

CELLULAR NEUROBIOLOGY

BIPN 140

Winter 2021

SYLLABUS

INSTRUCTORS: Matthew R. Banghart, Ph.D. and Stefan Leutgeb, Ph.D.

LOCATION: Remote via Zoom: <https://ucsd.zoom.us/j/95446592007>

TEXTBOOK: *Neuroscience*, Purves et al. 6th edition, Sinauer Associates Publishers

DATE		LECTURE TOPIC (Q=quiz) [Instructor]	TEXT	Handouts
Jan	5	(1) Neurons and Glia [MRB]	Ch 1	Glia, Cytoskeleton & Axonal Transport
	7	(2) The Passive Membrane I [MRB]	Ch 2	Passive Membrane Ephys Basics
	12	(3) The Passive Membrane II [MRB]	Ch 2-3	
	14	(4) The Active Membrane I (Q) [MRB]	Ch 3	
	19	(5) The Active Membrane II [MRB]	Ch 3-4	K ⁺ and Cl ⁻ channels
	21	(6) Channel Structure & Function (Q) [MRB]	Ch 4	Amino Acids
	26	MIDTERM EXAM 1 (Lec 1-6)		
	28	(7) Synaptic Transmission I [MRB]	Ch 5	
Feb	2	(8) Synaptic Transmission II [MRB]	Ch 5-6	Neurotransmitters
	4	(9) Intracellular Signaling & GPCRs (Q) [MRB]	Ch 7	
	9	(10) Synapse formation [MRB]	Ch 22-23	
	11	(11) Synaptic Plasticity I [SL]	Ch 7-8	
	16	(12) Synaptic Plasticity II (Q) [SL]	Ch 8	
	18	MIDTERM EXAM 2 (Lec 7-12)		
	23	(13) Sensory transduction I, Somatosensory system and pain [SL]	Ch 9-10	
	25	(14) Sensory transduction II, Visual system [SL]	Ch 11	
Mar	2	(15) Sensory transduction III, Auditory, vestibular, olfactory & gustatory systems [SL]	Ch 13-15	
	4	(16) Motor control I, Lower & upper motor neurons (Q) [SL]	Ch 16-17	
	9	(17) Motor control II, Basal ganglia & Cerebellum [SL]	Ch 18-19	
	11	(18) Cerebral cortex and cortical states [SL]	Ch 27-28	
	16	FINAL EXAM (Comprehensive)		11:30 am -2:30 pm

Grading:

Discussion Attendance	5%	(20 pts)
In-class Quizzes	10%	(40 pts)
Midterm Exam 1	20%	(80 pts)
Midterm Exam 2	25%	(100 pts)
Final Exam	40%	(160 pts)

The class is graded on a curve. See CAPES to get a sense of the average grades in this course.

GENERAL INFORMATION:**Instructors:****Professors:**

Dr. Matthew Banghart (mbanghart@ucsd.edu)

Dr. Stephan Leutgeb (sleutgeb@ucsd.edu)

Please only use Canvas to contact Dr. Banghart. Please do not use email.

Faculty Office Hours:

Friday 4-5 pm, <https://ucsd.zoom.us/j/91641150859>

An additional Final Exam Review Session will be held on Fri Mar 12, 4-6 pm.

Instructional Assistants (IAs):

IA	Email	Discussion	Office Hours
Giulia Livrizzi	gilivriz@ucsd.edu	Th 3-4 pm A01 (33056) https://ucsd.zoom.us/j/95406335162 Th 5-6 pm A02 (33057) https://ucsd.zoom.us/j/99290776997	M 5:30-6:20 pm https://ucsd.zoom.us/j/99954187011
Alejandro Dauguet	adauguet@ucsd.edu	Fr 11 am-12pm A03 (33058) https://ucsd.zoom.us/j/96438585658	M 10:00-10:50am https://ucsd.zoom.us/j/98158176216

Required text book:

Neuroscience, Purves et al. (6th edition, Sinauer Associates Publishers)

**5th edition is insufficient*

No physical reserves are available due to Covid-19.

Free access to the ebook is provided for the first two weeks of class (until drop/add ends) via RedShelf in Canvas. At that time students **can opt out** of purchasing the ebook. Questions: textbooks@ucsd.edu, [RedShelf Solve](#), [Inclusive Access FAQ page](#).

Supplemental texts

The Neuron, Levitan and Kaczmarek (any edition)

Principles of Neural Science, Kandel and Schwartz (any edition)

Ionic Channels of Excitable Membranes, Hille (any edition)

Lecture Notes:

Lectures will be podcast (audio and slides).

If you have questions concerning how to access course materials on Canvas, please contact Academic and Computing Services: <http://acms.ucsd.edu/>.

Assigned Readings:

Textbook readings are optional in that quiz and exam material will not come from the text without showing up in a problem set first. However, the readings, at least at a cursory level, are highly recommended as a way to review and/or prepare for the lecture material. Reading assignments provide further background on lecture material and often offer a more comprehensive treatment of the topic. Again, they should be used to *reinforce* concepts from class – not as a primary source of information. In other words, do not study the book for exams – look it over before and/or after class. Keep in mind that there are sections within each indicated chapter that we do not cover in class (see learning objectives if you are uncertain about a topic). In rare cases problem set answers must be obtained from the textbook – these will be indicated in the problem set. Once covered in a problem set the material from the book is fair game on an exam. Additional supplemental reading sources are provided for your further edification only.

Handouts:

Handouts will occasionally be provided on Canvas to supplement lectures and readings. **This information will be on problem sets, quizzes and exams.** Problem sets & exam questions from previous years will also be posted on Canvas for practice. Consider handouts to be even more critical than textbook readings. *Additional handouts not already listed on the syllabus may be provided as the course progresses.*

Articles:

Primarily research articles will be periodically discussed in class to demonstrate the significance of the lecture material. Aspects of the articles covered in class will appear in bonus questions on the exams. Articles will be posted on Canvas.

Discussions:

Discussion sessions will start the week of **Jan 11th**. There will be **no discussion sessions during the first week**. Attendance at each session is worth 2 points and general participation across all discussions is worth up to 2 points (9 sessions x 2 points + 2 participation points = 20 points total; this equates to 5% of the final grade). The sections are useful opportunities to ask questions about the lectures, handouts & readings and will be structured around working through solutions to several questions on the problem sets. Students may switch sections but this must be approved by both IAs. Students must attend their (re)assigned discussion section - drifting between sections is not allowed.

Problem Sets:

Problem sets will be released on Thursdays (or Wednesdays when possible) and will generally cover material from the previous Thurs and Tues lectures. They consist of sets of questions that will help you evaluate your understanding of the material covered in the lectures and the reading. They are very similar to questions you will have to answer on exams. To get the most out of them, treat them like assignments. They will not be graded, but will be discussed in section on Thursday and Friday. The answer key will be posted after the Friday discussion sections. **In the past there has been an excellent correlation between those who worked through the problem sets and those who received high grades in the course. Conversely, those students who show up at discussion having not worked earnestly on the problem sets clearly perform the most poorly.** Waiting for the key and showing up at discussion to “absorb” the answers simply doesn’t work. *The only reliable way to prepare for exams is to work through the problem sets without looking at the answer key.*

Quizzes:

As indicated in the syllabus, there will be 5 in-class quizzes, each worth 8 pts, or 2% of your total grade. **Quizzes will be administered via Canvas in real time.** Students who are taking the course asynchronously due to time-zone differences must make alternative arrangements with Prof. Banghart during the first week of class. Questions will be based strictly on material covered since the previous quiz, and will be very similar to questions on the problem sets and exams. The quizzes are intended to encourage you to review the lecture material frequently, rather than cramming before the exam, and to actually work on the problem sets, as the assigned problem sets will help with the quizzes. This is critical, as the course material is challenging and builds on itself. If you miss a concept from a lecture, you may be unable to keep up in a subsequent lecture and risk falling behind and getting lost. “Bring” calculators to class.

Exams:

Midterm exams will consist of short essays and problems and be administered in class (1 hr 20 min). The final exam (3 hr) will be distributed proportionally such that ~1/3 covers new material since the 2nd midterm, and 2/3 consists of a comprehensive exam that covers the entire course. The exams will cover material from lectures, quizzes, handouts and problem sets and exam questions will closely resemble questions in quizzes and problem sets. Calculators are required.

Learning Objectives:

These are literally, line-by-line summaries of the concepts that are covered on each slide in class, and that have been used over the years as the basis of problems on quizzes and exams. Yes the lists are long and may seem overwhelming, but they accurately represent everything that is fair game on your exams. No, a single exam can't possibly cover them all at once, but it will cover a representative selection. Reviewing lecture slides and prior problems (quizzes, problem sets, prior years' exams) to check off each line item is a great way to study for an exam. To be even more clear: we write the exams and quizzes by picking topics from these lists...

Academic Integrity:

Don't cheat – it so easy to do it and very common with online classes. You are likely to get caught and blow your entire investment in higher education, as well as your grade in this course. Students are expected to do their own work. UCSD's policy on academic integrity can be found here:

<https://academicintegrity.ucsd.edu/>.

Final Words:

Many students report this to be *THE MOST* challenging course they take. Upper division college students are expected to be capable of performing basic algebra (no calculus), so be ready to solve equations (this is inescapable in science). Furthermore, exams are based primarily on problem solving. Memorization of facts and keywords alone doesn't amount to much in this class. Students often note that other courses are not structured this way and feel unprepared. Problem solving is how the real world works, especially in science. It would be unfair to students to *not* be evaluated on problem solving in an upper-division course while obtaining a science degree, as such an education would leave them unprepared for a career in the real world. Do the problem sets.