

**BIOLOGICAL SCIENCES 455 Spring 2019**  
**Cellular, Molecular and Developmental**  
**Neurobiology**

*(the pace of the course can change from semester to semester depending on the background and interests of the participants – please check D2L regularly for updates to the schedule)*

**Instructor:**

**Dr. Ava J. Udvardia**

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Office hrs: T 3-5 pm or by appt.

**Prerequisites:** BioSci 315

**Lecture Schedule:** TR 9:30-10:45 in Lapham 250

**Course overview:** Nervous systems are among the most complex of physiological systems. In this course, we will cover nervous systems from basic biophysical properties of neurons to cellular and molecular basis of nervous system development and function.

**Course Objectives:** Students will gain an understanding of:

1. Cell biology and electrical properties of neurons
2. Molecular communication between neurons
3. Developmental origins of the nervous system
4. Signal transduction involved in development and function of the nervous system

**Required Text:** *Principles of Neurobiology* (2016), by Liqun Luo (ISBN: 978-0-8153-4494-0)

Assigned readings from the text unless otherwise stated. Readings should be done **before** class.

**Homework:** Answers to homework questions should be uploaded to D2L by 8:00 am prior to each lecture. Bring an electronic or printed copy to class for discussion. For completing and submitting each homework assignment on time, and participating in the group discussions, students may earn 5 extra credit points towards their exams. No other extra credit opportunities are available.

Date	Chapter	Topic	Reading
22-Jan	1	1. Organization of the Nervous System	Luo pg. 1-13
24-Jan	1	2. Organization of the Nervous System (continued)	Luo pg. 13-25
29-Jan	2	3. Cell Biological Properties of Neurons	Luo pg. 27-38
31-Jan	2	4. Electrical Properties of Neurons	Luo pg. 38-48
5-Feb	2	5. Propagation of Electrical Signals	Luo pg. 49-66
7-Feb	1 -2	<b>Exam 1</b>	Luo pg. 1 - 66
12-Feb		<b>Exam 1 post mortem</b>	
14-Feb	3	6. Neurotransmitter Release from Presynaptic Terminals - 1	Luo pg. 69-77
19-Feb	3	7. Neurotransmitter Release from Presynaptic Terminals - 2	Luo pg. 78-86
21-Feb	3	8. Response of Postsynaptic Targets - 1	Luo pg. 87-95
26-Feb	3	9. Response of Postsynaptic Targets – 2	Luo pg. 95-106
28-Feb	3	10. Signal Transduction and Synaptic integration	Luo pg. 106-118
5-Mar	3	<b>Exam 2</b>	Luo pg. 69-118
7-Mar		<b>Exam 2 post mortem</b>	

Date	Chapter	Topic	Reading
TBD	<b>GRAD ONLY</b>	Hodgkin AL and Huxley AF (1952) Currents carried by sodium and potassium ions through the membrane of the giant axon of Loligo. J Physiol 116:449–472	
12-Mar	4	11. Vision: Detection of Light Signals - 1	Luo pg. 121-128
14-Mar	4	12. Vision: Detection of Light Signals - 2	Luo pg. 129-135
<b>SPRING RECESS MARCH 18 - 22</b>			
26-Mar	4	13. Processing of Light Information in the Retina - 1	Luo pg. 135-141
28-Mar	4	14. Processing of Light Information in the Retina -2	Luo pg. 142-151
2-Apr	4	15. Information Processing in the Visual Cortex -2	Luo pg. 151-159
4-Apr	4	<b>Exam 3</b>	Luo pg. 121-159
9-Apr		<b>Exam 3 post mortem</b>	
TBD	<b>GRAD ONLY</b>	Hubel DH and Wiesel TN (1962) Receptive fields, binocular interaction and functional architecture in the cat's visual cortex. J Physiol 160:106–154.	
11-Apr	5	16. Wiring of the Visual System: RGC Axon Growth and Guidance	Luo pg. 167-180
16-Apr	5	17. Wiring of the Visual System: Experience and Neuronal Activity in Wiring	Luo pg. 180-190
18-Apr	5	18. Wiring of the Visual System: Neuronal Activity and Molecular Determinants	Luo pg. 190-197
23-Apr	7	19. Wiring the Nervous System: Patterning and Cell Fate	Luo pg. 277-286
25-Apr	7	20. Wiring the Nervous System: Cell Fate and Axon Guidance	Luo pg. 287-297
30-Apr	5,7	<b>Exam 4</b>	Luo pg. 167-197; 277-297
2-May		<b>Exam 4 post mortem</b>	
TBD	<b>GRAD ONLY</b>	Wong, RO, Meister, M, Shatz, CJ (1993) Transient period of correlated bursting activity during development of the mammalian retina. Neuron 11:923-938	
7-May		21. Wiring the Nervous System: Synaptogenesis at the NMJ	TBD
9-May		22. Nervous System Regeneration	TBD
13-May	1-5,7	<b>CUMULATIVE FINAL EXAM 10:00am - noon</b>	

**Graduate Student Only Requirements:**

Graduate students will meet three additional times outside of class for Journal Club discussions of the following classic papers:

1. Hodgkin AL and Huxley AF (1952) Currents carried by sodium and potassium ions through the membrane of the giant axon of Loligo. J Physiol 116:449–472
2. Hubel DH and Wiesel TN (1962) Receptive fields, binocular interaction and functional architecture in the cat's visual cortex. J Physiol 160:106–154.
3. Wong, RO, Meister, M, Shatz, CJ (1993) Transient period of correlated bursting activity during development of the mammalian retina. Neuron 11:923-938

Students should submit the written assignment to D2L by the indicated due date and bring a copy to the discussion.

**General Expectations:**

- Students should have a college level understanding of eukaryotic cell biology (PreReq enforced: BioSci 315 with earned grade of C or better)
- Spend at least 6.5 hours/week outside of class studying the material for this class:
- Reading assignments should be completed prior to lecture

- Students should be prepared to answer questions and participate in discussions about the reading
- Lecture notes and reading assignments should be reviewed with a study partner or group at least once/week
- Any concepts that are unclear to the student after reading and reviewing should be discussed with the professor at office hours (schedule alternative appointment if you have a class/work conflict with office hours)

**Time Investment:** We emphasize that students are assessed based on their performance on graded materials and not on the time put into the course. On average, students are expected to spend 48 hours per credit per semester on in-class activities and activities outside of the classroom. The following is a workload estimate and should be used as a guideline. Time spent on any given assignment as well as total time required to adequately learn the material will vary from individual to individual.

Total hours: 3 credits x 48 hours = 144 hours\*

In Class: 2.5 hours/wk x 15 weeks = 37.5 hours

Homework (assigned readings/lecture review): 6.5 hours/wk x 15 weeks = 97.5 hours

Additional exam preparation 3 hours x 3 exams = 9 hours

\* Graduate students should expect to spend an additional 20-24 hours on preparing for the journal club discussions

**Attendance Policy:** Students are expected to attend all lectures and to be seated prior to the start of class at 9:30 am. Attendance is required on exam days.

**Examination Policy:** Attendance is required on exam days. If you are absent on an exam day due to illness, your request to make up the exam must be accompanied by a physician's note. Make up exams must be scheduled within a week of the original date at a time that is approved by the instructor. Accommodations will be made for conflicts due to religious observances, but the instructor must be notified no less than two weeks in advance. If you have not made prior arrangements, you will not be permitted to take a make-up exam. The make-up exams may not be the same ones taken by the rest of the class and they may be in a different format (for example, oral exams).

**Examinations:** The exams cover material from lectures and reading assignments and will be mixed format with multiple choice and short answer/essay questions. The final exam will be cumulative.

**Registration Policy:** This course may not be taken with an audit or credit/no credit status. In the event of excess enrollment, priority will be given to students who are registering for the course for the first time. Students without prerequisites may be administratively dropped.

**Important Dates:**

February 7	Exam 1
February 18	Last day to drop full semester courses without W on record.
March 5	Exam 2
March 18-22	Spring Recess - No Classes
April 4	Exam 3
April 30	Exam 4
May 9	Last day of classes
May 10	Study day
<b>MAY 13</b> 10:00am - noon	<b>Final Exam - cumulative</b>

**Cell Phone Policy:** Cell phones should be turned off before class. Check messages after class and absolutely no texting.

**Academic Conduct Policy:** The University has a responsibility to promote academic honesty and integrity and to develop procedures to deal effectively with instances of academic dishonesty. Students are responsible for the honest completion and representation of their work, for the appropriate citation of sources, and for respect of others' academic endeavors. This course follows the guidelines and procedures detailed in the description of Student Academic Disciplinary Procedures found in Regents Policy

Statements, UWS Chapter 14 and UWM Faculty Document #1686 and can be found online at:

<http://uwm.edu/academicaffairs/facultystaff/policies/academic-misconduct/>

**Accommodations for Students with Disabilities:** If you need special accommodations to meet the requirements of this course, please contact the Student Accessibility Center (Mitchell Hall Room 112, 229-6287, <http://uwm.edu/arc/>) and inform the instructor after the first class meeting or at least two weeks before the first exam.

**Other University policies may be found at the following link:**

<http://www.uwm.edu/Dept/SecU/SyllabusLinks.pdf>

**Grading Formula:**

Final grades will be weighted as follows:

**Undergraduate students:**

Exam 1	15%
Exam 2	15%
Exam 3	15%
Exam 4	15%
FINAL EXAM	40%

**Graduate students:**

Exam 1	10%
Exam 2	10%
Exam 3	10%
Exam 4	10%
Journal club articles	30% (10% each)
FINAL EXAM	30%

**Grading Scale**

<u>Avg %</u>	<u>Grade</u>
93-100	A
90-92	A-
87-89	B+
83-86	B
79-82	B-
76-78	C+
70-75	C
66-69	C-
60-65	D