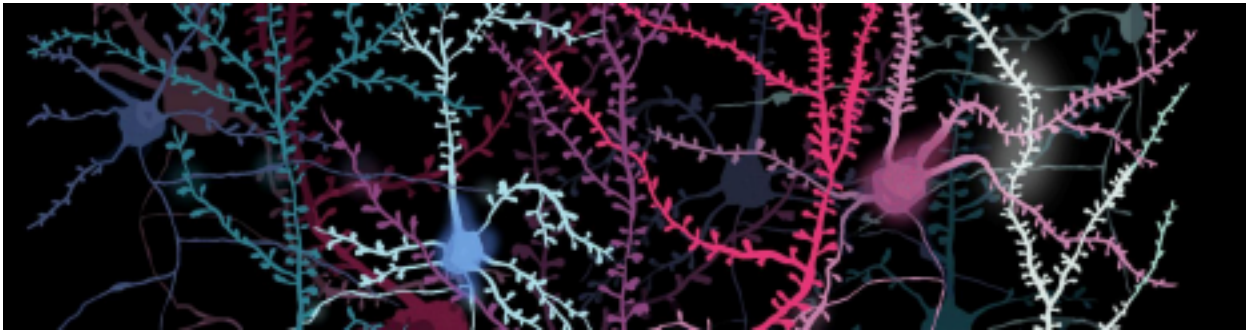




NEU 162: Learning and Memory

Spring, Bldg XXX D/D:Xpm-Xpm

Course format: 2 hours LEC, 1 hour DIS; 3 units

Overview

The biology of learning and memory is critical to our understanding of development, culture, behavioral change, the uniqueness of individuals, and limits to an organism's potential. We will study experimental investigations of learning and memory at the cellular, circuit, and population level. We will discuss these

topics in the context of normal development and disease. Students will become familiar with thinking about the brain at the level of circuits, cells, synapses, and proteins.

Prerequisites: C- or higher in NEU 100A and NEU 100B (concurrent enrollment in NEU 100B is allowed)

Textbook

Required textbook: "Neurobiology of Learning and Memory", by Jerry Rudy 3rd edition Oxford University Press:2020. 2nd edition will have many gaps but can be used.

Suggested reading: Neuroplasticity by Moheb Costandi, MIT Press: 2016. This introduction is useful if you have no prior knowledge. These books are available for purchase at campus bookstores or online.

However, this is an innovative course that brings together several latest research strands into a coherent whole but for which there is as yet no textbook! So as the class progresses, we will make increasing use of scientific reviews from the literature for our readings.

Instructors

Linda Wilbrecht, PhD, is a Professor in the departments of Neuroscience and Psychology. Her laboratory studies development and experience-dependent changes in learning and decision-making, with a particular focus on the frontal cortex and the striatum.

David Foster, PhD, is a Professor in the department of Neuroscience. His laboratory studies memory formation, particularly spatial memory, with a focus on medial temporal lobe brain areas and the hippocampus

in particular.

The Graduate Student Instructors are: XXX and XXX.

The lectures will be every XXX and XXX (see Syllabus) at Xpm IN PERSON in Bldg XX Room XXX.

Contact Information

Prof. Wilbrecht: wilbrecht@berkeley.edu Office Hours: XXX X-X bldg,rm

Prof. Foster: davidfoster@berkeley.edu Office Hours: XXX X-X bldg,rm

XXX: XXX@berkeley.edu Office Hours: XXX X-X bldg,rm

XXX: XXX@berkeley.edu Office Hours: XXX X-X bldg,rm

Lecture/Midterm Calendar Spring 2025

<i>Lecture Title</i>	<i>Read before class</i>
Module I: Cellular and molecular foundations of learning and memory	
1. Multiple learning and memory systems.	Rudy Chs 1 and 16
2. How do neurons work?	Rudy Ch 2, https://science.eyewire.org/neurons
Quiz 1	
3. Methods for studying brain circuits involved in learning	Rudy Ch 9
Homework 1	
4. How are synapses strengthened? LTP basics.	Rudy Ch 3
5. Learning about threats	Rudy Ch 20
6. How is LTP stabilized?	Rudy Chs 4,5,11
7. GPCRs and Neuromodulation	Schwartz and Luo, 2015 (handout)
Quiz 2	
8. How is learning strengthened by the HPA axis?	Rudy Ch 12
Homework 2	

<i>Lecture Title</i>	<i>Read before class</i>
9. Spine plasticity and neurogenesis	Frankland review (handout)
10. Comparative studies: birdsong learning	Alcock Ch 10 (handout)
11. Module 1 overview	
MIDTERM #1	
12. GSI Lecture 1	Frankland review (handout)
Module II: Behavioral neurophysiology of learning and memory	
13. Classic behavioral studies of learning and memory	Morris 1989 (handout)
14. Neural representations of space in the hippocampus	Moser Ann Rev, Foster and Knierim (handouts)
15. Neural correlates of learning and memory methodological issues	none
16. Reinforcement learning I: Conditioning and neural correlates	Daw and Tobler chapter (handout)
Homework 3	
17. Cognitive maps beyond the hippocampus	Moser Annual Review (handout)
18. The memory engram	Tonegawa review (handout)
19. Sleep replay and memory consolidation	TBD
20. Module 2 overview	
MIDTERM #2	
21. GSI Lecture 2	
22. Awake hippocampal replay	Carr and Frank review; Foster 2017 review (handouts)
23. Reinforcement learning II: theories	none

<i>Lecture Title</i>	<i>Read before class</i>
24. Social learning and neural representation of the other	Duvelle review, primary papers (handouts)
FINAL	

Discussion Sections

Weekly, 6 sections with max 25 students each

Important Information

Announcements

All important class announcements will be made through bcourses.

We will also make use of the forums feature of bcourses. If you have a question about the class material, rather than emailing, please post it to the forums, where one of the instructors will answer it. If you don't understand something, it is likely that many students in the class don't understand it, and

so by posting your question to the forums, the entire class benefits. We also encourage you to answer other student's questions if you know the answer.

Assessments

This is based on a combination of two small quizzes, three homework assignments, two midterms and the final.

We use homework assignments to expand your understanding of how neuroscience pertains to many aspects of our lives outside the classroom and to give you a feeling of independence in reading the basic scientific literature. Note that the section is intended to reinforce the lecture, but homework has this different, more expansive goal. Completion requires a written essay of approx. 500 words. There will be plenty of time to complete the homework assignments and so no make ups will be allowed.

The grade is calculated according to the following:

- Homework 14%
- Quizzes (2) 6%
- Midterm 1 24%
- Midterm 2 24%
- Final 30%
- Participation 2%

Quizzes

The quizzes will be multiple choice and will be given online through bcourses.

Midterm and Final

Midterms and finals will be a mixture of multiple choice and short answer. They will be closed book

exams. The two midterms will cover the material taught for that specific unit of the course. The final will cover all the material.

Missing exams

If a midterm is missed with a valid excuse, you may use the grade from the other midterm as a replacement. There is no make up for missing the final, but we can discuss an incomplete.

Regrade Policy

We do our best to avoid mistakes in grading. However, please note that we are as likely to make a mistake and assign credit where it wasn't deserved as we are to fail to assign credit where it was deserved. You are welcome to request a regrade, but please note that the entire paper will be regraded, with the result that your grade can either go up or down. Obviously, if you feel like we've made a big mistake, it is still in your best interest to have the entire paper regraded. However, if it is something small, you may be better off not requesting a regrade. The decision is yours.

Please understand that this policy is to try to ensure equitable treatment across the entire class of students. Different students have different personalities and some are less likely to complain about grades than others. This policy ensures that those differences do not end up affecting your grade.

Note, reevaluation of final grades is not allowed per campus policy, except in cases of clerical error.

Rules of Conduct

We expect all students to adhere to the UC Berkeley Honor Code: honesty, integrity and respect for others. Cheating and plagiarism are never tolerated.

The University of California strives to prevent and respond to harassment and discrimination. Engaging in such behavior may result in removal from class or the University. If you are the subject of harassment or discrimination there are resources available to support you. Please contact the Confidential Care Advocate (<http://sa.berkeley.edu/dean/confidential-care-advocate>) for non-judgmental, caring assistance with options, rights and guidance through any process you may choose. Survivors of sexual violence may also want to view the following website:
<http://survivorsupport.berkeley.edu>

For more information about how the University responds to harassment and discrimination, please visit the Office for the Prevention of Harassment and Discrimination website:
<https://ophd.berkeley.edu>

Statement in Support of Students with Disabilities

If you require course accommodations due to a physical, emotional, or learning disability, contact [UC Berkeley's Disabled Students' Program \(DSP\)](#). Notify the instructor and GSI through course email of the accommodations you would like to use. You must have a Letter of Accommodation on file with UC Berkeley to have accommodations made in the course.

UC Berkeley is committed to providing robust educational experiences for all learners. With this goal in mind, we have activated the ALLY tool for this course. You will now be able to download reading materials in a format that best fits your learning preference (i.e., PDF, HTML, EPUB, and MP3). For more information visit the alternative formats link or watch the video entitled, "[Ally in](#)

