# BIOLOGY 450

**NEUROBIOLOGY**

**Fall Semester, 2020**

**Course summary:** Neurobiology is a vast, rapidly-changing field of life science that focuses on the brains and nervous systems of diverse animals. This course will provide an overview of principles, concepts, and current research in neurobiology and related fields. Lectures will encompass topics such as cellular neurophysiology, neuroethology (the neurobiology of animal behavior), behavioral and sensory physiology, development of the nervous system and learning and memory. The class includes both textbook readings and analysis of primary research papers. It is intended for upper-level undergraduates (juniors and seniors) and beginning graduate students who wish to acquire a foundational knowledge of contemporary neurobiology.

**Instructor (first half of course):** Dr. Brad Dickerson ( [bdicker@email.unc.edu](mailto:bdicker@email.unc.edu) )

**Instructor (second half of course):** Dr. Toshi Hige ( [hige@email.unc.edu](mailto:hige@email.unc.edu) )

**Lectures:** 10:40 a.m. to 11:30 a.m. on Monday, Wednesday, and Friday on Zoom. The Zoom meeting ID will be announced on Sakai. This course has no lab.

**Textbook:** Neuroscience: Exploring the Brain by Bear et al. (4th edition). Supplementary readings on specific topics may also be assigned; these will be available as PDFs on Sakai.

# Office Hours: Virtual office hours (on Zoom) will be offered upon request. Students may request one by email.

**Grading:** Grading will be based on the following:

Exams 1-3 (80 pts each) 240

Worksheets on primary literature 40

Final Exam 80

# Total Points 360

**Exams:** Three mid-term exams and a Final exam will be offered via Sakai. There will be a sharp deadline for each exam, but students will be given some flexibility for when to work on the exams.

**Make-up Assignments:** To make up the cancelled classes, extra assignments will be issued. The detailed instruction will be provided later.

# TENTATIVE LECTURE SCHEDULE (expect changes):

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| --- | --- | --- | --- |
|  | Professor Dickerson |  | Professor Hige |

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| --- | --- | --- | --- |
| 1 | M | 8/10 | Course intro; anatomy of neurons |
| 2 | W | 8/12 | Membrane potentials; resting potential; Nernst equation |
| 3 | F | 8/14 | Bio-electricity; Goldman equation; ion pumps |
| 4 | M | 8/17 | Ion channels; electrical gradients and behavior: paramecium movement |
|  | W | 8/19 |  |
|  | F | 8/21 |  |
|  | M | 8/24 |  |
| 5 | W | 8/26 | Action potentials in theory |
| 6 | F | 8/28 | Action potentials in practice; action potential propagation; e-phys methods |
| 7 | M | 8/31 | Electrical and chemical synapses; neurotransmitters; neuromodulators |
| 8 | W | 9/2 | Primary literature reading (Electrical and chemical synapses) |
| 9 | F | 9/4 | Primary literature reading (Electrical and chemical synapses) |
|  | M | 9/7 | No Class; Labor Day |
| 10 | W | 9/9 | Primary literature reading (Electrical and chemical synapses) |
| 11 | F | 9/11 | Primary literature reading (Electrical and chemical synapses) |
| 12 | M | 9/14 | **Mid-term Exam 1** |
| 13 | W | 9/16 | Neuroethology; command neurons for escape behavior |
| 14 | F | 9/18 | Programs for movement; locust and fly flight |
| 15 | M | 9/21 | Path planning; goal-directed behavior; navigation |
| 16 | W | 9/23 | Primary literature reading (Neuroethology) |
| 17 | F | 9/25 | Primary literature reading (Neuroethology) |
| 18 | M | 9/28 | Primary literature reading (Neuroethology) |
| 19 | W | 9/30 | Primary literature reading (Neuroethology) |
| 20 | F | 10/2 | **Mid-term Exam 2** |
| 21 | M | 10/5 | Vision: phototransduction I |
| 22 | W | 10/7 | Vision: phototransduction II |
| 23 | F | 10/9 | Visual processing in the retina |
| 24 | M | 10/12 | Evolution of the visual system |
| 25 | W | 10/14 | Higher-order processing of vision |
| 26 | F | 10/16 | Developmental plasticity of visual circuits |
| 27 | M | 10/19 | Primary literature reading (Vision) |
| 28 | W | 10/21 | Primary literature reading (Vision) |
| 29 | F | 10/23 | Primary literature reading (Vision) |
| 30 | M | 10/26 | Primary literature reading (Vision) |
| 31 | W | 10/28 | **Mid-term Exam 3** |
| 32 | F | 10/30 | Mammalian olfactory system I |
| 33 | M | 11/2 | Mammalian olfactory system II |
| 34 | W | 11/4 | Invertebrate olfactory system |
| 35 | F | 11/6 | Learning and memory: synaptic plasticity |
| 36 | M | 11/9 | Learning and memory: invertebrate models |
| 37 | W | 11/11 | Primary literature reading (Learning and memory) |
| 38 | F | 11/13 | Primary literature reading (Learning and memory) |
| 39 | M | 11/16 | Primary literature reading (Learning and memory) |
| 40 | M | 11/23 | **Final Exam** |

**Honor Code:** Observance of the UNC Honor Code is expected. For more information on the honor code and honor system at UNC please visit https://studentconduct.unc.edu.

**Accommodations:** If you need an accommodation for a physical or learning disability, please contact Accessibility Resources and Services (ARS website: https://accessibility.unc.edu; phone: 919-962-8300; email: accessibility@unc.edu). Please also notify your instructors by e-mail or in person so that we can help ensure that suitable arrangements are made to meet your needs.