NJIT BIOLOGY

Course Syllabus

FALL 2019

BIOLOGY 341-001: INTRO TO NEUROPHYSIOLOGY

INSTRUCTOR:	Dr. Dirk Bucher	**EMAIL:**	bucher@njit.edu
OFFICE:	Central King Building 420G	**COURSE WEBSITE:**	https://canvas.njit.edu/
OFFICE HOURS:	M,R: 4:00pm – 5:00pm	**COURSE SCHEDULE:**	M, R: 2:30 – 3:50pm in CKB 341

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 Canvas, 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	25%
Midterm Exams (2)	40%
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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TENTATIVE SCHEDULE AND COURSE OUTLINE: Class will meet twice every week, unless otherwise noted.

WEEK/DATES		LECTURE TOPICS
Week 1	Mon, Sept. 02	**NO CLASS** – Labor day Holiday
	Thu, Sept. 05	Introduction and course overview – What is Neurophysiology?
Week 2	Mon, Sept. 09	***Section 1: Intrinsic neuronal properties***
	Thu, Sept. 12	*[Sept. 13: last day to Add/Drop a class]* Neurons and glia cells: Morphological and molecular diversity.
Week 3	Mon, Sept. 16	Membrane potential I: Ions, channels, Nernst Equation
	Thu, Sept. 19	Membrane potential II: GHK equation and equivalent circuit
Week 4	Mon, Sept. 23	Passive properties: Input resistance, capacitance, length constant, time constant
	Thu, Sept. 26	Action potential I: Ionic mechanisms
Week 5	Mon, Sept. 30	Action potential II: Hodgkin-Huxley formalism, propagation, myelination
	Thu, Oct. 03	Diversity of voltage-gated channels: molecular identities and effect on neuronal firing
Week 6	Mon, Oct. 07	***Section 2: Synaptic signaling***
	Thu, Oct. 10	Review, Q&A session
Week 7	Mon, Oct. 14	**MIDTERM EXAM I**
	Thu, Oct. 17	Electrical and chemical transmission: Gap junctions, crayfish escape system, frog neuromuscular junction.
Week 8	Mon, Oct. 21	Central synapses, small molecule transmitters and ionotropic receptors.
	Thu, Oct. 24	Metabotropic transmission, GPCRs, 2nd messenger signaling.
Week 9	Mon, Oct. 28	Transmitter release I: Quantal analysis.
	Thu, Oct. 31	Transmitter release II: SNARE complex, vesicle pools, postsynaptic receptors.
Week 10	Mon, Nov. 04	Transmitter types: Synthesis, transport, release, re-uptake and degradation.
	Thu, Nov. 07	Types of communication: Transmitters, neuromodulators, neurohormones.
Week 11	Mon, Nov. 11	Synaptic plasticity I: Short-term synaptic dynamics.
	Thu, Nov. 14	Synaptic plasticity II: Long-term synaptic dynamics. Aplysia gill withdrawal, LTP, LTD
Week 12	Mon, Nov. 18	Review, Q&A session
	Thu, Nov. 21	**MIDTERM EXAM II**
Week 13	Mon, Nov. 25	***Section 3: Sensory transduction mechanisms and simple coding principles*** Sensory transduction, modalities, coding principles.
	Thu, Nov. 28	**THANKSGIVIVING BREAK, NO CLASS!**
Week 14	Mon, Dec. 02	Somatosensory and auditory coding
	Thu, Dec. 05	Visual and chemosensory coding
Week 15	Mon, Dec. 09	Motor coding: posture and movement control
	Thu, Dec. 12	READING DAY
FINALS		**FINAL EXAM WEEK: DECEMBER 14-20, 2019**