

MCB 160L: Neurobiology Laboratory

Fall 2021

Course description

In this course you will be introduced to a variety of techniques that are commonly used to study the nervous system. Neurobiology is a diverse field that utilizes an incredible variety of experimental techniques. We have selected a few examples for you to work with from electrophysiology, optogenetics, cell biology, imaging, genetics, and anatomy. Experiments will be done on cells and invertebrates, and will cover molecular channel properties, neuronal cell physiology, development, and behavior. We hope that by analyzing the data from these experiments you will gain a better understanding of key principles in neuroscience. In addition, you will learn how to design experiments, troubleshoot experiments, analyze your data, and present your findings in written reports.

Prerequisites: Bio 1A/1AL; Physics 8A/B; MCB 160 or equivalents (concurrent enrollment okay)

Course organization

Every week, there is one hour of lecture on Monday that will introduce you to that week's lab, and then two lab sections that are four hours each.

Lecture: Monday 3-4pm in 101 Weill Hall. Lectures will not be recorded and attendance is required.

Lab section: T/Th or W/F 12-4pm in 4070 VLSB. Attendance is required in lab sections.

Instructors

Robin Ball (she/her, course director), rball@berkeley.edu, 134 Weill

Steve Brohawn (he/him), brohawn@berkeley.edu, 289 Weill

Marla Feller (she/her), mfeller@berkeley.edu, 195 Weill

Graduate student instructors

GSI	Email	Section
Laura Haetzel (she/her)	laura.haetzel@berkeley.edu	101: T/Th 12-4pm
Sophie Obayashi (she/her)	sobayashi@berkeley.edu	101: T/Th 12-4pm
Eric Hu (he/him)	ehu7@berkeley.edu	102: W/F 12-4pm
Miah Pitcher (she/her)	miah_pitcher@berkeley.edu	102: W/F 12-4pm

All office hours for instructors and GSIs will be announced and posted on bCourses.

Lab material

All the lab manual instructions and assignments will be available through the bCourses modules section. Instructions for each lab will be released on a weekly basis.

The lab manual provides important background information and the procedures for each lab. Before coming to each lab, you are expected to read the manual for that week's lab. Your

experiments will go much more smoothly and you will finish faster if everyone in your group has read the manual before class.

Please bring the lab manual with you to class on a laptop/tablet or with the relevant instructions printed. Some of the labs will take place in a lab room that has computers where you can also view the lab manual.

Assignments will be provided for each lab and will be due on Sundays at 11:59pm.

Textbook

There is no required textbook for this course, but you may need to refer to a neuroscience textbook such as:

1. Kandel, E.R., Schwartz, J.H., Jessell, T.M. , Siegelbaum, S.A. , Hudspeth, A.J. Principles of Neural Science. 5th edition, McGraw-Hill, 2013. Available online through the UCB library.
2. Luo, L. Principles of Neurobiology. 1st edition. Garland Science, 2015.
3. Hille, B. Ion Channels of Excitable Membranes. 3rd edition. Sinauer, 2001.

Assignments and grades

Lab assignments	20 %
2 Lab Reports	16 %
Article presentation	10 %
Exam 1	25 %
Exam 2	25 %
Lab participation	2 %
Lecture attendance	2 %

The course will not be curved. You are not in competition with other students in the class and we encourage you to work collaboratively. The grading scale is shown below. At the end of the semester, if the overall course average is low, we will shift the grading scale in your favor. Think of these percentages as the minimum you need to achieve this grade.

>93% A	77-80% C+	>70% P
90-93% A-	73-77% C	<70% NP
87-90% B+	70-73% C-	<60% F
83-87% B	67-70% D+	
80-83% B-	60-67% D	

Lab assignments

You will be completing a lab assignment for each lab. The instructions for these assignments will be provided on bCourses. Your assignments will include a summary of the procedures, graphs, images and analysis you generate for the lab. Lab assignments (also known as worksheets) will be due through bCourses on Sundays at 11:59pm PT. These will be valuable resources when you study for the exams.

Lab reports

You will write two lab reports. Guidelines for each report will be provided on bCourses. Think of the lab reports as journal articles where you can describe your experiments and results. The lab assignments for these two labs will help you generate the graphs and analysis you need for the lab reports. You will upload your lab reports in pdf format directly into bCourses. Lab reports are due at 11:59pm on the due date. You may not share graphs and/or analysis with your lab group. Everyone needs to make their own figures. Each student should write their own lab reports using their own words.

Late assignments

Late lab assignments and lab reports will receive an automatic point deduction through bCourses. You will lose 2% of the total points per day the assignment is late, up to 20% off. The late penalty is meant to keep you motivated to turn in assignments on time and to keep up with all the material. If you do need an extension on an assignment because you are sick or for some other life event, please contact your GSI and the instructor for that lab and propose a new due date. We will approve extensions on a case by case basis.

Journal article presentation

Seven times throughout the semester, a group of 4 students will give an oral presentation (15 minutes + 5 minutes for questions/discussion) based on a primary research article. Faculty instructors will choose articles related to the topics and techniques covered in the laboratory. Students will meet with the faculty in charge of that article to discuss the paper. Students should read the paper thoroughly before the meeting and be prepared to ask any questions that will help them to understand the goals of the work, technical details, results, or interpretations. These meetings usually last for about an hour. Faculty instructors will assign points for this meeting, based primarily on students' preparedness and their participation in the discussion. Students should use PowerPoint or other presentation tools to prepare graphical aids for their presentations. GSIs will grade the presentations, based on guidelines that they will communicate.

Written exams

There are two exams in this course: Exam 1 covers material from Labs 1-6 and Exam 2 covers material from Labs 7-11. The exams will be 2 hours long and take place during your lab section. Exams will be closed-note and will cover material from the lectures and labs.

Exam 1 will take place October 12 or 13. Exam 2 will take place on November 30 or December 1.

Lab participation

GSIs have the discretion to assign these points based on effort, preparedness, experimental technique, collaboration and active participation during class and presentations.

Lecture attendance

We expect students to attend the Monday lectures regularly. We will give the necessary biological background to understand the experiments and give you tips for doing the labs effectively. To encourage you to attend lecture, you will be given one point for each lecture you attend. Make sure you sign in when you enter the lecture room (look for the sign-up sheet on the side table). There will be 10 lectures total and you will receive 1 point for each lecture you attend, for a maximum of 8 points (you can miss two lectures without a consequence to your attendance points, though you will miss out on hearing our amazing and entertaining lectures).

Attendance in lab

Attendance in laboratory sessions is **required**. A laboratory missed for a documented medical reason can be made up through arrangement with your GSI. Labs missed for other than medical or official school function reasons are considered unexcused and cannot be made up. Official school-related excused absences include trips for music or sports activities or travel for scientific meetings, medical school/grad school interviews, etc.

Only one unexcused absence from a lab is permitted. A subsequent unexcused laboratory absence will decrease your total grade by up to 5%. Regardless of the reason for the absence, you should still complete the lab assignment. Get information about the lab and missing data from other students in your lab section.

Be on time to your lab section. If you are more than 10 minutes late for 3 days, your total grade will

decrease by up to 5%. Each subsequent tardy will result in further loss of points.

Covid-19 policies

We are still in the pandemic and expect everyone to follow the current guidelines announced by the campus. You are expected to have a green campus access badge, having been vaccinated or frequently getting tested. You should fill out the daily symptom screener before coming to campus. Whenever you are indoors, you should wear a mask over your nose and mouth. Consider this another laboratory safety rule, like wearing closed-toe shoes and pants. If you do not wear a mask, you will not be allowed to attend class.

If you have tested positive for Covid-19 or if you are feeling ill or have been asked to quarantine, please contact your GSI and do not come to class. This is considered an excused absence and you will still be able to do the assignments associated with the missed lab. As the semester progresses you will get to know your GSIs and the other students in your laboratory section, and you will be part of a friendly community. We want to keep our community safe, so please always follow the rules set out by the University and your instructors.

Student Honor Code

The student community at UC Berkeley has adopted the following Honor Code:

“As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others.”
The hope and expectation is that you will adhere to this code.

Collaboration and Independence: Reviewing lecture and reading materials and studying for exams can be enjoyable and enriching things to do with fellow students. This is recommended. However, unless otherwise instructed, lab reports are to be completed independently and materials submitted as lab reports should be the result of one’s own independent work.

Cheating: A good lifetime strategy is always to act in such a way that no one would ever imagine that you would even consider cheating. Anyone caught cheating on an exam in this course will receive a failing grade in the course and will also be reported to the University Center for Student Conduct. In order to guarantee that you are not suspected of cheating, please keep your eyes on your own materials and do not converse with others during exams. Do not discuss the exam with anyone else in the class until everyone has taken the exam.

Plagiarism: To copy text or ideas from another source without appropriate reference is plagiarism and will result in a failing grade for your assignment and usually further disciplinary action. For additional information on plagiarism and how to avoid it, see, for example: <http://gsi.berkeley.edu/teachingguide/misconduct/prevent-plag.html>. All lab reports will be checked for plagiarism by using Turnitin that compares reports to other students in the class and to websites. Use your own words unless you are using a direct quote.

Academic Integrity and Ethics: Cheating on exams and plagiarism are two common examples of dishonest, unethical behavior. Honesty and integrity are of great importance in all facets of life. They help to build a sense of self-confidence, and are key to building trust within relationships, whether personal or professional. There is no tolerance for dishonesty in the academic world, for it undermines what we are dedicated to doing – furthering knowledge for the benefit of humanity.

Your experience as a student at UC Berkeley is hopefully fueled by passion for learning and replete with fulfilling activities. We appreciate that being a student may be stressful. There may be times when there is temptation to engage in some kind of cheating in order to improve a grade or otherwise advance your career. This could be as blatant as having someone else sit for you in an exam, or submitting a written assignment that has been copied from another source. It could be as subtle as glancing at a fellow student’s exam when you are unsure of an answer to a question and are looking for some confirmation. One might do any of these things and potentially not get caught. However, if you cheat, no matter how much you may have learned in this class, you have failed to learn perhaps the most important lesson of all.

Safe, Supportive, and Inclusive Environment

Whenever a faculty member, staff member, post-doc, or GSI is responsible for the supervision of a student, a personal relationship between them of a romantic or sexual nature, even if consensual, is against university policy. Any such relationship jeopardizes the integrity of the educational process. Although faculty and staff can act as excellent resources for students, you should be aware that they are required to report any violations of this campus policy. If you wish to have a confidential discussion on matters related to this policy, you may contact the Confidential Care Advocates on campus for support related to counseling or sensitive issues. Appointments can be made by calling (510) 642-1988.

The classroom, lab, and work place should be safe and inclusive environments for everyone. The Office for the Prevention of Harassment and Discrimination (OPHD) is responsible for ensuring the University provides an environment for faculty, staff and students that is free from discrimination and harassment on the basis of categories including race, color, national origin, age, sex, gender, gender identity, and sexual orientation. Questions or concerns? Call (510) 643-7985, email ask_ophd@berkeley.edu, or go to <http://survivorsupport.berkeley.edu/>.

Diversity statement

The University of California considers the diversity of its students, faculty, and staff to be a strength and critical to its educational mission. Our community is enriched and enhanced by diversity along a number of dimensions, including race, ethnicity, national origins, gender, sexuality, class and religion. We welcome all our students in our class and hope that you always feel included. If there are aspects of the instruction within this course that result in barriers to your inclusion, please let us know. Your suggestions are encouraged and appreciated.

DSP accommodations

Students who need academic accommodations, should request them from the Disabled Students' Program, 260 César Chávez Center, 642-0518 (voice or TTY), <https://dsp.berkeley.edu>. DSP is the campus office responsible for verifying disability-related need for academic accommodations, assessing that need, and for planning accommodations in cooperation with students and instructors as needed and consistent with course requirements.

We are committed to fully supporting our students with disabilities, including meeting accommodations listed in a DSP letter. If you would like to discuss your accommodations with an instructor, please reach out to us.

Mental Health and Wellness

All students – regardless of background or identity – may experience a range of issues that can become barriers to learning. These issues include, but are not limited to, strained relationships, anxiety, depression, alcohol and other drug problems, difficulties with concentration, sleep, and eating, and/or lack of motivation. Such mental health concerns can diminish both academic performance and the capacity to participate in daily activities.

In the event that you need mental health support, or are concerned about a friend, UC Berkeley offers many services, such as free short-term counseling at University Health Services. A list of resources can be found here: <https://uhs.berkeley.edu/sites/default/files/mhresources.pdf>
A campus website having links to many resources is: <https://recalibrate.berkeley.edu/>

Remember that seeking help is a good and courageous thing to do – both for yourself and for those who care about you.

Services for Students Encountering Food and Housing Insecurity

If you are in a situation where you are facing challenges in gaining access to nutritious, affordable food during the semester, you can find help by going to the UC Berkeley basic needs program at

<http://basicneeds.berkeley.edu/> or the UC Berkeley Food Pantry at <https://pantry.berkeley.edu/>. You may be eligible for the CalFresh program as well.

A list of important resources for all students is on our bCourses page listed in the menu as "Student Resources". You will find links for mental health, medical needs, sexual harassment, the Gender Equity Resource Center, emergency food/cash/housing needs, legal support and disability accommodations. Please use these resources whenever you need them.

Letters of Recommendation

Any of the three instructors may be approached for a letter of recommendation. We are willing to provide a written evaluation for this purpose. So that we may prepare effective evaluations we ask that you follow the procedure outlined here. Be sure to attend the journal club discussion session with the instructor and attend office hours if you have questions. In addition, ask your laboratory section GSI to write a couple of paragraphs about your participation in section. Sometime after the end of the course, send a copy of your CV or resume and Personal Statement to the instructor and GSI. Please note that some instructors get asked for letters from many students and will only be able to accommodate a certain number of requests.

Schedule

SB = taught by Dr. Brohawn, RB = taught by Dr. Ball, MF = taught by Dr. Feller

Date	Day	Lab/Lecture	Assignments due
Aug 25	W	Lec 1: Lecture on statistics and hypothesis testing (MF – pre-recorded)	
Aug 26/27	Th/Fr	Introductions and safety Lab 1: Statistics exercise	Lab 1 due Aug 29
Aug 30	M	Lec 2: Action potential conduction (SB)	
Aug 31-Sep 3	Tu-F	Lab 2: Introduction to electrophysiology equipment (and library introduction)	Lab 2 due Sept 5
Sept 6		Labor Day (no lecture)	
Sept 7-10	Tu-F	Lab 3: Earthworm action potential	Lab 3 due Sept 12
Sept 13	M	Lec 4: Voltage clamp simulation (SB)	
Sept 14-17	Tu-F	Lab 4: Voltage clamp simulation	Lab 4 due Sept 19
Sept 20	M	Lec 5.1: Oocyte voltage clamp 1 (SB)	
Sept 21/22	Tu/W	Lab 5.1: Oocyte voltage clamp 1	
Sept 23/24	Th/F	Lab 5.1: Oocyte voltage clamp 1 Journal article #1	Journal article #1 Lab 5.1 due Sept 26
Sept 27	M	Lec 5.2: Oocyte voltage clamp 2 (SB)	
Sept 28/29	Tu/W	Lab 5.2: Oocyte voltage clamp 2	
Sept 30/Oct 1	Th/F	Lab 5.2: Oocyte voltage clamp 2 Journal article #2	Journal article #2 Lab 5.2 due Oct 3 Lab 5 report due Oct 8
Oct 4	M	Lec 6: Intro to Allen brain resources (RB)	

Oct 5/6	Tu/W	Lab 6.1: Allen brain cell types database	
Oct 7/8	Th/F	Lab 6.2: Allen brain atlas Journal article #3	Journal article #3 Lab 6 due Oct 10
Oct 11	M	GSI exam review	
Oct 12/13	Tu/W	Exam 1 (Labs 1-6)	Exam 1
Oct 14/15	Th/F	Lab 7: Neuroanatomy (brains!)	Lab 7 due Oct 17
Oct 18	M	Lec 8.1: <i>Drosophila</i> NMJ and optogenetics (RB)	
Oct 19/20	Tu/W	Lab 8: <i>Drosophila</i> NMJ intracellular recordings	
Oct 21/22	Th/F	Lab 8: <i>Drosophila</i> NMJ intracellular recordings Journal article #4	Journal article #4
Oct 25	M	Lec 8.2: <i>Drosophila</i> NMJ and optogenetics (RB)	
Oct 26/27	Tu/W	Lab 8: <i>Drosophila</i> NMJ intracellular recordings	
Oct 28/29	Th/F	Lab 8: <i>Drosophila</i> NMJ intracellular recordings Journal article #5	Journal article #5 Lab 8 due Oct 31
Nov 1	M	Lec 9: Immunocytochemistry + imaging (MF)	
Nov 2/3	Tu/W	Lab 9: Immunocytochemistry	
Nov 4/5	Th/Fr	Lab 9: Immunocytochemistry Journal article #6	Journal article #6 Lab 9 due Nov 7
Nov 8	M	Lec 10: Calcium imaging and Trp channels (MF)	
Nov 9/10	Tu/W	Lab 10: Calcium imaging	
Nov 11/12	Th/F	Veteran's Day (no lab)	Lab 10 due Nov 14
Nov 15	M	Lec 11: <i>C. elegans</i> and axon guidance (MF)	
Nov 16/17	Tu/W	Lab 11: <i>C. elegans</i> axon guidance	
Nov 18/19	Th/Fr	Lab 11: <i>C. elegans</i> axon guidance Journal article #7	Journal article #7 Lab 11 due Nov 21 Lab 11 report due 11/29
Nov 22-26		Thanksgiving break (no lecture or lab)	
Nov 29	M	GSI exam review	
Nov 30/Dec 1	Tu/W	Exam 2 (Labs 7-11)	Exam 2
Dec 2/3	Th/F	Lab party!	