Introduction to Neuroscience/ Biological Psychology (BIO-205/PSY-211)

COURSE INSTRUCTOR: BITTU K. (BITTU@ASHOKA.EDU.IN)

LEARNING OBJECTIVES

The goal of this class is to enable students to understand how a biological system mostly composed of salty proteinaceous water bounded by fat is able to signal information, perform complex computations and produce behaviour. We will start by understanding how single neurons can perform computations and can be understand in the same framework as electronic circuitry. We will understand then how complex information processing and calculation can happen as a result of the ways in which multiple neurons signal to and connect to one another. We will then look at how the brain is organized, and study the nervous systems of humans and other animals, approaching this through the lens of the various tools that neuroscientists have historically used to study neuronal connectivity and the brain. We will cover the electrical properties of nerve cells and voltage dependent membrane permeability; channels, transporters, neurotransmitters and their receptors; synaptic transmission; the brain and its development and plasticity. We will also study complex brain functions and the neural basis of complex cognition, learning and information processing.

We explore the ways in which the neuronal processes underlying behaviour have been deduced from various animal models of behaviour, and ways in which genetics and the environment shape the systems that produce behaviour during development. We will explore sensory perception and motor movement in depth. In order to equip students to become familiar with the level of rigour needed to think through some of these questions, we will also look at how to survey and evaluate literature in the field of biological psychology, how to quickly but accurately read graphs and how to cite literature.

We then turn to the question of how we learn, how we absorb new material, the ways in which our neural systems tend to conflate correlation and causation, and how critical thinking and

environmental training can change learning patterns and feedback to change the structure of the brain. We will take a quick look at the neural basis of complex and interesting phenomena such as motivation, emotion, cognition, consciousness, attention. We will end with an exploration of how neural systems can exhibit pathology, how neurodegeneration and trauma can impact the system, and how medication and drugs work, with a focus on the limitations of what we collectively understand and the pressing need for further research to take forward the field. This course eventually hopes to make clear the relationship between brain and behaviour.

COURSE GOALS AND STUDENT EXPECTATIONS

This course is offered to both biology and psychology students and covers the same ground as a standard course on Biological Psychology. It aims to introduce neuroscience as a specialized discipline, and to enable students to understand how a biological system is able to signal information, perform computations and produce behaviour.

The main expectation of students is that they pay full attention in class, alerting the TF or me, through class discussions or by posting on Piazza if there is anything they do not understand. Piazza posts are encouraged to be public, so that other students can benefit from reading responses to questions asked, although they can certainly be anonymous. Since each week of class builds on the previous week, it is important that everyone is on board, so if there is something that you are not clear on by the end of class, go through the material and attend the discussion section. The weekly quizzes should also provide feedback on what you do and do not fully comprehend, and I will also incorporate mistakes made in the exam into my class structure, explicitly addressing ways in which neural systems tend to be misunderstood.

COURSE STRUCTURE

Week	starts	Tuesday	Thursday	Assignments
1	27 Aug	What is a neuron?	How do neurons function? I	-
2	3 Sep	How do neurons function? II	How do neurons process information?	Quiz 1
3	10 Sep	What is a neural circuit?	How do neurons communicate?	Quiz 2
4	17 Sep	Synapses and drugs	What is in a human brain?	Quiz 3
5	24 Sep	What is in the human spinal cord?	Experimental neuroscience	Quiz 4
6	1 Oct	Genetics and development	Neural development	-
	8 Oct	Dussehra and	Mid semester break	
7	15 Oct	Animal behaviour	Human and animal brains	Quiz 5
9	22 Oct	Learning and memory I	Learning and memory II, Nature vs. Nurture	Quiz 6
10	29 Oct	Sensory perception and Movement (and sport and art)	Emotion and "rationality", Motivation, inhibition	Quiz 7
11	5 Nov	Communication and language	Decision making	Quiz 8
12	12 Nov	Attention and sleep	Consciousness!	Quiz 9
13	19 Nov	Mood, depression, anxiety	Drugs and medicines for the brain	Quiz 10
14	26 Nov	Schizophrenia, Parkinsons and Alzheimers	Trauma, neurodegeneration and recovery	Quiz 11
15	3 Dec	Reading week		-
16	10 Dec	Exam week		-

GRADING

This class will have eleven weekly quizzes, all open book. The idea behind this is to keep providing conceptual testing to enable you to check the soundness with which you have understood the material. There will be no testing requiring rote learning or simply checking familiarity with information. The best 9 out of 11 will count towards 90% of your final grade. If one wants to pick the best 8 out of 11, one can make up for one test with the submission of an assignment on a topic of one's choice related to the neural basis of behaviour, or neuroscience, counting for 10% of one's final grade.

The quizzes will be administered by Google Forms. This requires a laptop or phone in class. Email the TF if this is a problem for any student at any point in time. The quizzes will be administered at the beginning of the Thursday class, and should take 15 minutes. Grades will be autograded and returned with the answer scheme by the following Tuesday at the latest, for immediate feedback.

Here is the assignment prompt:

Pick a question of interest - but it must be in the field of neuroscience, not psychology. To answer this, pick a review paper if you can find one, and at least 1 original research papers to review, and write 500 words on the answer to your question. Frame the question in a sentence or two, and dive into what you have learned. You will be assessed on the accuracy of your description of the contents of each of the papers you have looked at, as well as your critical understanding of what they contribute and where they fail to find convincing answers to your question. Feel free to look at more papers; but if you describe and critically assess two papers, one review and one original, that should suffice for an A.

You can use scholar.google.com to search; for medical searches one can additionally use the search engine Pubmed (https://www.ncbi.nlm.nih.gov/pubmed/). Full text can be found at sci-hub.tw, where you can just enter the full title of the paper.

Your participation in class or even by email or Piazza will count towards the remaining 10%. In terms of class participation, questions in class will be counted, as will engaging on Piazza, by email, etc. Your attendance is a small part of your participation grade.

The grading scheme will be absolute, not relative or curved or cluster based - guidelines are objectively defined and no competition between students is involved, so please feel free to learn from and engage with each other. The standard conversion is > 90% A, 85-90 A-, 80-85 B+, 75-80 B and so on.. <45 F. If no students get an A, this is revised downwards to >85 A, 80-85 A-, .. etc., but no further.

Feedback on testing and evaluation paradigms is welcomed.

MATERIALS AND RESOURCES

The recommended textbook for this course is Biological Psychology by James W. Kalat. I have a physical copy of the 11th edition. A soft copy of the 10th edition is also available on Piazza - the 10th and 11th editions do not differ hugely and I'd recommend this for anyone who is comfortable with reading on their computers.

For additional reading students can refer to:

Kandel, E. R., Schwartz, J. H., & Jessell, T. M. (2000). Principles of neural science. New York: McGraw-Hill, Health Professions Division.

Purves, D., Augustine, G., Fitzpatrick, D., Hall, W., Lamantia, A.-S., & White, L. (2012) Neuroscience. Sinauer Associates, Inc.: Sunderland, MA.

Soft copies of all are available on Piazza.

Language diversity - will be enabled upon request.

COMMUNICATION AND FACULTY EXPECTATIONS

I will use Piazza to communicate with students. In addition, students can use Piazza to communicate with each other, and to ask shared questions and initiate discussions. In case anyone finds Piazza hard to use, you can email me at: bittu@ashoka.edu.in

I will typically respond to an email between Tuesday and Thursday within 24-48 hours. Between Friday and Monday, if I am away for fieldwork, you may not receive replies to questions until Monday night.

Office hours - 3-4 pm every Tuesday, in my office: room 308 in the new science block. People can always write in to me for extra office hours; I will email if I need to be out of office during these hours for official reasons.

The Teaching Fellow for this course, Susan Mathew <susan.mathew_ugta@ashoka.edu.in> will also hold office hours, and these can be scheduled by appointment. For any questions that you find difficult to ask in class, or for any concerns around quiz grading, please write to her, and if she thinks your question needs additional clarification she will pass the request on to me.

This course will also use innovative teaching tools in the discussion section, such as simulations, to understand how various factors affect neuronal functioning, and experiments to demonstrate neurons in action and how various interventions affect neuronal functioning.

POLICIES

Attendance: will be tracked for class participation, but not as a barrier to doing exams, etc. Missing class is a student's loss. For students who miss class for unavoidable reasons, they can visit the TA, during office hours for help.

Accessibility/Universal Design for Learning: This syllabus is designed to be disability accessible, in terms of font use and structure. If anyone has feedback on how to make the course more accessible, or would like specific changes put in place to make the syllabus, class slides, class teaching, or materials for this course more accessible, please write to me and copy the Office of Learning Support in your email.

No plagiarism tolerance policy!

No cheating policy: cooperative group work is encouraged, and all work is open book. However, identical wording across submissions will be considered a form of plagiarism. Only ideas can be shared.

No discrimination or ridicule policy!!!

Laptop and phone policy -   phone checking is discouraged simply because it leads to gaps in conceptual understanding. Laptops can be helpful for discussion sections and simulations. Food and drink are allowed in class.