

Syllabus
Advanced Neurobiology I 146:445/Neurobiology 710:555
Monday and Wednesday 2:00-3:20PM, SEC-111, Busch Campus
 Fall 2023
 Rutgers University
 Department of Cell Biology and Neuroscience

Course Director: Bonnie Firestein, PhD
firestein@biology.rutgers.edu

Additional Instructors: Rafiq Huda, PhD David Margolis, PhD
rafiq.huda@rutgers.edu david.margolis@rutgers.edu

TA: TBA

Supplementary Texts: Principles of Neural Science. Kandel et al. (Not required)
 From Neuron to Brain. Nicholls et al. (Not required)
 The Neuron. Levitan and Kaczmarek. (Not required)
 Synapses. Cowan et al. (Not required)

Course Description

This course will serve as the basis for an advanced understanding of how the fundamental processes in neurons mediate communication and go awry in disease states.

Enduring Understanding 1: Neurons are electrical cells and communicate through synaptic transmission	
Essential Question 1A: How do neurons communicate with each other and transmit signals?	
Goal 1	Understand how ion movement acts to generate action potentials.
Goal 2	Understand how voltage-gated ion channels contribute to the electrical activity of neurons.
Goal 3	Understand what an action potential is and how it is propagated.
Goal 4	Understand what synaptic transmission is and how it is regulated.
Essential Question 1B: What is the underlying molecular mechanism for learning and memory?	
Goal 1	Understand the molecular mechanisms underlying short-term plasticity.
Goal 2	Understand the molecular mechanisms underlying long-term plasticity.
Enduring Understanding 2: Molecular components of a synapse and changes in disease or injury states.	
Essential Question 2A: What are the key molecular components of a synapse?	

Goal 1	Understand how neurotransmitters are made, released, and inactivated.
Goal 2	Understand the two different types of synapses and their components.
Goal 3	Understand how to devise experiments to test a hypothesis about synaptic signaling.
Essential Question 2B: What are the consequences of aberrant synaptic signaling?	
Goal 1	Understand how altered neurotransmission results in neurodegenerative and neurocognitive disorders.
Goal 2	Understand how protein interactions are important for recovery after injury.
Enduring Understanding 3: Neural circuits and their role in health and disease	
Essential Question 3A: How do neural circuits function?	
Goal 1	Understand the diverse techniques for assessing neural circuit function in-vivo.
Goal 2	Understand circuit computations underlying attention and motor planning.
Goal 3	Understand how inhibitory interneurons shape circuit responses.
Goal 4	Understand the contribution of non-neuronal astrocytes to circuit function.
Essential Question 3B: How do neural circuits change during learning and disease?	
Goal 1	Understand how dynamic regulation of neural circuits supports behavioral functions.
Goal 2	Understand how neural circuits become dysfunctional during neurological disease.

CBN Learning Goals

- 1. Master factual and conceptual knowledge in cell biology and neuroscience that will provide a solid foundation for success in advanced training and professional careers.**
 - We will cover a broad range of material in this course, including the foundation of electrical signaling, the pre and postsynaptic structure and function of a neuron, the neural circuits underlying behavioral phenomenon, and the experimental designs needed to test questions about these topics.
 - Lecture modules will be organized in ways to emphasize problem solving rather than rote memorization.
- 2. Develop an ability to summarize, integrate and organize information.**
 - Practice quizzes, review sessions, and other exercises will focus on the application of learning to identify patterns in complex information and design experiments capable of creating new knowledge.
- 3. Use scientific reasoning to evaluate the potential for current research and new discoveries to improve our understanding of cell biology and neuroscience and its relevance to human health and to our society.**

- All modules will relate the material to physiological function, such as learning and memory, and the molecular mechanisms underlying neurocognitive and neurological disease and injury states. Once completed, the student will have a better understanding of the reason that learning and memory or attention dysfunction occurs in patients.

Assessments and Course Activities

Lecture Modules: All content delivery in this course will be in person; however, lecture videos will be posted on our Canvas site at the beginning of each module. **We encourage you to watch the videos prior to lectures, but this is not a requirement. However, there are four quizzes in each module. You must complete all four quizzes by the end of the module. No extensions on due dates will be given. You have unlimited tries, and only the highest grade will count.**

We have also posted extra required material on Canvas. For example, there may be movie clips that you will be required to watch. This will be stated in the videos and in class.

Videos in Module 2 include closed captioning and have been edited for accuracy. Please turn on the closed captioning button by clicking on the cc box.

Playposit questions: In **Module 2**, there will be practice questions throughout the videos. These are not mandatory and are not for credit. They are to help you master the material.

Practice Quizzes: Each lecture module will have four quizzes with practice questions. These quiz questions are found in standalone quizzes within the module. These quizzes are **formative assessments**, meaning they are meant to help you gauge your mastery of the material, focus your learning, and practice with the style of questions you will find on the exams. As such, you may retake the practice quizzes over again (unlimited tries) over the course of the module. Only your highest score will be saved and counted towards your overall grade in the course. However, all practice quizzes **MUST** be completed by the day indicated in the syllabus. **Quizzes cannot be made up once the module closes under any circumstances.**

Format of in-person sessions: We will hold two in-person sessions per week. The instructor will review the lectures for that week. This will take approximately 45 minutes. After lecture, the TA will hold a review session. This will be a chance for you to ask questions, review material, and generally check in with the TA and your classmates.

Additional TA Review Sessions: There will be TA sessions after the lecture so that students can ask questions in smaller groups. The TA will reach out to coordinate schedules for additional reviews prior to exams.

Exams: There will be three online exams on Canvas. These exams will include a variety of approaches to test knowledge, depending on the Module, and include multiple choice exams, video submissions, and essay questions. Exams including multiple choice questions will require some level of critical thinking in order to select the most appropriate answer. **Exams must be taken on the indicated day in the syllabus in class.** **Please bring your computer.** You should plan your schedule on these days to reserve 80 minutes to take the exam. **Exams will not be rescheduled or re-opened once started.** Individual exceptions will only be made in the event of a serious, prolonged, and documented illness or family emergency.

The first two exams are given as scheduled, the last exam will be given during final exam week. The three exams are not cumulative and are weighed equally for the final grade. No extra credit will be given.

We will take certain measures to ensure the integrity of the exam process and minimize cheating. This will include strict time limits on exams, randomized question and answer orders, and a one-at-a-time question format. Thus, you should carefully select your answer before moving to the next question. Importantly: **we will NOT be using any remote proctoring software or lockdown browsers in this course. The exams will be online in person during the class time. Please bring your laptop on the exam day.**

Graduate Level Credit: Students taking the course for graduate level will be required to complete an extra assignment per module.

Grading: Final course grades will be assigned according to the total points accumulated from scores on the assignments indicated below. Neither individual assignments nor final course grades will be “curved” in any way. Your final grade in the course will be determined by the weighted average of your scores using the following distribution:

Assignment	Value	Final Grade	Final Average
Practice Quizzes	24%	A	90.0-100.0
Exam 1 + Exam 2 + Exam 3	76%	B+	87.0-<90.0
		B	80.0-<87.0
		C+	77.0-<80.0
		C	70.0-<77.0
		D	50.0-<70.0
		F	0.0-<50.0

Each module = 100 points; Your final grade is average of the three modules.

Course format: Classes will meet at Science and Engineering Resource Center, Busch Campus, Room 111 on Mondays and Wednesdays from 2:00 to 3:20pm. All lecture videos will be made available online through Canvas and TA-led weekly recitation sessions will be follow the lectures. Students can schedule office hours with faculty instructors and the TA as needed.

Teaching evaluations: We know that it is tedious to fill out instructor and TA evaluations; however, this is an important part of our understanding of how to best educate students like you! We will put a short amount of time aside in class when evaluations are due. **If >75% of the class fills out the evaluations, we will add 2 percentage points to everyone’s final grade as an incentive.**

Example Date	Subject
	Module 1 – Electrical signaling (Margolis)
Sept 6, 11	Basis of neuronal excitability – Ion movement and voltage-gated channels
Sept 13, 18	The action potential and synaptic transmission
Sept 20, 27	Short-term and long-term synaptic plasticity – No class on Sept 25
Oct 2, 4	Neural correlates of learning & memory – No class Oct 5
Oct 8	All quizzes from Module 1 are due
Oct 9	Module 1 exam
	Module 2 – Organization of the synapse (Firestein)
Oct 11, 16	Neuronal communication and Neurotransmitters
Oct 18, 23	Postsynaptic Density
Oct 25, 30	Protein-protein interaction domains
Nov 1	Signal Transduction
Nov 5	All quizzes from Module 2 are due
Nov 6	Module 2 exam

	Module 3 – Neural Circuits in health and disease (Huda)
Nov 8	Methods for interrogating neural circuit function <i>in vivo</i>
Nov 13, 15	No class - SfN
Nov 27, 29	Cortical and subcortical circuits for attention (no class on Nov 22 – Fri classes)
Dec 4, 6	Neural circuit basis of motor planning and action selection
Dec 11, 13	Contribution of non-neuronal astrocytes to circuit function
Dec 15	All quizzes from Module 3 are due
TBA	Module 3 exam

Course Policies and Resources

Academic Integrity Policy:

<http://academicintegrity.rutgers.edu/academic-integrity-policy>

Violations include: cheating, fabrication, plagiarism, denying others access to information or material, and facilitating violations of academic integrity.

Student-Wellness Services:

Just In Case Web App

<http://codu.co/cee05e>

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

Counseling, ADAP & Psychiatric Services (CAPS)

(848) 932-7884

17 Senior Street, New Brunswick, NJ 08901

www.rhscaps.rutgers.edu/

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

Crisis Intervention:

<http://health.rutgers.edu/medical-counseling-services/counseling/crisis-intervention>

Report a Concern: <http://health.rutgers.edu/do-something-to-help>

Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181

3 Bartlett Street, New Brunswick, NJ 08901

www.vpva.rutgers.edu

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

Disability Services

(848) 445-6800

Lucy Stone Hall, Suite A145, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled,

participate in an intake interview, and provide documentation:
<https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

Scarlet Listeners

(732) 247-5555

<http://www.scarletlisteners.com>

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.