

MCB175: Principles of Cell Physiology

Monday and Wednesday 1:30-2:45PM, Biological Laboratories Room 1080

Course staff:

Nicholas Bellono, nbellono@harvard.edu

Nurunisa Akyuz, nneyzi@gmail.com

Rebecka Sepela, rsepela@fas.harvard.edu

Julius Tabin, jtabin@g.harvard.edu

Katelyn Comeau Boulanger, katelyn_comeau@g.harvard.edu

Course description: How do cells communicate and respond to their environment? MCB175 explores foundational principles in cell physiology and membrane biophysics, including ion channel structure and function; transport mechanisms; electrical signaling in the brain and nonexcitatory cells; second messengers; organellar signaling. We delve into these core concepts through examples of signaling mechanisms in specialized cell types, disease states, and organismal adaptations. Through reading and discussing primary literature and scientific writing assignments, students strengthen skills in critical thinking, interpretation of data, and experimental strategy. Students also give presentations and design a research project based on course topics.

Lecture: Lecture will cover basic concepts and then use research projects as examples to demonstrate those concepts in practice. Office hour available by appointment.

Discussion: Nearly each week different students will choose a paper to present from the reading list, and a group will be assigned to read that paper with anticipation of providing critique.

Assignments:

- Reading quizzes: Answer questions about the assigned paper each week.
- Exams: 1) Applying basic concepts to electrophysiology problems using MetaNeuron software; and 2) reading and understanding primary literature.
- Participation: Students are expected to participate in discussion, present papers, and ask questions during others' presentations. Students will submit peer evaluations of paper presentations on Canvas.
- Research proposal: 2-page written proposal, 10 min presentation and peer evaluation. It is expected that students will start thinking about, assembling, and reaching out for help on their proposal throughout the semester. More information on canvas.

Grading:

A for effort: Students will receive full credit if they are engaged, participate, and assemble a compelling research proposal. [Consistently fulfilling your course responsibilities](#) goes a long way.

Reading quizzes 14%

Exams 21%

Class participation 35%

Project proposal 30%

Canvas:

Details regarding all assignments, reading, and course information can be found on Canvas. Handouts covering basic ion channel concepts are also posted in Canvas.

Accommodations for students with disabilities:

Students needing academic adjustments or accommodations because of a documented disability must present their Faculty Letter from the Accessible Education Office (AEO) and speak with the course instructor by the end of the second week of the term. Failure to do so may result in the Course Head's inability to respond in a timely manner. All discussions will remain confidential, although Faculty are invited to contact AEO to discuss appropriate implementation.

Academic integrity policy:

You are encouraged to discuss all assignments with classmates, but assignments should be your own writing and reflect your thought process. Refer to assignment instructions for more detail. In all work, use citations and references as you would for any published documents. For more information, consult:

http://lifesciences.fas.harvard.edu/files/lifesci/files/guide_to_citing_in_the_life_sciences.pdf?m=1411135909

Schedule:

- *Background*

Sept 4 W: electrophysiology: Frankenstein to squid, animal room and greenhouse tour - *Nick*

Sept 9 M: membrane potential, transport mechanisms – *Nurunisa / Rebecka*

Sept 11 W: action potentials – *Nurunisa / Rebecka*

Sept 16 M: voltage-gated ion channels + discussion - *Nurunisa / Rebecka*

Sept 18 W: + Discovery of channels / simple experiments – *Nick* + paper presentation by *Julius*

Take home exam (the basics)

- *Specific topics*

Sept 23 M: ion channel adaptations: evolution of novel features and behavior - *Nick*

Sept 25 W: paper presentations: channel adaptations

Sept 30 M: vision – *Mike Do*

Oct 2 W: non-visual phototransduction - *Philippe Morquette*

Oct 7 M: ion channels in hearing – *Nurunisa*

Oct 9 W: paper presentations: ion channels in hearing

Oct 14 M: *Holiday*

Oct 16 W: paper presentations: sensory system channels

Oct 21 M: sensory system evolution – *Rebecka*

Oct 23 W: paper presentations:

Oct 28 M: museum tour of interesting animals

Oct 30 W: toxins: evolutionarily honed pharmacology - *Bruce Bean*

Take home exam (analyzing literature)

Nov 4 M: paper presentations: toxins

Nov 6 W: illuminating electrical signaling across biology – *Adam Cohen*

Project proposal abstract due

Nov 11 M: *Holiday*

Nov 13 W: paper presentations: organellar signaling

Nov 18 M: non-excitable cells: basic science to disease - *Nick* + proposal presentation by *Katelyn*

Nov 20 W: paper presentations: non-excitable cells

- *Projects*

Nov 25 M: project presentations

Nov 27 W: *Holiday*

Dec 2 M: project presentations

Dec 4 W: project presentations

Dec 9 M: make up presentation day (reading period)

Dec 11 W: **Final written proposals due**