Course Description:
This course will introduce you to the structures, systems, methods, and theories that enable the nervous system to control normal and abnormal human behavior. This course will cover a range of topics. On the practical side, you will learn the essential elements of neuroanatomy and neurophysiology that provides a basic introduction to neurons, brain organization, and functional specialization of brain structures related to language, learning, memory, pain, reward and sensory/motor systems. We will also investigate how the nervous system is influenced and controlled by bioactive substances including natural stressors and hormones, pharmacological therapeutics and recreational drugs. We will end with an examination of neurological disorders and some of its treatments.

Course Materials:
Top Hat Subscription: A subscription to Top Hat will be required. Please visit www.tophat.com to signup; subscriptions are $24/semester or $36 per year. You will receive an invitation with a 6-digit join code that you must enter to gain access to the course.

There is no required textbook for this course. However, if you wish to reinforce concepts discussed in lecture and prefer to study with a traditional textbook, I provide page references from this textbook: Behavioral Neuroscience (2017; 8th edition) by S. Marc Breedlove and Neil V. Watson. Please note- the 7th or older editions of this textbook were titled “Biological Psychology” (the publisher retitled the textbook for this brand-new edition). Older editions are perfectly useable and much less costly. Two copies of the 7th edition are on reserve in Snell Library for your reference.

I provide several case studies as PDFs on Blackboard from:
Fractured Minds: A Case-Study Approach to Clinical Neuropsychology / Ogden (2005)

Additional readings, animations, and interactive websites to accompany the lecture material are posted on Blackboard. Please check Blackboard regularly to stay up-to-date with readings and class announcements.

Class Format:
This course will consist primarily of in-class lectures. Whenever possible, material will be presented in the form of case studies in order to examine and consolidate material in a more thoughtful and discussion stimulating manner. To make lectures more engaging and to encourage student participation and attendance, students are encouraged to collaborate with your peers to answer interactive Top Hat questions during each class on your smart phone, laptop or tablet.

My lecture slides will be posted on Blackboard by 9AM on Tuesdays or noon on Thursdays before class to help with your note taking. I record my lectures (see “Tegrity Classes” on Blackboard) and make them available so you can refer back to them when studying or so you can watch them at home in the event that you miss class. However, this is NOT an online class so watching the recorded lectures in lieu of attending class on a regular basis is not advisable. Unexpected computer issues might arise so I cannot guarantee that each lecture will be recorded. If you miss class, Blackboard is your source to find out what you missed and how you should prepare for the next class.
**Peer tutoring:**
Students requiring additional help are advised to come to my office hours with questions. There are also at least five excellent peer tutors (Paneed Jalili, Norik Kirakosian, Katie Levitsky, Lucia Ryll, Abigail Woodruff) available through the Peer Tutoring Program ([http://www.northeastern.edu/csastutoring/](http://www.northeastern.edu/csastutoring/)). Additionally, I work directly with our work study peer tutor, Geetha Nichanametla (nichanametla.g@husky.neu.edu). Email her directly to schedule a peer tutoring appointment. There is no charge for peer tutoring services.

**Evaluation Format:**
Your final grade will be based on work during the semester in the following proportions:

3 EXAMS worth 30% each.
Exam 1 will be on Tuesday, Feb 7\textsuperscript{th}.
Exam 2 will be on Thursday, Mar 16\textsuperscript{th}.
Exam 3 will be on Tuesday, Apr 18\textsuperscript{th}.
Exams are non-cumulative in topic but knowledge of fundamental concepts covered earlier in the semester will be assumed. You will need to bring your university photo ID and a #2 pencil to take exams.

Exam format will consist of:
- multiple choice
- fill-in-the blank
- matching
- problem solving
- true/false

If you are satisfied with your three exam scores, you are NOT required to take the cumulative exam during Finals week. If you take all three exams AND the cumulative final, I will automatically drop your lowest exam score.

The cumulative final exam is the only option for a missed exam. There will be no other makeup exams under any circumstances. This includes illness, family emergencies, or other misfortunes.

10% “Course Average” score in Top Hat.
On average, three Top Hat questions will be asked each class period. Additional questions will occasionally be assigned as homework. Questions will be weighted 50% for accuracy and 50% for participation. Classroom questions can only be completed during lecture. If you have an academic-related excuse for missing class (University Athletes, coop/graduate school interview, jury duty, etc.) or documented extended medical absence, please contact me prior to class so I can assign those questions to you as homework. Top Hat questions cannot be assigned as homework after they have been put in “review mode” for the class to study. You will have at least 48 hours to complete any Top Hat homework questions so there will be no deadline exceptions.

Grades will be on the ABCDF scale with +/- grades. It is anticipated that letter grades for this course will be assigned according to the scale below, although these grade cutoffs may be lowered at my discretion. They will NOT be raised. Individual requests for extra credit work cannot be granted.

A’s (90-100%)
B’s (80-89.9%)
C’s (70-79.9%)
D’s (60-69.9%)
F (below 60%)
**Academic Integrity and violations thereof:**
Honesty in academic work is expected of all students. Academic dishonesty is a very serious offense, recognized by the students themselves in the Academic Integrity Policy ([http://www.northeastern.edu/osccr/academic-integrity-policy/](http://www.northeastern.edu/osccr/academic-integrity-policy/)), and renders the offender liable to disciplinary action. Students caught violating academic policy will be penalized according to the severity of the offense. Possible penalties range from grade reduction on the particular exam to grade reduction or failure for the entire course.

This course follows the College of Science Academic Course Policies, which are viewable at this link: [http://www.northeastern.edu/cos/wp-content/uploads/2014/11/Northeastern-COS-Policies-Template.pdf](http://www.northeastern.edu/cos/wp-content/uploads/2014/11/Northeastern-COS-Policies-Template.pdf)

**Students with Disabilities:**
Accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disability Resources Center.
TOPICAL OUTLINE

BIOLOGICAL PSYCHOLOGY – PSYC 3458

BLOCK 1. The Cellular Basis of Behavior.
• The Pseudoscience of Phrenology and a Brief History of the Brain.
• Genetics in a Nutshell and Other Essential Building Blocks of Biology (Central Dogma).
• How Protein Structure Affects Function.
• How Organelles are Specialized in Neurons.
• Neuron Doctrine versus Reticular Theory.
• Law of Dynamic Polarization.

• The Chemistry of Lipids.
• Why the Phospholipid Bilayer is a Problem for Ions.
• Passive Diffusion versus Active Transport.
• The Semi-Permeable Membrane.
• The Nernst Equation and the Goldman Equation.
• The Ionic Basis of a Neuron’s Resting Potential.

• The Electrically Excitable Domain.
• The Action Potential Explained.
• Functions of the Sodium Channel.
• Functions of the Potassium Channel.
• Factors Affecting Action Potential Conduction Speed.
• Case Study of Multiple Sclerosis, a Demyelinating Disease.
• The Importance of Poisons and Toxins.

• The Chemically Excitable Domain.
• Summation and Integration.
• Functions of the Calcium Channel.
• Acetylcholine and Glutamate - Excitatory Neurotransmitters.
• Case Study of Myasthenia Gravis.
• Gamma-Amino Butyric Acid (GABA) and Glycine - Inhibitory Neurotransmitters.
• Learning and Memory - Habituation and Sensitization of a Behavior.
• Learning and Memory - Hebb’s Postulate and NMDA Receptors.

EXAM 1 (Tuesday, Feb 7th)
BLOCK 5. The Spinal Cord and Brain.
- Peripheral and Central Nervous Systems.
- Orientation and Gross Subdivisions of the Brain.
- Functional Role of the Different Lobes in Your Brain.
- Case Study on Frontal Lobe Dysfunction.
- Integrative Circuits in the Spinal Cord for Sensory and Motor Responses.
- Reflex Arcs.
- Ventricles. Meninges and the Blood Brain Barrier.

BLOCK 6. Pleasure and Pain.
- Limbic System.
- Is There a “Pleasure Circuit” in the Brain?
- The Role of Dopamine in Reward Pathways.
- Ascending Nociceptor Systems and Substance P.
- Descending Analgesia Systems.
- Top-down vs. Bottom-up Approaches to Understanding Pain Perception.
- The Mechanism of Opioid Peptide Action on Pain Transmission.

BLOCKS 7 & 8. Sensory Systems.
- Common Functions of Sensory Neurons.
- The Role of Inhibition in Sensory Networks.
- Somatosensory System – Homunculus.
- Auditory System and Mechanoreceptors.
- Breakdown of Language – Case Studies of Aphasia.
- Vision – Case Study of Visual Agnosia.
- Olfaction.
- Sensory Mix-ups – the McGurk Effect and Synesthesia.

EXAM 2 (Thursday, Mar 16th)
BLOCK 9. Dopamine Dysregulation and Disease.
- The Importance of the Basal Ganglia.
- *How Too Little Dopamine can Lead to a Motor Disease – Case Study of Parkinson’s.*
- *The Dopamine Hypothesis of a Disease of Thought and Emotion – Case Study of Schizophrenia*

BLOCK 10. Other Neurological Conditions.
- The Genetics of Huntington’s Disease.
- *Structural Abnormalities – Case Study of Alzheimer’s Disease.*
- Epilepsy and Seizures.
- *Memory Consolidation and Amnesia- the Case Study of Patient H.M.*

BLOCK 11. Psychopharmacology.
- Agonists and Antagonists.
- Pharmacokinetics.
- Addiction, Tolerance, and Withdrawal.
- Central Nervous System Depressants.
- Central Nervous System Stimulants.
- The GABA Receptor Complex.
- Hallucinogens.

BLOCK 12. Hormones and Behavior.
- Hormones as Circulating Signaling Molecules Produced by Endocrine Glands.
- Steroid Hormones as Nuclear Receptors.
- Genomic (slow) and Non-genomic (rapid) Effects of Steroids on the Nervous System.
- Organizational and Activational Effects of Steroids.
- Hormone Extirpation and Replacement Technique.
- Sex Differences in Brain and Behavior Including Drug Addiction and Depression.

**EXAM 3 – (Thursday, Apr 18th)**
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