Neural Circuits

Instructors

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All class-related email must:
- include "PNB 3SN3" in the subject line
- originate from McMaster accounts
- use proper forms of address
- be free of inappropriate abbreviations

Do not send email to the instructor or TAs through Avenue; your email may or may not be seen and will not be answered.

Email that fails to conform to these guidelines will not be answered.

Responses will normally be made within 48 hours.

Course logistics

Lectures:	ABB 136
Discussions:	ABB 136, PC 311, PC 316 – locations announced on Avenue and in class
Office hours:	Mondays 13:00-15:00, PC 310
TA office hours:	by appointment
course website:	Avenue

Course description

Neural Circuits is an introductory course in systems neuroscience. During the first few weeks of the term students will review basic neuroscience and begin to delve into key concepts and techniques needed to read original articles in systems neuroscience. Students will learn about model neural circuits and, in four modules, will explore specific areas of systems neuroscience in more depth through reading and discussion of original research articles. (assigned discussion groups $\leq$ 25).

Course Objectives

This course aims to introduce students to concepts and techniques in modern systems neuroscience and to give students tools for reading, discussing, and thinking critically about original work in the field. After successfully completing the course, the student should be able to:

- explain general principles of systems neuroscience
- describe commonly used techniques in systems neuroscience
- logically present arguments from experimental systems neuroscience
- read and intelligently discuss original articles in systems neuroscience
- clearly and concisely present experimental data from original neuroscience articles

Materials

Text: Neuroscience (4^{th} ed.), Purves et al.

This text was chosen to help students minimize costs, as those who have taken PNB 2F03 already own this book. Additional review articles may be posted for techniques or concepts not covered in the text.

Coursepack: The coursepack includes four chapters: "The Uncertainty of Science" (Feynman); the introductory chapter from The Synaptic Organization of the Brain (Shepherd), a collection about systems neuroscience; "Physiology of Synaptic Transmission and Short Term Plasticity" (Regehr and Stevens) from Synapses; and Chapter 7 of From Neuron to Brain (Nicholls et al), an alternative introductory text that covers cable theory better than our text.

Articles: Within the modules sections of the course, each student will be required to read 12 original research articles. These articles are freely available through the university servers and will be linked from the course website on Avenue.

Calculator: The McMaster Standard Calculator (Casio FX-991) will be permitted in tests and in class.

Evaluation

Distribution of marks

In-class exercises	10%	group/individual
Discussion	10%	individual
Quizzes/written work	25%	individual
Midterm examination	20%	individual
Final examination	35%	individual

In-class exercises (ICE)

Each lecture session will include at least one of these individual and/or group activities. They involve group discussion followed by the submission of a short written component, to be evaluated by the TAs.

Discussion

Each student will make two brief (<3 min) oral presentations during the modules section of the course. Oral presentations will be evaluated by peers and the TAs. Additionally, students will be evaluated on the quality and relevance of their contribution(s) to the discussion.

Quizzes/written work

At the beginning of each class session, students will either submit a short written assignment (5 in all) or take a short quiz covering the assigned reading for that session. The lowest mark of the five written assignments and the lowest mark of the quizzes will be dropped. Written work will be marked by the TAs for content, organization, grammar, and—above all—clarity. Students are warned that their writing may be held to a higher standard than that to which they are accustomed.

Midterm

Covering content from lectures and readings up to Feb 14

Final

A cumulative exam covering material from all class lectures and all required readings, including the original research articles

The instructor reserves the right to adjust final marks up or down, in light of special circumstances and/or overall performance.

Missed Work

Late work will be assessed a 10% penalty for each day (or portion thereof) overdue. All requests for academic relief for missed work must be accompanied by a McMaster Student Absence Form or other notification from the appropriate Associate Dean. Discretionary notes will generally not be accommodated. Missed in-class work for which university approval is presented may be replaced with the average of other in-class work. If a student misses a test and has obtained appropriate university approval, the grade may be redistributed or a make-up test may be given, at the discretion of the instructor. Note that a missed test may be replaced by a test of a different format, including possibly an oral exam in the presence of the instructor and a TA.

Academic Integrity

We expect university students to follow the highest standards of academic integrity at all times. Note that, according to the McMaster University Academic Integrity Policy, Section 17, "Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage." Students who engage in academic dishonesty will receive a zero on the relevant test or assignment and will be reported to the Office of Academic Integrity. This can result in more serious consequences including loss of credit with a notation on the transcript, "Grade of F assigned for academic dishonesty," and even suspension/expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty and to avoid any appearance of academic dishonesty. Three examples of academic dishonesty include: plagiarism, improper collaboration, and copying or using unauthorized aids. For additional information and clarification, consult the Academic Integrity Policy at http://www.mcmaster.ca/academicintegrity.

Schedule

January	3	Introduction to systems neuroscience Dissecting neural pathways Ionic basis of the resting membrane potential
	10	The membrane potential The action potential Cable theory Measuring neuronal activity
	17	The synapse Vesicle recycling Short-term plasticity
	24	Reading, thinking, and writing about science Module I: Building neuronal circuits: Axon Guidance
	31	Module I: Discussion

		Building neuronal circuits: developmental plasticity
February	7	Building neuronal circuits LTP, LTD, STDP, homeostatic plasticity, silent synapses Midterm review
	14	Midterm
	21	Reading Week
	28	The cerebellar circuit; the VOR Jamming avoidance circuits
March	6	Retinal circuits Module II: Topographic Maps; Map refinement
	13	Module II: Discussion Module III: Sound localization
	20	Module III: Discussion Circadian rhythms
	27	Central Pattern Generators Module IV: Addiction
Apr	3	Module IV: Discussion
TBA		Final Exam

Notes

The instructor and university reserve the right to modify portions of the course or course schedule, depending on special circumstances. Any such changes will be announced in class and posted on the course website. It is each student's responsibility to check the course website on Avenue regularly for updates. No one may record any part of the class without prior consent of all individuals present.