DMRC QUARTERLY

Diabetes and Metabolism Research Center Newsletter

THE OHIO STATE UNIVERSITY
WEXNER MEDICAL CENTER

April 2022

Greetings from the Director:

Springtime is one of the most gorgeous times of the year in the country. As the days lengthen, the weather warms, and bright flowers bloom, we can't wait to get outside and enjoy the beauty of the season. We hope you will take the opportunity to walk, run, or bike outside, as there are many, many health benefits of exercise and physical activity. We have some exciting news to share with you because the DMRC has been working hard to expand its clinical and basic research efforts in a variety of areas, including type 1 and type 2 diabetes, metabolism, and obesity, as well as immunometabolism research. Our T32 is completing it first official course in Cardiometabolic Science, and we have a new postdoctoral fellow who has joined our T32 Cardiometabolic Science Training program as a 4th postdoctoral fellow. The DMRC continues the official search for a leader of our planned Type 1 Diabetes Research program. We have committed resources, but the DMRC is mobilizing our Community support to substantially enhance these resources to attract the brightest and best. Please let us know if you are interested in joining a committee to support this recruitment. The OSU Diabetes Center of Clinical Excellence (DMCE) is scheduled to open August, 2022; more to come in our Summer Newsletter.

I'm excited to announce that our next DMRC events will be the annual "**Islet Cell Invitational**," which will take place on September 26, 2022, at Columbus Country Club. Then our next annual "**Dining for Diabetes" Education and Research Update**, will take place on Thursday, October 20, 2022, at the Ohio Union's Archie Griffin Ballroom. More information will be available soon.

Wishing you a bright, warm, beautiful, and safe spring!

Willa Hsueh, MD
Director, Diabetes and Metabolism Research Center
Division of Endocrinology, Diabetes and Metabolism

Researcher Spotlight:

Shyam S. Bansal, PhD

Dr. Shyam S. Bansal, PhD, is an Assistant Professor in the Department of Physiology and Cell Biology, and an investigator at the Dorothy M. Davis Heart & Lung Research Institute. He is also the Chair of the DHLRI Education Committee. The focus of his research is to study immuno-inflammatory mechanisms of heart failure (HF). More, specifically he is working on elucidating the role of CD4+ helper T-cells in mediating pathological left-ventricular (LV) remodeling during ischemic HF, and to identify T-cell specific mechanisms that can be targeted to quell activated T-cells with an ultimate purpose to ameliorate LV remodeling and inhibit progressive cardiac dysfunction. Dr. Bansal is experienced in different mouse models of HF and is well-versed with the temporal kinetics of immunological mechanisms that determine wound healing *vs* pathological tissue-remodeling in rodents. His laboratory is experienced in the isolation of immune cells from the failing and non-failing hearts, and heart-draining mediastinal lymph nodes with expertise in multi-color cytometry to simultaneously identify several innate (infiltrating and resident macrophages, neutrophils and different dendritic cells) and adaptive immune cells (B-cells, and CD4+ and CD8+ T cells) in a single sample. In addition, he has significant expertise in studying rodent cardiac physiology using classical techniques such as

echocardiography to measure cardiac function as well as pressure-volume studies to measure cardiac contractility and relaxation parameters. He is also interested in identifying the role of exosomes in regulating immune activation post-ischemic injury and have optimized size-exclusion methods to isolate intact exosomes quintessential to study their interaction with the immune cells. The key ideas being explored in his laboratory are i) what are the signals released by the ischemic heart that regulate tolerogenic *vs* immunogenic inflammatory responses, ii) what are the signaling mechanisms that mediate pathogenic activation of T-cells, and iii) designing small drug molecules to reverse pathological changes in T-cells to promote wound-healing and improve cardiac function.

Dr. Bansal is a board-certified pharmacist from India and was ranked 6th (with a percentile of 99.96) in the country among all pharmacy students in the national graduate aptitude test examination (GATE). He was also ranked 1st in the country in an examination conducted by the National Institute of Pharmaceutical Education and Research (NIPER), a premier national institute for pharmaceutical sciences in India, from where he earned a master's degree in Pharmaceutics (science of drug delivery). In 2007, Dr. Bansal came to the US for masters and PhD in Pharmacology and Toxicology from the University of Louisville (UofL), Louisville, KY. His graduate work involved designing of slow-release biodegradable polymeric sub-cutaneous implants for the delivery of poorly bioavailable natural polyphenolics to enhance their chemo-preventive properties. For his achievements, Dr. Bansal was selected as the outstanding graduate student by his department, and his findings have now been patented by the UofL. Following his initial post-doctoral training in nanochannel drug delivery at the Methodist Hospital Research Institute, Houston, TX, in 2012 he joined the laboratory of Dr. Sumanth D. Prabhu at the University of Alabama at Birmingham (UAB), a nationally recognized cardiologist and physician-scientist. Under Dr. Prabhu's tutelage, he started exploring the role of T-cells in ischemic HF. From his studies, Dr. Bansal showed that CD4+ helper T-cells undergo a temporal pathological transition during HF and inhibition of CD4+ T-cells could be developed as a promising therapy for HF. He also showed that due to sustained pro-inflammatory milieu, regulatory T-cells, classically considered protective and anti-inflammatory, lose their immune-suppressive potential and promote pathological LV remodeling. His studies are published in several high-profile journals and were recommended as one of the most influential findings by the faculty of 'F1000Prime'. Under Dr. Prabhu's mentorship, Dr. Bansal also secured a post-doctoral fellowship from the American Heart Association followed by a K99/R00 'Mentored Transition to Independence' grant from the NHLBI, which was funded in the first attempt.

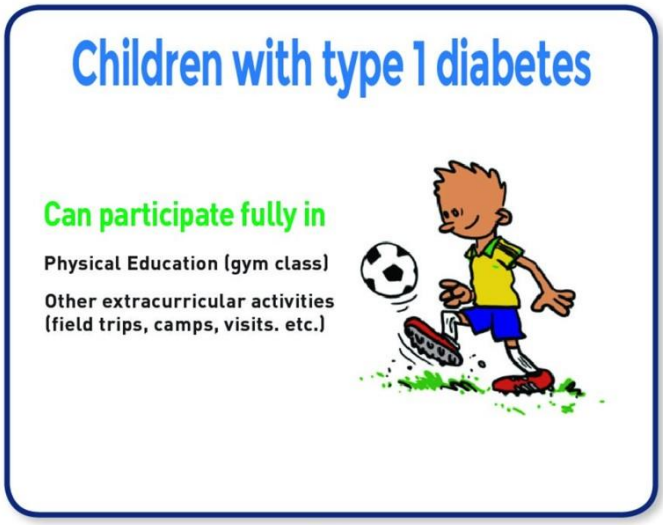
In 2018, Dr. Bansal joined the Ohio State University to start his independent academic career. He continued working on CD4+ T-cells with an ultimate goal of identifying molecular mechanisms that lead to pathological activation of T-cells, and to design novel drug molecules against them. To realize this goal, he used a combination of high-throughput RNA sequencing and advanced immunological techniques. Using his multi-disciplinary training in pharmacy, pharmacology and toxicology, Dr. Bansal not only discovered a potential pathway but also successfully identified a novel drug molecule that selectively inhibits CD4+ T-cells at clinically translatable doses, and blunts their activation to derive therapeutic immunomodulatory effects during HF. In a short span of 3 years, he has submitted 2 patents out of this work as the lead inventor. In a different project, Dr. Bansal also identified an important role of TNF receptor (TNFR) 1 in mediating T-cell survival and proliferation, and more importantly in regulating tolerogenic *vs* immunological activation of immune cells during autoimmune like-responses, such as in HF. Findings from this work formed the basis of first R01 from the National heart and Lung research Institute of NIH. Additional studies in Dr. Bansal's laboratory involve identifying the metabolic regulation of immune cell activation during HF and he is specifically focusing on the role of mTORC1 and mTORC2. Dr. Bansal's scientific feats could also be judged by the fact that he was selected as the finalist for the prestigious 'Melvin L. Marcus Early Career Investigator' award and the 'Outstanding Early Career Investigator' award by the American Heart Association and by the council on Basic Cardiovascular Sciences, respectively.

Dr. Bansal considers mentoring and training the next generation of scientists as his utmost responsibility as a teacher, and he believes that the most effective way to achieve this is by instilling scientific curiosity at an early age. To accomplish this, Dr. Bansal regularly reviews scientific projects from the middle and high-school students at the district and state level. He also mentors and guides a team of 10-12 year old students to review articles for the journal 'Frontiers for Young Minds', which publishes scientific articles that can be understood by the middle and high-school students. Dr. Bansal also regularly reviews pre-and post-doctoral grants for the American heart Association and is a reviewer with the National Science Foundation.

From the Clinic:

Type 1 Diabetes and Exercise Management for Youth

Sports are an important part of our culture. Most high schools in the United States have organized team sports, and these activities can become extremely competitive as early as middle school. When children with type 1 diabetes are athletic, it is critical that their parents, health care professionals and teachers teach them how to plan ahead of time so that they can be their best athletic selves. Diabetes should not prevent youth from achieving their exercise goals, whether they are for fun on occasion or at a higher level of performance. Indeed, many people with T1D have gone on to achieve extraordinary athletic achievements. Developing an exercise management plan for a young person with T1D entails first understanding their physical activity pattern and then selecting the appropriate strategy. There are few strategies for controlling blood glucose levels before, during, and after exercise. Among these tools are glucose monitoring, carbohydrate intake, insulin adjustments, and exercise strategies.



There are no existing guidelines for children's target blood glucose levels at the start of exercise. Glucose monitoring data, on the other hand, allows for the refinement of future exercise strategies and can inform how different factors and behaviors influence blood glucose levels. The level of blood glucose at the start of exercise can be used to tailor glycemic management strategies.

Factors influencing the amount of carbohydrate intake required to prevent exercise-mediated hypoglycemia include body mass, circulating insulin levels and the type, intensity and duration of exercise. If exercise is occurring when circulating insulin levels are high, such as within 3 h of a meal-time insulin bolus, then up to 1.0–1.5 g of carbohydrate/kg ideal body weight/ hour of sustained activity may be required. The blood glucose level and trend at the start of exercise are other factors to consider and recommendations based on these parameters should be individualized.

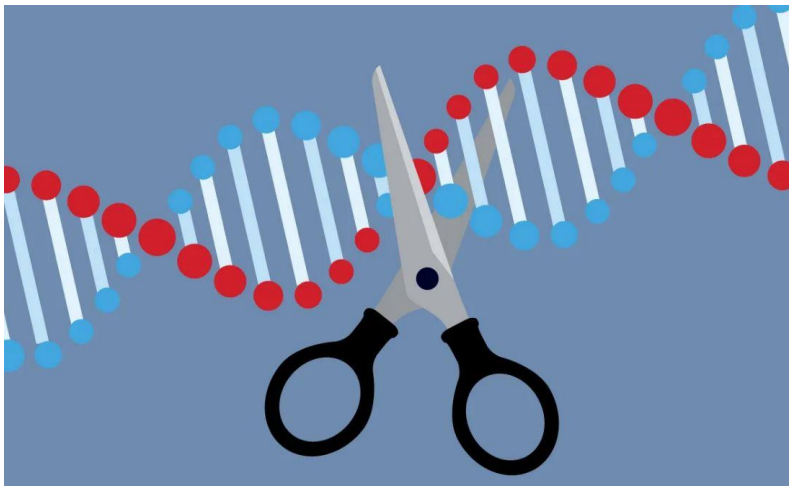
Exercise Tips for Youth with Diabetes. These tips can help avoid diabetes problems during exercise:

- **Test yourself.** Your doctor will tell you when to test your glucose levels — often you'll need to check them before, during, and after exercise.
- **Take the right dose of insulin.** Your doctor might recommend adjusting your insulin dosage for exercise or sports. If you inject insulin, you might not want to inject a part of your body used for your sport before exercise (like injecting your leg before soccer). This could cause the insulin to be absorbed too quickly. If you wear an insulin pump, be sure that it won't be in the way for exercise and that it won't get disconnected. Talk to your doctor about what you should do when you want to go without the pump.
- **Eat right.** Your diabetes health care team will also help you adjust your meal plan so you have enough energy for exercise. For example, you might need to eat extra snacks before, during, or after working out. Be sure to maintain the proper diet for your diabetes — don't try strategies like loading up on extra carbs before running or cutting back on food or water to get down to a certain weight for wrestling. These activities can be dangerous for people with diabetes.
- **Bring snacks and water.** Whether you're playing football at the school or swimming in your backyard, keep snacks and water nearby.
- **Pack it up.** If you'll be exercising away from home, pack your testing supplies, medications, medical alert bracelet, emergency contact information, and a copy of your diabetes management plan. Keep these items in a special bag that you don't have to pack and repack every time you go out.
- **Tell your coaches.** Be sure that your coaches know about your diabetes. Tell them about the things you need to do to control diabetes that might happen before, during, or after a game.
- **Take control.** Don't hesitate to stop playing or take a break in your exercise routine if you need to eat a snack, drink water, or go to the bathroom. You should also take a break if you feel any signs that something is wrong.

Clinical guidelines, as well as a recent comprehensive consensus statement on exercise and T1D, provide comprehensive evidence-based recommendations. Diabetes complications can be avoided during exercise by being prepared and following diabetes management plan.

Frontiers in Endocrinology *Nemours TeensHealth*

Clinical Trial News:



The First Gene-Edited Cell Replacement Therapy Takes a Step Forward

The launch of a clinical trial for VCTX210 to test a gene-edited stem cell replacement therapy for type 1 diabetes (T1D). They passed an important milestone: the first person has received the therapy. This novel therapy is designed to eliminate the need for immune suppression.

How It Works: To cure people with established T1D, two things must happen. The body must regain the ability to produce insulin, and the cells that make the insulin must be able to thrive inside the body, safe from immune attack. The approach taken by ViaCyte and CRISPR utilizes gene-edited precursor cells to accomplish this. Precursor cells are cells that require further maturation before they are fully functional. These cells have been genetically modified to make them immune-evasive, i.e., they can function inside the body without being attacked by the immune system. Because they have been designed to evade the immune system, immunosuppressive therapy is not required to keep the cells alive. This phase I trial is studying the safety of the therapy, the body's ability to tolerate it, and the immune-evasiveness of the cells. Enrollment began in late 2021 in Canada. If the phase I trial is successful, further trials will specifically look to examine the efficacy of the therapy to see if it works as planned, restoring insulin production without the need for chronic immune suppression.

Please visit the JDRF to read the full article "The First Gene-Edited Cell Replacement Therapy Takes a Step Forward."

Please visit Clinical trial of VCTX210 to read "Clinical trial of VCTX210, a gene-edited stem cell replacement therapy for this disease."

Research Updates:

JACC: Basic to Translational Science

"*Short-Chain Carbon Sources Exploiting Pleiotropic Effects for Heart Failure Therapy"*

Heart failure is the leading cause of morbidity and mortality in the developed world, unfortunately, currently, there are no effective therapies that can slow the progression of disease and significantly improve prognosis. The recent success of SGLT-2 inhibitors in patients with heart failure has partly been attributed to their association with increased ketone bodies (KBs) that results in improved myocardial energetics. Our lab has shown that similar small molecules, short-chain fatty acids (SCFAs) are preferentially oxidized over ketone bodies in failing hearts. In this review, we presented pre-clinical and clinical evidence in support of the potential of KBs and SCFAs as novel strategies for the treatment of heart failure.

Despite advances in understanding of the pathological mechanisms underlying the progression of heart failure (HF), it remains the leading cause of morbidity and mortality in the developed world. Of particular concern is the lack of effectiveness of current therapies in improving outcomes for patients with HF with preserved ejection fraction (HFpEF), who account for half of all patients presenting with HF. Therefore, the urgent need for novel and effective therapeutic strategies to treat patients with HF cannot be overstated. Over the past decade, a ketogenic diet and exogenous ketone bodies (KBs) have garnered a great deal of public attention. Several preclinical studies have demonstrated the cardioprotective effects of elevating levels of circulating KBs. Recently, sodium-glucose cotransporter-2 (SGLT2) inhibitors have shown remarkable effects in improving cardiovascular outcomes in patients with HF, irrespective of diabetic status. Adding to the intrigue was the observation that SGLT2 inhibitors were associated with increased circulating KBs. Thus, interest in exploring KB metabolism as a therapeutic target for treatment of HF has since amplified. Short-chain fatty acids (SCFAs) are carboxylic acids containing up to 5 carbons, including acetate (2 carbons), propionate (3 carbons), and butyrate (4 carbons), generated primarily as products of fermentation of dietary fibers by the intestinal microbiota. Following the publication of the findings of large randomized clinical trials with associations of high-fiber diets with favorable cardiovascular outcomes, increasing attention has been given to exploring cardio protective effects of SCFAs. In particular, the protective properties of high-fiber diets against systemic hypertension and HF have been explored in preclinical studies and found to be closely associated with the salutary effects of SCFAs. Consistent with these

studies, findings from large cohorts have revealed decreased levels of SCFAs in the gut, as well as in the circulation of patients with HF and/or hypertension. In addition to the potential of KBs and SCFAs as alternative fuels for the heart, accumulating experimental evidence suggests that both KBs and SCFAs exert a wide array of non-metabolic functions, as signaling molecules and epigenetic modifiers and in affecting the regulation of inflammation and immunity, blood pressure (BP), the autonomic nervous system, and prevention of oxidative stress. In this review, we present the perspective that the key non-metabolic activities of KBs and SCFAs, along with their potential role in cardiac energy metabolism, make them promising targets for the treatment of patients with HF. Circulating KBs are transported into cells by monocarboxylate transporters. KBs diffuse into mitochondria entering oxidative metabolism via b-HB dehydrogenase 1 to ultimately produce acetyl-CoA and entry into the tricarboxylic acid cycle. There is little direct evidence for de novo extrahepatic ketogenesis. Indeed, labeling artifact occurs because of reverse flux through the reversible key enzymes involved in the ketone utilization pathway, including succinyl-CoA:3-ketoacid CoA transferase, b-HB dehydrogenase 1, and acetoacetyl- CoA thiolase 1, a process called “pseudoketogenesis,” as reviewed previously. Endogenous SCFAs are generated primarily as products of fermentation of dietary fibers and resistant starches by the intestinal microbiota. SCFAs can also be administered exogenously. SCFAs enter cells via monocarboxylate transporter and are oxidized after entry into mitochondria to enter the tricarboxylic acid cycle. SCFAs can influence energy metabolism, inflammation and immunity, regulation of BP, and the autonomic nervous system. Circulating levels of SCFAs can vary considerably, likely depending on the timing of serum collection (fasting vs. postprandial), dietary content, species type, method of quantification, and whether exogenous supplementation is used to bolster the levels. In general, acetate has the highest circulating level, with serum concentrations ranging from 100 to 1,000 mM, whereas the concentrations of propionate and butyrate are typically <20 mM but can be elevated up to >200 mM via exogenous supplementations. Intravenous infusion of sodium butyrate can raise the level even further to >500 mM without significant toxicities. Although in the absence of such supplementation, baseline endogenous circulating SCFAs are less likely to provide significant fuel for the myocardium, the high affinity of SCFAs for the respective G protein–coupled receptors (GPRs) can induce pleotropic nonmetabolic effects at even these low concentrations.

About the author: *Dr. Challa obtained his medical degree from University of Gondar, Ethiopia. He then came to the US to attend a graduate school at Florida State University where he completed his PhD in biomedical sciences. There through a pre-doctoral grant from AHA, he*

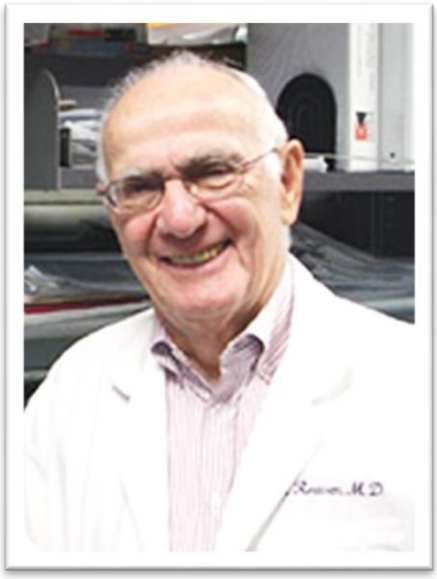
studied molecular mechanisms of cardiac remodeling focusing on the process of myocardial fibrosis. After completing his PhD, he worked as a postdoctoral associate at Yale University before joining the internal medicine residency program at UPMC under the International Scholars Track. After completing his internal medicine residency, he joined OSU for a cardiology fellowship in July/2020. Since Jan/2022, he has been doing basic science research in cardiac metabolism under the mentorship of Dr. Lewandowski and sponsored by the T32 Cardiometabolic Science Postdoctoral Training Program. His goal is to become independent physician scientist treating patients with HF clinically and understanding the process of metabolic remodeling in the failing heart in the lab with the long-term plan of discovering novel ways to target cardiac metabolism for the treatment of HF

Please visit: JACC: Basic to Translational Science to read the full article *"Short-Chain Carbon Sources Exploiting Pleiotropic Effects for Heart Failure Therapy"*

Science Updates:

Insulin Resistance

Gerald "Jerry" M. Reaven, MD, could easily be epitomized as the "Father of Insulin Resistance." Jerry Reaven, who gained international recognition for coining the term Syndrome X — now known as metabolic syndrome. Dr. Reaven was one of the first researchers to argue for the existence of insulin resistance, a diminished response to the hormone insulin. Dr. Reaven is credited with developing the insulin suppression test, the first quantitative method to measure insulin-mediated glucose uptake in humans. Using this technique, he established the importance of insulin resistance in human disease and, importantly, in type 2 diabetes.



It was a controversial concept that met with huge opposition. But Dr. Reaven proved the naysayers wrong. In the 1950s, when Reaven started out as a researcher, it was believed that

there was only one type of diabetes and that it was caused by a lack of insulin. He was tenacious when it came to defending his scientific observations. He didn't like to accept opinions; he liked to accept facts that generated from well-controlled scientific investigations. In 1988, he also introduced the novel idea of a link between insulin resistance and a cluster of other metabolic abnormalities that together greatly increased the risk for cardiovascular disease, which he called Syndrome X. Never one to back down from a fight, Reaven broke ground when he argued for the existence of insulin resistance as an early and critical link in the development of Type 2 diabetes and conducted numerous studies over many decades proving the existence of insulin resistance and its many implications for metabolic diseases and cardiovascular diseases. Jerry Reaven continued to actively conduct research until his bad health finally kept him at home. He co-authored more than 800 papers in scientific journals. He was also the author of several books, including a popular book on Syndrome X and its repercussions on cardiovascular health. He was a mentor to many scientists both at Stanford and around the world.

His son, Peter Reaven, MD, continues in his father's footsteps and has been actively working on clinical and research background in insulin resistance, diabetes, dyslipidemia and vascular disease, where he has pursued these related lines of investigation with multiple approaches, including in vitro studies, animal models, and carefully controlled intervention trials in clinical research center settings. During the past two decades, Dr. Peter Reaven has been closely involved in the development, conduct and analysis of large, multicenter clinical trials and in utilizing these studies for identification of standard and novel risk factors for cardiovascular disease. He was a quest lecturer on our T32 Cardiometabolic Science Course recently, where he shared a research update on insulin resistance and clinical syndromes associated with it. In his lecture, Dr. Peter Reaven shared that insulin-mediated glucose uptake (IR) varies more than six-fold in apparently healthy individuals and that approximately 25% of this variability can be attributed to differences in adiposity. Risk factors for type 2 diabetes and cardiovascular disease are seen primarily in obese people who are also insulin-resistant. Insulin resistance is associated with a multitude of CVD risk factors and there is an increasing number of clinical conditions closely associated with (and in some cases, partially mediated by or contributing to) insulin resistance.

In the News:

“Most U.S. adults with diabetes aren't managing the risks for heart disease.”

According to a new analysis aimed at guiding doctors and patients on the latest approaches to help people with Type 2 diabetes in the United States, the majority of people with the disease aren't managing risk factors for heart disease. Type 2 diabetes is the most common form of diabetes. It affects more than 34 million people in the U.S., according to the Centers for Disease Control and Prevention. Cardiovascular disease is the leading cause of death and disability among people with Type 2 diabetes, which occurs when the body is unable to efficiently use the insulin it makes or when the pancreas loses its capacity to produce insulin. Adults with Type 2 diabetes are twice as likely to die from cardiovascular causes – including heart attacks, strokes and heart failure – compared to adults who do not have diabetes.

“Fewer than 1 in 5 adults with Type 2 diabetes who are not diagnosed with heart disease have healthy levels for blood sugar, blood pressure and cholesterol and don't smoke”, said Dr. Joshua Joseph, assistant professor of medicine in the Division of Endocrinology, Diabetes and Metabolism at the Ohio State University College of Medicine. Dr. Joseph led the panel of experts that wrote the new report from the American Heart Association, which was published Monday in Circulation. It offers a review of the latest science on diabetes and heart disease, including findings about new medications that have changed diabetes care in recent years. "This new scientific statement is an urgent call to action to follow the latest evidence-based approaches and to develop new best practices to advance Type 2 diabetes treatment" and reduce the risk of cardiovascular disease, Dr. Joseph said in a news release. Breaking down the four walls of the clinic or hospital through community engagement, clinic-to-community connections, and academic-community-government partnerships may help address and support modifiable lifestyle behaviors such as physical activity, nutrition, smoking cessation, and stress management as one

way to continue to address and advance diabetes management. To read full news please visit: Modern Healthcare News

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Please Join Us:

Endocrine Update 2022
Division of Endocrinology, Diabetes and Metabolism
Department of Internal Medicine
College of Medicine

April 30th, 2022

Virtual Conference Link: Please contact osuendocrineupdate@osumc.edu for a virtual link

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We will be implementing breakout rooms throughout today's conference, which will feature presentations from the following pharmaceutical companies:

Corcept	Novo Nordisk - Obesity	Alexion	Boehringer Ingelheim
Novo Nordisk - Diabetes	Recordati Rare Diseases	Eli Lilly	Tandem

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7:30 - 7:45 AM	***Welcome and Event Overview*** Kathleen Wyne, MD
7:45 – 8:45 AM	***Evolving Approaches to Thyroid Cancer Guidelines: Dynamic Risk Assessment and Active Surveillance*** Matthew Ringel, MD
8:45 - 9:15 AM	***Transgender Patient Care*** Roger Harty, MD
9:15 - 9:45 AM	***Adrenocortical Testing: Do Order, But Don't Misinterpret!*** Lawrence Kirschner, MD, PhD
9:45 – 10:15 AM	***How to Manage New Insulins*** Lubna Munshi, MD
10:15 – 10:45 AM	***Use of DM Technology in Management of Pregnancy*** Elizabeth Buschur, MD

10:45 - 11:15 AM **BREAK**

11:15 – 12:00 PM ***CGM Guidelines and Data Interpretation***
Kathleen Dungan, MD, MPH

12:00 – 12:30 PM ***Panel Discussion***
Featuring morning presenters

12:30 – 12:45 PM **LUNCH**

12:45 - 1:15 PM **LUNCH cont'd, *Meet the Expert Sessions***
Room 1: Elizabeth Snyder, RD, *Practical Application of CGM Therapy*
Room 2: Amy James, RPh, *Lipid Case Study*
Room 3: Fadi Nabhan, MD, *Initial Management of Low-Risk Thyroid Cancer*
Room 4: Roger Harty, MD, *Caveats of Testosterone Replacement Therapy*

1:15 – 1:45 PM ***Lp(a): A Lipoprotein Particle that Finally has Clinical Utility***
Kathleen Wyne, MD, PhD

1:45 – 2:15 PM ***New Strategies for Management of Post-Transplant Endocrine Diseases***
Shumei Meng, MBBS, PhD

2:15 - 2:45 PM ***Acromegaly; New Pituitary Society Guidelines***
Luma Ghalib, MD

2:45 – 3:15 PM ***Non-Alcoholic Fatty Liver Disease***
Na Li, MD, PhD

3:15 – 3:45 PM ***How Does Physical Activity Fit Within Weight Management?***
Benjamin O'Donnell, MD

3:45 - 4:15 PM **BREAK**

4:15 – 4:45 PM ***Issues with Osteoporosis Medication Discontinuation***
Steven Ing, MD

4:45 – 5:15 PM ***Extracellular Vesicles, an Increasingly Recognized Means of Endocrine Communication***
Willa Hsueh, MD

5:15 PM **END**