

# NROC69 The Synaptic Organization of the Brain

Winter, 2012; Tuesdays 10-12am, HW214

Instructor: Professor Rutsuko Ito

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Office hours with Prof Ito (SW555): Tuesdays, 1-3pm

Office hours with Mr McKeever (Venue TBD): Tuesdays, 12-1pm on Jan 31<sup>st</sup>, March 13<sup>th</sup> and April 3<sup>rd</sup>

## **Note on contacting Professor Ito or Mr McKeever:**

***Please post course/content related questions to relevant blackboard discussion forum for the benefit of other students. All other questions must be sent to [nro69.utsc@gmail.com](mailto:nro69.utsc@gmail.com). Please note that emails pertaining to NROC69 sent to Professor Ito's or Mr McKeever's personal accounts will NOT be answered.***

## **Course Overview**

Synaptic organization is the study of principles underlying the organization of synapses and neurons into circuits that mediate the functional operations of different brain regions. It is a multidisciplinary and multi-level subject that integrates experimental findings from a vast number of disciplines including molecular neurobiology, neuroanatomy, neurochemistry, neurophysiology, neuropharmacology and behavioural neuroscience. We start with a focus on the property of the synapse as a basic unit of neural circuit organization, moving up to the property of whole neurons and multi-neuronal local circuits characteristic of a given brain region, then explore the interactions between various circuits forming a neural system, right up to system-system interactions that occur in a normal and abnormal brain. We will also explore some exciting new developments in the field such as the use of receptor knockouts in rodents to establish causal functions of specific receptors, optogenetic techniques in the investigation of neural circuitries in brain function, and the approach of looking at network oscillations in the brain as underlying certain functions.

## **Course Textbook**

The lecture series will be based on the primary course text, *Synaptic Organization of the Brain*, (Gordon M Shepherd, 5<sup>th</sup> Ed). There will also be assigned readings for each lecture, most of which will be original empirical papers pertaining to the lecture topic. Reading these papers will serve as excellent preparation for the final exam.

## **Tentative Course Outline**

Jan 10	Introduction to the organizational principles of the mammalian brain (Chapter 1)
Jan 17	Pre-synaptic and post-synaptic mechanisms of neurotransmission (Chapters 1&2)
Jan 24	Synaptic integration and neuromodulation (Chapters 1&2)
Jan 31	Synaptic organization of the thalamus (Chapter 8)
<b>Feb 7</b>	<b>Midterm test on lectures 1-4 (2hrs)</b>
Feb 14	Synaptic organization of the basal ganglia (Chapter 9)
<b>Feb 21</b>	<b>Reading Week - no class</b>

Feb 28	Synaptic organization of the hippocampus (Chapter 11)
Mar 6	Synaptic plasticity and learning
Mar 13	Synaptic organization of the neocortex (Chapter 12)
<b>Mar 20</b>	<b>Midterm test on lectures 5-8 (2hrs)</b>
Mar 27	Synapses in networks: network oscillations
Apr 3	Optogenetics: light activated neurons
<b>Final exam:</b>	<b>Date TBA by Registrar (3hrs)</b>

**Resources:** Lectures slides and PDFs of papers for assigned reading will be posted on the course website (in the "Content" section) **by midnight at the latest** the night before the lecture. You may find it useful to print out a copy of the slides and bring it to the lecture for note taking. Other resources (such as videolinks) will become available throughout the course to supplement the lecture slides.

**Drop date: March 25th** (Last day to drop UTSC S courses and have them remain on the transcript with a grade of LWD indicating withdrawal without academic penalty. After this date grades are recorded on transcripts whether course work is completed or not (with a '0' assigned for incomplete work) and they are calculated into GPAs).

**Scheduling conflict:** A web option will not be offered for this course, so it would be your responsibility to ensure that you are able to attend all the lectures. ***We will not answer emails concerning scheduling conflict.***

### Evaluation

Although the emphasis will be on material covered during lectures, the tests may contain material from the relevant textbook readings. As the lectures will always cover some information not contained in the texts (and vice versa), it is important that you both attend the lectures and do the assigned readings.

### **Midterm Tests 1 & 2 (25% overall grade each)**

Each test will consist of multiple-choice questions and short answer questions on the material covered in the preceding 4 lectures.

### **Final exam (50% overall grade)**

This exam will have 3 sections:

- 1) **Multiple-choice questions (10% overall grade)** on lectures 9 and 10.
- 2) **Short essay (20% overall grade):** There will be five essay questions covering different topics presented in lectures 1-8 and you will be required to choose one question to answer. The essay must have an introduction, main body and a conclusion.
- 3) **Critical analysis of empirical paper (20% overall grade):** You will be provided with an empirical paper to read, and will be required to answer questions that are designed to test your understanding of the paper, as well as the research topic. You will also be asked to write a missing abstract for the paper ***in your own words.***

The best strategy for the final exam is for you to learn the material for lectures 9 and 10, and then select three or four of the earlier lectures that most interest you to revise in detail. ***It is also essential that you read the assigned papers from each lecture and become familiar with the format of scientific writing. I will also provide some questions that will go with some of the papers that will help you to critically analyse the paper.***

## **Course Policies**

### **Missed exams**

***You are expected to make every effort to take required mid-terms/final exam.*** Absence from a mid-term/exam will only be granted for genuine, legitimate reasons, including a documented family emergency, or a documented severe illness. **There will be no make-up tests for the two midterms.** If you are unable to attend a mid-term and have a legitimate excuse, the remaining course material will be re-weighted. **There will be one make-up for the final exam for those who are unable to attend the original scheduled date due to a legitimate excuse. Mid-terms/exams that are missed without a genuine, legitimate reason will receive a 0% mark.**

## **Grading**

### **Scale**

<b>NUMERICAL MARKS</b>	<b>LETTER GRADE</b>	<b>GRADE POINT VALUE</b>
90 - 100%	A+	4.0
85 - 89%	A	4.0
80 - 84%	A-	3.7
77 - 79%	B+	3.3
73 - 76%	B	3.0
70 - 72%	B-	2.7
67 - 69%	C+	2.3
63 - 66%	C	2.0
60 - 62%	C-	1.7
57 - 59%	D+	1.3
53 - 56%	D	1.0
50 - 52%	D-	0.7
0 - 49%	F	0.0

### **Guidelines (<http://www.writing.utoronto.ca/advice/general/grading-policy>):**

**A+** Outstanding performance, exceeding even the A described below.

**A** Exceptional performance: strong evidence of original thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter with sound critical evaluations; evidence of extensive knowledge base.

**B** Good performance: evidence of grasp of subject matter; some evidence of critical capacity and analytic ability; reasonable understanding of relevant issues; evidence of familiarity with the literature.

**C** Intellectually adequate performance: student who is profiting from her or his university experience; understanding of the subject matter and ability to develop solutions to simple problems in the material.

**D** Minimally acceptable performance: some evidence of familiarity with subject matter and some evidence that critical and analytic skills have been developed.

**F** Inadequate performance: little evidence of even superficial understanding of the subject matter; weakness in critical and analytic skills; with limited or irrelevant use of literature.

**Note:** for all written work, consistently poor spelling/grammar will be penalised. Please make use of the UTSC writing centre if you feel you need additional help with writing or want to develop your writing skills further: <http://ctl.utsc.utoronto.ca/twc/>.

### **Contesting a grade**

All requests for a re-grade must be submitted **in writing** within two weeks of the day the grade is received. Only requests that include adequate written justification of an error in the original grading will be considered. *A legitimate request will result in the entire exam or assignment being re-graded. Your overall grade may be raised, lowered, or it may stay the same.* If there has been an error in our arithmetic, please let us know and we will immediately recalculate your grade (no written request necessary). **Arbitrary requests for grade increases will not be entertained (e.g., "I need to get into grad school, so could you please give me a higher grade?").**

### **Video and Auditory Recording**

For reasons of privacy as well as protection of copyright, unauthorized video or audio recording in classrooms is prohibited. This is outlined in the Provost's guidelines on *Appropriate Use of Information and Communication Technology*. Note, however, that these guidelines include the provision that students may obtain consent to record lectures and, "in the case of private use by students with disabilities, the instructor's consent must not be unreasonably withheld."

### **Accessibility**

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office as soon as possible. I will work with you and AccessAbility Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC AccessAbility Services staff (located in S302) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or [ability@utsc.utoronto.ca](mailto:ability@utsc.utoronto.ca).

### **Academic Integrity**

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (<http://www.governingcouncil.utoronto.ca/policies/behaveac.htm>) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

#### **On tests and exams:**

- Using or possessing unauthorized aids.
- Looking at someone else's answers during an exam or test.
- Misrepresenting your identity.

#### **In academic work:**

- Falsifying institutional documents or grades.
- Falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see <http://www.utoronto.ca/academicintegrity/>).