

Faculty of Science Course Syllabus
Department of Physiology & Biophysics
PHYL 4000 / NESC 4185
Synaptic Function & Plasticity
Fall 2020

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Seminars: Thu 1435 – 1655 Synchronous remote seminars

Course Description

In this course we analyze and discuss research publications in cellular and systems neurophysiology. Specific topics covered are mechanisms of neurotransmission, Hebbian and homeostatic plasticity, modulation of excitability, dendritic integration of synaptic input, and neural circuits. Emphasis is placed on current research questions in these areas and methodologies used to address them.

Course Prerequisites

Prerequisite course: Either [NESC 2570/PHYL 2570](#) or [PHYL 2041](#) or permission of course instructor

Prerequisite knowledge/skills: Basic understanding of neuronal excitation, synaptic transmission, and molecular signaling systems at the level of a second-year neuroscience course

Learning Outcomes

Analytical and communication skills

When given a research publication in cellular neurophysiology, you will be able to:

- Recognize and independently investigate unfamiliar concepts and methods
- Determine appropriate experimental approaches to address a research question in cellular neurophysiology and identify the limitations of and alternatives to the chosen methodologies
- Critically evaluate the scientific results and assess the validity of their interpretation
- Place the study's findings in the context of previous work to assess their novelty and significance
- Identify unresolved gaps in knowledge or new research questions uncovered by the study and devise experimental approaches to confront them
- Communicate the context, rationale and outcome of scientific studies in oral presentations

Knowledge and comprehension of cellular neurophysiology

After completing this course, you will be able to:

- Describe instances in which regulation of neurotransmitter receptor transcription, posttranscriptional and posttranslational modification, trafficking and protein interactions affect synaptic transmission
- Characterize regulatory mechanisms altering neurotransmitter release

- Discuss how the morphological plasticity of excitatory synapses contributes to the experience-dependent adaptation of cortical circuits
- Specify mechanisms and consequences of Hebbian plasticity (LTP, LTD, STDP)
- Outline instances and potential mechanisms of homeostatic plasticity
- Explain how the excitability of neurons is dynamically regulated
- Dissect how dendritic integration of synaptic input is modulated by active dendritic conductances in a cell-specific manner
- Illustrate methodologies allowing the classification of neurons and the identification of their afferent and efferent connections
- Discuss the function of place cells and grid cells in hippocampus and entorhinal cortex, respectively

Course Organization

Synaptic Function & Plasticity is taught in one seminar per week. In the week preceding the seminar, the students receive two research publications. After an initial study of the papers, we will determine **learning issues** that need to be researched to be able to fully understand and critically appreciate the publications. Every student is asked to post at least two learning issues by Saturday, 4 pm. They can include unfamiliar experimental techniques, protein or genes mentioned, or concepts examined. Each student will then be assigned one learning issue for further research. The student will compose a short report outlining his/her findings, to be submitted before the seminar on Thursday at 8 am. In the first hour of the seminar, the learning issues will be discussed in class with fellow students. In the second part of the seminar, students will present two research publications in a short format (15-20 min). Presentations are followed by a short discussion.

Course Materials

The website on Brightspace serves as platform for resources and communication for NESC 4185 / PHYL 4000. Publications to be discussed are posted on this site. Students use a wiki to collect potential learning issues, post their responses on selected learning issues and review learning issue responses from other students. Paper presentations of students are also posted.

In addition, students can use a number of different resources. Textbooks such as *Neuroscience* from Dale Purves et al. (Sinauer) or *Neuroscience. Exploring the Brain* from Mark Bear and collaborators (Lippincott) are great for background readings and general information. Copies of both books are available at the Dalhousie Library. For learning issues, students will search research publications available electronically at the Dalhousie Library. Suggestions on how to efficiently perform a literature search on a specific topic, compose learning issue responses, structure paper presentations, and discuss and review the assignments of other students are posted on Brightspace.

Course Assessment

Component	Weight (% of final grade)
Assignments	
-- Presentation of one research publication	12% for each presentation
-- Written responses on learning issues (one extensive, 5 other)	12% for response to extensive learning issue 6% for response to other learning issues
-- Review of one paper presentation and one extensive learning issue response	6% 6%
Final exam (During exam time)	34%

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (<50)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies

The seminars in this course depend on student participation through learning issue responses and paper presentations. To ensure a continued level of participation throughout the term, student paper presentations are assigned during the first seminar, and the number of students not providing learning issue responses in each seminar will be limited. **Students are responsible for all assignments they have accepted.** If a student discovers ahead of time that she/he is not able to complete a certain assignment, she/he may arrange that another student fills in for her/him (e.g. by swapping dates for paper presentations). If a student misses a seminar due to a sudden illness or other unforeseen circumstances and is unable to post and present an assignment, she/he is required to submit a *Student Declaration of Absence* (please upload to the dropbox on Brightspace). Missed learning issue responses can be submitted after the absence, but not later than on the date of the next seminar. Missed paper presentations cannot be compensated for. Rather, their grade value will be added to that of the final exam.

Course Schedule

Date	Topic
Sep 10	Course orientation
Sep 17	Regulation of neurotransmitter release
Sep 24	Synaptic cell adhesion and scaffolding proteins
Oct 1	Neurotransmitter receptors
Oct 8	Synapse-specific plasticity: LTP, LTD and spike-timing dependent plasticity
Oct 15	Homeostatic plasticity
Oct 22	Morphological plasticity of synapses
Oct 29	Regulation and plasticity of neuronal excitability
Nov 5	Dendritic integration of synaptic input
<i>Nov 12</i>	<i>No Class (Fall Study Break)</i>
Nov 19	Neural circuits (I): Methods to probe neuronal diversity and connectivity
Nov 26	Neural circuits (II): Hippocampus
Dec 3	Review session: Bring your questions

ACCOMMODATION POLICY FOR STUDENTS

Students may request accommodation as a result of barriers related to disability, religious obligation, or any characteristic protected under Canadian Human Rights legislation. The full text of Dalhousie's Student Accommodation Policy can be accessed [here](#).

Students who require accommodation for classroom participation or the writing of tests and exams should make their request to the **Advising and Access Services Centre (AASC)** prior to or at the outset of the regular academic year. More information and the ***Request for Accommodation*** form are available at www.dal.ca/access.

ACADEMIC INTEGRITY

Academic integrity, with its embodied values, is seen as a foundation of Dalhousie University. It is the responsibility of all students to be familiar with behaviours and practices associated with academic integrity. Instructors are required to forward any suspected cases of plagiarism or other forms of academic cheating to the Academic Integrity Officer for their Faculty.

The Academic Integrity website (<http://academicintegrity.dal.ca>) provides students and faculty with information on plagiarism and other forms of academic dishonesty, and has resources to help students succeed honestly. The full text of Dalhousie's ***Policy on Intellectual Honesty*** and ***Faculty Discipline Procedures*** is available here:

http://www.dal.ca/dept/university_secretariat/academic-integrity/academic-policies.html

STUDENT CODE OF CONDUCT

Dalhousie University has a student code of conduct, and it is expected that students will adhere to the code during their participation in lectures and other activities associated with this course. In general:

“The University treats students as adults free to organize their own personal lives, behaviour and associations subject only to the law, and to University regulations that are necessary to protect

- the integrity and proper functioning of the academic and non – academic programs and activities of the University or its faculties, schools or departments;
- the peaceful and safe enjoyment of University facilities by other members of the University and the public;
- the freedom of members of the University to participate reasonably in the programs of the University and in activities on the University's premises;
- the property of the University or its members.”

The full text of the code can be found here:

http://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

SERVICES AVAILABLE TO STUDENTS

The following campus services are available to help students develop skills in library research, scientific writing, and effective study habits. The services are available to all Dalhousie students and, unless noted otherwise, are free.

Service	Support Provided	Location	Contact
General Academic Advising	Help with <ul style="list-style-type: none"> - understanding degree requirements and academic regulations - choosing your major - achieving your educational or career goals - dealing with academic or other difficulties 	Killam Library Ground floor Rm G28 Bissett Centre for Academic Success	In person: Killam Library Rm G28 By appointment: <ul style="list-style-type: none"> - e-mail: advising@dal.ca - Phone: (902) 494-3077 - Book online through MyDal
Dalhousie Libraries	Help to find books and articles for assignments Help with citing sources in the text of your paper and preparation of bibliography	Killam Library Ground floor Librarian offices	In person: Service Point (Ground floor) By appointment: Identify your subject librarian (URL below) and contact by email or phone to arrange a time: http://dal.beta.libguides.com/sb.php?subject_id=34328
Studying for Success (SFS)	Help to develop essential study skills through small group workshops or one-on-one coaching sessions Match to a tutor for help in course-specific content (for a reasonable fee)	Killam Library 3rd floor Coordinator Rm 3104 Study Coaches Rm 3103	To make an appointment: <ul style="list-style-type: none"> - Visit main office (Killam Library main floor, Rm G28) - Call (902) 494-3077 - email Coordinator at: sfs@dal.ca or - Simply drop in to see us during posted office hours All information can be found on our website: www.dal.ca/sfs
Writing Centre	Meet with coach/tutor to discuss writing assignments (e.g., lab report, research paper, thesis, poster) <ul style="list-style-type: none"> - Learn to integrate source material into your own work appropriately - Learn about disciplinary writing from a peer or staff member in your field 	Killam Library Ground floor Learning Commons & Rm G25	To make an appointment: <ul style="list-style-type: none"> - Visit the Centre (Rm G25) and book an appointment - Call (902) 494-1963 - email writingcentre@dal.ca - Book online through MyDal We are open six days a week See our website: writingcentre.dal.ca