MCB81/80x Course Intro: The Complex Species from MCB81/80x on Vimeo.

MCB 81: Fundamentals of Neuroscience

Harvard College/GSAS: 159708
Fall 2017

Meeting Time/Place: Class Session: Wednesday, Friday 11:00am - 11:59am, Location: Vanserg 210

Section: Mondays 11:00am-11:59am

Labs: Monday 6-8pm (periodically throughout semester), Northwest Basement Labs

Exam Group: N/A
Course Description: An intensive introduction to topics in neuroscience, ranging from the inner workings of neurons, to the function of small neuronal networks, to the function of brain systems that give rise to perception, thought, emotion, cognition and action. The course will emphasize student-directed learning and will follow an "inverted" structure: students will be expected to watch lecture videos and complete exercises outside of class, and classroom time will be primarily reserved for discussion and in-class exercises.

Note: This course serves as a more rigorous alternative to MCB 80 and is primarily intended for students who intend to concentrate in neurobiology or who intend to pursue neurobiology as a secondary field. MCB 81 may not be taken for credit by students who have taken MCB 80.

Supporting Website: http://www.fundamentalsofneuroscience.org

Enrollment Note: Enrollment will be limited to **30 students**. We will ask interested students to fill out a brief questionnaire (**due by midnight, 9/3**) describing their background and why they are interested in taking the course. If student interest exceeds our enrollment cap, we may run a lottery. We apologize in advance to any students who are not able to enroll. Due to the uncertainty around enrollment, we encourage students interested in MCB81 to also consider shopping MCB80.

Format / Philosophy / Who is this course for?:

MCB 81 is â€œflipped classroomâ€ course â€“ students will be expected to do substantial reading and exploration of online materials outside of class, and class time will be reserved for discussion, demonstrations and lab exercises. The flipped classroom philosophy is built upon the central tenant that classroom time is better spent actively discussing and synthesizing ideas, rather than trying to passively absorb facts in lecture format. Students will be required to be active participants in class discussion, and participation will count for a significant portion of studentsâ€™ grades. Outside-of-class materials will include online readings as well as lessons from MCB81â€™s sibling online HarvardX course (MCB80x).

A common complaint about introductory science courses is that they often feel like exercises in â€œstamp collectingâ€ â€“ students memorize a litany of facts, and then they regurgitate them for an exam. In an effort to avoid this trap in MCB 81, our guiding premise is that **this course aims to teach students to think like neuroscientists**. To be sure, â€œthinking like a neuroscientistâ€ requires learning a certain body of factual knowledge, but weâ€™ll expect you to get those facts outside of class, so that we can focus *in class* on what puzzles, interests, or inspires you about the material. Consistent with our â€œthink-like-a-neuroscientistâ€ mantra, weâ€™ll incorporate several elements not typically found in an introductory science course: First, many section meetings will focus on **reading original neuroscience papers** from the primary literature. Thus, in addition to learning about what is known in neuroscience, weâ€™ll heavily emphasize *how* that knowledge was discovered, and students will get firsthand experience reading / interpreting / dissecting scientific papers. Weâ€™ll also include several **exploratory lab sessions** (during section timeslots throughout the semester) in which you get hands-on experience with real neuroscience tools, and during which weâ€™ll encourage you to ask your own questions. Finally, in recognition of that fact that communication is a critical component of being a scientist, the course will include **two major creative presentation assignments that take the place of traditional midterm and final exams**. In these assignments, students will work in groups to deeply

research a paper or topic of their choosing and produce an â€œexplainerâ€ video that clearly and concisely explores topics in neuroscience at multiple levels of analysis (molecular, cellular, systems, etc.). These assignments will become a part of the online course MCB80x (http://www.fundamentalsofneuroscience.org) where we anticipate that they will be viewed by thousands of students around the world. More details about these assignments will be available during shopping week.
The ideal student will be self-motivated and driven by an interest in neuroscience that extends beyond filling requirements; potential neurobiology concentrators are especially encouraged to consider taking this course. We hope to enroll a diverse group of students, with different backgrounds, interests, and strengths.

Relationship to MCB80: MCB81 is intended to be an interchangeable, â€œdrop-inâ€ alternative to MCB80. MCB81 will count for all of the same concentration and MBB requirements as MCB80. One exception: MCB81 does not explicitly count for Gen Ed credit. MCB81 is intended primarily for those interested in potentially concentrating in Neurobiology, or those who would like to pursue a secondary in Neurobiology. In general, MCB81 will be more rigorous and more time-intensive than MCB80, and it will involve much more interaction with the course staff, as compared to MCB80. Topic coverage will be largely the same between the two courses, though there will be some variation in exactly which topics are covered. Both courses will prepare students for any upper-level couse in Neurobiology.

Prerequisites: There are no hard-and-fast prerequisites, but it would be helpful to have some previous background in biology and/or chemistry. Students with strong quantitative backgrounds are also welcome, irrespective of past exposure to courses in biology.

Outside-of-class reading / viewing: Students will be assigned readings from a variety of sources, including textbook chapters, research articles and reviews, and video/interactive lessons. Each of these reading types are detailed below. Reading assignments will be available at least one week prior class. We strongly encourage students to read these materials as they come (rather than reading far ahead), so that the material will be fresh in mind for class discussion. Students will also be expected to seek out other information (e.g. on the internet) as appropriate.

Online Material / Lectures / Interactive Materials:

MCB 81 will partly rely on its online sibling **MCB80x** for lectures and interactive lessons (yes, the naming conventions are a bit confusing -- weâ€™re working on fixing that, but the registrar moves slowly). You can check out the online course at http://www.FundamentalsOfNeuroscience.org. MCB80x is part of Harvardâ€™s ambitious HarvardX online education initiative and has been accessed to date by almost 200k students from 207 countries. As part of their participation in MCB 81, students will create materials that will become part of MCB80x.

An interactive simulation / lesson from the MCB80x online course

Textbook (online): UTHealth Neuroscience Online (http://neuroscience.uth.tmc.edu)

Textbook (physical; optional): â€œNeuroscience: Exploring the Brainâ€ by Bear, Connors, & Paradiso. 4th edition.

Course Forums / Online Communication: For course discussion, logistics, etc., we will be using Slack (http://www.slack.com). Slack is basically a big group chat room divided into topic-based channels, and itâ€™s a good place to discuss course material with your fellow students and to communicate directly with course staff. It can be accessed on the web, or via native apps for Mac, Windows, iOS and Android. Upon enrolling in the course, youâ€™ll receive an invitation to join our Slack team by email.

You can also find us on Twitter with the handle @HarvardMCB81.

Assignments:

Problem Sets: Weâ€™ll have two traditional problem sets early in the course when we cover bioelectricity in neurons. Please consult the course calendar for due dates.

Midterm Project: For the midterm project, students will work in groups of 4 to create a ~15 min

presentation (+5 min questions) describing a primary research article in plain language. The presentation will be filmed live in a specially-designed studio setup in the Bok Center, with the intention that the resulting videos will become part of MCB80x, the online â€œsiblingâ€ to MCB81. Students will work with their TF to choose an appropriate paper and to vet drafts at various stages of completion, and an annotated bibliography will be due prior to the presentation (consult calendar) Optional evening/daytime workshops on visual communication, oral communication and storyboarding will be available from the Bok Center and MCB 81 staff to help construct an effective presentation. All members of the group will be expected to contribute to the final project, but not all students need to contribute in the same way. All students will be required to complete a brief collaboration questionnaire detailing the contributions of each group member.

The Bok Center studio, where midterm and final presentations will be filmed.

Final Project: For the final project, students will work in groups of 3-4 to create a ~20 min presentation that explains a neuroscience topic of broad public interest in plain language, suitable for dissemination on the MCB80x course website and on public venues (e.g. Youtube, Vimeo). The project should be anchored in subjects covered in the course and should span multiple levels of analysis â€“ e.g. molecular, cellular, systems, etc. neuroscience. The presentation will be accompanied by a ~5 page, single-spaced written report that complements the presentation. Students will work with course staff to choose an appropriate topic and to iterate on drafts of the presentation.

Midterm Peer Feedback: All student midterm presentations will be screened in class, and fellow students will be asked to produce a roughly 1-page constructive formal critiques of these presentations.

Daily Response Prompts: at midnight Eastern time before each class discussion, students will be required to have completed a brief short answer assignment to prepare for discussion. For each session, this assignment will ask: 1) â€œWhat was the most interesting take-away message / big idea that you learned from this sessionâ€™s materials?â€ 2) â€œWhat aspects of the material puzzle you? What parts are still unclear?â€, and 3) â€œWhat do you wish you had learned more about?â€ Additional questions may be added on a class-by-class basis.

Exploratory lab sessions, featuring lab kits from Backyard Brains.

Labs: MCB81 will include a series of laboratory sessions scheduled periodically throughout the semester on Mondays 6-8pm in the NWL basement labs. These lab sessions will be exploration-focused, with students being encouraged to ask their own questions. No formal lab reports will be required.

Grading:

Grades will be computed as a weighted average of the following components:

- Class Participation: 30%
- Problem Sets: 10%
- Midterm Project: 25%
- Final Project: 30%
- Peer Grading: 5%

There will be no midterm or final exams in this course.

There will be no explicit â€œcurveâ€ applied to grades â€“ everyone can, in principle, get an â€œAâ€ if everyone performs up to a high standard. We anticipate that the course will be challenging and involve a great deal of work. However, we are committed to providing regular, clear feedback on where you stand, with ample time for course-correction.

Office Hours:

Standard office hours for the course staff are listed below (other times available by appointment):

- Prof. Cox: Wednesdays at 1pm, unless announced otherwise (Northwest 219.40)
- Dean: Tuesdays 2:30-3:30pm (Northwest 169)
- Tara: Mondays 9:30-11am (Northwest 169)