MCB 163L: Neuroanatomy Lab

Development, structure (gross and microscopic), and functional relationships of the mammalian nervous system

Preface

This course provides you with a basic understanding of the principles of brain structures and function. These concepts will be useful in graduate or medical studies, and they can refine your ideas about biological complexity and order. The course is designed to prepare you for the advanced neuroscience courses that are an essential part of the postgraduate curriculum. Our emphasis is, therefore, more integrative and broadly-based than in most neuroanatomy courses. In addition to the fundamental structural biology of the central and autonomic nervous systems we will study developmental neurobiology, the sensory, motor and limbic systems, as well as aspects of neurochemistry, action potential conduction and neuropathology. These are essential ingredients of a global perspective on modern neuroscience.

Course Organization

The course consists of 1 hour of lecture and two 3 hour lab sessions a week.

Lectures are on Mondays 2-3 pm in 101 Barker.

Laboratory sections are all in 4048 VLSB and lab sections are listed below.

Lab 101	TuTh	9 – 12 pm
Lab 102	TuTh	2 – 5 pm
Lab 103	WF	2 – 5 pm

Prerequisites: Biology 1A/1AL; MCB 160 (or taken concurrently), MCB 161 recommended

Instructors

* Office hours are listed on bCourses*

Henk Roelink <roelink@berkeley.edu>
Professor of Genetics, Genomics and Development
Office: 171 Koshland

Henk Roelink has a long-standing interest in the development of the central nervous system. His studies have focused on the molecular nature and mechanism of action of signaling molecules involved in the induction of distinct neurons in the developing CNS. He has a PhD from the University of Amsterdam based on research in to Wnt signaling in tumors and embryos, performed at the Netherlands Cancer Institute and Stanford University. He was a post-doc in the lab of Thomas Jessell (the co-author of the Principles of Neural Science textbook) at Columbia University in New York studying neural development, and has worked at the University of Washington School of Medicine in Seattle before moving to UC Berkeley in 2008.

Henk Roelink has taught both gross- and neuroanatomy to medical students during his tenure at the University of Washington School of Medicine and has taught MCB 163 since 2012. He also teaches genetics, and animal development to graduate and undergraduate students. He likes to teach anatomy from a developmental perspective.

Stephan Lammel <lammel@berkeley.edu>
Professor of Neurobiology
Office: 145 Life Sciences Addition

Stephan Lammel research interest aims on the organization and function of neural circuits. His studies have focused on understanding the role of dopamine midbrain neurons in mediating motivated behaviors. He has a PhD from Philipps University Marburg (Germany). He was a post-doc in the lab of Robert Malenka at Stanford University before joining UC Berkeley in 2015.

Stephan Lammel currently teaches Neurobiology of Disease (MCB 165). During his PhD in Germany he taught medical students in physiology. At UC Berkeley he has also taught a graduate class (Decoding neural circuit function in the mammalian brain, MCB 290). He enjoys to teach how state-of-the-art techniques can be used to study neuropsychiatric diseases.

Robin Ball <rwball@berkeley.edu>
Lecturer in Cell & Developmental Biology and Neurobiology
Office: 134 Life Sciences Addition

Robin Ball has studied the development of the neuromuscular junction, focusing on the role of the BMP pathway in the regulation of synaptic homeostasis. She obtained her PhD from UC Berkeley in the lab of Ehud Isacoff and did a post-doc at McGill University in Montreal. Robin returned to Berkeley, her hometown, in 2010 to focus on undergraduate teaching and science education research.

Robin also teaches MCB 32 (non-majors human physiology course), MCB 38 (stem cell biology), MCB 133L (cell biology lab), MCB 160L (the other neuroscience lab) and MCB 165 (neurobiology of disease).

Graduate student instructors

GSI	Email	Section
Hayley Bounds	hayley_bounds@berkeley.edu	101
Bill Croughan	bill_croughan@berkeley.edu	102
Lily Xue Gong	lilyxuegong@berkeley.edu	103

Textbook

There is no required textbook, but you will likely need to reference neuroscience textbooks such as:

1. Kandel, E.R., Schwartz, J.H., Jessell, T.M. , Siegelbaum, S.A. , Hudspeth, A.J. Principles of Neural Science. Fifth edition, McGraw-Hill, 2013. Available online through the UC Berkeley library.
2. Luo, L. Principles of Neurobiology. First edition. Garland Science, 2015.
3. Martin, J.H. Neuroanatomy. Text and Atlas. Fourth edition. McGraw-Hill, 2012.

Course policies

Lab notebook	10 %
2 Presentations (4% each)	8 %
4 Lab Reports (8% each)	32 %
Exam 1	20 %
Exam 2	20 %
Oral exam	10 %

Lab notebook

You are required to bring your lab notebook with you to every lab session. Your notebook should include a summary of the procedures, notes about the experiment, data collected during lab, drawings and images you make during lab, and answers to questions in the lab manual or worksheets. You can find more details about the notebook after the course schedule. GSIs will randomly check lab notebooks throughout the semester, so always bring your lab notebook and keep up with your work. This will be an invaluable resource when you study for the exams.

Lab reports and presentations

You will write four lab reports and make two group presentations on your experiments. You will receive further instructions and guidelines for these assignments. The due dates are listed below and in the schedule.

Lab 7 (C elegans) report due Oct 4/5
Lab 10 (earthworm nerve) report due October 18/19
Lab 11 presentation October 30/31
Lab 11 (immunohistochemistry) report due November 1/2
Lab 13 presentation November 29/30
Lab 13 (Allen brain atlas) report due December 7

Written exams

There are two exams in this course: Exam 1 covers material from Labs 1-6 and Lectures 1-3. The beginning of this course really focuses on brain anatomy, so you can think of exam 1 as your anatomy exam. Expect to identify specific regions of the nervous system in images of human and sheep brains. Exam 1 happens during your lab section.

Exam 2 is Thurs Nov 15 evening (8-10pm in 2060 VLSB). Exam 2 covers all material from the course, but focuses on material from Labs 7-12 and Lectures 4-9.

For both exams, study the lecture slides, the extra study questions (page 9), and the questions and images in the lab manual.

Oral exam

We will give you a list of important questions related to each lab and lecture. You should work on answering these questions when you do the corresponding lab. Instructors will randomly choose students to answer the questions, without notes, during lab section. This means you need to always be ready to explain and discuss the previous questions. You will not be graded on these answers, but we hope you take this initial test run through the questions seriously. Ask the student who is presenting questions and ask your GSI to clarify, so you understand the answers.

On November 8/9, there will be an oral exam using those same questions. You will meet with one of the instructors (without other students in the room) who will ask you two of these questions at random. 10% of your grade will be determined by how well and thoroughly you are able to answer the two questions. This is a good practice for learning how to talk about scientific concepts.

Missed exams
If you have official school travel that conflicts with the exams, please inform your GSI and the professors, and we will do our best to give you a make-up exam. Unexcused missed exams will receive 0 points.

Attendance and participation
Attendance in laboratory sessions is **required.** A laboratory missed for a documented medical reason can be made up through arrangement with your GSI. More than one missed lab requires a written excuse from a relevant health professional on their letterhead within one week. 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, your lab notebook should still be up to date. Get information about the lab and missing data from other students in your lab section.

Be on time to your lab section. Oral exam questions are reviewed in the first 10 minutes of 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.

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, homework assignments are to be completed independently and materials submitted as homework 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 a quiz or 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 the quizzes and exams.

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

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. And we also 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. And 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/.

Date	Day	Lab/Lecture	Assignments due
Aug 23/24	Th/F	ATTEND THE FIRST LAB! Intro to course + library exercise	
Aug 27	*M*	*Lec 1: Organization of brain (HR)*	
Aug 28/29	Tu/W	Lab 1: Brain models, 3D atlas, Intro Brain Explorer, MRI activity	
Aug 30/31	Th/F	Lab 2: Human brain and spinal cord, sheep brain outside structures, cranial nerves	
Sep 3	*M*	*No class - Labor Day*	
Sep 4/5	Tu/W	Lab 3.1: Sheep brain (sagittal and horizontal)	
Sep 6/7	Th/F	Lab 3.2: Sheep brain (subcortical)	
Sep 10	*M*	*Lec 2: Vision and auditory (HR)*	
Sep 11/12	Tu/W	Lab 4: Eye and auditory sensory organ anatomy	
Sep 13/14	Th/F	Lab 5: EEG	
Sep 17	*M*	*Lec 3: Reflexes (sensory and motor pathways) (HR)*	
Sep 18/19	Tu/W	Lab 6: Neurological exam + case studies	
Sep 20/21	Th/F	Exam 1 in lab section	Exam 1 in lab
Sep 24	*M*	*Lec 4: Axon guidance and motor circuitry (RB)*	
Sep 25/26	Tu/W	Lab 7.1: C elegans DV patterning (behavior testing)	
Sep 27/28	Th/F	Lab 7.2: C elegans DV patterning (imaging)	
Oct 1	*M*	*Lec 5: Optogenetics and Electrophysiology (RB)*	
Oct 2/3	Tu/W	Lab 8: Drosophila behavior and optogenetics	
Oct 4/5	Th/F	Lab 9: Intro to electrophysiology	Lab 7 report due
Oct 8	*M*	*Lec 6: Earthworm nerves and action potential conduction (RB)*	
Oct 9/10	Tu/W	Lab 10.1: Earthworm nerve recordings	
Oct 11/12	Th/F	Lab 10.2: Earthworm nerve recordings	
Oct 15	*M*	*Lec 7: Mouse brain anatomy and neurotransmitter systems (SL)*	
Oct 16/17	Tu/W	Lab 11.1: Day 1 IHC and brain slice activity	
Oct 18/19	Th/F	Lab 11.2: Day 2 IHC and Nissl staining	Lab 10 report due
Oct 22	*M*	*Lec 8: Imaging (SL)*	
Oct 23/24	Tu/W	Lab 11.3: Day 3 IHC mounting slides	
Oct 25/26	Th/F	Lab 11.4: Day 4 IHC imaging and prepare presentation	
Oct 29	*M*	*Lec 9: Papez circuit (HR)*	
Oct 30/31	Tu/W	Lab 11 group presentations	Lab 11 presentations
Nov 1/2	Th/F	Lab 12: Intro to Allen brain atlas (using Papez circuit)	Lab 11 report due
Nov 5	*M*	*Lec 10: Allen Brain atlas project (RB)*	
Nov 6/7	Tu/W	Lab 13.1: Develop Allen brain project	
Nov 8/9	Th/F	Oral exam in lab section	Oral exam
Nov 12	*M*	*No class - Veteran's Day*	
Nov 13/14	Tu/W	Lab 13.2: Allen brain project	
Nov 15/16	Th/F	Lab 13.3: Allen brain project	Exam 2 - Thursday Nov 15 evening
Nov 20-23	*T-F*	*NO LAB*	
Nov 27/28	Tu/W	Lab 13.4: Prepare presentation	
Nov 29/30	Th/F	Lab 13 group presentations	Lab 13 presentations
Dec 7	F	Lab 13 reports due	Lab 13 report due