MCB465 Human Metabolic Disease
INFORMATION & POLICIES
SPRING, 2024

Tues, Thurs 3:30-4:45 pm (75 min lecture, 3 hr credit lecture course), 157 Noyes

A. COURSE DESCRIPTION

Regulation of the levels of cholesterol, bile acids, fat and glucose in the body is essential for the maintenance of health. Disruption of metabolic and energy homeostasis plays a crucial role in human metabolic diseases, such as, obesity, type II diabetes, fatty liver, cardiovascular diseases, and even, certain types of cancers. This course will examine how lipid and sugar levels and energy balance are controlled under normal physiological conditions and how they are misregulated under metabolic disease conditions. In addition, this course will cover emerging new concepts in the control of metabolism, including, aging, circadian rhythms, microRNAs, and altered cancer cell metabolism. Methodologies leading to scientific discoveries and potential preventive and therapeutic agents will be also discussed.

B. COURSE INSTRUCTOR

Instructor:

Sayeepriyadarshini Anakk
Associate Professor
Department of Molecular and Integrative Physiology
School of Molecular and Cellular Biology
Office: 453 Med Sci Bldg
anakk@illinois.edu

T.A.:
Amanda Weiss
Graduate student,
Department of Molecular and Integrative Physiology,
School of Molecular and Cellular Biology
email: awe1ss@illinois.edu
Office hours: Tues: 2:30-3:30 pm and 5:00-6:00 pm; and Thurs 2:30-3:30 pm

TA Office:

C. COURSE TIMETABLE

Classes will be held from 3:30-4:45 pm (75 min lecture) on Tuesday and Thursday at 157 Noyes. The first class will be held on **Tuesday, January 16, 2024.**

D. CLASS MATERIALS FOR THE COURSE

PowerPoint lecture notes will be posted online. However, if you would like to read more about lecture topics, Basic Medical Biochemistry by Lieberman and Marks, Medical Physiology by Walter Boron and Emile Boulpaep, and on-line free version of a text "The Medical Biochemistry Page" will be useful. There is **no official textbook** so **attending classes is strongly recommended.**

E. TOTAL POINTS IN THE COURSE: TOTAL 200 POINTS

THREE EXAMINATIONS (75 min EXAM): Examinations will be a combination of multiple choice, fill-in blank, and short essay questions. The short essay questions will involve data interpretation and designing experiments.

Examination I: 50 points
Examination II: 45 points
Examination III: 45 points
Assignments: 10 points
I Clicker : 10 points
Project Presentation Final: 40 points

Makeup exams will be given only in case of illness or other emergency. A letter from the McKinley Health Center or the Emergency Dean is mandatory. The student must contact both TA (awe1ss@illinois.edu) and Dr. Anakk (anakk@illinois.edu) within 48 h after the missed exam.

F. ACCESSING LECTURE MATERIALS IN THE WEB

The instructor of the course, Dr. Anakk, will place lecture materials and reading assignments on the course web site. Use your netid and campus AD password to login.

G. GRADING POLICY

MCB 465 is graded on the basis of total points accumulated throughout the semester. No distinction will be made between graduate and undergraduate students.

There is no fixed score for the different grade levels, but in the past years, about 30 % students received A- and above (eg, 2021: A+ total 185 above, A 175 above, A- 170 above), about 40-50 % students received B- and above (B- total 150 above), and about 20 % students received C+ and below.

H. James Honor Student Project

James honor students can select one of the lecture topics and write a summary paper (2-3 pages, double-spaced, 12 font, **Deadline May 10th,** e-mail to Dr. Anakk). Once students select a topic, Dr. Anakk will assign 1-2 original articles and 1 review article to help understanding the materials.

MCB465: Human Metabolic Disease

Spring Semester, 2024
Tuesday and Thursday
3:30PM – 4:50PM

Part I: Overview of Cellular Metabolism and Metabolic Signaling

1/16 #1 Course Information and Policies

Cellular Metabolism I:
Catabolism and Anabolism, Nutrients as Fuels, Digestion of Nutrients, Network of Metabolic Pathways, Metabolic Intermediates, Glycolysis (ATP Production from Glucose)

1/18 #2 Cellular Metabolism II:
Fuel Oxidation (TCA cycle, Oxidative Phosphorylation, Electron Transport Chain in Mitochondria), Anabolic Pathway (Synthesis of Carbohydrates, Proteins, and Lipids), Regulation of Cellular Metabolic Pathways

1/23 #3 Short-Term and Long-Term Control of Metabolism:
Metabolic Tissues, Endocrine and Neural Control of Metabolism

1/25 #4 Short-Term and Long-Term Control of Metabolism:
Metabolic Tissues, Endocrine and Neural Control of Metabolism

1/30 #5 Brief Overview of Cellular Signaling: Membrane Receptor Signaling

2/01 #6 Brief Overview of Cellular Signaling: Nuclear Receptor Signaling

Part II: Metabolic Disease and Potential Therapy

2/06 #7 Diabetes Mellitus Type 1: Pathology and Management / **Review for Exam I**

2/08 **EXAMINATION I (3:30-4:45 pm, Lectures #1-7)**

2/13 #8 Diabetes, and Metabolic Syndromes.
Obesity and Type 2 Diabetes Mellitus: Type 2 DM, MODYs, Gestational DM, and

2/15 #9 Obesity and Cardiovascular Disease: Key Players of Cholesterol Metabolism, Hypercholesterolemia, Atherosclerosis and Therapeutic Agents for Treating these diseases

2/20 #10 Energy Balance and Obesity I:
Hypothalamic Control of Appetite and Leptin Biology

2/22 #11 Energy Balance and Obesity II:
Hypothalamic Control of Appetite and Leptin Biology

2/27 #12 Adipose Biology: Adipose Tissue as a Key Endocrine Organ that Controls Energy Balance, Adipogenesis, Adipokines, Brown Adipose Tissue (BAT) vs. White Adipose Tissue (WAT), Fat Browning, Energy-dissipating BAT and Adaptive Thermogenesis.

2/29 #13 Obesity-Induced Non-Alcoholic Fatty Liver Disease (NAFLD): a disease spectrum ranging from Simple Steatosis to Non-Alcoholic Steatohepatitis (NASH), Liver Fibrosis and Cancer

3/04 #14 **Review for Exam II**

3/06 **EXAMINATION II (3:30-4:45 pm, Lectures #8-14)**

3/19 #15 Obesity and Hypertension, Obesity and Female Infertility (PCOS)

3/21 #16 Bile Acids and Hepatobiliary Diseases:
Bile Acids as Signaling Molecules Controlling Metabolism and Energy Balance (Gallstone, Cholestasis, Jaundice, Fibrosis, Cirrhosis, Liver Cancer) Bile acids and Gut Microbiome

Part III: Current Topics in Metabolic Regulation

3/26 #17 Metabolic Actions of Fibroblast Growth Factor 15/19 (FGF15/19) and FGF21:New Endocrine Hormones Controlling Metabolism and Energy Balance

3/28 #18 Post-Translational Modifications (PTMs) and Metabolism:
Therapeutic potential of targeting aberrant PTMs of metabolic regulators: e.g.) Obesity-induced phosphorylation of PPARg: New diabetes drug target?

4/02 #19 Circadian Clock and Metabolism:
Central and Peripheral Clocks: Molecular Basis of Controlling the Circadian Clock; Circadian Rhythm Asynchrony and Metabolic Disease

4/04 #20 AMPK (AMP-activated Kinase): A Key Cellular Energy Sensor

4/09 #21 **Review for Exam III**

4/11 **EXAMINATION III (3:30-4:45 pm, Lectures #15-21)**

4/16 #22 Aging and Metabolism:
Discovery of Aging Controlling Genes in Model Organisms
Mammalian Seven Sirtuins and Diseases
SIRT1: A Key Regulator Linking Metabolism and Aging

4/18 #23 Cancer Cell Metabolism:
Altered Cancer Cell Metabolism (The Warburg Effect): Cancer's Achilles Heel

4/23	#24	Group1 (Project presentation)
4/25	#25	Group 2 (Project presentation)
4/30	#26	Group 3 (Project presentation)
5/02	#27	Reading Day
5/07	#27	Group 4 (Project presentation)

Topics in Metabolism

1. Cancer
2. Aging
3. Cardiovascular disorder
4. Circadian Rhythmn