<u>BIOL 11.09</u> (Fall 2025): Biology of the Brain – Professor Dipon Ghosh

This course seeks to introduce students to the wonders of the brain and how it works through its basic cellular unit: the neuron. Importantly, this course is intended for students *with no prior knowledge* interested in indulging their curiosity about basic biology and neuroscience. We will first establish some fundamental principles of the biology of the neuron. Next we will examine how neurons connect with one another, change and learn, and control behavior. Finally, we will explore our current understanding of neurobiology in disease and neurotechnology. The class will consist of lectures with weekly quizzes and culminate with a cumulative final exam.

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Lecture:	MWF 12:50 – 1:55 PM, LSC 201
Instructor:	Professor Dipon Ghosh, LSC 334
Email:	dipon.ghosh@dartmouth.edu
Office Hours:	Tuesdays 1:20 – 2:10 PM (12 X-hour) Thursdays 2:00 – 3:00 PM [unless otherwise indicated]
Textbook:	No textbook required; however, *The Neuron: Cell and Molecular Biology, 3rd edition* and *Principles of Neural Science, 6th edition* are available via reserves at the library as supplements for lecture material
Available:	PowerPoint slides will be posted on Canvas
Prerequisites:	None
Class Schedule:	Please find below a tentative schedule for the course. Note that the schedule is subject to change.

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Learning Goals:

1. *Develop familiarity with the basics of biology and how the brain works.* The primary goal for this course is to introduce you to basic concepts of biology with an emphasis on the neuron. We will learn fundamental concepts and principles of biology and neuroscience. An overarching goal of the course is to promote conversational fluency in biology and neuroscience and help you engage with contemporary neuroscience-related topics of interest to you and/or covered by media. The course might also help you cultivate and sharpen your interests in biology – even with no prior knowledge – and prepare you for more advanced courses in the future.

2. *Increase analytical skills related to science and science media.* A secondary – and more minor – goal for this course is to help you practice analytical skills necessary to apply your understanding of course material to new situations (in the form of a question on a quiz, science-related media, etc.).

Discussion and Lectures:

A tentative schedule of class meetings and lecture topics is detailed below. The course can be thought of through the following sections:

Part 1 – breaks down the cell biology of the neuron as it relates to function

Part 2 – focuses on the dynamic aspects of neuron-to-neuron connections

Part 3 – explores how neurons help perceive and navigate the world

Part 4 – examines how neuronal function and dysfunction affects human health

Class Schedule:

(*Please note that the schedule is subject to change and that lecture topics might not follow the exact and discrete timings described below.*)

[Organized by Session #; Date; and Topic]

1	Sept. 15	Course Overview
		Part 1: How to Make a Neuron
2	Sept. 17	Protein Structure and Function
3	Sept. 19	Lipid Membrane Structure and Function
4	Sept. 22	The Action Potential
5	Sept. 24	The Action Potential
6	Sept. 26	Signal Propagation I: Vesicles
7	Sept. 29	Signal Propagation II: Transmitters
8	Oct. 1	Signal Propagation III: Receptor Signaling
9	Oct. 3	Signal Propagation IV: Information
10	Oct. 6	Protein Trafficking
11	Oct. 8	Establishing Neuronal Morphology
12	Oct. 10	Neuronal Metabolism
13	Oct. 13	Glial Functions in the Brain
		Part 2: Neuronal Circuits
14	Oct. 15	Exploring a Reflex Circuit
15	Oct. 17	Neuronal Pathfinding and Synaptogenesis
16	Oct. 20	Synaptic Plasticity
17	Oct. 22	Peripheral Nervous System
		Part 3: Neurons and Behavior
18	Oct. 24	Sensory Systems I
19	Oct. 27	Sensory Systems II

20	Oct. 29	Sensory Systems III
21	Oct. 31	Sensory Systems IV
22	Nov. 3	Connecting Internal State with Behavior
23	Nov. 5	Connecting Diet with Behavior
24	Nov. 7	Sensorimotor Systems in Ecological Interactions
		Part 4: Neurons and Health
25	Nov. 10	Neuronal Dysfunction and Neurodegeneration
26	Nov. 12	Neuronal Dysfunction and Neurodegeneration
27	Nov. 14	Neurons on Drugs
28	Nov. 17	Neurotechnology

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Course Mode and Attendance:

We will meet in-person for lectures on MWF at the designated “12” class time. Office hours will take place during the X-hour on Tuesdays and an additional hour on Thursdays. In-class attendance is strongly encouraged but not required.

Assignments and Grading Policies:

Grading will be based on a total of eight weekly quizzes – completed by noon on Wednesdays, unless noted otherwise – and a final exam with set time limits and deadlines offered through Canvas. Quizzes can be taken with the assistance of notes and course materials. The lowest quiz score will be replaced with the highest for the final grade. The use of AI for these assessments is prohibited; note that AI can produce misleading or incorrect information that leads to incorrect answers. No additional homework will be required for the class. Final grades will be determined as follows:

Quizzes: – 80%

Final Exam: – 20%

Academic Honor Principle:

As stated by the Dartmouth College Student Handbook: "Any student who submits work which is not his or her own, or commits other acts of academic dishonesty, violates the purposes of the College and is subject to disciplinary action, up to and including suspension or separation." The complete text of the Academic Honor Principle is available online. Any violations of the Honor Principle will be referred to the Undergraduate Judicial Affairs Office and can result in a hearing before the Committee on Standards and can result in your suspension for multiple terms or, in the most extreme cases, separation from the College. Note that the Faculty Handbook of Dartmouth College states explicitly that College Faculty members are obligated to report potential violations of the Academic Honor Principle to the Dartmouth College Committee on Standards. Should the Committee on Standards find the student to be in violation of the

Academic Honor Principle, punishments usually involve suspension for multiple terms or separation of the student from the College.

For the purposes of this class, this policy applies both to the quizzes and the final exam. You should take the quizzes and final exam by yourself without the assistance of others and AI.

Wellness Support for Dartmouth Students:

We recognize that the academic environment at Dartmouth can be challenging and intense. Please note several resources available to you on campus to support your wellness, including: your undergraduate dean, Counseling and Human Development, and the Student Wellness Center. Finally, please feel free to reach out to me at any point to discuss any matters arising.

Student Accessibility Services:

Students requesting disability-related accommodations and services for this course are required to register with Student Accessibility Services *(SAS; Apply for Services webpage; student.accessibility.services@dartmouth.edu; 1-603-646-9900)* and to request that an accommodation email be sent to Prof. Ghosh in advance of the need for an accommodation. If necessary, students should schedule a follow-up meeting with Prof. Ghosh to determine relevant details such as what role SAS or its Testing Center may play in accommodation implementation. This process works best for everyone when completed as early in the quarter as possible. If students have questions about whether they are eligible for accommodations or have concerns about the implementation of their accommodations, they should contact the SAS office. All inquiries and discussions will remain confidential.

Religious Observances:

Dartmouth has a deep commitment to support students' religious observances and diverse faith practices. Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me as soon as possible—before the end of the second week of the term at the latest—to discuss appropriate course adjustments.

Title IX:

At Dartmouth, we value integrity, responsibility, and respect for the rights and interests of others, all central to our Principles of Community. We are dedicated to establishing and maintaining a safe and inclusive campus where all community members have equal access to Dartmouth's educational and employment opportunities. We strive to promote an environment of sexual respect, safety, and well-being. Through the Sexual and Gender-Based Misconduct Policy (SMP), Dartmouth demonstrates that sex and gender-based discrimination, sex and gender-based harassment, sexual assault, dating violence, domestic violence, stalking, etc., are not tolerated in our community.

For more information regarding Title IX and to access helpful resources, visit Title IX's website (sexual-respect.dartmouth.edu). Note that as a faculty member, I am required to share disclosures of sexual or gender-based misconduct with the Title IX office.

If you have any questions or want to explore support and assistance, please contact the Title IX office at 603-646-0922 or TitleIX@dartmouth.edu. Speaking to Title IX does not automatically

initiate a college resolution. Instead, much of their work centers around providing supportive measures to ensure you can continue to engage in Dartmouth's programs and activities.

Special appointments:

Please email Prof. Ghosh to set up an appointment to discuss one-on-one any specific concerns, difficulties, or interests that you have related to the course.