Testimony
Before the
Special Committee on Aging
United States Senate

"Redefining Reality: How the Special Diabetes Program is Changing the Lives of Americans with Type 1 Diabetes"

Statement of
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Chairman Collins, Ranking Member Casey, and distinguished Members of the Committee, thank you for your invitation to testify at this hearing on type 1 diabetes. I am Griffin P. Rodgers, M.D., M.A.C.P., Director of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), which is one of the 27 Institutes and Centers of the National Institutes of Health (NIH) within the U.S. Department of Health and Human Services (HHS). It is my great honor to be here today to tell you about some of the significant recent scientific progress and future research opportunities in type 1 diabetes and its complications, including research supported by the *Special Statutory Funding Program for Type 1 Diabetes Research* (*Special Diabetes Program*).

Diabetes takes an enormous personal and economic toll on our country, but we are making great strides in efforts to reduce that burden through the support of biomedical research. As such, NIH invests more than $1 billion a year in diabetes research, including studies on type 1 diabetes, type 2 diabetes, gestational diabetes, and diabetes complications; NIDDK supports the majority of diabetes research at NIH. The NIH investment includes funding from the *Special Diabetes Program*, which has enabled the agency to undertake challenges in type 1 diabetes beyond what we could support with our regular appropriations, and to conduct certain types of trials, like comparative effectiveness trials and trials of generic drugs, that were unlikely to have been conducted by the private sector. The NIH investment in combating type 1 diabetes 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, the American Diabetes Association (ADA), and the Leona M. and Harry B. Helmsley Charitable Trust.

Through the invaluable support of Congress, through collaborative and coordinated research efforts, through the hard work of our scientists, and through the dedication of our clinical research volunteers, we have made important progress toward our goals of understanding, preventing, treating, and ultimately curing type 1 diabetes.

ALLEVIATING THE BURDEN OF MANAGING TYPE 1 DIABETES

It is imperative that the research we support ultimately reach and benefit the public, so I am excited to share with you how our investments are paying off. As you know, management of type 1 diabetes is extremely burdensome. Because their pancreatic insulin-producing beta cells have been destroyed by the immune system, people with type 1 diabetes—or the parents of young children with the disease—must do the work of the lost beta cells by monitoring blood glucose levels and administering insulin. Since I last testified before this Committee 2 years ago, several new continuous glucose monitors (CGMs)—devices that automatically track blood glucose levels throughout the day and night—have been approved by the FDA. These include: the first CGM that does not require fingerstick calibration; the Medtronic 4 (co)-4 (t)-2 (or)3 (g)12 (Bocio)2 (anol

or *Special Diabetes Program*-supported research contributed to the development or testing of each of these devices.

We are also supporting other promising research that could help alleviate the burden of managing type 1 diabetes. For example, an NIDDK-supported small business is developing an improved formulation of glucagon, which is a hormone that raises blood glucose levels (as opposed to insulin, which lowers them). People with type 1 diabetes may need to administer glucagon in an emergency when their blood glucose levels fall dangerously low. Currently, glucagon is available in powder form and must be mixed with liquid right before use. But a soluble, stable glucagon formulation under development would be ready-to-use in a rescue pen. Such a device could make it less burdensome for patients and caregivers, such as school personnel, to administer glucagon in an emergency.

DEVELOPING BETTER TECHNOLOGIES TO IMPROVE GLUCOSE CONTROL

While we are extremely excited about this progress, we recognize that there is still work to do to reduce the burden of the disease. Despite these advances in technology, children here today and people of all ages with type 1 diabetes remain susceptible to dangerous and frightening episodes of hypoglycemia (low blood glucose) and to developing long-term complications that affect their eyes, kidneys, nerves, heart, and other organs. The NIDDK's landmark Diabetes Control and Complications Trial (DCCT) and its follow-up study, the Epidemiology of Diabetes Interventions and Complications (EDIC), demonstrated that intensive blood glucose control, beginning as soon as possible after diagnosis, prevented or delayed the development of these long-term complications. D

diabetes improved blood glucose control and reduced hypoglycemia compared to usual care during extended vigorous outdoor exercise at a ski camp.[7]

NIDDK continues to build on recent successes and to support research at all stages to advance artificial pancreas technology. First, NIDDK is supporting clinical trials that are testing artificial pancreas technologies in larger groups, in wider age ranges, over longer periods of time, and in largely unrestricted conditions. Some of the trials are testing the cutting-edge CGMs that I mentioned earlier in my testimony. For example, some of these trials could advance the goal of having interoperable artificial pancreas components so that newly developed insulin pumps and glucose sensors could be paired with existing algorithms, making it easier and faster to develop next-generation artificial pancreas systems. Additionally, one of the trials is testing artificial pancreas technologies in children potentially as young as 4 years old, which could expand the user population for this technology. The commercially available hybrid artificial pancreas is approved in children age 7 and older.

Second, NIDDK continues to support research conducted by small businesses to develop innovative technologies to improve the components of artificial pancreas devices. With *Special Diabetes Program* support, small businesses are developing improved glucose sensors, insulin pumps, and formulations of insulin and glucagon, including the glucagon formulation I described earlier. Improved components could help speed the development of more fully automated artificial pancreas technology and make the devices simpler and more user friendly.

Third, NIDDK recognizes that new tools and technologies for type 1 diabetes management will only benefit people if they can use them. Therefore, we also support research to identify the most effective ways to incorporate artificial pancreas technologies into clinical care and how to enhance the usability of these new tools to help patients in their decision making. This includes *Special Diabetes Program*-supported research that is studying glucose management technologies in adults age 65 years or older, to improve glucose control, quality of

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fears, but also felt better overall, despite the need to take daily immunosuppressive drugs to prevent transplant rejection.[9] These patient-reported outcomes are consistent with the clinical benefits that -0.004 Tc 0u.e

Results from TEDDY are also providing insights into childhood health and development in general, specifically new details about how environmental factors affect the microbes in the gut (*i.e.*, the gut "microbiome") as children age.[12] In one of the largest ever clinical microbiome studies in infants and children, the researchers discovered that children's gut microbiome developed in three distinct phases: a developmental phase (3–14 months of age), a transitional phase (15–30 months of age) where the microbiome diversifies, and a stable phase (31–46 months of age) where the microbiome's composition is largely established. Breastfeeding—even partially—was found to play a crucial role in infants' gut microbiome development, and probiotics, antibiotic use, and other factors also had an effect. Researchers also found a possible beneficial effect on risk for type 1 diabetes from bacteria that produce short-chain fatty acid molecules. These molecules are often made during fermentation of indigestible carbohydrates like fiber, and further future research will be needed to determine whether these molecules or the bacteria that produce them protect against type 1 diabetes. These results from TEDDY are just the tip of the iceberg with respect to the findings that are expected to stem from this effort that have the potential to revolutionize our ability to prevent type 1 diabetes.

TESTING STRATEGIES TO PREVENT OR SLOW THE

This concept of first testing agents in new-onset type 1 diabetes through TrialNet TN, and then testing them earlier in the disease course, has been a successful model for TrialNet operations. Two of TrialNet's ongoing three prevention trials are testing agents that were previously studied in people with newly diagnosed type 1 diabetes: abatacept and anti-CD3 monoclonal antibody. Results of the anti-CD3 trial were published last month in the *New England Journal of Medicine*, and we are excited about the promise of this therapy for preventing progression to

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We are also committed to extracting as much knowledge as possible from the large amounts of data that are being generated from *Special Diabetes Program*-supported research. For example, HIRN researchers are exploring machine learning and artificial intelligence approaches to data analysis. The software that HIRN is developing will be open-source and

CONCLUDING REMARKS

I appreciate this opportunity to share with you these exciting scientific advances, ongoing efforts, and emerging opportunities in type 1 diabetes research. We are extremely grateful for the continued support of Congress that has allowed 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 our dedicated clinical study participants, without whom the clinical research I described today would not be possible. With the remarkable progress already achieved through support from the *Special Diabetes Program*—and the promise of future research—NIH remains steadfast in our goals of preventing, treating, and ultimately curing type 1 diabetes. With continued research, it is possible to imagine that people could lead a life free of the burden of type 1 diabetes and its complications.

Thank you Chairman Collins, Ranking Member Casey, and Members of the Committee. I will be pleased to answer any questions you may have.

Griffin P. Rodgers, M.D., M.A.C.P.
Director, 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 more than 630 employees and a budget of nearly $2.03 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. More 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. In 2018 Dr. Rodgers was elected as a fellow to the American Association for the Advancement

Steering Committee, NIH-Food and Drug Administration (FDA) Joint Leadership Council, and NIH-Centers for Medicare & Medicaid Services (CMS) Leadership Council, among others.