

# Behavioral and Neural Genetics

01:447:484  
Spring Term, 2022  
Syllabus

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

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

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

**Office Hours:** 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>

### **Class Attendance**

Students are expected to attend all classes; if you miss one or two classes, 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:**

#### **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/](http://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.

#### **Violence Prevention & Victim Assistance (VPVA)**

**(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / [www.vpva.rutgers.edu/](http://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, Livingston Campus, 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/getting-registered>

**Scarlet Listeners**

(732) 247-5555 <http://www.scarletlisteners.com>

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

## Class Schedule

Date	Day	Lecturer	Topic	
<b>Jan.</b>	19	Tue	Shumyatsky	Introduction and Methods
	21	Thu	Shumyatsky	Introduction and Methods (Continued)
	26	Tue	Shumyatsky	RNA in situ hybridization, immunohistochemistry, introduction to transgenics and gene targeting
	28	Thu	Shumyatsky	Review on Memory; Behavioral Experiments
<b>Feb.</b>	2	Tue	Shumyatsky	2nd Review of Transgenics; Behavioral approaches; What the H.M. case taught us
	4	Thu	Shumyatsky	Pre-Exam Review
	9	Tue	Shumyatsky	<b>Exam 1</b>
	11	Thu	Shumyatsky	Single Cell cDNA Libraries
	16	Tue	Shumyatsky	Single Cell cDNA Libraries (continued)
	18	Thu	Shumyatsky	Genes and Fear
	23	Tue	Shumyatsky	Genes and Fear (continued)
	25	Thu	Shumyatsky	Paper presentation 1 – Shumyatsky et al, Cell 2002
<b>Mar.</b>	2	Tue	Shumyatsky	(1) IEG and (2) Design a Behavioral Experiment
	4	Thu	Shumyatsky	Paper presentation 2 – Shumyatsky et al, Cell 2005
	9	Tue	Shumyatsky	Microtubules and memory
11	Thu	Shumyatsky	<b>Exam 2</b>	
16	Tue	--	No Class	
18	Thu	--	No Class	
23	Tue	Shumyatsky	Epigenetics	
25	Thu	Shumyatsky	Stathmin in maternal care and social behavior	
30	Tue	Shumyatsky	Paper presentation 3 – Dias & Ressler, Nature Neuro 2014	
<b>Apr.</b>	1	Thu	Shumyatsky	Paper presentation 4 – Ramamoorthi et al, Science, 2011
	6	Tue	Shumyatsky	cAMP, PKA, dominant-negative approach
	8	Thu	Shumyatsky	<b>Exam 3</b>
	13	Tue	Shumyatsky	Paper presentation 5 – SEFL; Sullivan et al. 2017
	15	Thu	Shumyatsky	Aging Brain + Optogenetics
	20	Tue	Shumyatsky	Paper pres. 6 – Hippocampal engrams Lacagnina et al. 2019
	22	Thu	Shumyatsky	Memory strength is dependent on transcription changes
	27	Tue	Shumyatsky	TBD
	29	Thu	Shumyatsky	<b>Exam 4</b>