

2024 Advanced Diabetes Graduate Level Course

Course Name: Multidisciplinary Approaches to Study Diabetes (GBS788 VTC)

Aimed at: 2nd Year and beyond GBS students

Theme: P3

Course Director: Dr. Sasanka Ramanadham

Course Co-Director: Dr. Sushant Bhatnagar

Course Instructors (in alphabetical order):

Dr. Anand/Rita Basu (Professors, Dept Medicine; Endo, Diabetes and Metabolism)
Dr. Sushant Bhatnagar (Assoc Professor, Dept Medicine; Endo, Diabetes and Metabolism)
Dr. Fernando Bril (Asst Professor, Dept Medicine; Endo, Diabetes and Metabolism)
Dr. Jake Chen (Professor, Genetics and Computer Science)
Dr. Kirk Habegger (Assoc Professor, Dept Medicine; Endo, Diabetes and Metabolism)
Dr. Andrew Hardaway (Asst Professor, Department of Psychiatry & Behavioral Neurobiology)
Dr. Chad Hunter (Professor, Dept Medicine; Endo, Diabetes and Metabolism)
Dr. Jeonga Kim (Assoc Professor Dept Medicine; Endo, Diabetes and Metabolism)
Dr. Sasanka Ramanadham (Professor, Dept CDIB)
Dr. Glenn Rowe (Asst Professor Dept Medicine; Cardiovascular Disease)
Dr. Anath Shalev (Professor, Dept Medicine; Endo, Diabetes and Metabolism)
Dr. Jared Taylor (Asst Professor, Dept. Microbiology)
Dr. Adam Wende (Assoc Professor, Dept Pathology; Mol Cell Pathol)
Dr. Martin Young (Professor, Dept Medicine)

Course Duration:

14 Lecture weeks
This will be a 3 Hour GBS Advanced Course

Lecture Hours:

Meet Wednesdays for 2 hours (28 hours total); 3 take-home exams

Course Material: ppt, send to students and lecturers 2-3 days prior to lecture

Student's Assessment: Course grade must be a letter grade (A, B, C,,,))

Tentative Topics to be Covered

Dr. Fernando Bril (Asst Professor, Dept. Medicine; Endo, Diabetes and Metabolism)

Classification of/genetics of diabetes (Types 1 and 2, incl MODY, secondary DM, lipodystrophic diabetes)

How classification informs clinical therapeutic choices / underlying mechanisms of treatment / personalized medicine for diabetes

Intro to whole body glucose metabolism (incl non-insulin hormonal regulation -- can divide with Kirk)

Dr. Sushant Bhatnagar (Assoc Professor, Dept. Medicine; Endo, Diabetes and Metabolism)

Hour 1: Overview of insulin secretion pathway, which will include the role of GLUT2, GK, glycolytic metabolites, K_{ATP} channel, the concept of coupling factors, signaling pathways (fatty acids, amino acids, and incretins) in insulin secretion. Overview of the maturation of insulin granules, regulation of SNARE complex, fusion modes of insulin granules, and recent developments in connecting the metabolism to the exocytotic site.

Hour 2: Role of key autocrine, paracrine, and endocrine factors affecting beta cell function, adaptation of beta cell function in obesity and type 2 diabetes, novel approaches (genetics and bioinformatics) to identify factors affecting beta cell function in obesity and type 2 diabetes.

Dr. Chad Hunter (Professor, Dept. Medicine; Endo, Diabetes and Metabolism)

Hour 1: Overview of mammalian pancreas/islet/beta-cell development, with a particular focus on islet morphogenesis, cell type differentiation, and the underlying transcription factors/co-regs, signaling cascades, and epigenetic involved.

Hour 2: Applying what has been learned about islet development toward the generation of new beta-cells for future diabetes therapies - e.g. trans-differentiation of related cell types into beta-cells, embryonic stem cell directed differentiation into beta-cells, etc.

Dr. Jeonga Kim (Assoc Professor, Dept. Medicine; Endo, Diabetes and Metabolism)

1. Insulin signaling in metabolic tissues
2. Mechanisms and pathophysiology of insulin resistance
3. Underlying mechanisms for current pharmacological treatments for type 2 diabetes

Dr. Kirk Habegger (Assoc Professor, Dept. Medicine; Endo, Diabetes and Metabolism)

Cover Obesity and Metabolic Syndrome including:

- Genetic Factors in Obesity
- Hypothalamic Regulation of Feeding, Energy Expenditure, and Obesity
- Integration of Metabolic Processes
- Research Methodologies and Animal Models of Diabetes and Obesity

Dr. Glenn Rowe (Asst Professor, Dept. Medicine; Cardiovascular Disease)

Hour 1: Outline the underlying pathologies that contribute to metabolic syndrome (obesity, diabetes and cardiovascular disease). Will focus on the contribution of mitochondrial dysfunction (impaired biogenesis, dynamics and mitophagy) in the development of metabolic syndrome. We will also talk about the regulation of the pathways that are involved in maintaining bioenergetics.

Hour 2: We will have a group discussion on a recent paper which covers all or some of these concepts.

Dr. Adam Wende (Assoc Professor Dept. Pathology; Mol Cell Pathol)

Hour 1: Consequences of complications associated with diabetes and poor glycemic control, with a particular focus on epigenetics in both cardiac and vascular biology. This will include a summary of clinical data supporting the role of diabetes in CVD as well as ways to detect these molecular changes.

Dr. Martin Young (Professor, Dept, Medicine)

Hour 1: Discuss the different ways in which cardiometabolic diseases (obesity, diabetes, dyslipidemia, hypertension) increase risk for heart disease development. This will include a brief overview of different forms of heart failure, as well as the contribution of perturbations in metabolism, autonomic/sympathetic tone, humoral factors, inflammation, and shear stress towards the etiology of heart disease during cardiometabolic diseases.

Hour 2: An interactive discussion of a recently published research article focused on the treatment of heart failure during diabetes

Dr. Andrew Hardaway (Asst Professor, Dept. Psychiatry & Behavioral Neurobiology)

Hour 1: Energy Intake. We will review the cellular and molecular pathways in and interconnected with the brain that either promote or inhibit energy and fluid intake. We will explore different basic science technologies used to determine these pathways.

Hour 2: Energy Expenditure. We will review the cellular and molecular pathways in and interconnected with the brain that regulate energy expenditure including metabolism, regulation of body temperature, and glucose homeostasis. We will explore preclinical techniques used to determine these pathways.

Dr. Sasanka Ramanadham (Professor, Dept. CDIB)

1. Broad Introduction/Review of different classes of lipids
2. Role/Mechanism of select lipids in β -cell function/survival and in autoimmunity and T1D
3. Exposure to lipidomics (mass spectrometry approaches)

Dr. Jared P Taylor (Asst Professor, Dept. Microbiology)

Hour 1: Discuss how the immune response contributes to pancreatic beta-cell destruction in Type 1 diabetes

Hour 2: I plan to discuss how the immune system contributes to insulin-resistance in Type 2 diabetes with a particular focus on adipose tissue inflammation. The bulk of that lecture will be focused on adipose tissue macrophages, but it is apparent that other immune cell subsets (T cells) also contribute to inflammatory processes.

Dr. Jake Chen (Professor, Dept. Genetics, Computer Science, and Biomedical Engineering)

Introduction to Systems Biology

Dr. Anand/Rita Basu (Professors, Dept. Medicine; Endo, Diabetes and Metabolism)

Translational Approaches

Dr. Anath Shalev (Professor, Dept. Medicine; Endo, Diabetes and Metabolism)

Hour 1: Go over current diabetes therapies and the problems still not addressed.

Hour 2: Discuss example(s) of translational research and moving discoveries into the clinic.

The Fall 2024 Lecture schedule will be as follows:

Tentative Schedule

Jan. 10 - Dr. Fernando Bril (review of diab/tissues => diagnosis/treatment)

Jan. 17 - Dr. Sushant Bhatnagar (insulin secretion)

Jan. 24 - Dr. Chad Hunter (transcription in beta cell transcription)

Jan. 31 - Dr. Jeonga Kim (adipose)

Feb. 7 - Dr. Kirk Habegger (liver)

Take-home exam 1

Feb. 14 - Dr. Glenn Rowe (Ca/Skeletal muscle)

Feb. 21 - Dr. Adam Wende (heart/epigenetics)

Feb. 28 - Dr. Martin Young (cardiomyopathy)

March 6 - Dr. Andrew Hardaway (neuro/diabetes/GLP)

Take-home exam 2

March 13 - Dr. Sasanka Ramanadham (lipid signaling in T1D)

March 20 - Dr. Jared Taylor (T1D immunology)

March 27 – Dr. Jake Chen (Bioinformatics)

April 3 - Dr. Anand/Rita Basu (translation)

April 10 - Dr. Anath Shalev (translation)

Take-home exam 3