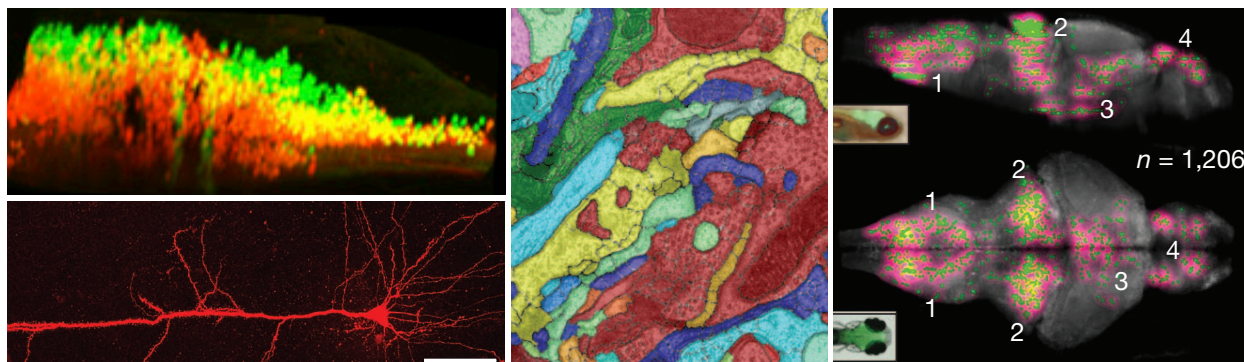


BIONB 4200: FRONTIERS IN NEUROSCIENCE



Course credit: 2 credit hours
 Grading option: S/U only
 Meets Mondays 2:55-4:10 PM
 Location: Mudd W364

Instructor: Dr. Kim McArthur
 klm323@cornell.edu
 Office hours: by appointment
 Office location: Mudd W101

Announced in 2013, the BRAIN Initiative will bring together neuroscientists and technological innovators to advance our understanding of how the human brain really works. What are the big questions that we will be able to answer with these new methodological approaches? How can these advances in understanding be translated into improved prevention and treatment of mental illness and neurological disease?

In this course, you will learn more about model systems and cutting-edge technology used to ask questions at the frontiers of neuroscience, guided by primary literature and in-class discussions. You will also evaluate neuroscientific research in the context of public policy and the need for clinically relevant neuroscience. Grading will be based on participation in class discussions, and each of you will be expected to lead discussion at least once during the semester. For each topic, we will discuss current findings in basic science, related technological breakthroughs, and the clinical and ethical implications. Of course, I want to introduce each of you to new ideas and approaches in neurobiology. More importantly, I hope that this course will push you to ***think like scientists - to not only understand a new idea but to apply it, discuss it, evaluate it, and challenge it.***

In this course, we will accomplish the following learning outcomes:

- ★ Learn about state-of-the-art approaches and techniques in neuroscience, and become familiar with key issues facing the field.
- ★ Read and evaluate primary scientific literature.
- ★ Give clear and engaging presentations of scientific material.
- ★ Participate in informed and respectful discussions about scientific research.
- ★ Integrate new information from current primary literature with material learned in other classes.
- ★ Evaluate approaches to important scientific questions - strengths, limitations, and implications for human health.

Course materials: All course materials will be made available on the course Blackboard site. These include links to weekly readings and descriptions of each assignment.

Performance Assessment:

- ☒ Attendance (x12) - 12% total
- ☒ Follow-up questions (x1) - 2% total
- ☒ Completion of literature ?'s (x8) - 16% total
- ☒ Discussion leadership - 30% total
- ☒ Panel participation (x2) - 40% total (15% + 25%)

Satisfactory Grade = 70% points earned or higher

COURSE STRUCTURE

The semester will be divided into two broad topics at the frontiers of neuroscience: 1) cell types and connectivity; and 2) neuronal activity and perturbation. For each topic, we'll begin with a brief overview, then read and discuss selected pieces of primary literature to deepen our understanding of the big questions involved and the technological approaches used to address them, and conclude with simulated review panels.

PRESENTATION + DISCUSSION

Most days in class will have the same basic structure, with most time spent on group presentations and discussions. A pair of students will **lead discussion** of a journal article - providing context for the questions asked, clarifying the approaches used, and evaluating the significance and innovation of the project. All students will be responsible for reading the journal article before class and answering four **primary literature questions**, which will be due at the beginning of class - these worksheets are intended to help you understand the article, articulate your remaining questions, and encourage participation in the class discussion. You must answer these questions for 8/9 readings - you may complete all 9 and count the top 8 scores.

FOLLOW-UP QUESTIONS

The field of neuroscience is fast-paced and complex, and our discussions this semester will test the limits of our understanding. We're all going to have a lot of questions - and there's no way we'll be able to chase down the answer to every one of those questions in-class. (Indeed, some of the most interesting questions may not have a clear answer yet.) Thus, during each class period, we'll identify follow-up questions - things that interest us, things that confuse us - and assigned students will **pursue these questions outside of class and report back briefly at the beginning of the next class period**. Each student will be responsible for pursuing one follow-up question this semester.

REVIEW PANELS

Before scientific research can be done, each project competes to receive funding. Most of that funding is awarded by the National Institutes of Health (NIH). Institutes at NIH receive applications for federal grants, which are evaluated by review panels composed of scientists from across the country. These review panels read the grant proposals, discuss their merits, and recommend which projects should receive funding. This semester, we will hold two simulated review panels. For each review panel day, you'll be divided into small groups (panels). **You'll prepare by reading brief descriptions of several grant proposals, investigating supporting materials, and filling out an evaluation worksheet for each proposal.** You'll meet with other members of your review panel in-class to discuss your evaluations. Finally, you'll simulate a funding council meeting, coming together as a class to discuss your findings and recommendations.

COURSE SCHEDULE

	TOPIC	PREPARATION	IN-CLASS
1/26	Introduction		Course overview + discussion Sign up for presentation slots
2/2	Cell types & connections	Kratsios et al (2012) + ?'s	Topic overview Presentation (me) + discussion
2/9	Cell types & connections	Kinkhabwala et al (2011) + ?'s	Presentation + discussion
BREAK			
2/23	Cell types & connections	Takemura et al (2013) + ?'s	Presentation + discussion Sign up for review panels
3/2	Cell types & connections	Flavell et al (2013) + ?'s	Presentation + discussion Preview review panel
3/9	Review Panel #1	Panel-specific readings Impact WS (x2)	Review panel meetings Discussion
3/16	Activity & perturbation	Ahrens et al (2012) + ?'s Debriefing WS	Topic overview Presentation (me) + discussion Course assessment #1 (optional)
3/23	Activity & perturbation	Gradinaru et al (2009) + ?'s	Presentation + discussion
BREAK			
4/6	Activity & perturbation	Tye et al (2011) + ?'s	Presentation + discussion
4/13	Activity & perturbation	Warden et al (2012) + ?'s	Presentation + discussion
4/20	Activity & perturbation	Chen et al (2013) + ?'s	Presentation + discussion
4/27	Review panel #2	Panel-specific readings Impact WS (x2)	Review panel meetings Prepare for council meeting
5/4	Review Panel #2	Debriefing WS	Council meeting Discussion + debriefing Wrap-up & course assessment #2

ASSIGNMENTS & ATTENDANCE

By assigning work outside of class, my objective is to help you learn - by suggesting structured ways for you to read scientific literature, by providing sets of questions that will help you evaluate scientific approaches, and by encouraging you to prepare for class discussions. Most of your grade will depend on your preparation for class and participation in discussions - as leaders and as contributors. I have provided assessment criteria (rubrics) for each graded assignment; please refer to these often as you prepare for class.

All written assignments are due at the beginning of the designated class period (unless otherwise specified). Written assignments may be submitted as hard-copy (handed to me in-class) or sent electronically (submitted on Blackboard). Because primary literature questions are designed to prepare students for in-class activities, they cannot be turned in late for partial credit.

Because in-class participation is critical for learning in this course, **you should plan to attend every class period**, and attendance will count towards your grade. In particular, you must attend class when you are assigned to answer follow-up questions, when you are assigned to lead a discussion, and during review panels. You may miss one class period without losing points for attendance - however, you must still submit written assignments before the beginning of the class period for that day, to receive credit for the assignment; further, if you miss a day when you are scheduled to present or participate in review panels, you will lose points for those assignments according to the following policies. If you are unable to attend class because of an **excused absence (e.g. medical emergency, family emergency)**, please let me know as soon as possible, and we will arrange a make-up assignment for you - note that you will be asked to provide evidence of the emergency (e.g. doctor's note).

If you miss class for **any other reason, including routine illness**, the following policies apply:

- You will not receive credit for attendance that day - note that you may miss one day without losing points.
- You may receive credit for assigned homework (e.g. primary literature worksheets) if you submit the assignment electronically before the beginning of the designated class period.
- If you were supposed to receive a follow-up question assignment that day, you may email me to receive that assignment - you will receive full credit as long as you attend the following class period (when you are assigned to present your findings) and address the follow-up question in-class. You will not receive credit for your follow-up question if you do not attend class on the day that you are assigned to give your answer.
- Primary literature presentations are like exams - you'll be doing a fair amount of preparation, and it's very important that you make every effort to attend. If you do not attend because of a routine illness (e.g. cold, flu), you will not receive full credit - it would be unfair to your classmates otherwise. However, you may receive partial credit for work you've done to prepare for the presentation, based on your self-assessment (which all students will complete for this assignment anyway) and an additional assessment of your preparatory work completed by other members of your group. I understand that people get sick, and I sympathize - but it's also important to be fair to your classmates.
- Review panels are also like exams. If you do not attend because of a routine illness, you will not receive full credit for the day - however, you will receive partial credit for completing the evaluation worksheets, if you submit them before the beginning of class on the designated day.

If you know that you will miss several class periods for other reasons (e.g. travel), please come and talk to me early in the semester - it might not be appropriate for you to continue in the class. If you lose a lot of points due to routine illness and are concerned about your final grade, I am willing to consider giving make-up assignments on a case-by-case basis, but these will be assigned at my discretion.

If you have any questions or concerns about these policies, please let me know - I'm happy to discuss them with you.

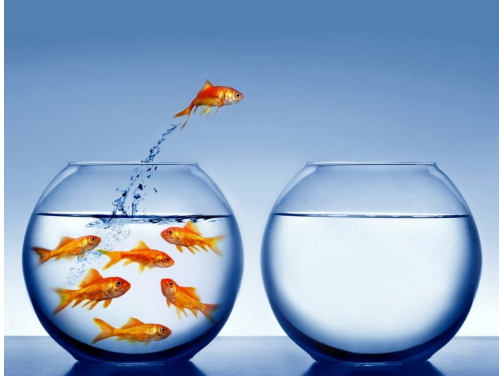
Accommodations for Students with Disabilities

In compliance with the Cornell University policy and equal access laws, I am available to discuss appropriate academic accommodations that may be required for students with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances, so arrangements can be made. Students are encouraged to register with Student Disability Services to verify their eligibility for appropriate accommodations.

Academic Integrity

Each student in this course is expected to abide by the Cornell University Code of Academic Integrity. Any work that you turn in for credit must be your own original work. I encourage you to discuss your work with others - classmates, other students, even other professors. However, you must complete each assignment yourself, in your own words, and you must cite other people's ideas and contributions when appropriate - if you have any questions about when it's appropriate to cite a source, please let me know.

Front page image credits: Kinkhabwala et al. (2011) *PNAS* (upper left); Chen et al. (2013) *Nature* (lower left); Takemura et al. (2013) *Nature* (middle); Ahrens et al. (2012) *Nature* (right)



Imagination is more important than knowledge. For knowledge is limited to all we now know and understand, while imagination embraces the entire world, and all there ever will be to know and understand.

- Albert Einstein

About the Instructor

I am a postdoctoral fellow in the Fetcho lab in the Department of Neurobiology & Behavior. I spend most of my time in the laboratory doing research - and this is the first course that I'm teaching on my own. In the lab, I'm studying the process of circuit-building in the hindbrain of larval zebrafish - specifically, how cranial motor neurons get organized early in development, how this organization leads to proper formation of motor circuits, and what happens when this process goes wrong. I'm looking forward to sharing my enthusiasm for neuroscience and getting to know all of you this semester.

Contact Information

The best way to contact me with questions or comments is by email (klm323@cornell.edu). I check and respond to emails every morning - I'll send a reply the morning after I receive the email, even if I have to get back to you later with the answer to your question. I share an office with other researchers in the Fetcho lab (W101) - feel free to drop by with a quick question, or email me for an appointment. I'm here to help you learn, and I encourage you to ask questions early and often if the assignments or course material are unclear - or if you just want to talk about science. I'm also happy to field questions about careers in academia and research.