

## BIOLOGY 641-002: SYSTEMS NEUROSCIENCE

<b>INSTRUCTOR:</b>	Dr. Jorge Golowasch	<b>EMAIL:</b>	<a href="mailto:golowasch@njit.edu">golowasch@njit.edu</a>
<b>OFFICE:</b>	Central King Bldg.	<b>OFFICE HOURS:</b>	By appointment (Email)
<b>COURSE SCHEDULE:</b>	M,W: 1:00PM – 2:20PM ▪ FMH 308	<b>COURSE WEBSITE:</b>	<a href="https://canvas.njit.edu/">https://canvas.njit.edu/</a>

**COURSE DESCRIPTION:** This course will examine neurophysiological phenomena from the systems perspective. After reviewing the basic concepts of cellular neuroscience such as excitability, impulse conduction, we focus on the integration of activity at the network level. The goal is to provide the basic knowledge to understand neurobiological processes at the systems level. This course assumes a good understanding of basic concepts (covered in the pre-requisite course Principles of Neurobiology, BIOL315) and will thus review them very quickly. Students who have not taken the pre-requisite course are strongly encouraged to get the textbook ahead of time and review the pertinent chapters.

### TEXTBOOK:

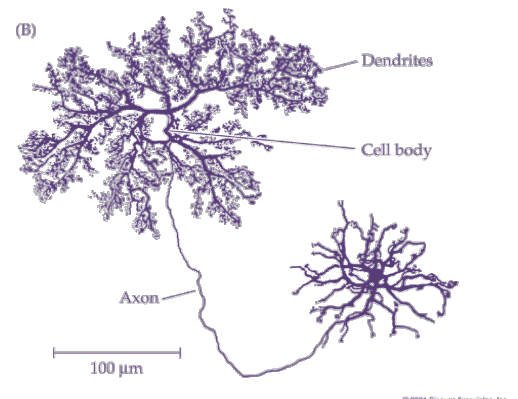
- Neuroscience (Fifth or Sixth Edition); Dale Purves, et al Editors, Sinauer Associates © 2012; **eText:** ISBN-10: 0-87893-587-8, ISBN-13: 978-0-87893-587-1; **Print:** ISBN-10: 0-87893-695-5, ISBN-13: 978-0-87893-695-3.

### LEARNING OUTCOMES:

1. Describe the cellular structure of the nervous system and the general organization of the central and peripheral nervous system
2. Understand the electrical properties of neurons and how action potentials are generated and propagate along axons
3. Describe the mechanisms of neural interaction through synaptic transmission
4. Describe the principles of sensory transduction
5. Describe the principles of motor function
6. Understand how neural networks can lead to the production of sensory perception, motor behavior and higher level functions such as learning and memory
7. Describe the development of the nervous system and the basic principles of neural plasticity

### IMPORTANT RULES AND COURSE POLICIES:

- **Academic Integrity:** The [Academic Integrity Code](#) strictly enforced!
- **Electronic Devices:** The use of cell phones and other electronic devices during class or exam times is prohibited.
- **Make-Up Exams:** There will be no make-up exams. Students who miss an exam due to a valid medical excuse need to provide a valid document proof. The grade of exams missed because of a valid excuse will be equal to the average of all other exams. Students who miss an exam without a valid excuse will receive a zero (0) for that exam. Late papers without a valid excuse will also receive a zero (0).



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### IMPORTANT RULES AND COURSE POLICIES CONT'D:

- **Course Repetition Policy:** An NJIT student may take a single course no more than four times (counting NJIT and other institutions), including withdrawals. If an undergraduate course is repeated at NJIT or the course is transferred from another institution, only then the lowest of the grades is excluded in computation of the cumulative GPA. All grades are shown on the student's transcript.
- **Final Exam Conflict Resolution:** Rules found [here](#).

### REVIEW PAPER:

Honors and graduate students must write a review paper based on a topic related to Systems Neuroscience. Submit the files electronically on Canvas in Word format (NOT pdf).

- The paper topic must be submitted to the instructor via email and approved by **Sunday April 12**.
- A draft of paper will be due via email on **Sunday, April 19**. This draft must include Title and Author, draft Summary (abstract) and highlights of the sections to be covered in the Body (see the final version instructions below) and a brief bibliography (at least 5 references). In addition, attached as an Appendix, the draft should include a Summary of at least three scientific research papers on this topic (400 words maximum, one paragraph per paper, or one integrated paragraph covering all three). Alternatively, these summaries may be in bullet-point format (400 words max).
- The final version will be due on the day of the final exam (**May 8-14, TBA when posted by Registrar**). Submit the files electronically on Canvas in Word format (NOT pdf). The paper should consist of:
  - ❖ Title and Author
  - ❖ Summary (max 200 words)
  - ❖ Introduction (Significance and Background)
  - ❖ Body (divided into sections)
  - ❖ Conclusions
  - ❖ References (no web page references allowed)

**GRADING POLICY:** The final grade in this course is determined as follows:

GRADE SCALE:					
A	90.1-100	C	60.1-68	Midterm 1 (Feb. 17)	10%
B+	83.1-90	F	0-60	Midterm 2 (Mar. 23)	20%
B	74.1-83			Midterm 3 (Apr. 13)	20%
C+	68.1-74			Paper (May 18-14)	30%
				Final (May 18-14)	20%

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**COURSE OUTLINE:**

WEEK	DATES	TOPICS
1	Jan. 20 Jan. 22	Introduction; Ion Channels and Transporters • [REVIEW]
2	Jan. 27 Jan. 29	Bioelectricity; The Resting Membrane Potential • [REVIEW]
3	Feb. 3 Feb. 5	Action Potential Generation; Action Potential Propagation • [REVIEW]
4	Feb. 10 Feb. 12	Synaptic Transmission, Excitation and Inhibition • [REVIEW]
5	Feb. 17 Feb. 19	Neurotransmitters and Receptors; Short- and Long-Term Synaptic Plasticity
6	Feb. 24 Feb. 26	Functional Organization of the Nervous System
7	Mar. 2 Mar. 4	Somatic Sensory System: Touch and Proprioception; Pain
8	Mar. 9 Mar. 11	Vision: the Eye and Transduction of Light ; Central Visual Processing
9	3/16-18	<b>SPRING BREAK – MARCH 15-22, 2020 – NO CLASSES</b>
10	Mar. 23 Mar. 25	The Auditory System: The Ear & Transduction of Sound; Central Auditory Processing
11	Mar. 30 Apr. 1	Lower Motor Systems; Upper Motor Systems
12	Apr. 6 Apr. 8	Basal Ganglia
13	Apr. 13 Apr. 15	Development of the Nervous System
14	Apr. 20 Apr. 22	Cortical States: Sleep and Wakefulness
15	Apr. 27 Apr. 29	Learning and Memory; Effect of climate change on the nervous system and behavior <i>Additional Topic:</i> The Vestibular System, The Olfactory System, The Gustatory System, Cerebellar Function [Time Permitting]
<b>FINALS</b>		<b>FINAL EXAM WEEK: MAY 8-14, 2020</b>