

BIO 418/518 Integrative Neuroscience, Spring 2018

Course description: This course examines the major functions of the nervous system, perception and motor control, at molecular, cellular, and systems levels. In addition, it considers the neural basis of behavior, and the cellular and molecular basis of neural diseases. At the end of the course, students should be able to (1) describe the cellular basis of sensory transduction for all the major senses, (2) identify how sensory information is transformed by the brain, (3) describe how motor commands are initiated in the brain and carried out, (4) describe brain development and the molecular signaling pathways involved, and (5) identify the current understanding of the basis for major neural diseases.

Prerequisite: BIO 417/517

Time and Location: MWF 9–9:50, Cooke 127B

Instructor:	Dr. Shermali Gunawardena	Dr. Kathryn Medler	Dr. Matthew Xu-Friedman
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Required textbook: Neuroscience (Fifth Edition) by Purves et al.

Grading: Letter grades will be determined from 4 in-class midterms of 100 points each (400 total points). An optional comprehensive final will also be offered. The final will be worth 100 points, and, if it is higher, will replace the lowest midterm grade. Your grade cannot be hurt by taking the comprehensive. No extra credit will be given. Grades will be posted on UBLearns.

Grading scale: $\geq 90\%$ = A, 80–89% = B, 70–79% = C, 60–69% = D, $< 60\%$ = F

A curve may also be applied and pluses and minuses assigned at the instructors' discretion. For students seeking an "Incomplete", please review the [university policy](#), and contact one of the faculty.

Makeup policy: Make-up exams are allowed only for medical reasons. You must notify the instructors about the medical problem within 24 hours of the exam, before the key is posted. To schedule a makeup exam, you must submit a signed doctor's note explaining why you could not attend the exam at the scheduled time. The note must include the doctor's name and phone number for verification. If you must miss an exam for a non-excused reason, you may take the optional comprehensive final to replace the missed exam. There will be no makeup for the comprehensive exam.

It is each student's responsibility to attend lecture, take notes, and study the material covered. Each student is responsible for any announcement given in class.

Academic integrity: Students are expected to adhere to the highest standards of academic honesty. Please refer to the University's [Academic Integrity Policy](#) for more information.

Accessibility: For students requiring special accommodations for physical or learning disabilities, please contact the [Office of Accessibility Resources](#).

518REC Requirements

The recitations are held from 1–3 PM in Cooke 109 on the Mondays indicated. Students will discuss papers related to lectures. Be prepared to answer detailed questions concerning the importance of the paper, the methods used, the experimental findings, and the significance of the study. The grade is based on performance in discussions (20 points per recitation, 120 points total). Attendance at all recitations is required. Missing two or more recitations will result in a zero for the recitation grade.

Lecture Outline

Class	Date	Topic	Reading*	Lecturer	518
1	1/29	Olfaction I	Ch 15	M	
2	1/31	Olfaction II	Ch 15	M	
3	2/2	Taste I	Ch 15	M	
4	2/5	Taste II	Ch 15	M	
5	2/7	Development Basics	Ch 22	X-F	
6	2/9	Proliferation and induction	Ch 22	X-F	
7	2/12	Axonal transport	BB	G	
8	2/14	Axon guidance	Ch 23	G	
9	2/16	Neurotrophic factors	Ch 23	G	
10	2/19	Hox genes and migration	Ch 22	X-F	
11	2/21	Critical periods	Ch 24	X-F	
12	2/23	Ocular Dominance Columns	Ch 24	X-F	
13	2/26	Exam 1 (lectures 1–12)			
14	2/28	Hearing I: Ear	Ch 13	X-F	
15	3/2	Hearing II: Hair cells	Ch 13	X-F	
16	3/5	Hearing III: Central	Ch 13	X-F	G
17	3/7	Sound localization I	Ch 13, Carew 3	X-F	
18	3/9	Sound localization II	Ch 13, Carew 3	X-F	
19	3/12	Echolocation	Carew 2	X-F	X-F
20	3/14	Vestibular	Ch 14	X-F	
21	3/16	Exam 2 (lectures 14–20)			
		Spring Break - no class			
22	3/26	Electrosense I	BB	X-F	
23	3/28	Electrosense II	BB	X-F	
24	3/30	Muscles & spinal cord	Ch 16	X-F	
25	4/2	Feedback and descending control	Ch 16/17	X-F	X-F
26	4/4	Cortex and striatum	Ch 17/18	X-F	
27	4/6	Striatum, cont'd	Ch 18	X-F	
28	4/9	Motor example: Birdsong	Carew 5	X-F	X-F
29	4/11	Alzheimer's disease/Taupathies	pp 713–4, BB	G	
30	4/13	Huntington's disease	p 411, BB	G	
31	4/16	Parkinson's disease	pp 408–12, BB	G	G
32	4/18	Exam 3 (lectures 22–30)			
33	4/20	ALS	BB	G	
34	4/23	Prion disease	pp 427–8, BB	G	
35	4/25	Fragile X syndrome	BB	G	
36	4/27	Autism	BB	G	
37	4/30	Therapies		G	
38	5/2	Stem cells I	p 479, BB	G	
39	5/4	Stem cells II	p 479, BB	G	
40	5/7	Repair and regeneration	Ch 25	G	G
41	5/9	Repair II	Ch 25	G	
42	5/11	Exam 4 (lectures 31–41)			
	5/16	Optional Comprehensive Final	Cooke 127B	9–11 AM	

*Chapters and page numbers refer to readings in the Purves book. “BB” means readings will be announced in class and posted on UBLearn.

Learning Objectives

<u>Learning Outcome</u>	<u>Depth</u>	<u>Specific Objectives</u>	<u>Assessment</u>
1. Provide breadth of knowledge of basic principles and concepts	1	Apply basic physical, chemical, biochemical, and physiological principles to understand nervous system function	Exams
2. Provide depth within specialized areas	2	Understand how signals are transduced and conveyed centrally for sensory systems	Exams 1,2,3
		Understand the basics of neuronal development	Exam 1
		Understand the basics of motor system organization from low (i.e. muscle) to high (i.e. brain) levels	Exam 3
		Understand the pathology behind neural diseases, as well as environmental and genetic causes	Exams 3,4
		Understand the neuronal basis for behavior in key model systems	Exams 2,3
3. Provide an understanding of experimental design and methodology	1	Know critical experiments that were used to expose the mechanisms involved in each area above	Exams
4. Develop approaches for integration of information	1	Understand the contribution of genetics and cell biology to neural diseases	Exams 3,4
		Understand how molecular and genetic information guide development of the nervous system	Exam 1
5. Encourage critical thinking and hypothesis building	0	N/A	
6. Provide skills in scientific communication	0	N/A	
7. Provide contemporary information	2	Understand key recent findings in sensory systems, development, motor systems and neural diseases	Exams
8. Encourage appreciation of scientific values	0	N/A	

Depth of 2 means major emphasis, 1 means moderate emphasis, and 0 means little to no emphasis.

The objectives of the course will be considered to have been met when 80% of the enrolled students achieve a final course grade of D or higher. This represents a point score that is 60% of the total possible points.