NJIT BIOLOGY

Course Syllabus

Fall 2015

BIOLOGY 698: NEUROPHYSIOLOGY

INSTRUCTOR:	Dirk Bucher (bucher@njit.edu)	**COURSE WEBSITE:**	http://njit2.mrooms.net/
OFFICE HOURS:	T: 10:30 am, T: 10:30 am – CKB 337	**COURSE SCHEDULE:**	T, F: 2:30 – 3:55 pm in FMH 205

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	20%
Midterm Exams	30%
Homework assigments	20%
Final Exam	30%
TOTAL	**100%**

Grading Scale	
A	88.1 - 100
B+	80.1 - 88
B	73.1 - 80
C+	66.1 - 73
C	60.1 - 66
F	0 - 60

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

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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 01	Introduction and course overview – What is Neurophysiology?
	Fri, Sep 04	Neurons and glia cells: Morphological and molecular diversity
Week 2	Tue, Sep 08	*[Sep 08: last day to Add/Drop a class]* Membrane potential I: Ions, channels, Nernst Equation
	Fri, Sep 11	Membrane potential II: GHK equation and equivalent circuit
Week 3	Tue, Sep 15	Passive properties: Input resistance, capacitance, length constant, time constant
	Fri, Sep 18	Action potential I: Ionic mechanisms
Week 4	Tue, Sep 22	Action potential II: Hodgkin-Huxley formalism, propagation, myelination
	Fri, Sep 25	Diversity of voltage-gated channels: molecular identities and effect on neuronal firing
Week 5	Tue, Sep 29	Review, examples and exercises
	Fri, Oct 02	Review, examples and exercises
Week 6	Tue, Oct 06	**MIDTERM EXAM I**
	Fri, Oct 09	Electrical and chemical transmission: Gap junctions, crayfish escape system, frog neuromuscular junction.
Week 7	Tue, Oct 13	Central synapses, small molecule transmitters and ionotropic receptors.
	Fri, Oct 16	*Homework assignment, no class*
Week 8	Tue, Oct 20	Metabotropic transmission, GPCRs, 2nd messenger signaling.
	Fri, Oct 23	Transmitter release I: Quantal analysis.
Week 9	Tue, Oct 27	Transmitter release II: SNARE complex, vesicle pools, postsynaptic receptors.
	Fri, Oct 30	Transmitter types: Synthesis, transport, release, re-uptake and degradation.
Week 10	Tue, Nov 03	Types of communication: Transmitters, neuromodulators, neurohormones.
	Fri, Nov 06	Synaptic plasticity I: Short-term synaptic dynamics.
Week 11	Tue, Nov 10	Synaptic plasticity II: Long-term synaptic dynamics. Aplysia gill withdrawal, LTP, LTD
	Fri, Nov 13	Review, examples and exercises
Week 12	Tue, Nov 17	Review, examples and exercises
	Fri, Nov 20	**MIDTERM EXAM II**
Week 13	Tue, Nov 24	Sensory transduction, modalities, coding principles.
	Fri, Nov 27	Somatosensory and auditory coding
Week 14	Tue, Dec 01	Visual and chemosensory coding
	Fri, Dec 04	Motor coding: posture and movement control
Week 15	Tue, Dec 08	Review, examples and exercises
	Fri, Dec 11	**READING DAY, NO CLASS**
FINAL EXAM WEEK: Dec 15-21 (FINAL EXAM DATE TBA)		