Psychology
UNIVERSITY OF TORONTO

PSY492H1 S
– Neurobiology of Learning and Memory
Thursday 2-5 pm Sidney Smith Hall Room 1086

Contact Information

Instructor:	**Teaching Assistant(s):**
Professor Kaori Takehara-Nishiuchi	Evi Myftaraj
Office Hours:	**Office Hours**:
Appointment only	Appointment only

Course Description, Goals, and Prerequisites

This course will review the present understanding of genetic and physiological changes in the brain when animals acquire new information and form stable memory traces. It will cover the basic physiology and molecular biology of neurons and explain how distinct networks of neurons change as animals form, stabilize, and recall different types of memory. By the end of this course, you will understand the current views on the biological mechanisms of learning and memory and use this knowledge to evaluate new findings critically.

Note about prerequisites: The prerequisites of this course are PSY201H1/ECO220Y1/EEB225H1/GGR270H1/POL222H1/SOC202H1/STA220H1/STA238H1/STA248H1/STA288H1/PSY201H5/STA215H5/STA220H5/PSYB07H3/STAB22H3/STAB23H3/STAB57H3, and PSY260H1/PSYB38H3 or PSY290H1/PSY290H5/PSYB64H3/HMB200H1/PSL300H1. It is your responsibility to ensure that you have met ***all*** prerequisites listed in the Psychology section of the A&S Calendar for this course. If you lack any prerequisites, you will be removed. No waivers will be granted.

Course Delivery

Lectures: Lectures will be delivered in person. The in-person lecture will not be recorded or live-streamed.

Class Discussion: Class discussion will take place online asynchronously on “Discussions” in Quercus. Rather than emailing me, you are encouraged to post your questions on Quercus to benefit everyone.

Office hours: Virtual office hours will be held by appointment only. Please contact me via Quercus email to book an appointment.

Reading Material/Textbook(s)

(a) Textbook: *The Neurobiology of Learning and Memory* ***3rd edition****, Jerry W Rudy (2020) Sinauer* (I do not recommend that you use the 1st or 2nd edition.)

(b) Assigned reading for the research report: *The molecular and systems biology of memory. Kandel ER, Dudai Y, and Mayford MR, Cell 157(1): 163 – 186 (2014)*

Course Evaluation/Marking Scheme

Your final grade will be assessed as follows;

Term Tests	***February 16th: Test 1 (25%)*** ***April 6th: Test 2 (25%)***
Research Report	***March 2nd: Literature Review (25%)*** ***March 23rd: Research Proposal (25%)***

Course Website

The website associated with this course is accessible via Quercus.

Course Policies

Contact: You can ask questions during the lectures, post them on "Discussions" in Quercus, or email me via Quercus. If you need to discuss any other issues and concerns, please make an appointment for an individual virtual meeting by sending an email via Quercus. I will try my best to reply to emails within three business days.

Attendance: I expect students to attend every lecture. Lectures will cover the assigned chapters in the textbook; however, they will also contain additional materials that will deepen your understanding of the course content. The test will include questions on anything mentioned during the lectures, regardless of whether it is from the textbook or not. Lecture slides will be posted on the "Files" tab in Quercus on the day of the lectures.

Missed Assignments and Tests: You will lose all the marks assigned to the assignment if you miss it. If you have legitimate excuses, such as family emergencies, illness, and religious holidays, please record your absence through the ACORN online absence declaration AND email me how many days you reported as an absence. This needs to be done within one week of the missed assignment. If your excuses are judged valid, the missed assignment will be removed from the calculation of the final mark. There will be no make-up assessment or test.

Penalties for Lateness: The request for the deadline extension for the writing assignments must be submitted by three business days before the actual deadline. It should be

accompanied by legitimate excuses, such as family emergencies, illness, and religious holidays. The penalty for late submission without a pre-approved extension is a reduction by 10% of the maximum mark applicable for each assignment for each business day that the assignment is late. Therefore, an assignment submitted more than ten business days after the deadline will have a mark of zero recorded for that assignment.

Copyright: The materials provided in this course are for the use of the students enrolled in the course. Any course materials should not be shared, distributed, or sold in print or digitally outside the course without permission.

Changes in the syllabus*:* The course content, grading policies, and schedule may be changed to accommodate class needs. Any changes to the syllabus will be announced and then voted on in class.

Academic Resources

Accessibility Needs: 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 Accessibility Services at (416) 978 8060; accessibility.utoronto.ca.

Writing: As a student here at the University of Toronto, you are expected to write well. The University provides its students with a number of resources to help them achieve this. For more information on campus writing centres and writing courses, please visit http://www.writing.utoronto.ca/.

Academic Integrity and Plagiarism: 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 (**www.governingcouncil.utoronto.ca/policies/behaveac.htm**) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences.

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 **www.utoronto.ca/academicintegrity/resourcesforstudents.html**).

Other Resources: Student Life Programs and Services (http://www.studentlife.utoronto.ca/)
Academic Success Services (http://www.asc.utoronto.ca/)
Counselling and Psychological Services (http://www.caps.utoronto.ca/main.htm)

Details on Assignments

Term tests: The test will be conducted online on Quercus. The test questions will be released at 2:10 pm on February 16th and April 6th (EST). By 5 pm on the same day (EST), you need to submit your answers to the "Assignments" tab in Quercus. The questions will be related to any topics covered during the lecture. The grade will be posted in Quercus within three weeks from

the test. The TA will then hold a virtual test review session. Any questions about the grading should be asked by sending me an email via Quercus within two weeks from the TA's review session. Your email needs to explain which questions you are concerned about and why. If your concerns are valid, I will schedule an individual virtual meeting to re-evaluate your answers to the questions. Please note that the re-evaluation may lower your mark.

Research Report: This assignment is designed to improve your ability to critically evaluate the primary research articles. The assigned reading [*The molecular and systems biology of memory Kandel ER, Dudai Y, and Mayford MR, Cell 157(1): 163 – 186 (2014)*] reviews the history and recent development of research on biological mechanisms of memory. You need to write one literature review and one research proposal on one of the topics covered in this review article. Your papers should be written on double-spaced pages. Please use 12-point font and 1-inch margins. Include a cover page (with your name and student number) in addition to an APA-style reference for cited articles.

Part 1: Literature Review: due at 5 pm on March 2nd (EST)

You are required to write a summary of **seven** primary research articles on the topic of your choice. By using PubMed, you need to find articles that were **published after 2012**. Each article should be summarized in ~one page (total of seven pages). You are encouraged to find and summarize articles using different methodologies (*e.g.*, neurophysiological, molecular biological, behavioral study). Up to two articles can be selected from those cited in the assigned reading.

Part 2: Research Proposal: due at 5 pm on March 23rd (EST)

No research article can answer all questions and provide perfect evidence for the hypothesis. Always several points are left for future investigations. As a sequel to the literature review, you will write a research proposal that addresses a gap in the current understanding of the biological mechanisms of the topic of your choice. Your proposal needs to include the following sections:

1) Introduction (~2 pages)

Briefly summarize the current understanding of the biological mechanisms of the topic of your choice. Then, explain what is missing in the current understanding. End with a clear statement showing what remaining questions your experiments will address.

2) Methods (~2-3 pages)

Explain detailed procedures of the proposed experiments, including participants/subjects, behavioural paradigms, control and experimental groups, and outcome measures.

3) Results (~2-3 pages)

Describe what kind of results you are expecting to observe. You are encouraged to include figures that depict the expected results.

4) Discussion (~1 page)

Briefly interpret the expected results and discuss their meaning for the original question.

The proposal will be evaluated based on the following criteria:

Importance of the question --- Introduction section justifies the importance of the question that the proposed experiment will address.

Effectiveness of experiment --- Sufficient methodological details are provided to justify the proposed experiment is the best way to address the question.

Logic of expected outcome --- Expected results are logical and are thoroughly explained.

Novelty of research --- No previous publication used the same methodologies to address the question.

Course Outline/Schedule

Date	Topic	Assignments
January 12th	Overview of the course, concepts, and history of the neurobiology of learning and memory	Chapter 1
January 19th	Review of basic molecular biology and physiology, modifiable synapses underlying simple memory	Chapters 2, 3, 8
January 26th	Episodic memory1 – Acquisition: brain systems	Chapters 9, 10, 16, 17
February 2nd	Episodic memory2 – Acquisition: physiological process	Chapters 3, 9, 10, 14
February 9th	Episodic memory3 – Acquisition: molecular process	Chapters 3, 4, 9, 10, 14
February 16th	**Term Test 1**	
February 23rd	Reading week (No class)	
March 2nd	Episodic memory4 – Consolidation and maintenance: brain systems **Literature Review due**	Chapters 17, 18
March 9th	Episodic memory5 – Consolidation and maintenance: molecular process	Chapters 5, 6, 7, 8, 11, 13
March 16th	Associative memory 1	Chapter 20
March 23rd	Associative memory 2 **Research Proposal due**	Chapters 15, 20
March 30th	Memory modulation and skill learning	Chapters 12, 19
April 6th	**Term test 2**	