

# Behavioral and Neural Genetics

**01:447:484**  
**Spring Term, 2023**  
**Syllabus**

**Lecture Meets:** Tuesday & Thursday, 3:50 PM - 5:10 PM

**Prerequisites:** 447:380 or 447:384

**Instructor:** Dr. Gleb Shumyatsky, Ph.D. [gleb@hginj.rutgers.edu](mailto:gleb@hginj.rutgers.edu)  
Department of Genetics

**Office Hours:** Wednesday 3-6 PM; email me to set up

## Course Description and Goals

This course introduces students to molecular neuroscience and mouse genetics in research on behavior, memory and neuron function with an emphasis on the contemporary methods and new discoveries in neuroscience.

Departmental Learning goals <https://genetics.rutgers.edu/academics/undergraduate/learning-goals>

The goals are to learn the terms, concepts and theories in Behavioral and Neural Genetics. This knowledge will then be used to critically analyze current research in the field of neuroscience with the emphasis on the molecular and mouse genetics approaches. Students will be taught the ability to integrate the material learned from multiple courses into understanding current research. We will critically analyze published research articles and understand how research uses multiple disciplines and how it can be used to tackle problems in the life sciences in general. This course is focused on gene expression and its multiple layers of control. The primary course materials will be assigned current research reviews, research papers and other online resources.

## Course Objectives

- To learn how to understand and analyze the primary scientific literature.
- To understand how hypotheses are formulated.
- To understand why particular approaches and techniques are employed
- To understand why new technology is crucial for the scientific progress
- To understand how experiments are performed (both technically and conceptually).
- To understand how data are analyzed and interpreted.

## Course Materials and Required Reading List for Course

The list of the required reading for the course will be available on Sakai. Except for the 1<sup>st</sup> lecture, the assigned reading must be completed prior to attending class on the indicated date. Come to class prepared to discuss the papers and other required reading.

1. Principles of Neural Science, by Kandel, et al. Sixth Edition (2021), (ISBN 9781259642234) – recommended.
2. Original research articles posted on Canvas website - Required.

### **Attendance Policy**

Students are responsible for all materials related to this course, including material presented in lectures, material posted on-line and assigned reading. Participants are expected to attend all meetings of the course. Late assignments will not be accepted, and no makeup will be given for them. **Only one makeup exam will be permitted** for a student that fails to attend an exam; a reasonable explanation for the absence will be required (e.g., illness).

### **Performance Expectations and Evaluation Methods**

Every student is expected to present (being in the group of 4-6 people) an original published research paper and regularly participate in discussion during every class. They are expected to keep a daily journal detailing their understanding of the readings. Discussions of papers and active participation in class is required for a good grade and counts for 20% of the final grade. There are four exams with no final exam. Each exam counts for another 20% of the final grade.

Grades will be based on student performance on exams and work in class. Contribution towards the final course grade will be as follows:

#### **20% of the grade – Active participation in class (this is critical!)**

- 20% of the grade - Exam 1
- 20% of the grade - Exam 2
- 20% of the grade - Exam 3
- 20% of the grade - Exam 4

### **Important: points will be taken off for not following instructions or not meeting deadlines.**

Grades will be calculated based on overall course performance. The following grading scale will be used:

- 90% A
- 85% B+
- 75% B
- 70% C+
- 60% C

We reserve the right to modify the grading scale downward (e.g., making the lowest A an 88%), but we will not adjust the grading scale upward. Grades below “C” will be determined based on the final score distribution at the end of the course.

**Academic integrity policy**

Cheating and plagiarism will not be tolerated. In accordance with departmental and University Policy, violations of academic integrity will immediately be referred to the dean. See the following website for details: <http://academicintegrity.rutgers.edu>

*Rutgers University takes academic dishonesty very seriously. By enrolling in this course, you assume responsibility for familiarizing yourself with the Academic Integrity Policy and the possible penalties (including suspension and expulsion) for violating the policy. As per the policy, all suspected violations will be reported to the Office of Student Conduct. Academic dishonesty includes (but is not limited to):*

- *Cheating*
- *Plagiarism*
- *Aiding others in committing a violation or allowing others to use your work*
- *Failure to cite sources correctly*
- *Fabrication*
- *Using another person's ideas or words without attribution, including re-using a previous assignment*
- *Unauthorized collaboration*
- *Sabotaging another student's work*

*If you are ever in doubt, consult your instructor.*

**Class Attendance**

Students are expected to attend all classes; if you miss a class, please use the University absence reporting website <https://sims.rutgers.edu/ssra> to indicate the date and reason for your absence. An email is automatically sent to the course instructor.

**Rules of conduct**

No cell phones are allowed in class. Laptops are permitted for the purpose of taking notes but not for surfing Internet or playing games. Such behavior is distracting to other students in the class. If found violating this policy, a student will no longer be allowed to bring his/her laptop to class. Electronic recording of lectures or classmate presentations are not permitted.

Readings: There will be assigned readings that pertain to the topics we will cover in class. We will NOT cover all areas that are presented in book chapters or research papers and you are expected to read the assigned material.

**Student-Wellness Services:**

- Student Success Essentials: <https://success.rutgers.edu>
- Student Support Services: <https://www.rutgers.edu/academics/student-support>
- The Learning Centers: <https://rlc.rutgers.edu/>
- The Writing Centers (including Tutoring and Writing Coaching): <https://writingctr.rutgers.edu>

- Rutgers Libraries: <https://www.libraries.rutgers.edu/>
- Office of Veteran and Military Programs and Services: <https://veterans.rutgers.edu>
- Student Health Services: <http://health.rutgers.edu/>
- Counseling, Alcohol and Other Drug Assistance Program & Psychiatric Services (CAPS): <http://health.rutgers.edu/medical-counseling-services/counseling/>
- Office for Violence Prevention and Victim Assistance: [www.vpva.rutgers.edu/](http://www.vpva.rutgers.edu/)

## Class Schedule

Date	Day	Lecturer	Topic		
<b>Jan.</b>	17	Tue	Shumyatsky	L1: Introduction and Methods	
	19	Thu	Shumyatsky	L2: Introduction and Methods (Continued)	
	24	Tue	Shumyatsky	L3: RNA ISH, IHC, introduction to TG/gene targeting	
	26	Thu	Shumyatsky	L4: Behavioral approaches; review on memory	
	31	Tue	Shumyatsky	L5: Behavioral approaches; review on memory	
<b>Feb.</b>	2	Thu	Shumyatsky	L6: The role of amygdala-enriched genes in fear	
	7	Tue	Shumyatsky	L7: Transgenics and gene targeting	
	9	Thu	Shumyatsky	L8: Transgenics and gene targeting	
	14	Tue	Shumyatsky	<b>Exam 1</b>	
	16	Thu	Shumyatsky	L9: Review of Exam 1 and Fear conditioning (AMY vs. HPC)	
	21	Tue	Shumyatsky	L10: Single Cell cDNA Libraries	
	23	Thu	Shumyatsky	Paper presentation 1 – Shumyatsky et al, Cell 2002	
	28	Tue	Shumyatsky	L11:(1) Single Cell cDNA Libraries (continued)	
	<b>Mar.</b>	2	Thu	Shumyatsky	Paper presentation 2 – Shumyatsky et al, Cell 2005
		7	Tue	Shumyatsky	L12: Preparation for exam
	9	Thu	Shumyatsky	<b>Exam 2</b>	
	14	Tue	--	No Class	
	16	Thu	--	No Class	
	21	Tue	Shumyatsky	L13: IEG and Design a Behavioral Experiment	
	23	Thu	Shumyatsky	L14: Aging Brain + Epigenetics	
	28	Tue	Shumyatsky	Paper presentation 3 – Dias & Ressler, Nature Neuro 2014	
	30	Thu	Shumyatsky	Continue with Paper presentation 3...	
<b>Apr.</b>	4	Tue	Shumyatsky	Paper presentation 4 – Ramamoorthi et al, Science, 2011	
	6	Thu	Shumyatsky	Continue with Paper presentation 4...	
	11	Tue	Shumyatsky	<b>Exam 3</b>	
	13	Thu	Shumyatsky	Paper presentation 5 – SEFL; Sullivan et al. 2017	
	18	Tue	Shumyatsky	L15: cAMP, PKA and dominant-negative approach	
	20	Thu	Shumyatsky	L16: Stathmin in memory and social behavior	
	25	Tue	Shumyatsky	Paper pres. 6 – Hippocampal engrams Lacagnina et al. 2019	
	27	Thu	Shumyatsky	<b>Exam 4</b>	