MCB 160L: Neurobiology Laboratory
Fall 2020

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, invertebrates, and humans, and will cover molecular channel properties, neuronal cell physiology, sensory systems, 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

Course organization
The course is entirely online for this semester. Each week will be devoted to one lab though there are a few that last two weeks. Every week there will be:
1. One hour of lecture that will introduce you to that week's lab. The one hour lecture will be synchronous – meaning they will be held Mondays 3-4 pm via Zoom (links will be posted on bCourses). Lectures will also be recorded, but we encourage to attend the synchronous lectures whenever possible. The two lectures not scheduled for Mondays (see schedule below), will be recorded and posted for you to watch prior to the corresponding lab section.
2. Two lab sections that are two hours each via Zoom. The lab sections are only synchronous – meaning they will NOT be recorded and you are expected to attend. They will either be Tuesday/Thursday or Wednesday/Friday 2-4 pm via Zoom (links will be posted on bCourses).
3. Material needed for each lab will be provided via bCourses.
4. Students will be organized into lab groups for the purposes of going through lab material and making a presentation.

Instructors
Robin Ball (she/her, course director), 134 LSA
Steve Brohawn (he/him), 289 LSA
Marla Feller (she/her), 195 LSA

Graduate student instructors

GSI		Section
Karina Bistrong (she/her)		101: T/Th 2-4pm
Logan Thomas (he/him)		101: T/Th 2-4pm
Nate Munet (he/him)		102: W/F 2-4pm
Vael Gates (they/them)		102: W/F 2-4pm

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

Lab material

1. We will provide sections from a lab manual on bCourses for each lab.
2. Videos showing the techniques used for that week's lab will be provided and should be watched prior to your lab section. Experimental aspects of the labs that you will learn from these videos will be included in lab assignments and/or exams.
3. Sample data will be provided via bCourses.
4. Assignments will be provided for each lab and will be due on Sundays at 11:59pm following the lab sections.

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	15 %
4 Lab Reports	25 %
Article presentation	10 %
Exam 1	25 %
Exam 2	25 %

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 will be due through bCourses on Sundays at 11:59pm Pacific Time. These will be valuable resources when you study for the exams.

Lab reports

You will write four 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. 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.

Journal article presentation
Eight times throughout the semester, a group of 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 over zoom 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.

Online exams
There are two exams in this course: Exam 1 covers material from Labs 1-5 and Exam 2 covers material from Labs 6-10. The exams will be 2 hours long and will take place online (on Gradescope).

Exam 1 will take place **October 9**. Exam 2 will take place on **December** 4. You will get 2 hours to complete the exam online, but you may access it at any point on exam day. The exams will be open-note, but you will not have enough time to complete the exam if you look up all the information. Please study for the exam as you would for an in-class exam. You are not allowed to collaborate or discuss the exam with other students in class. You are expected to complete your own work and will sign an honor code statement at the start of the exams.

Attendance in lab
Attendance in laboratory sessions is **highly recommended.** These will not be recorded.

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 welcome students with disabilities in this course and will provide the accommodations in your DSP letter. Please discuss your accommodations with an instructor during the first weeks of the semester. We are here to help 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

Date	Day	Lab/Lecture	Assignments due
Aug 26	***W***	*Lec 1 - Intro to course + lecture on statistics and hypothesis testing (MF – pre-recorded)*	
Aug 27/28	Th/Fr	Lab 1: Statistics exercise	
Aug 31	*M*	*Lec 2: Action potential conduction (SB)*	
Sep 1/4	Tu-F	Lab 2: Earthworm action potentials	
Sept 7		*Labor Day*	
Sep 8	***Tu***	*Lec 3: Voltage-clamp (SB) (prerecorded)*	
Sep 8-11	Tu-F	Lab 3: Voltage-clamp computer simulations	
Sep 14	*M*	*Lec 4.1: Ion Channels 1 (SB)*	
Sep 15/16	Tu/W	Lab 4.1: Oocyte voltage-clamp 1	
Sep 17/18	Th/F	Lab 4.1: Oocyte voltage-clamp 1 Journal article #1	Journal article #1
Sept 21	*M*	*Lec 4.2: Ion Channels 2 (SB)*	
Sep 22/23	Tu/W	Lab 4.2: Oocyte voltage-clamp 2	
Sep 24/25	Th/F	Lab 4.2: Oocyte voltage-clamp 2 Journal article #2	Journal article #2 Lab 4 report due 9/27
Sep 28	*M*	*Lec 5: Drosophila NMJ (RB)*	
Sep 29-30	Tu/W	Lab 5: Optogenetics Drosophila NMJ	
Oct 1/2	Th/F	Lab 5: Optogenetics Drosophila NMJ Journal article #3	Journal article #3 Lab 5 report due 10/4
Oct 5	*M*	*No Lecture*	
Oct 6/7	Tu/W	Exam review	

Oct 9	F	**Exam 1 online (Labs 1-5)**	Exam 1
Oct 12	*M*	*Lec 6.1: Allen brain cell types database (RB)*	
Oct 13-14	Tu-W	Lab 6.1: Defining neuronal cell types	
Oct 15-16	Th-F	Lab 6.1: Defining neuronal cell types Journal article #4	Journal article #4
Oct 19	*M*	*Lec 6.2: Allen brain atlas (RB)*	
Oct 20/21	Tu-W	Lab 6.2: Intro to Allen brain atlas	
Oct 22/23	Th/F	Lab 6.2: Intro to Allen brain atlas Journal article #5	Journal article #5
Oct 26	*M*	*No lecture*	
Oct 27/28	Tu/W	Lab 7: Allen Brain Atlas group project	
Oct 29/30	Th/F	Lab 7: Allen Brain Atlas group project	Lab 7 report due 11/1
Nov 2	*M*	*Lec 8 Immunocytochemistry + imaging (MF)*	
Nov 3/4	Tu/W	Lab 8: Immunocytochemistry	
Nov 5/6	Th/Fr	Lab 8: Immunocytochemistry Journal article #6	Journal article #6
Nov 9	*M*	*Lec 9: C. elegans and axon guidance (MF)*	
Nov 10/11	Tu/W	Lab 9: C. elegans, axon guidance	
Nov 12/13	Th/F	Lab 9: C. elegans, axon guidance Journal article #7	Journal article #7
Nov 16	*M*	*Lec 9: Calcium imaging and Trp channels (MF)*	
Nov 17/18	Tu/W	Lab 10: Calcium imaging	
Nov 19/20	Th/Fr	Lab 10: Calcium imaging Journal article #8	Journal article #8, Lab 8 report due 11/22
Nov 23-27		*Thanksgiving break (no lecture or lab)*	
Nov 30	*M*	*No lecture*	
Dec 1/2	Tu/W	Exam review	
Dec 4	F	**Exam 2 online (Labs 6-10)**	Exam 2