Spring 2-1-2019

BIOH 380.01: Cellular and Molecular Neuroscience

Darrell A. Jackson
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Cell and Molecular Neuroscience (BIOH 380)
Spring Semester 2019, 3 credits

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Course Description: The material covered will give students a practical knowledge of the subcellular organization and function of the nervous system. Students will learn how brain energy metabolism is a dynamic, and highly regulated process. We will explore the variety forms of neuronal chemical communication that may not conform to basic concepts of synaptic signaling. We will learn about the early development of the brain and the molecular regulation of neurogenesis. We will study processes that are involved in the growth and guidance of axons leading to the formation as well as the elimination of synapses. We will explore the basic mechanisms involved in learning and memory. Finally, students will learn about the molecular and cellular mechanisms associated with neurodegenerative disease.

Learning Outcomes:

1. To learn the subcellular organization of the nervous system: organelles and their function
2. To learn the concepts related to functional metabolism in the central nervous system
3. To learn the non-classical signaling and the different types of intracellular signaling that are aspects of neuronal function
4. To learn the molecular and cellular processes involved in early brain development, neurogenesis, and synaptogenesis
5. To learn the cellular processes involved in repair of the damaged brain
6. To learn about the cellular mechanisms involved in the process of learning and memory
7. To learn about the cellular mechanisms that underlie neurodegenerative diseases

Prerequisites: Fundamentals of Neuroscience (BIOH 280), and Cellular and Molecular Biology (BIOB 260)

Required Textbook: From Molecules to Networks: An Introduction to Cellular and Molecular Neuroscience, Edited by John H. Byrne and James L. Roberts, 3rd Edition (ISBN 978-0-12-397179-1)

Recommended Textbook: Principles of Neural Science, Edited by Eric R. Kandel, James H. Schwartz, Thomas M. Jessell, Steven A. Siegelbaum, and A.J. Hudspeth, 5th Edition (ISBN 978-0-07-139011-8)

Class hours:
Lectures: MWF 3-3:50 PM SB 174

Examination dates:
TBA

Student Conduct:
All students must act professionally and practice academic honesty. Academic misconduct is subject to academic penalty by the course instructors and/or disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code (http://www.umt.edu/vpsa/policies/student_conduct.php).

Students with Disabilities:
Students with disabilities may request reasonable accommodations by contacting the course coordinator. The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students (DSS). "Reasonable" means the University permits no fundamental alterations of academic standards or retroactive modifications. For more information, consult the UM Disability Services for Students website (http://www.umt.edu/dss/Current_Students/default.php).

This course may require the student to access documents produced by third parties. Every attempt is made to use only accessible third-party documents and websites in this course; however, students are encouraged to notify the instructor if third-party material is not accessible. For non-accessible PDFs, students can send the PDF to convertdoc@umontana.edu for conversion to both an accessible PDF and Rich Text File. Course Materials: Instructors will place course materials online in Moodle. Students are responsible for online material in addition to the assigned readings and information presented in class.

Evaluations:
Students will evaluate the instructors online. The evaluations will be available to students during the last week of the semester. Students will receive one point of extra credit for each evaluation they fill out.

Attendance Policy:
Attendance at all lectures is expected of students. Contact the course coordinator if absences are anticipated or in case of illness or emergency. Instructor may deduct points for lecture absences at their discretion. Seminar attendance may be assigned and available for extra credit at the discretion of the instructor.

Test Policy:
No exam will be given early. Only under an unforeseen emergency or unusual circumstances will an excused absence from a test be permitted. When such an exception is granted, the appropriate form must be filed with the Office of Student Services. A makeup exam will be in written format and must be taken within one week of the original test date. Students have **one week** from the time of the test return date to resolve any grading questions.

Class Presentation/Questions: 5 points each/60 points:
Students will be assigned figures to discuss during presentations, and will be expected to answer following questions; 1) What hypothesis is being tested, 2) What method was used, 3) Was the hypothesis successfully tested (total of 5-points).

Grading:
Two Exams: 75 points/each (total 150 points)
Cumulative Final Exam: 100 points
Writing 10-page review article: 80 points
Student Presentation: 60 points
Student Participation: 20 points (extra credit)

Total Class points: 390

Evaluation of Student Performance:
Classroom attendance is mandatory. Students are responsible for all material covered in lecture. Assigned textbook readings are meant to assist the student in their comprehension of course materials. The final comprehensive exam will be a two-hour exam. Course grades will be determined as follows: A 90-100%, B^+ 87-89%, B 83-86%, B^- 80-82%, C^+ 77-79%, C 73-76%, C^- 70-72%, D 63-66%, D- 60-62%, <60% F.

2019 Course Schedule:

Week 1

Friday
Time: 3-3:50 PM
Topic-Overview of Course and Content

Week 2

Monday
Time: 3-3:50 PM
Topic-Subcellular Organization of the Nervous System: organelles and Their Function continued, Byrne, Heidelberger, and Waxham 19-48

Wednesday
Time: 3-3:50
Topic- Subcellular Organization of the Nervous System: organelles and Their Function continued, Byrne, Heidelberger, and Waxham 19-48

Friday
Time: 3-3:50 PM
Topic: Subcellular Organization of the Nervous System: organelles and Their Function continued, Byrne, Heidelberger, and Waxham 19-48

Week 3

Monday
Holiday

Wednesday
Time: 3-3:50 PM
Topic-Patterning of the nervous system, Kandel et al. 1165-1186

Friday
Time: 3-3:50 PM
Topic-Patterning of the nervous system, continued, Kandel et al. 1165-1186

Week 4

Monday
Time: 3-3:50 PM
Topic- Student Presentations

Wednesday
Time: 3-3:50 PM
Topic- Differentiation and Survival of Nerve Cells, Kandel et al. 1187-1208

Friday
Time: 3-3:50 PM
Topic- Differentiation and Survival of Nerve Cells continued, Kandel et al. 1187-1208

Week 5

Monday
Time: 3-3:50 PM
Topic- Student Presentations

Wednesday
Time: 3-3:50 PM
Topic- The Growth and guidance of Axons, Kandel et al. 1209-1232
Formation and Elimination of Synapses, Kandel et al. 1233-1258

Friday
Time: 3-3:50 PM
Topic- The Growth and guidance of Axons continued, Kandel et al. 1209-1232
Formation and Elimination of Synapses continued, Kandel et al. 1233-1258

Week 6

Monday
Time: 3-3:50 PM
Topic- Student Presentations

Wednesday
Time: 3-3:50 PM
Topic- Exam 1 review

Friday
Time: 3-3:50 PM
Exam 1

Week 7

Monday
Holiday

Wednesday
Time: 3-3:50 PM
Topic- Neurotransmitter receptors, Byrne, Heidelberger, and Waxham 285-321

Friday
Time: 3-3:50 PM
Topic- neurotransmitter receptors continued, Byrne, Heidelberger, and Waxham 285-321

Week 8

Monday
Time: 3-3:50 PM
Topic- Student Presentations

Wednesday
Time: 3-3:50 PM
Topic- Intracellular Signaling, Byrne, Heidelberger, and Waxham 119-148

Friday
Time: 3-3:50 PM
Topic- Intracellular Signaling continued, Byrne, Heidelberger, and Waxham 119-148

Week 9

Monday
Time: 3-3:50 PM
Topic- Student Presentations

Wednesday
Time: 3-3:50 PM
Topic- Pharmacology and Biochemistry of Synaptic Transmission, Byrne, Heidelberger, and Waxham 207-237

Friday
Time: 3-3:50 PM
Topic- Pharmacology and Biochemistry of Synaptic Transmission continued, Byrne, Heidelberger, and Waxham 207-237

Week 10

Monday
Time: 3-3:50 PM
Topic- Student Presentations

Wednesday
Time: 3-3:50 PM
Topic- Molecular Mechanisms of Neurotransmitter Release, Byrne, Heidelberger, and Waxham 443-448, 454-466

Friday
Time: 3-3:50 PM
Topic- Pharmacology and Biochemistry of Synaptic Transmission continued, Byrne, Heidelberger, and Waxham 207-237
(Draft of paper's abstract due by 5:00 PM)

Week 11

Monday
Time: 3-3:50 PM
Topic- Student Presentations

Wednesday
Time: 3-3:50 PM
Topic-Review of exam 2

Friday
Time: 3-3:50 PM
Exam 2

Week 12

Spring Break

Week 13

Monday
Time: 3-3:50 PM
Topic- Student presentation

Wednesday
Time: 3-3:50 PM
Topic- Molecular Mechanisms of Neurotransmitter Release, Byrne, Heidelberger, and Waxham 443-448, 454-466

Friday
Time: 3-3:50 PM
Topic- Molecular Mechanisms of Neurotransmitter Release, Byrne, Heidelberger, and Waxham 443-448, 454-466

Week 14

Monday
Time: 3-3:50 PM
Topic- Student Presentations

Wednesday
Time: 3-3:50 PM
Topic- Different forms of long-term potentiation, Kendal et al., 1490-1503

Friday
Time: 3-3:50 PM
Topic- Different forms of long-term potentiation continued, Kendal et al., 1490-1503
(Draft of paper due by 5:00 PM)

Week 15

Monday
Time: 3-3:50 PM
Topic- Student Presentations

Wednesday
Time: 3-3:50 PM
Topic- Repairing the Damaged Brain, Kandel et al., 1284-1305

Friday
Time: 3-3:50 PM
Topic- Repairing the Damaged Brain continued, Kandel et al., 1284-1305

Week 16

Monday
Time: 3-3:50 PM
Topic- Student Presentations

Wednesday
Time: 3-3:50 PM
Topic- Student Presentation

Friday
Time: 3-3:50 PM
Topic- Review Final Exam

Week 17

Final Exam