

Molecular Neuroscience

NROC36H3S

University of Toronto Scarborough
Winter 2018
Tue 1-3pm: SW128

Instructor: Maithe Arruda Carvalho

Office hours: Mon 1-3 pm, SW533

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**Any questions referring to this course must be first addressed to the TAs.*

This course will provide students with a thorough background in the molecular and cellular mechanisms underlying neuronal communication in the central nervous system. We will explore concrete examples of that communication within the physiological (e.g. learning and memory) and pathological (e.g. neurodegenerative disorders) realms. We will start with the building blocks of synaptic communication, by learning about intracellular signalling, modulation of neuronal DNA and protein expression, and neurotransmitter systems. We will then use this knowledge to understand the specific molecular and cellular steps necessary for enabling neuronal communication. This will serve as a base to our understanding of how these mechanisms can be used in the brain to encode information in the form of synaptic plasticity in learning and memory. We will close by examining how these same mechanisms can be co-opted in pathological instances to impair cognitive and emotional function.

Course Learning Objectives

By the end of this course, students will:

- Understand the core principles underlying synaptic communication in the central nervous system, and how these mechanisms contribute to synaptic plasticity and learning
- Be provided with an overview of some of the main contemporary concepts and applications of molecular and cellular neuroscience
- Understand how molecular and cellular methods can be applied in research to address the latest challenges within the field
- Practice reading and analysing scientific articles relevant to the area
- Think critically and express themselves about unresolved questions in the field
- Gain the necessary background to critically evaluate the design, analysis, and conclusions of molecular neuroscience research
- Improve their oral and written communication skills through in-class discussions and feedback on written assignments and short-answer questions on exams

Course Materials

Students will be provided with complementary readings for each lecture, which will include textbook chapters and papers (see timetable). Mostly, this course will use selected chapters from two textbooks available online through the UTSC library website:

- **From molecules to networks: an introduction to cellular and molecular neuroscience** edited by John H. Byrne, James L. Roberts.

<http://www.sciencedirect.com.myaccess.library.utoronto.ca/science/book/9780123971791>

- **Principles of neural science** edited by Eric R. Kandel et al.

<https://search.library.utoronto.ca/details?9548509&uuid=55d35fed-dbbe-4682-9afb-d8169f98181b>

Additional empirical papers may be assigned in advance of lectures. Content in both textbooks is quite overlapping, so students are encouraged to choose the one whose style they prefer. Handouts of lecture slides will be posted on blackboard by midnight at the latest the night before the lecture.

Course Evaluation

Summary of Evaluation:

	<u>Percent of final grade</u>	<u>Date</u>
Writing assignment	15%	March 6th
Term tests 1 and 2 (in class)	25% each	Feb 6 th , Mar 20 th
Final Exam	35%	Exam Period

Description of evaluation components:

1. Writing Assignment (15%)

This assignment will consist of a critical review of an empirical research paper. You will be given a choice between two assigned papers. Papers will be assigned on February 6th through an announcement on blackboard. You will write a critique of the paper of your choice which will be broken down in three sections:

1. Brief summary of results – In this section you will briefly summarize the main results of the paper
2. Critical review – In this section you will evaluate this article in detail focusing on its main strengths and weaknesses. This exercise is supposed to emulate the reviewing of a paper by a scientific journal. So think about the paper in terms of its conclusions and interpretations - Does the data support the conclusions? Are the experiments well designed and controlled? Are the techniques appropriate?
3. Recommendation – In this section you will justify, based on your critical evaluation in the last section, whether you'd accept or reject this paper, or if you would require specific experiments to be done so you can accept the paper (major or minor revisions). Justify your choice!

This assignment will develop your critical and scientific writing skills. It will also give you a glimpse into the editorial process of any submitted manuscript to a journal. Importantly, you will receive feedback on your assignment identifying areas that require improvement.

The paper must be a maximum of 5 pages, excluding references, double spaced, in Calibri font 11, with 1" margins. In-text citations must follow the Journal of Neuroscience citation style. List all the references cited in the text in alphabetical order by first author's last name following Journal of Neuroscience citation style. Here is one example of Journal of Neuroscience citation style:

Drew MR, Denny CA, Hen R (2010) Arrest of adult hippocampal neurogenesis in mice impairs single-but not multiple-trial contextual fear conditioning. *Behav Neurosci* 124:446–454.

This assignment will be submitted through Blackboard and Turnitin. Submissions are due **by 11:59PM on March 6th**. Late submissions will be accepted with a **penalty of 50% for every day late**. To submit your assignment, click on Course materials: Writing assignment. You will submit your assignment in two steps (please follow the prompts). First you'll submit your file to Turnitin. Following that, you will submit the same file to blackboard.

2. Term Tests 1 and 2 (25% each) – Feb 6th and March 20th, in class, 1h50m each

Tests will be based on the material covered on the lectures (Lectures 1-4 for midterm 1, and lectures 5-8 for midterm 2). Each midterm will consist of multiple-choice and short answer questions. Midterms will take place in class, and will last 1h50m each.

3. Final Exam (35%) – Exam period

The final exam will be scheduled during the exam period and will be comprised of two sections:

Section 1 (10%)

Short answer and multiple choice questions spanning lectures 9 and 10

Section 2 (25%) – Research paper analysis

An empirical research paper will be posted 2 weeks prior to the final exam. Students should carefully read the paper in preparation for the exam. You'll be required to answer questions assessing your understanding of the paper, its research topic, as well as providing a critical analysis of its content. Your experience with the writing assignment will help with this process.

Overview of Course Schedule:

The following table presents the schedule of lectures and midterms as they will occur over the course of the term, and the due dates for the assignment.

Lecture	DATE	CONTENT	LOCATION	Complementary Reading	TO DO
1	Jan 9	Course Introduction and Recap of intracellular signaling	SW128	Excerpt from Molecular Biology of the cell (on course reserves)	
2	Jan 16	Regulation of Neuronal Gene Expression and Protein Synthesis	SW128	MtN chapter 5	
3	Jan 23	Neurotransmitter synthesis and removal	SW128	MtN chapter 7, PoN chapter 13	
4	Jan 30	Neurotransmitter release	SW128	MtN chapter 15, PoN chapter 12	
	Feb 6	Term test 1	SW128		Papers assigned
5	Feb 13	Neurotransmitter receptors I: Ionotropic Receptors	SW128	MtN chapter 11, PoN chapter 10	
	Feb 20	Reading Week – No Class			
6	Feb 27	Neurotransmitter receptors II: Metabotropic Receptors	SW128	MtN chapter 10, PoN chapter 11	
7	Mar 6	Molecular basis of associative learning	SW128	PoN chapter 66, MtN chapter 18	Writing assignment due
8	Mar 13	Molecular basis of synaptic plasticity I	SW128	MtN chapter 18, PoN chapter 67, List of papers will be posted on Blackboard	
	Mar 20	Term test 2	SW128		
9	Mar 27	Molecular basis of synaptic plasticity II	SW128	MtN chapter 18, List of papers will be posted on Blackboard	
10	Apr 3	Molecular mechanisms of disease	SW128	MtN chapter 21 on course reserves, PoN chapter 44	

Course Grading Scheme:

Following the University Assessment and Grading Practices Policy:

(<http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/grading.pdf>; <http://www.artsci.utoronto.ca/newstudents/transition/academic/grading>):

<i>Letter Grade</i>	<i>Grade point value</i>	<i>Numerical Mark</i>	<i>Grade Definition</i>
<i>A+</i>	<i>4.0</i>	<i>90 - 100%</i>	Excellent: Strong evidence of original thinking; good organization; capacity to analyze and synthesize; superior grasp of subject matter with sound critical evaluations; evidence of extensive knowledge base.
<i>A</i>	<i>4.0</i>	<i>85 - 89%</i>	Excellent
<i>A-</i>	<i>3.7</i>	<i>80 - 84%</i>	Excellent
<i>B+</i>	<i>3.3</i>	<i>77 - 79%</i>	Good: Evidence of grasp of subject matter; some evidence of critical capacity and analytic ability; reasonable understanding of relevant issues; evidence of familiarity with literature.
<i>B</i>	<i>3.0</i>	<i>73 - 76%</i>	Good
<i>B-</i>	<i>2.7</i>	<i>70 - 72%</i>	Good
<i>C+</i>	<i>2.3</i>	<i>67 - 69%</i>	Adequate: Student who is profiting from his/her university experience; understanding of the subject matter; ability to develop solutions to simple problems in the material.
<i>C</i>	<i>2</i>	<i>63 - 66%</i>	Adequate
<i>C-</i>	<i>1.7</i>	<i>60 - 62%</i>	Adequate
<i>D+</i>	<i>1.3</i>	<i>57 - 59%</i>	Marginal: Some evidence of familiarity with subject matter and some evidence that critical and analytic skills have been developed.
<i>D</i>	<i>1.0</i>	<i>53 - 56%</i>	Marginal
<i>D-</i>	<i>0.7</i>	<i>50 - 52%</i>	Marginal
<i>F</i>	<i>0</i>	<i>0 - 49%</i>	Inadequate: Little evidence of even superficial understanding of subject matter; weakness in critical and analytic skills; with limited or irrelevant use of literature.

Note: Consistently poor spelling/grammar will be penalized. Please make use of the resources available at the UTSC writing centre for additional help with writing: <http://ctl.utsc.utoronto.ca/twc/>.

Course Policies:

Missed Term Work due to Medical Illness or Other Emergency:

All students citing a documented reason for missed term work must bring their documentation to the Psychology Course Coordinator in SW427C **within three (3) business days** of the assignment due date. You must bring the following:

- (1.) A completed [Request for Missed Term Work form](http://uoft.me/PSY-MTW) (<http://uoft.me/PSY-MTW>), and
- (2.) Appropriate documentation to verify your illness or emergency, as described below.

Appropriate Documentation:

In the case of missed term work due to **illness**, only an **original copy** of the official [UTSC Verification of Illness Form](http://uoft.me/UTSC-Verification-Of-Illness-Form) will be accepted (<http://uoft.me/UTSC-Verification-Of-Illness-Form>). Forms are to be **completed in full**, clearly indicating the start date, anticipated end date, and severity of illness. The physician's registration number and business stamp are required.

In the case of **medical emergency**, an original copy of the record of visitation to a hospital emergency room should be provided.

In the case of a **death of a family member**, a copy of a death certificate should be provided.

In the case of a **disability-related** concern, an email communication should be sent directly to the Course Coordinator (psychology-undergraduate@utsc.utoronto.ca) from your Disability Consultant at AccessAbility Services, detailing the accommodations required. The Course Instructor should also be copied on this email.

For U of T **Varsity athletic commitments**, an email communication should be sent directly to the Course Coordinator (psychology-undergraduate@utsc.utoronto.ca) from a coach or varsity administrator, detailing the dates and nature of the commitment. The email should be sent **well in advance** of the missed work.

Documents covering the following situations are **NOT acceptable**: medical prescriptions, anything related to personal travel, weddings/personal/work commitments.

Procedure:

Submit your (1.) [request form](#) and (2.) [medical](#)/other documents in person **within 3 business days** of the missed test or assignment. Forms should be submitted to **SW427C between 9 AM - 4 PM**, Monday through Friday. If you are unable to meet this deadline for some reason, you must contact the Course Coordinator via email (psychology-undergraduate@utsc.utoronto.ca) within the three business day window. Exceptions to the documentation deadline will only be made under exceptional circumstances.

Within approximately one week, you will receive an email response from the Course Instructor / Course Coordinator detailing the accommodations to be made (if any). You are responsible for checking your official U of T email and Blackboard course announcements daily, as accommodations may be time-critical. The Course Instructor reserves the right to decide what accommodations (if any) will be made for the missed work.

Failure to adhere to any aspect of this policy may result in a denial of your request for accommodation.

Note that this policy applies only to missed term work (assignments and midterms). Missed final exams are handled by the Registrar's Office (<http://www.utsc.utoronto.ca/registrar/missing-examination>)

Mid-terms/exams that are missed without approved justification (see above) will receive a 0% mark.

If accommodation is granted:

- If you miss the first term test, your second term test will be a cumulative exam (based on lectures 1-8)
- If you miss the second term test, there will be one make up exam on the week of March 27th. However, as this exam will be very close to the final exam, please note that this may take away from important preparation for the final exam.

Contesting a grade

Re-grade requests will only be considered within two weeks of the grade being received. These will only be considered if adequate written justification is provided by the student. If granted, re-grading will consist of re-evaluation of the complete assignment, potentially leading to a change in the grade in either direction, i.e. a grade increase, no change, or decrease. Requests without a solid rationale will not be considered (e.g. higher grade needed for entering grad school, etc.).

Video and Auditory Recording

For reasons of privacy and copyright, unauthorized video or audio recording in classrooms is prohibited. This is in accordance with the Provost's guidelines on Appropriate Use of Information and Communication Technology. Please note 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".

Copyright of lecture material

As protection of copyright, unauthorized copying, use, or uploading on www of any of the lecture slides, lecture handouts or course materials produced by Professor Arruda-Carvalho is **strictly prohibited**.

AccessAbility statement:

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 as soon as possible.

AccessAbility Services staff (located in Rm SW302, Science Wing) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations [416-287-7560](tel:416-287-7560) or email ability@utsc.utoronto.ca. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

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/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppj_un011995.pdf) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

In papers and assignments:

- Using someone else's ideas or words without appropriate acknowledgement;
- Submitting your own work in more than one course without the permission of the instructor;
- Making up sources or facts;
- Obtaining or providing unauthorized assistance on any assignment.

On tests and exams:

- Using or possessing unauthorized aids;
- Looking at someone else's answers during an exam or test;
- Misrepresenting your identity; and
- When you knew or ought to have known you were doing it.

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; and
- When you knew or ought to have known you were doing so.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If students have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, they are expected to seek out additional information on academic integrity from their instructors or from other institutional resources.

Note: You may see advertisements for services offering grammar help, essay editing and proof-reading. Be very careful. If these services take a draft of your work and significantly change the content and/or language, you may be committing an academic offence (unauthorized assistance) under the *Code of Behaviour on Academic Matters*.

It is much better and safer to take your draft to the Writing Centre as early as you can. They will give you guidance you can trust. Students for whom English is not their first language should go to the English Language Development Centre.

If you decide to use these services in spite of this caution, you must keep a draft of your work and any notes you made before you got help and be prepared to give it to your instructor on request.

Turnitin

Normally, students will be required to submit their course essays to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site
