

**CAPS 421 (3 credits).**

**Advanced Cellular and Molecular Physiology**

**Course coordinators: I. Robert Nabi, T. Michael Underhill**

**LSI 1.510 Mondays/Wednesdays 2-4 PM**

A 4<sup>th</sup> year undergraduate course to explore recent advancements in cellular and molecular physiology that have revolutionized our understanding of cell function in health and disease.

**Course Outline**

Each class will focus on a concept and the presentation of 1-2 seminal papers. The course instructor will provide an introduction to the concept and present the papers. Students will then be responsible for leading the discussion on select papers.

1. Welcome and Introduction - Sept. 4 (Nabi and Underhill)
2. Stem cells and aging (Underhill; Sept. 9, 11, 16, 18)
  - a. Accelerated aging conditions – Progeroid Syndromes
  - b. Induced pluripotent stem cells – models for human disease
  - c. Cellular basis of progeria and novel therapies – defects in tissue homeostasis, renewal and regeneration
  - d. Treatments for genetic diseases – from biology to therapeutics
3. Stem cells and tissue regeneration (Underhill; Sept. 30, Oct. 2)
  - a. Tissue regeneration – restoration of tissue/organ function
  - b. Tissue regeneration and the liver – an interesting paradigm
4. Stem cells, tissue renewal and cancer (Underhill; Oct. 7, 9)
  - a. Intestinal tissue renewal and stem/progenitor cells
  - b. Intestinal tissue stem/progenitor cells and origin of cancer
5. Trafficking in the secretory pathway (Nabi; Oct. 21, 23, 28)
  - a. Endoplasmic reticulum organization and function
  - b. Endoplasmic reticulum quality control and CFTR in cystic fibrosis
  - c. The Golgi and protein glycosylation in cancer
6. Plasma membrane domains and endocytosis (Nabi; Oct. 30, Nov 4, 6)
  - a. Plasma membrane organization and receptor signaling
  - b. Endocytosis and the CLIC pathway
  - c. Lysosomes and autophagy: ESCRT and Parkinson's disease
7. Cancer and super-resolution microscopy (Nabi; Nov. 13, 18)
  - a. Cancer progression: Epithelial-mesenchymal transition and invadopodia
  - b. Single molecule localization microscopy
8. Review (Nabi, Nov. 25; Underhill, Nov. 27)

## **Evaluation**

One final exam will evaluate the content covered in the lectures and short quizzes at the beginning of each class will test the content covered in the assigned readings. Each student will be responsible for preparing discussion questions and leading the discussion for one paper. They will also be responsible for preparing a short summary of the paper (no more than 2 pages) including a general introduction to the subject, presentation of the selected paper, interpretation, conclusion and identification of weaknesses. The student is expected to demonstrate a clear understanding of the paper and its relevance to the field and will be evaluated on the overall clarity and quality, as well as their critique of the paper. In this way, the students will not only get an understanding of the fundamental findings that advanced our knowledge of cell physiology, but also the technical advance(s) needed for its development.

Tentative grading scheme:

Short quizzes on assigned paper(s) at beginning of class	15%
One publication, provide questions and lead discussion	15%
One short write-up on above presented paper	20%
Final exam (introductory content plus 3-4 papers from each of the 2 sections)	50%

## **Instructors**

- I. I. Robert Nabi, Professor, Dept. of Cellular and Physiological Sciences, Life Sciences Institute; [irnabi@mail.ubc.ca](mailto:irnabi@mail.ubc.ca)
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