Zoology/Psychology 523: Neurobiology

Credits: 3 (fall term)

Canvas URL: https://canvas.wisc.edu/courses/118462

Course Designations:
Level - Intermediate
L&S Credit – Biological Sciences. Counts towards the Natural Sciences requirement.
Counts as Liberal Arts and Science credit in L&S

Meeting time and location: Tuesday/Thursday: 1:00 – 2:15 p.m. Biochemistry 1125

Instructional Mode: Predominantly face-to-face, with on-line delivery of some course material

Credit hours for the course: 3 (lecture based)
This course meets for two 75-minute class periods each week over the fall semester and carries the expectation that students will work on course learning activities (reading, writing, problem sets, studying, etc) for about 2 hours out of classroom for every class period. This syllabus includes more information about meeting times and expectations for student work. Weekly optional discussions are provided by teaching assistants.

INSTRUCTORS AND TEACHING ASSISTANTS

Instructor: Stephen C. Gammie, Ph.D.
Professor
Department of Integrative Biology
Office: 412 Birge Hall
Office hours: Wednesday 9-10 a.m. or by appointment.
E-mail: scgammie@wisc.edu
Phone: 262-3457 (office)

Instructor: Seth S. Blair, Ph.D.
Professor
Department of Integrative Biology
Office: 315 Zoology Research Building
Office hours: Wednesday 9-10 a.m. or by appointment.

E-mail: ssblair@wisc.edu
Phone: 262-1345 (office)

OFFICIAL COURSE DESCRIPTION

Course Description: Basic mechanisms in cellular neurophysiology: electrophysiology and chemistry of nerve signals, mechanisms in integration, simple nervous pathways and their behavioral correlates. We highly recommend entering students have a strong background in the principles of basic electricity (charge, voltage, current, resistance, capacitance), as provided by Physics 104, 202, 208, or a strong high school physics program. Enroll Info: None

Requisites: (ZOOLOGY/BIOLOGY/BOTANY 151 or ZOOLOGY 101 or BIOCORE 485) and (CHEM 103/104 or CHEM 109)

Learning outcomes:

1) Understand the molecular mechanisms of cellular neurophysiology, including the ionic basis of the resting and action potential, and the ionic and chemical bases of synaptic signaling.
2) Understand the basis of sensory perception at the receptor level.
3) Demonstrate how neuronal signaling is integrated into simple nervous pathways and their behavioral correlates.
4) Apply principles of neuronal function to activity-dependent changes in rhythmic neuronal activity, neuronal plasticity and memory.
5) Understand some of the state-of-the-art approaches to neuronal function.
6) Understand key steps in the development of the nervous system, and explain and apply the experimental approaches underpinning that understanding
7) Elucidate connections between genetics, pharmacology and the functioning of the nervous system.
8) Understand the mechanisms underlying a subset of disorders of the nervous system and the bases of current treatments.

Grading:
Final grade: 9% = quizzes (8 quizzes); 90% = exams (4 midterm exams); 1% = completion of SimUText software assignment.

Eight quizzes (2 prior to each exam): 5 points each
Four midterms exams: 100 points each
Completion of SimUText module, Action Potentials Extended: 10 points

Total = 450 points

Letter Grades:
92-100% = A; 88-91% = AB; 82-87% = B; 78-81% = BC; 70-77% = C; 60-69% = D; 0-59% = F

Class Schedule
Figures to learn from Neuroscience Online will be provided in lecture.
Quiz dates will be provided both in Canvas and in lecture.
9.6 Introduction; structure of neurons and glial cells; basic principles and circuits
Optional reading of Chapter 2: use this chapter as a resource throughout course
9.11 Membranes and ionic basis of membrane potential
Chapter 3
SimUText: Sections 1 and 2
9.13 Ionic mechanisms of action potentials
Chapter 4
SimUText: Sections 3 and 4
9.18 Action potential continued; evolution and the nervous system
9.20 Synaptic transmission, including neurotransmitter release and receptor response
Chapter 5; Chapter 6 from beginning to page 152.
9.25 Synaptic transmission continued
9.27 EXAM I
10.2 Synaptic transmission continued. Complexities of neuronal signaling and new research tools
Chapter 6
10.4 Sensory systems: touch, hot, cold, pain, osmolarity, photoreception, and magnetoreception
pp 385; 415-25; 429; 437-42; 448-51; 312-315
10.9 Sensory systems: smell and taste
pp 265-74; 276; 278-85
10.11 Genes, gene expression, and the nervous system
10.16 Pharmacology and the brain
pp 761-3; 768-71
10.18 Mental health and neurodegenerative disorders
pp 39-40; 751-8; 771-9
10.23 EXAM II
10.25 Synaptic plasticity and memory
10.30 Circuitry: reflexes and central pattern generators
11.1 Circuitry: the retina
11.6 Circuitry: visual pathways
11.8 Activity and neural development
11.13 EXAM III
11.15 Trophic factors
11.20 Synaptogenesis
11.22 THANKSGIVING (NO CLASS)
11/27 Axon guidance
11.29 Early neural development I
12.4 Early neural development II

12.6 Regeneration and recovery
12.11 EXAM IV

Required textbooks, software & other course materials

Neuroscience: Exploring the Brain. Mark Bear, Barry Connors, and Michael Paradiso. Fourth Edition. Walters Kluwer Publishers. 2016. Available as hardback or electronic.

Action Potentials Extended. SimUText. SimBio. Interactive software tool for learning the basis of the resting potential, the action potential, and neuronal signaling.

Free on-line resources

Neuroscience Online. UTHealth.

Allen Brain Atlas

National Center for Biotechnology Information (NCBI)

Exams, Quizzes, Papers, & other major graded work:

Quizzes are multiple choice and will be taken on-line via Canvas. There are two quizzes prior to each exam and they are low stakes (low points) with the idea that they help students prepare for the exam.

The exams are multiple choice and taken in class. Because the study of neurobiology is non-linear, material presented earlier in the course may appear in later exams.

The SimUText software, Action Potentials Extended, provides an interactive way for the students to learn about the resting potential, the action potential, and neuronal signaling. The software indicates whether students completed the tutorials. Full credit is given to each student who completes all sections.

Homework & other assignments:

Students will be given weekly study guides that include numerous questions and some math problems. These are not graded, but provide students an avenue for focusing their studies.

RULES, RIGHTS & RESPONSIBILITIES

- See the Guide's to Rules, Rights and Responsibilities

ACADEMIC INTEGRITY

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the

assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to studentconduct.wiscweb.wisc.edu/academic-integrity/.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

McBurney Disability Resource Center syllabus statement: "The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA." http://mcburney.wisc.edu/facstaffother/faculty/syllabus.php

DIVERSITY & INCLUSION

Institutional statement on diversity: "Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world." https://diversity.wisc.edu/