NEUROSCIENCE (BISC 4532) - Fall 2021 Syllabus

Instructor: Marija Kundakovic, Ph.D.
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Class schedule: Mondays and Thursdays 4:00-5:15 PM
Class location: John Mulcahy Hall 108
Office hours via Zoom: https://fordham.zoom.us/j/6275667038
Mondays 1:30 - 3:30 PM
Thursdays 1:30 - 3:30 PM

Course page: http://fordham.blackboard.com

Recommended Textbook: Mark F. Bear, Barry W. Connors, Michael A. Paradiso (2015). Neuroscience: Exploring the Brain, 4th Edition, Wolters Kluwer (ISBN 978-0781778176)

Class Description: This course will serve as an introduction to the rapidly moving and very exciting field of Neuroscience. We will first cover the basic structure of the nervous system; types of brain cells; gene regulation in the brain; and will learn how brain cells work and communicate. Following this, we will learn the neural mechanisms underlying sensory and motor systems as well as complex behaviors, including emotion, sleep, and learning and memory. Finally, we will explore risk factors and mechanisms underlying mental disorders and will learn about their treatments. The class will be concluded with the emerging field of neuroepigenetics, and we will explore how the environment and our genes interact to shape brain structure and function.

9/2 **Lecture 1: Introduction to Neuroscience**
Readings: Chapter 1

9/7 **No Class (Labor Day)**

9/8 **Lecture 2: Basic Structure and Cells of the Nervous System**
Readings: Chapters 2 and 7
Note: Classes Follow a Monday Schedule

9/9 **Lecture 3: Gene Regulation and Action Potential**
Readings: Chapters 3 and 4

9/13 **Lecture 4: Synaptic Transmission and Cell Signaling**
Readings: Chapter 5

9/16 **Lecture 5: Neurotransmitter Systems**
Readings: Chapter 6

9/20 **Lecture 6: Methods in Neuroscience**
Readings:

1. Wong ML, Medrano JF. Real-time PCR for mRNA quantitation. Biotechniques. 2005 Jul;39(1):75-85.
2. Das et al. Chromatin immunoprecipitation assay. Biotechniques. 2004 Dec;37(6):961-9.
3. Li Y, Tollefsbol TO. DNA methylation detection: bisulfite genomic sequencing analysis. Methods Mol Biol. 2011;791:11-21.

Watch the video: **Reading and Analyzing Neuroscience Research Papers**
(Video covers the article: Kundakovic et al. (2015). DNA methylation of BDNF as a biomarker of early life adversity. *Proc Natl Acad Sci U S A.* 112(22):6807-13.)

9/23 Recap 1 and Discussion

9/27 EXAM #1

9/30 Lecture 7: The Eye and the Central Visual System
Readings: Chapters 9 and 10

10/4 Lecture 8: The Chemical Senses and the Auditory System
Readings: Chapters 8 and 11

10/7 Lecture 9: The Somatic Sensory System
Readings: Chapter 12
Dempsey-Jones H, Wesselink DB, Friedman J, Makin TR (2019). Organized Toe Maps in Extreme Foot Users. Cell Rep 28(11):2748-2756.
https://www.sciencedaily.com/releases/2019/09/190910111412.htm

10/11 No Class (Columbus Day)

10/14 Lecture 10: Control of Movement
Readings: Chapters 13-14

10/18 Lecture 11: Chemical Control of the Brain and Behavior
Readings: Chapter 15

10/21 Lecture 12: Sex and the Brain
Readings: Chapter 17
McCarthy MM, Arnold AP. Reframing sexual differentiation of the brain. Nat Neurosci. 2011 Jun;14(6):677-83.

10/25 Students' Presentations – Part I (Sensory/Motor Systems, Stress, Sex Hormones)

10/28 Recap 2 and Discussion

11/1 EXAM #2

11/4 Lecture 13: Brain Mechanisms of Language, Brain Rhythms, and Sleep
Readings: Chapters 19 and 20

11/8 Lecture 14: Mental Disorders I: Schizophrenia
Readings: Chapter 22
Weinberger DR, Dzirasa K, Crumpton-Young LL. Missing in Action: African Ancestry Brain Research. Neuron. 2020 Aug 5;107(3):407-411.

11/11 Lecture 15: Mental Disorders II: Affective Disorders
Readings: Chapter 22
https://www.theatlantic.com/science/archive/2019/05/waste-1000-studies/589684/

11/15 TBD

11/18 Students' Presentations – Part II (Schizophrenia, Depression, Bipolar Disorder)

11/22 Lecture 16: Substance Abuse and Dependence
Readings: Chapter 22
Nestler EJ (2005) Is there a common molecular pathway for addiction? *Nat Neurosci.* 8(11):1445-9.

11/25 No Class (Thanksgiving Recess)

11/29 Lecture 17: Learning and Memory
Readings: Chapters 24 and 25

12/2 Lecture 18: Epigenetics, Environment, and Psychiatric Disorders
Readings:
Kundakovic M and Jaric I (2017). The Epigenetic Link between Prenatal Adverse Environments and Neurodevelopmental Disorders. *Genes 8*, 104.

12/6 Students' Presentations – Part III (Drug Abuse and Addiction, Learning/Memory, Neuro-Epigenetics)

12/9 Recap 3 and Discussion

12/15 - 12/22 Final Examinations: EXAM #3

Class schedule is subject to change.

Grading

Midterm Exams (1-2): multiple-choice questions and short essay questions - each 270 points

Final Exam (3): multiple-choice questions and short essay questions - 300 points

Research article presentation and feedback on classmates' presentations - 160 points

Extra credit (up to 20 points) – Neuroscience-related blog postings and other options, all to be confirmed with the Instructor.

Final grades: A = 94-100%, A- = 90-93.99%, B+ = 87-89.99%, B = 83-86.99%, B- = 80-82.99%, C+ = 77-79.99%, C = 73-76.99%, C- = 70-72.99%, D = 60-69.99%, F = BELOW 60

Attendance: Students are expected to attend all lectures and exams as scheduled. Excused absences from lectures are permitted for the following reasons: illness or injury, religious holidays, death in the student's immediate family, required participation in a University-sponsored event, or Graduate/Professional School or Fellowship Interview. Students are expected to email the instructor in advance of an excused absence.

The maximum number of total absences cannot exceed four class meetings. Make-up exams will be allowed only under rare circumstances - in case of medical/family emergency or other serious event - with appropriate supporting documentation and a Dean's note.