**USC** Dornsife

**BISC/NEUR 407**

**Cellular and Molecular Neuroscience**

**Units: 4.0**

**Spring 2019**

**Location:**  **THH 210**

**Instructor:** Dion Dickman, Ph.D. and Bruce Herring, Ph.D.

**Office**: HNB 309 (Dickman) and HNB 328A (Herring)

**Office Hours**: by appointment

**Contact Info**: 213-740-7533, [dickman@usc.edu](mailto:dickman@usc.edu)

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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:* 11:00-12:20 *location:* THH 210

**Required Reading:**

*Principles of Neural Science*. Fifth 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:**

Section Time Day Location TA name

**13416D** 9:30 AM-10:50 AM T THH B9 Bochuan Teng

**13418R** 12:00 PM-1:20 PM W ZHS 360 Bochuan Teng

**13417D** 9:30 AM-10:50 AM Th THH B9 Pragya Goel

**13419R** 2:00 PM-3:20 PM Th HNB 107 Pragya Goel

**Teaching Assistants:**

Pragya Goel: [pragyago@usc.edu](mailto:pragyago@usc.edu) *Office hours: 1-2 PM Thursday in HNB 120A*

Bochuan Teng: [bochuant@usc.edu](mailto:bochuant@usc.edu) *Office hours: 3-4 PM Tuesday in HNB 120A*

**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 reaching 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. The averages between tests may vary and will be curved appropriately. Any concern about tests 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.

**Course Schedule: A Weekly Breakdown**

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|  | **Topics/Daily Activities** | **Chapter** | **Pages** |
| Week 1 01.08 | Course overview and Neural Development | 52 | 1165-1171 |
| Week 1 01.10 | Patterning of the nervous system | 52 | 1172-1185 |
| Week 2 01.15 | Differentiation of Nerve cells | 53 | 1187-1199  *For Discussion:* Kwon et al. 2011 |
| Week 2 01.17 | Neuronal survival and growth | 53 | 1200-1208 |
| Week 3 01.22 | Axon growth and guidance I | 54 | 1209-1231 |
| Week 3 01.24 | Axon growth and guidance II | 54 | 1209-1231 |
| Week 4 01.29 | **Exam I, 11 am, THH 210** |  |  |
| Week 4 01.31 | Synaptogenesis I | 55 | 1233-1249 |
| Week 5 02.05 | Synaptogenesis II | 55 | 1233-1249 |
| Week 502.07 | Neurotransmitter release | 9, 12 | 189-191; 260-264; 278-285  *For Discussion:* Paolicelli et al. 2011 |
| Week 6 02.12 | The Active Zone | Reviews | Biederer et al., 2017 Review  Sudhof 2012 Review |
| Week 6 02.14 | Diseases of the nerve and motor units | 14 | 307-330 |
| Week 7 02.19 | Neuronal injury and repair | 57 | 1287-1304 |
| Week 7 02.21 | Sleep and synapses | 51 | 1140-1157 |
| Week 8 02.26 | **Exam II**, **11 am THH 210** |  |  |
| Week 8 02.28 | Cell types of the CNS | 4 | 71-99  *For Discussion:* Yagishita et al. 2014 |
| Week 9 03.05 | Central Synapses I | 10 | 211-234  Feng and Zhang, 2009 Review |
| Week 903.07 | Central Synapses II | 10 | 211-234  Feng and Zhang, 2009 Review |
|  | *Spring break* |  |  |
| Week 1003.19 | Mammalian Synaptogenesis I | 55 | 1249-1257  McAllister, 2007 Review |
| Week 1003.21 | Mammalian Synaptogenesis II | 55 | 1249-1257  McAllister, 2007 Review |
| Week 1103.26 | Learning and Memory I | 67 | 1488-1519  Herring and Nicoll, 2016 Review |
| Week 1103.28 | Learning and Memory II | 67 | 1488-1519  Herring and Nicoll, 2016 Review |
| Week 1204.02 | **Exam III**, **11am THH 210** |  |  |
| Week 1204.04 | Second Messengers | 11 | 236-259 |
| Week 1304.09 | Glia and glial diseases |  | Zuchero and Barres, 2015 Review  Clarke and Barres, 2013 Review  *For Discussion:* Roy et al., 2016 |
| Week 1304.11 | Schizophrenia | 62 | 1389-1399 |
| Week 1404.16 | Autism | 64 | 1425-1439  Sadybekov et al. 2017 |
| Week 1404.18 | Mood and Anxiety Disorders | 63 | 1403-1423 |
| Week 1504.23 | Parkinson’s Disease | 43 | 991-995  Logan et al., 2017 |
| Week 1504.25 | Alzheimer’s Disease | 59 | 1329-1344 |
| 05.07 | **FINAL**, **11am-1pm** |  |  |

**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 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](mailto: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/*](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.