NJIT BIOLOGY

Course Syllabus

FALL 2014

BIOLOGY 341-001: INTRO TO NEUROPHYSIOLOGY

INSTRUCTOR:	Dr. Dirk Bucher	**EMAIL:**	bucher@njit.edu
OFFICE:	Boyden Hall 314	**COURSE WEBSITE:**	http://njit2.mrooms.net/
OFFICE HOURS:	T, R: 10:00am – 11:00am	**COURSE SCHEDULE:**	T, R: 4:00 – 5:25pm in FMH 308

COURSE SUMMARY: This course will examine the nervous system from a functional perspective. The goal is to understand how ion channels and other components of nerve cells give rise to electrical excitability and synaptic function, and how those properties are then used for coding information and higher order function in the nervous system.

TEXTBOOK: "From Neuron to Brain", 5th ed, Nicholls et al.; Sinauer 2012; ISBN 9780878936090. Be sure to have access to Moodle2, login with UCID).

LEARNING GOALS: AT THE END OF THE COURSE STUDENTS WILL BE ABLE…

- To understand in some detail how electrical and chemical signaling within and between nerve cells works.
- To understand the experimental and theoretical approaches used to study neurophysiology, both for basic research and medical diagnostics.
- To understand fundamental principles of how the nervous system uses electrical activity to encode and decode information about the outside world and internal states.
- To further develop critical thinking and communication skills. This will be measured in the ability to interpret graphs, experimental designs, and problem discussion. Students will be required to participate in 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
Participation & Weekly Quizzes	30%
Midterm Exams	35%
Final Exam	35%
TOTAL	**100%**

GRADING SCALE			
A	88.1 - 100	C	60.1 - 66
B+	80.1 - 88	D	50.1 - 60
B	73.1 - 80	F	0 - 50
C+	66.1 - 73		

IMPORTANT RULES AND POLICIES:

The NJIT 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 and verifiable documentation. The grade of exams missed for a valid reason will be determined on a case-by-case basis. **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.

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SCHEDULE AND COURSE OUTLINE: Class will meet twice every week, unless otherwise noted.

WEEK/DATES		LECTURE TOPICS
Week 1	Tue, Sep 02	Introduction and course overview – What is Neurophysiology?
	Thu, Sep 04	Neurons and glia, diversity of cell types, synapses and networks, complexity.
Week 2	Tue, Sep 09	*[Sep 08: last day to Add/Drop a class]* Membrane potential I: membranes, ions and ion channels; Ohm's law; Equilibrium potentials, Nernst Equation.
	Thu, Sep 11	Membrane potential II: contribution of different ions, GHK equation.
Week 3	Tue, Sep 16	Passive properties: input resistance; capacitance, "synaptic integration".
	Thu, Sep 18	Voltage-gated ion channels I: Action potentials; Hodgkin-Huxley model.
Week 4	Tue, Sep 23	Action potential propagation.
	Thu, Sep 25	Voltage-gated ion channels II: single channel currents, molecular and functional diversity of channel types, intrinsic excitability.
Week 5	Tue, Sep 30	Synapses I: Electrical and chemical connections.
	Thu, Oct 02	Synapses II: SNARE complex, postsynaptic densities, quantal theory of transmitter release.
Week 6	Tue, Oct 07	Review, Q&A session
	Thu, Oct 09	**MIDTERM EXAM I**
Week 7	Tue, Oct 14	Metabotropic synapses and neuromodulation.
	Thu, Oct 16	Short-term synaptic plasticity
Week 8	Tue, Oct 21	Long-term synaptic plasticity
	Thu, Oct 23	Neural coding: general principles
Week 9	Tue, Oct 28	Sensory systems I: Introduction; mechanoreception, proprioception
	Thu, Oct 30	Sensory systems II: Chemical senses
Week 10	Tue, Nov 04	Sensory systems III: Vision
	Thu, Nov 06	Motor coding and muscle physiology
Week 11	Tue, Nov 11	Reflexes and central pattern generation
	Thu, Nov 13	Review, Q&A session
Week 12	Tue, Nov 18	**MIDTERM EXAM II**
	Thu, Nov 20	Neurons, Circuits & Behavior: Neural processing stages. [Fortune]
Week 13	Tue, Nov 25	Theoretical approaches to understand neuron and network function
	Thu, Nov 27	**THANKSGIVIVING BREAK**, NO CLASS!
Week 14	Tue, Dec 02	Network Plasticity
	Thu, Dec 04	Neural correlates of complex brain functions
Week 15	Tue, Dec 09	Review, Q&A session
	Thu, Dec 11	READING DAY, NO CLASS
FINALS		**FINAL EXAM WEEK: DECEMBER 15-19, 2014**