

Molecular Genetics Graduate Topic Course

Course Title: Mitochondrial Genetics in Health and Disease

Course Location: PGCRL 12.9701, 686 Bay Street

Course Time and Date: October 8th to November 12th, 2020

Course Instructor(s): Neal Sondheimer, MD, PhD and Dr. Thomas Hurd, PhD

Instructor Contact Information: neal.sondheimer@sickkids.ca and thomas.hurd@utoronto.ca

Course Overview:

Mitochondria are essential intracellular organelles that contain their own genomes. This course will focus on understanding how mitochondrial genomes are maintained, inherited and expressed, and how their dysfunction contributes to diseases such as cancer. Students will learn both fundamental concepts as well as recent advances in the field of mitochondrial genetics.

The structure of the course is as follows. Students will be organized into 6 groups. Each group will be assigned a topic from endosymbiotic theory to the role mitochondria play in cancer (see below). Groups will then develop and present a 30-minute power point-assisted lecture that would be suitable to teach this topic to a class of first year graduate students.

Course Objectives:

- Provide an introduction to mitochondrial genetics including how mitochondrial DNA originated, and how it is maintained and expressed
- Define key concepts in mitochondrial genetics such as heteroplasmy, purifying selection, halogroup and bottleneck.
- Explore principles of the role of mitochondrial function in diverse pathologies such as cancer and neurodegeneration.
- Teach students how to synthesize information and give successful oral presentations.

Marking Scheme:

- 30% in-class participation. We expect all students to participate in all aspects of each class. This includes asking questions of the lecturers and participating in the evaluation and discussion of the methods, data and conclusions, as well as the significance of the results for the field.
- 30% presentation of paper figures. We will ask for volunteers from the non-lecturers to present various figures from the primary research papers we assign. If there are no volunteers, we will select the presenters.
- 40% introductory lecture (30 min) with 10% for slide and presentation organization/quality, 10% for ability to answer questions and 20% for content.

If you anticipate missing a class you must let both Drs. Sondheimer and Hurd know in advance, given the weight on participation and the fact that there are only six classes. Providing that you

had a legitimate reason for missing the class, you will be provided with an assignment based on the reading for that week that you can use to make up for the lost class.

The basic outline for what will be covered in the six weeks is below. We require that you arrange a meeting with us at least one full week prior to your presentation so we can go over your draft presentation and provide feedback.

Week 1: Mitochondrial Endosymbiotic Theory and Comparative Genetics (October 8th, 2020)

Week 2: Mitochondrial-Nuclear Interactions (October 15th, 2020)

Week 3: Mitochondrial Inheritance (October 22nd, 2020)

Week 4: Mitophagy (October 29th, 2020)

Week 5: Mitochondrial Medical Genetics (November 5th, 2020)

Week 6: Mitochondria and Cancer (November 12th, 2020)