

USC Dornsife

BISC/NEUR 407
Cellular and Molecular Neuroscience
Units: 4.0

Spring 2025

Location: ZHS 159

Instructors: Dion Dickman, Ph.D. and Rita Barakat, Ph.D.

Office: HNB 309 (Dickman) and SGM 722 (Barakat)

Office Hours: by appointment via zoom

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Course Description

According to the Merriam-Webster Dictionary, neuroscience is defined as a branch of the life sciences that deals with the anatomy, physiology, biochemistry, or molecular biology of nerves and nervous tissue and especially with their relation to behavior and learning.

Learning Objectives

This course is designed to assist you in understanding how individual nerve cells develop, find targets, and establish functional synapses, and how dysfunction in this process contributes to neurological and neuropsychiatric diseases.

Recommended Preparation: Bisc 421: Neurobiology core course; Cell Biology

Lectures: Tuesday and Thursday; Time: 11:00 am - 12:20 pm location: ZHS 159

Required Reading:

Principles of Neural Science. Fifth or Sixth Edition. Kandel, Schwartz, Jessell, Siegelbaum, Hudspeth.

Journal articles for the Discussion section:

1. Kwon et al. "Glutamate induces de novo growth of functional spines in developing cortex." *Nature*, 2011.
2. Paolicelli et al. "Synaptic pruning by Microglia is necessary for normal brain development." *Science*, 2011.
3. Yagishita et al. "A critical time window for dopamine actions on structural plasticity of dendritic spines." *Nature*, 2014.
4. Roy et al. "Memory retrieval by activating engram cells in mouse models of early Alzheimer's disease." *Nature*, 2016.

Suggested Reading

Development of the Nervous System. Third Edition. Dan Sanes, Thomas Reh, William Harris.

Discussions

		Days	Times	Location	TA
Discussion	13413	Wednesday	2:00-3:20 pm	THH B10	TBD
Discussion	13415	Wednesday	10:00-11:20 am	HNB 100	TBD
Discussion	13416	Tuesday	2:00-3:20 pm	HNB 100	TBD
Discussion	13417	Thursday	9:30-10:50 am	HNB 107	TBD
Discussion	13418	Wednesday	12:00-1:20 pm	GFS 222	TBD
Discussion	13419	Thursday	2:00-3:20 pm	SOS B48	TBD

Teaching Assistants TBD

Course Material

Course materials (syllabus, readings, lecture figures, etc.) will be available on Blackboard. <https://blackboard.usc.edu>. Develop the habit of checking Blackboard. Many important announcements will appear first on Blackboard.

Expected work for students outside of class

Students are expected to devote, at minimum, 4-6 hours of reading each week outside of class on the required course material and text reading. Further, there will be quizzes and class discussions during each weekly discussion section, and students will be expected to study for at least 1 hour each week in preparation for the discussion and quiz. Finally, primary papers are assigned that students are expected to read, prepare presentations, and lead discussions. This is expected to require, at minimum, 3-4 hours each week. Thus, at least 10 hours of work is expected from each student to devote outside of class each week as mandatory preparation and work for this course.

Grading

The course is divided into two modules with two exams given during each module, each worth 100 points. Any concern about test scores should be directed to the professor responsible for that test. The full grade for the Discussion Section is 100 points and is based on oral presentations, quizzes, and participation; more detailed information will be provided at the first discussion group meeting. **There are no make-up quizzes or exams.** Final grades will be normalized to achieve the following letter grade distribution: 30% A's; 20% A-'s; 20% B+'s; 15% B's; 5% B-'s; 10% < B-. Students will be notified of their letter grade standing after the second exam and after the final exam.

Exam format

Exams consisting of multiple choice and short answer questions will be administered in class only. It is course policy that there are **NO MAKE UP EXAMS under any circumstances**. Please make sure to note the exam dates on the syllabus and be sure to attend each exam in person.

Missed exams

No make-up exams will be given in this course. If you miss an exam due to illness you may present a valid medical excuse to your TA within one week **before** the missed exam (within 48 hours before the missed Final). You should notify your TA *in writing* that you were seen by a doctor; make sure that you include (a) the doctor's name and phone number and (b), a statement authorizing us to discuss with the doctor whether you were too ill to take the exam. We will contact the doctor and decide whether you have a valid excuse. If you do, your grade for that

exam will be based on the average of your other three other midterm and final exam scores, called “prorating”. If you do not have a valid excuse, or fail to provide it within the allotted time before the exam, you will receive a zero for that exam.

Please note: It is the policy of the student health center to not provide routine medical excuses (i.e., they will not issue a slip stating that you were seen at the health center). Simply going to the health center is not a valid reason for missing an exam. If you are seriously ill and are seen by a doctor (at the health center or elsewhere), you must turn in a written notification to your TA as described above.

If two or more exams are missed for any reason, you will not be able to pass the course. If there were legitimate health reasons that precluded you from taking more than one exam, a final grade of Incomplete (IN) will be assigned.

Students who wish to miss an examination for observance of a religious holiday should be aware of the University’s policy on such absences, published at: <http://orl.usc.edu/religiouslife/holydays/absences.html>.

Course Schedule: A Weekly Breakdown

Chapter/pages for Kandel 5th edition; numbers in parentheses indicate corresponding chapter/pages for the 6th edition.

	Topics/Daily Activities	Chapter	Pages
Week 1 01.14	Course overview and Neural Development	52 (45)	1165-1171 (1107-1114)
Week 1 01.16	Patterning of the nervous system	52 (45)	1172-1185 (1115-1129)
Week 2 01.21	Differentiation of nerve cells	53 (46)	1187-1199 (1130-1143)
Week 2 01.23	Neuronal survival and growth	53 (46)	1200-1208 (1144-1154)
Week 3 01.28	Axon growth and guidance I	54 (47)	1209-1231 (1156-1179)
Week 3 01.30	Axon growth and guidance II	54 (47)	1209-1231 (1156-1179)
Week 4 02.04	Exam I, 11 am, ZHS 159		
Week 4 02.06	Synaptogenesis I	55 (48)	1233-1249 (1181-1199)
Week 5 02.11	Synaptogenesis II	55 (48)	1233-1249 (1181-1199) <i>For Discussion:</i> Kwon et al. 2011

Week 5 02.13	Neurotransmitter release	9, 12 (12, 15)	189-191 (254-259); 260-264 (324-328); 278-285 (343-354) <i>For Discussion:</i> Kwon et al. 2011
Week 6 02.18	The Active Zone	Reviews	Biederer et al., 2017 Review Sudhof 2012 Review
Week 6 02.20	Diseases of the nerve and motor units	14 (57)	307-330 (1421-1445) <i>For Discussion:</i> Paolicelli et al. 2011
Week 7 02.25	Neuronal injury and repair	57 (50)	1287-1304 (1240-1257)
Week 7 02.27	Sleep and synapses	51 (44)	1140-1157 (1081-1098)
Week 8 03.04	Exam II, 11 am ZHS 159		
Week 8 02.29	Cell types of the CNS	4 (7)	71-99 (133-163)
Week 9 03.05	Central Synapses I	10 (13)	211-234 (273-299) Feng and Zhang, 2009 Review <i>For Discussion:</i> Yagishita et al. 2014
Week 9 03.07	Central Synapses II	10 (13)	211-234 (273-299) Feng and Zhang, 2009 Review <i>For Discussion:</i> Yagishita et al. 2014
Week 10 03.16	<i>Spring break</i>		
Week 10 03.14	<i>Spring break</i>		
Week 11 03.19	Mammalian Synaptogenesis I	55 (48)	1249-1257 (1198-1208) McAllister, 2007 Review
Week 11 03.21	Mammalian Synaptogenesis II	55 (48)	1249-1257 (1198-1208) McAllister, 2007 Review
Week 12 03.26	Learning and Memory	67 (54)	1488-1519 (1339-1368) Herring and Nicoll, 2016 Review
Week 12 03.28	Exam III, 11am ZHS 159		
Week 13 04.02	Second Messengers	11 (14)	236-259 (301-322)
Week 13 04.04	Glia and glial diseases		Zuchero and Barres, 2015 Review

			Clarke and Barres, 2013 Review <i>For Discussion:</i> Roy et al., 2016
Week 14 04.09	Schizophrenia	62 (60)	1389-1399 (1488-1499) <i>For Discussion:</i> Roy et al., 2016
Week 14 04.11	Autism	64 (62)	1425-1439 (1523-1541) Sadybekov et al. 2017
Week 15 04.16	Mood and Anxiety Disorders	63 (61)	1403-1423 (1501-1520)
Week 15 04.18	Parkinson's Disease	43 (38)	991-995 (947-948) Logan et al., 2017
Week 16 04.23	Alzheimer's Disease	59 (64)	1329-1344 (1561-1580)
Week 16 04.25	Review session		
05.07	FINAL ZHS 159		

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct/>.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* <http://equity.usc.edu/> or to the *Department of Public Safety* <http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us>. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage sarc@usc.edu describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* <http://emergency.usc.edu> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.