The Journal of Undergraduate Neuroscience Education (JUNE), Spring 2014, 12(2):A159-A166
Supplementary Material #1
by Willard & Brasier

Syllabus for Controversies in Neuroscience (03-101)

Mini-1, Fall 2013

Course Description:
This course is designed to be an introduction to neuroscience with an emphasis on current research topics. Students are expected to develop an appreciation for modern hypotheses of brain function and of the problems that contemporary systems neuroscience seeks to address. They will also become conversant in the scientific techniques that facilitate our understanding of brain function.

The course will be structured around historical and active controversies in neuroscience. Students will be expected to understand the foundational material and its relationship to the controversies discussed. Additionally, students should understand the methodology and data behind each competing theory.

Learning Objectives:
In this course, you will learn to read and evaluate scientific results, both on your own and during in-class discussions. You will be able to determine why some results provide compelling evidence for a particular theory and other results may cause difficulty for the theory. You will learn how to provide thoughtful judgments of competing theories, based on evidence, and begin to develop capabilities to participate meaningfully in scientific discussions. Most importantly, you will learn the value of the scientific approach and of weighing evidence and the impact of science.

Class times: MWF 9:30 – 10:20, WEH 5328

Relevant text: *The Structure of Scientific Revolutions*, Kuhn, © 1962, ISBN: 978-0226458120

Instructor: Daniel (DJ) Brasier
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Faculty aspirations:
- Teach you about science – being skeptical, pursuing questions, formulating hypotheses, designing experiments, carrying them out, and making sense of them. Sometimes good ideas are wrong and sometimes (really, always) trying to answer interesting questions only leads to more questions.
- Excite you about neuroscience and about science in general.
- Prepare you to be critical scientific thinkers

Specific Educational Objectives:
- Understand concepts in sensory neuroscience such as receptive fields, maps, labeled lines, and hierarchical processing.
- Understand the methods and approaches used to analyze neural systems.
- Understand the biological bases of some brain disorders.
- Learn to explore and read the primary scientific literature.

How to succeed in Controversies in Neuroscience:

- **Read the assigned readings** *before* **class.** The most important way to make sure you get valuable use out of class time is to walk in the door with some background and basis for understanding the material. You only get to have the lecture once, and the worst thing you can do is have that be your first exposure to the material.
- **Be prepared to discuss assigned scientific literature readings in class.**
- **Come with questions about the readings.** It is vitally important to everyone's success in the class that we spend as much of the lecture time going over the most interesting and challenging concepts. If we spend most of the class discussing things that everyone understood from the reading and then only a small amount of time quickly covering the parts that made no sense, then you will struggle on those issues at the exams; worse, you may never learn them.
- **Ask questions in class.** Whether these are for clarification, repetition, or because you're interested and want to know more, student questions make for a better learning environment for all.
- **Attend class and be attentive in class.** Attending class is the most important thing that you can do to be successful in this class. Take notes during class. Discuss class with each other and with the instructor.
- ***Speak up in class!***
- **Review/think about/talk about what was covered in class.** In addition to simply showing up for class, spend time between lectures looking over your notes and thinking about what was discussed. This daily review of material is an immensely helpful way of preparing for the next lecture, having questions answered in a timely fashion and learning the material. You can do this alone or in groups with other students in the class. You should expect to spend on average 6 hours/week outside class preparing for lectures (9 units means 3 hours in class, 6 hours outside class).
- **Read (about the brain).** Lots of stuff gets written about the brain. You can go to the library, look on-line, read the newspaper/magazines. Talk to me or the TAs to find other stuff that people have written about the brain. All of this will make you a more sophisticated student and will help you to integrate the topics covered in the course.
- **Contact the instructor.** Send e-mail any time. Call or visit during office hours for help with any aspect of the course.
- **Success in this course is about more than your grade.** We want you to learn to think scientifically about your brain. This will serve you well long after you stop caring about your transcript.

Evaluation:

40%	Highest scoring report
20%	Lowest scoring report
20%	Class participation
20%	Final exam

- **Written reports.** Each unit in this class revolves around an active controversy in neuroscience. Generally, these controversies include competing views, each of which is supported by its own body of data. The written reports require students to briefly summarize a controversy and explain the central pieces of data that support each side of the controversy. The students will then take a side in the controversy, and explain why they agree with that side. Finally, the students must explain how the data that conflict with their view can be explained.
    - **Details about the proposals (length, etc.) will be given out at the second class meeting.**
- **Final exam.** The final exam is cumulative and covers all the material from the course.

Academic Integrity:

- **Cheating.** Cheating of any sort will not be tolerated. For example, if quiz or exam answers are copied from another student, both students will receive zeros; if graded exams or quizzes are altered and resubmitted for a higher score, the revised score will be zero. In addition, these and other forms of cheating may also be referred to the Academic Review Board for more severe penalties. This warning has two purposes: 1) to dissuade a small number of students from even thinking about cheating; and 2) to persuade the large majority that they will get a fair grade based on their individual performance.
- **Plagiarism.** Cheating also includes plagiarism, the presentation of the work of another person as one's own. This applies whether the source of the material is a printed book, a web site, or work of another student from this course or any other course. Lifting even a single sentence without appropriate attribution constitutes plagiarism. Read Promoting Academic Integrity (http://www.cmu.edu/policies/documents/Cheating.html) for official university policy on this issue. Any source you reference (aside from the class text book) must be referenced, even if you only used the source for ideas and did not quote a single word. This applies to all work at CMU, but is especially relevant in this class on the reports.

Responsibilities

The choice to take this course is entirely up to you. If you do choose to take the course, please do your best to be a good course citizen. Although I never take attendance, this means you should make every effort to attend all classes on time and to participate in class discussions and activities.

In turn, I will make every effort to build a valuable learning experience for every student. If there is ever any way I can improve your learning, or if any topic doesn't capture your interest, I welcome feedback (either in class, outside of class, or anonymously).

Finally, it is everyone's responsibility to be respectful of others during class.

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Controversies in Neuroscience Schedule

Please check Blackboard regularly for **required readings** & course updates.

Date	Required Reading	Class Topic
Unit 1: Systems Neuroscience: Is the Hippocampus used for spatial or declarative memory?		
8/26		Introduction
8/28-30	Milner	HM & memory
9/4-9	O'Keefe, etc.	Place cells
9/11-16	Squire/Eichenbaum	Non-spatial memory
Unit 2: Cellular Neuroscience: Is long-term potentiation (LTP) presynaptic or postsynaptic?		
9/18		Synaptic transmission
Unit 1 report due 9/23 in class or by e-mail or in Dr. Brasier's office by 4:30 pm		
9/20-23	Bliss & Lomo	Long-term synaptic potentiation & depression
9/25-30	Stevens & Malinow	Quantitative analysis of synaptic strength & Presynaptic LTP
10/2-4	Nicoll; Malenka	Silent synapses
*Unit 1 report **optional** re-write due 10/7 by e-mail or in Dr. Brasier's office by 4:30 pm*		
10/7-11	Mossy Fibers, etc.	Other synapses
10/14		Final exam review
Unit 2 report due 10/16 by e-mail or in Dr. Brasier's office by 4:30 pm		
10/16		Pre-exam Q&A session, 8:00 – 9:30 pm, WEH 5312
Final Exam on 10/18, time & location TBA		

Reading list:

Alvarez P, Lipton PA, Melrose R, Eichenbaum H (2001) Differential effects of damage within the hippocampal region on memory for a natural nonspatial odor-odor association. Learn Mem 8:79-86.
Burton S, Murphy D, Qureshi U, Sutton P, O'Keefe J (2000) Combined lesions of hippocampus and subiculum do not produce deficits in a nonspatial social olfactory memory task. J Neurosci 20(14):5468-5475.
Clark RE, Broadbent NJ, Zola SM, Squire LR (2002) Anterograde amnesia and temporally graded retrograde amnesia for a nonspatial memory task after lesions of hippocampus and subiculum. J Neurosci 22(11):4663-4669.
Isaac JTR, Nicoll RA, Malenka RC (1995) Evidence for silent synapses: implications for the expression of LTP. Neuron 15:427-434.
Kauer JA, Malenka RC, Nicoll RA (1988) A persistent postsynaptic modification mediates long-term potentiation in the hippocampus. Neuron 1:911-917.
Liao D, Hessler NA, Malinow R (1995) Activation of postsynaptically silent synapses during pairing-induced LTP in CA1 region of hippocampal slice. Nature 375:400-404.
Malinow R, Tsien RW (1990) Presynaptic enhancement shown by whole-cell recordings of long-term potentiation in hippocampal slices. Nature 346:177-180.
Milner B, Corkin S, Teuber H-L (1968) Further analysis of the hippocampal amnesic syndrome: 14-year follow-up study of H.M. Neuropsychologia 6:215-234.
Milner B, Squire LR, Kandel ER (1998) Cognitive neuroscience and the study of memory. Neuron 20:445-468.
Morris RGM, Garrud P, Rawlins JNP, O'Keefe J (1982) Place navigation impaired in rats with hippocampal lesions. Nature 297:681-683.
Scoville WB, Milner B (1957) Loss of recent memory after bilateral hippocampal lesions. J Neurol Neurosug Psychiatry 20:11-21. Reprinted (2000) J Neuropsychiatry Clin Neurosci 12(1):103-113.
Shrager Y, Kirwan CB, Squire LR (2008) Neural basis of the cognitive map: path integration does not require hippocampus or entorhinal cortex
Stevens CF, Wang Y (1994) Changes in reliability of synaptic function as a mechanism for plasticity. Nature 371:704-707.
Wills TJ, Lever C, Cacucci F, Burgess N, O'Keefe J (2005) Attractor dynamics in the hippocampal representation of the local environment. Science 308:873-876.
Zhang S-J, Ye J, Miao C, Tsao A, Cerniauskas I, Ledergerber D, Moser M-B, Moser EI (2013) Optogenetic dissection of entorhinal-hippocampal functional connectivity. Science 340:1232627.

Readings given on exams but not seen in class:

Both courses:
Bender KJ, Allen CB, Bender VA, Feldman DE (2006) Synaptic basis for whisker deprivation-induced synaptic depression in rat somatosensory cortex. J Neurosci. 26(16):4155-4165.

Seminar only:
Jeneson A, Mauldin KN, Squre LR (2010) Intact working memory for relational information after medial temporal lobe damage. J Neurosci 30(41):13624-13629.

Upper division only:
Williford T, Maunsell JHR (2006) Effects of spatial attention on contrast response functions in macaque area V4. J Neurophysiol 96:40-54.