability is a sign of cardiac autonomic neuropathy, a complication of diabetes that increases the risk of mortality. SEARCH also found that youth with type 1 diabetes had increased carotid intima-media thickness (indicative of the presence of atherosclerosis) compared to youth without type 1 diabetes, and that this association may be attributable to poor blood glucose control.[14] These data indicate that this population shows signs of CVD risk early in the course of the disease. To inform future research directions related to CVD in type 1 diabetes, the

[13] http://www.ncbi.nlm.nih.gov/pubmed/22961570
[14] http://www.ncbi.nlm.nih.gov/pubmed/23564920

NIDDK and the National Heart, Lung, and Blood Institute co-sponsored a workshop in October 2014, at which experts discussed research questions that are important to pursue.

EMERGING OPPORTUNITIES IN TYPE 1 DIABETES RESEARCH

Building on the recent research advances I have described, the NIH is supporting new and emerging research in type 1 diabetes and its complications. For example, the NIDDK supports behavioral research to identify ways to improve adherence to the difficult treatment regimens required to manage type 1 diabetes. Data from children participating in the SEARCH study indicate that most teenagers do not meet the goals for intensive glucose control recommended by the ADA. Average glucose control is closer to that of the conventional, rather than the intensive treatment group of the DCCT. This information is worrisome because we know that the intensive control group had a dramatic reduction in long-term complications compared to the conventional control group. Thus, it is imperative that research identify ways to help people manage their disease to improve long-term outcomes. Toward this end, the NIDDK is supporting behavioral research studying different age groups—from young children, to adolescents, to adults—because each age group faces unique challenges when it comes to managing the disease.

Since currently clinical research is often costly and time-consuming, the NIDDK is focusing on approaches to streamline and accelerate type 1 diabetes research and make it possible to get answers more quickly. Thus, lack of biomarkers that predict disease progression and response to therapy is a major obstacle to the development and testing of new therapeutic approaches. To overcome this obstacle, NIDDK is fostering creative new research to develop biomarkers for complications and for progressive loss of beta cells.

The NIDDK also remains committed to providing access to research resources that will increase our understanding of type 1 diabetes and its complications. For example, we support distribution of human islets from organ donors and ancillary studies of type 1 diabetes clinical studies and make samples and data from completed studies available to the research community through the NIDDK Central Repositories. These types of approaches reduce duplication, make resources broadly available, and maximize the return on our past scientific research investments. The NIDDK is also supporting training and career development programs to recruit and retain scientists with different areas of expertise whose talents will enhance the type 1 diabetes research field.

Looking forward, the NIDDK support of type 1 diabetes research will continue to be guided by the 2011 Diabetes Research Strategic Plan, which the Institute spearheaded with broad external input. The statutory Diabetes Mellitus Interagency Coordinating Committee (DMICC), chaired by NIDDK, also serves a key function by coordinating activities and reducing duplication across several HHS and non-HHS government entities. Earlier this year, under the auspices of the DMICC, we solicited input from scientific and lay experts about future directions that could be supported with the recent extension of the Special Diabetes Program through FY 2017. Guided by that input, strategic plans, and input that the NIH receives at venues such as scientific conferences and workshops, the NIH is now identifying the most compelling areas of current research opportunity to pursue with the new funds and will ensure that the Program continues its exceptional track record of supporting cutting-edge type 1 diabetes research.

CONCLUDING REMARKS

I appreciate this opportunity to share with you these few recent advances, ongoing efforts, and emerging opportunities in type 1 diabetes research. We are grateful for the continued support of the Congress and the Administration that has allowed the NIH to vigorously support research to combat type 1 diabetes and its complications. We look forward to continuing our strong partnerships with patient advocacy groups, research institutions, and our sister Federal Agencies. We also thank all of the clinical study volunteers, without whom the clinical research I described today would not be possible. Working with all of these partners, the NIH remains steadfast in our goals of preventing, treating, and ultimately curing type 1 diabetes.

Thank you, Chairman Collins, Senator McCaskill, and Members of the Committee for your attention. I will be pleased to answer any questions you may have.

Griffin P. Rodgers, M.D., M.A.C.P.

National Institute of Diabetes and Digestive and Kidney Diseases

Dr. Griffin P. Rodgers was named Director of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)--one of the National Institutes of Health (NIH)--on April 1, 2007. He had served as NIDDK's Acting Director since March 2006 and had been the Institute's Deputy Director since January 2001. As the Director of NIDDK, Dr. Rodgers provides scientific leadership and manages a staff of over 600 employees and a budget of $1.9 billion.

Dr. Rodgers received his undergraduate, graduate, and medical degrees from Brown University in Providence, R.I. He performed his residency and chief residency in internal medicine at Barnes Hospital and the Washington University School of Medicine in St. Louis. His fellowship training in hematology was in a joint program of the NIH with George Washington University and the Washington Veterans Administration Medical Center. In addition to his medical and research training, he earned an MBA, with a focus on the business of medicine/science, from Johns Hopkins University in 2005.

As a research investigator, Dr. Rodgers is widely recognized for his contributions to the development of the first effective — and now FDA approved — therapy for sickle cell anemia. He was a principal investigator in clinical trials to develop therapy for patients with sickle cell disease and also performed basic research that focused on understanding the molecular basis of how certain drugs induce gamma-globin gene expression. Recently, he and his collaborators have reported on a modified blood stem-cell transplant regimen that is highly effective in reversing sickle cell disease in adults and is associated with relatively low toxicity. He has been honored for his research with numerous awards including the 1998 Richard and Hinda Rosenthal

Foundation Award, the 2000 Arthur S. Flemming Award, the Legacy of Leadership Award in 2002, and a Mastership from the American College of Physicians in 2005.

Dr. Rodgers has been an invited professor at medical schools and hospitals both nationally and internationally. He has been honored with many named lectureships at American medical centers and has published over 200 original research articles, reviews, and book chapters, has edited four books and monographs, and holds three patents.

Dr. Rodgers is a member of the American Society of Hematology, the American Society of Clinical Investigation, the Association of American Physicians, the American Academy of Arts and Sciences, and the Institute of Medicine of the National Academy of Science, among others. He served as Governor to the American College of Physicians and as Chair of the Hematology Subspecialty Board and a member of the American Board of Internal Medicine Board of Directors.