Purpose-Built Quantitative Magnetic Resonance Methods to Probe the Pathogenesis of Type 2 Diabetes

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Abstract

In this lecture I will discuss the development of purpose-built quantitative MR methods, informed by chemistry and biophysics, to probe the pathogenesis of type 2 diabetes. Recent studies have suggested that adipose tissue hypoxia, brought on by adipocyte hypertrophy, is a primary pathway to systemic insulin resistance. This “hypoxia-driven insulin resistance hypothesis” has been indirectly inferred from histologic data, yet adipose hypoxia and adipocyte hypertrophy have not been directly resolved in vivo. Rationally designed quantitative MR methods provide a means to these ends - adipose pO₂ can be calculated from measures of triglyceride longitudinal relaxation and adipocyte size can be calculated from measures of triglyceride diffusion. These quantitative MR techniques provide completely new insight into adipose tissue structure and function and its key role in the pathogenesis of insulin resistance and type 2 diabetes.

Bio-Sketch

Scott Beeman, Ph.D., is an Assistant Professor of in the School of Biological and Health Systems Engineering. He holds a B.S.E. and Ph.D. in Biomedical Engineering from Arizona State University and completed his postdoctoral research training at the Washington University School of Medicine’s Biomedical Magnetic Resonance Laboratory. Dr. Beeman received an NIH K01 Career award in 2016 and joined the faculty at Washington University in January of 2017. He recently joined the SBHSE faculty in August of 2019. The mission of Dr. Beeman’s laboratory is to design quantitative magnetic resonance (MR)-based methods, informed by the fundamental biophysics that underpin the complex in vivo MR signal, to advance the scientific understanding of health and disease. Current funded research efforts are aimed at developing quantitative MR-based methods to interrogate the unknown pathogenesis of type 2 diabetes and its downstream complications.