

## BIOLOGY 315-001: PRINCIPLES OF NEUROBIOLOGY

**INSTRUCTOR:** Jorge Golowasch

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**COURSE SCHEDULE:** T, F: 10:00 – 11:25AM in CKB 222

**COURSE WEBSITE:** <http://moodle.njit.edu/>

**COURSE SUMMARY:** This introductory-level course will review the basic principles of how the nervous system is organized, and how neurons, synapses and neuronal circuits function in order to produce behavior. We will work our way from the molecular level up to discuss behavior and systems-level issues (development of the nervous system, memory, sensory mechanisms, etc.).

**TEXTBOOK:** "Principles of Neurobiology" by Liqun Luo (2016), from Garland Science, ISBN 978-0-8153-4492-6. Be sure to have access to Moodle (<http://moodle.njit.edu/>, login with your NJIT UCID; and use NJIT email).

**LEARNING GOALS:** At the end of the course Students will be able...

- 1) To understand and be able to utilize basic concepts in cellular neuroscience.
- 2) To relate how biological molecules work with how electrical currents are generated in neurons.
- 3) To explain how a neuron generates electrical activity in molecular terms.
- 4) To describe and explain how a neuron interacts with others to generate functional neuronal networks.
- 5) Explain how sensory and motor system function. Explain the basic elements in development and plasticity of the nervous system.
- 6) To develop some basic critical thinking skills. This will be measured in the ability to interpret graphs, to design an experiment, to discuss a problem.

Students will be required to participate in group discussions and instructor-led discussions of the material as they analyze problems and propose possible mechanisms used by neurons to solve them. Weekly quizzes will be used to test some of these goals and reinforce the learning of the material.

**GRADING POLICY & SCALE:**

| Assignment              | Percentage  |
|-------------------------|-------------|
| Weekly Quizzes          | 30%         |
| Midterm Exams           | 35%         |
| Final Exam (Cumulative) | 35%         |
| <b>TOTAL</b>            | <b>100%</b> |

| Grading Scale |            |
|---------------|------------|
| <b>A</b>      | 88.1 - 100 |
| <b>B+</b>     | 80.1 - 88  |
| <b>B</b>      | 73.1 - 80  |
| <b>C+</b>     | 66.1 - 73  |
| <b>C</b>      | 60.1 - 66  |
| <b>D</b>      | 50.1 - 60  |
| <b>F</b>      | 0 - 50     |

**IMPORTANT RULES AND POLICIES:**

- ⊗ [Academic Integrity Code](#) is strictly enforced.
- ⊗ **The use of cell phones and other two-way electronic devices during class or exam times is prohibited.**
- ⊗ If you miss an exam due to a valid medical excuse you need to provide a doctor's note or other valid & verifiable documentation. The grade of exams missed for a valid reason will be determined on a case-by-case basis.
- ⊗ Final exam conflict resolution rules: <http://www.njit.edu/registrar/exams/conflict.php>

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**Course Repetition Policy:** An NJIT student may take a single course no more than four times (counting NJIT and another 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.

**SCHEDULE AND COURSE OUTLINE:** Dates listed by week; class will meet twice every week, unless otherwise noted.

| WEEK / DATES                                 |             | LECTURE TOPICS   | BOOK CHAP |
|--|-------------|--|-----------|
| Week 1                                       | 9/6, 9      | Entrance quiz • Introduction • Principles of signaling and organization of the nervous system • Putting together a network that can produce a behavior • Maps • Methods  | Chap 1    |
| Week 2                                       | 9/13, 16    | Nerve Cells, Anatomy, Cytoarchitecture • The Membrane • General electrical properties of excitable cells<br><i>[Sept 12: Last day to Add/Drop a class]</i>   | Chap 1, 2 |
| Week 3                                       | 9/20, 23    | Glial cells • Techniques • Intracellular transport • Ion transport • Electrical properties of cells • Resting potential • Passive properties • Neuronal electrophysiology • Interpretation of an I-V graph • Ionic channels, gating and ion currents | Chap 1, 2 |
| Week 4                                       | 9/27, 30    | Ionic channels, gating and ion currents • Action potential generation, propagation.  | Chap 2    |
| Week 5                                       | 10/4, 7     | Action potential generation, propagation.<br><b>MIDTERM 1 (Oct 7)</b>  | Chap 3    |
| Week 6                                       | 10/11, 14   | Ionic channels, gating and ion currents • Neuronal communication: Chemical synaptic transmission • Receptors • Ca <sup>++</sup> hypothesis Transmitter synthesis • Quantal release • Neurotransmitter release • Indirect transmission                | Chap 3    |
| Week 7                                       | 10/18, 21   | Neurotransmitters and modulators • Receptors • Ionotropic, metabotropic actions • Post-synaptic responses  | Chap 3    |
| Week 8                                       | 10/25, 28   | Metabotropic transmission, Short term synaptic plasticity<br>Auditory system   | Chap 3, 6 |
| Week 9                                       | 11/1, 4     | Auditory system as a model of sensory systems and integration<br><b>MIDTERM 2 (Nov 4)</b>  | Chap 6    |
| Week 10                                      | 11/8, 11    | Auditory system as a model of sensory systems and integration<br>Motor systems and regulatory systems  | Chap 6, 8 |
| Week 11                                      | 11/15, 18   | Motor systems and regulatory systems   | Chap 8    |
| Week 12                                      | 11/22, 23   | Memory and learning<br><i>[Wed 23 is a Friday]</i>   | Chap 10   |
| Week 13                                      | 11/29, 12/2 | <b>MIDTERM 3 (Nov 29)</b><br>Circuits and complex behaviors  | Chap 9    |
| Week 14                                      | 12/6, 9     | Wiring (development) of the nervous system (by Dr. Friedman, RU-N)   | Chap 7    |
| Week 15                                      | 12/13       | Nervous system disorders   | Chap 11   |
| <b>FINAL EXAM WEEK: DECEMBER 16-22, 2016</b> |             |  |           |

If you can't access Moodle, you need to activate your NJIT UCID. Visit: [http://moodle.njit.edu/rutgers\\_students.php](http://moodle.njit.edu/rutgers_students.php)