

# Psych 3FA3: Neurobiology of Learning and Memory

(2016-2017, Term 1)

## Instructor:

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## TAs:

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## Weekly Schedule:

Class: Monday, 3:30-4:20 pm (BSB 136)

Class: Thursday, 3:30-5:20 pm (BSB136)

Tutorial/Group Work: Monday, 2:30-3:20 (BSB136), starting week 5

Group Work: Wednesday, 2:30-4:20 (BSB136), starting week 5

## Office Hour (PC 415)

## Virtual Classroom:

<http://avenue.mcmaster.ca/>

## Course Description

This course will explore empirical and theoretical accounts surrounding the neural basis of learning and memory. Neural mechanisms will be discussed from several perspectives ranging from cognitive neuroscience to synaptic physiology. Students will attain some understanding of the rationale and methodology of a variety of strategies that are used in the investigation of the neural mechanisms underlying learning and memory. The course will start with a historical perspective and an overview of the multiple memory systems. This model emphasizes the fact that memory is composed of multiple, separable systems that are associated with specific neurobiological substrates. A number of brain mechanisms subserving learning and memory at the systems level, cellular level, and molecular level will subsequently be discussed.

The lectures, required and supplementary readings, in conjunction with student discussion/presentations, are meant to provide students with both an overview of some of the currently "hot" areas in the field as well as some basic tools useful for research in this field. Moreover, students are expected, through active learning (discussions, presentations, and written critiques), to gain experience in critically evaluating research literature and in communicating ideas through written and oral presentations.

During 5 of the 13 weeks, introductory material will be covered in a traditional lecture format. In the remaining 8 of the 13 weeks, for 1 hour only, introductory lectures will be given by the instructor and there will be another hour of student group discussions, and another hour of class presentations.

**Class Schedule**

Week of		Monday (3:30-4:20 pm)	Thursday (3:30-5:20pm)
1	Sept 5		Course overview
2	Sept 12	Lecture	Lecture
3	Sept 19	Lecture	Lecture
4	Sept 26	Lecture	Lecture Group discussion of Module 1
5	Oct 3	Lecture	Presentation of Module 1 (Multiple memory systems I) Presentation feedback from the Instructor Group discussion of Module 2
	Oct 10	Mid-term recess	
6	Oct 17	Lecture	Presentation of Module 2 (Multiple memory systems II) Presentation feedback from the Instructor Group discussion of Module 3
7	Oct 24	Lecture	Presentation of Module 3 (Perceptual learning: visual system) Presentation feedback from the Instructor Group discussion of Module 4
8	Oct 31	Midterm exam	Presentation of Module 4 (Hippocampus: Spatial learning in humans I) Presentation feedback from the Instructor Group discussion of Module 5
9	Nov 7	Lecture	Presentation of Module 5 (Hippocampus: Spatial learning in humans II) Presentation feedback from the Instructor Group discussion of Module 6
10	Nov 14	Lecture	Presentation of Module 6 (Hippocampus: place cells) Presentation feedback from the Instructor Group discussion of Module 7
11	Nov 21	Lecture	Presentation of Module 7 (LTP I: behavioural approaches) Presentation feedback from the Instructor Group discussion of Module 8
12	Nov 28	Lecture	Presentation of M8 (LTP II: cellular approaches) Presentation feedback from the Instructor Lecture
13	Dec 5	Review	

## **Overall Requirements**

The course includes three learning formats:

- Reading
- Lecture
- Discussions/Presentations/Critiques

### **Reading Materials**

Reading 1: Eichenbaum, H. (2012). *The Cognitive Neuroscience of Memory: An Introduction*, 2<sup>nd</sup> Edition, New York: Oxford University Press. (Available in Campus Bookstore)

The textbook by Eichenbaum will provide background information for the lectures.

Reading 2: Psychology 3FA3 courseware (available in Campus Bookstore)

The required readings provided in the courseware are 8 empirical papers (see list in page 5). In addition to the required readings, there are some written commentaries discussing these 8 papers. These supplementary reading materials are provided in another courseware available in Campus Bookstore.

### **Lectures**

Instructor's lectures will be delivered for total of three hours in the first few weeks, and for one or two hours in the rest of the 13 weeks.

Lecture topics:

- History
- Multiple memory systems
- Cortex
- Spatial learning
- LTP

### **Discussion/Presentations/Critiques (8 weeks)**

For the later part of the 8 weeks in the term, the two hours on Thursday's classes will be reserved for class presentations (by 2 selected groups) and then for group discussion (for all groups).

- **Discussions:** During class time (for 0.5-1 hour), each group will discuss the empirical paper listed for the target module which is scheduled to be formally presented the week next. At the end of the discussion, the group will be required to hand in a written summary of the issues discussed.
- **Presentations:** Each group will be assigned 2 of the 8 modules for which they will be responsible for giving a formal presentation of the empirical papers to the class. For each module, the presentation in class is done by two groups (one as a primary presenter, the other as a "commentator", see below).
- **Critiques:** Each student will be required to write critiques for any 2 (one among modules 1-4, the other among modules 5-8) of the 8 modules (but not the ones they are presenting in class). The content of the critiques should be discussed during group discussions mentioned above; however, the critiques must be written individually, **not** as a group.

The group discussion, in-class presentation and writing of the critiques should all be based on the empirical papers listed in each module.

**Presentation assignment for the 8 modules (M) among the 8 groups (G)**

Role	M1	M2	M3	M4	M5	M6	M7	M8
As primary presenters	G1	G2	G3	G4	G5	G6	G7	G8
As commentators	G5	G6	G7	G8	G1	G2	G3	G4

**Evaluation**

	Marked by	Performance	%	Total %
<b>WORK AS A GROUP</b>				
Group Discussion Notes	TAs		8	8
Presentation as primary presenter	Instructor/Peers		7.5	15
Presentation as commentator	Instructor/Peers		7.5	
<b>WORK AS AN INDIVIDUAL</b>				
Written Critiques (Total 2)	TAs		10	20
	TAs		10	
Participation	Peers	Within group	4	12
	Instructor/TAs	In class/group	8	
Written Exam	Midterm	TAs	15	45
	Final	TAs	30	

## Required readings for each module

### 1. Multiple memory systems I

Vargha-Khadem, F., Gadian, D. G., Watkins, K. E., Connelly, A., Van Paesschen, W., & Mishkin, M. (1997). Differential effects on early hippocampal pathology on episodic and semantic memory. *Science*, 277, 376-380.

### 2. Multiple memory systems II

Kesner, R. P., Bolland, B. L., & Dakis, M. (1993). Memory for spatial locations, motor responses, and objects: triple dissociation among the hippocampus, caudate nucleus, and extrastriate visual cortex. *Experimental Brain Research*, 93, 462-470.

### 3. Perceptual learning: visual system

Gilbert, C. D. & Wiesel, T. N. (1992). Receptive field dynamics in adult primary visual cortex. *Nature*, 356, 150-152.

### 4. Hippocampus: Spatial learning in humans I

Maguire, E. A., Gadian, D. G., Johnsrude, I. S., Good, C. D., Ashburner, J., Frackowiak, R. S. et al. (2000). Navigation-related structural change in the hippocampi of taxi drivers [see comments]. *Proc Natl Acad Sci U S A*, 97, 4398-4403.

### 5. Hippocampus: Spatial learning in humans II

Maguire, E. A., Burgess, N., Donnett, J. G., Frackowiak, R. S., Frith, C. D., & O'Keefe, J. (1998). Knowing where and getting there: a human navigation network [see comments]. *Science*, 280, 921-924.

### 6. Hippocampus: place cells

Wilson, M. A. & McNaughton, B. L. (1993). Dynamics of the hippocampal ensemble code for space. *Science*, 261, 1055-1058.

### 7. LTP I: behavioural works

Bannerman, D. M., Good, M. A., Butcher, S. P., Ramsay, M., & Morris, R. G. M. (1995). Distinct components of spatial learning revealed by prior training and NMDA receptor blockade. *Nature*, 378, 182-186.

### 8. LTP II: cellular approaches

Riout-Pedotti, M. S., Friedman, D., Hess, G., & Donoghue, J. P. (1998). Strengthening of horizontal cortical connections following skill learning. *Nature Neuroscience*, 1, 230-234.

## **DETAILED REQUIREMENTS**

### **Discussions:**

- Each group will discuss the empirical paper listed for the target module which is scheduled to be formally presented in class one week after the discussion.
- At the end of the one-hour discussion, the group will be required to hand in a written summary of the issues discussed.
- The summary sheet will be graded and **only students who attend the discussion** will be given the grade.

### **Presentations**

- The primary presenting group should present the basic findings (**15 minutes**).
- The “commentator” group should make comments on the paper (**15 minutes**) and explore the broader issue(s) related to the empirical papers. For the issues to be addressed, this group may follow the guidelines for writing the 2nd part of a critique.
- All group members must participate in the presentations and the answering of questions during/following the presentation.
- **On the top right corner of each slide of the presentation, identify the name of the presenter(s) for that slide**
- Oral presentations will be graded by class as well as by the instructor, based on the content delivered, the logical flow of ideas, and the presentation style.
- The presentations should incorporate proper audiovisual aids (e.g., Powerpoint slides) and handouts if necessary. The presentation slides should be submitted to avenue **by 8 pm, the day before the presentation**. If there is any revision after that, make sure you submit again the final copy of the ppt file within 24 hours of the presentation.

### **Critiques**

- For 2 of the 8 modules (NOT the module they are responsible for presenting), students are expected to write a critique based on the empirical paper listed in that module. Students will be given the opportunity to write **three** critiques, in which case, the two critiques with the highest marks will be included in the final grade.
- The hard copy of the critique of a module is due at class when that module is being presented. Late critiques will not be accepted. The electronic version of the critique should **ALSO** be submitted to avenue by the time the module is being presented.
- See separate sheet for detailed instructions for the suggested content of the critique.

### **Participation Grades**

Participation graded for within group performance by peer group members

- At the end of the term, each member will be required to hand in a written evaluation of the contributions of each of their group members.
- Both, grades (in terms of %) and a written justification should be provided for **ALL** aspects of participation (e.g. including intellectual contribution and contribution of time and effort, etc).

- Typically, all group members will be given the same grade for the discussion note and presentation, however the instructor reserves the right to factor-in peer evaluations, and may adjust the presentation marks for certain individuals accordingly (e.g., those who contribute very little to the joint effort).

Participation graded by instructor/TAs:

Participation grades will be assigned based on the student's performance in the following aspects:

- Attendance in class and at group meetings **and punctuality**
- Active learning
  - Contributions to class and group discussions
  - Contributions to group discussions
  - Contributions to literature search (students are encouraged to share suitable articles with the group and class)
  - Showing initiative in organizing group activities
- Providing extensive and informative feedback to other students on their oral presentation, by completing a very brief evaluation form at the end of each presentation
- Providing feedback and suggestions to the teaching of this course (e-mail to the instructor)

### Exams

The written exams (closed book) will cover lecture and required readings materials. Midterm tests can only be written at the times indicated. There will be no make-up tests or special sessions for any student. Students with valid reasons for missing a midterm test must consult the Dean of Studies office for their faculty (e.g. Science or Social Science). If (and only if) there is adequate written justification for missing the test, such students will have their grades proportionately re-weighted, increasing the relative contribution of the other portion of the grades. The exams will consist of short answer and essay questions.

Final grades will be assigned according to the following conventional scheme:

90-100	85-89	80-84	77-79	73-76	70-72	67-69	63-66	60-62	57-59	53-56	50-52	0-49
A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F

The instructor reserves the right to adjust final marks up or down, on an individual basis, in light of special circumstances and/or the individual's overall performance in the course.

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

Attention is drawn to the *Statement on Academic Ethics* and the *Senate Resolutions on Academic Dishonesty* as found in the Senate Policy Statements distributed at registration and available in the Senate Office. Any student who infringes one of these resolutions will be treated according to the published policy.