

**Syllabus for Systems Neuroscience (03-363)
and Advanced Systems Neuroscience (03-763)**
Spring, 2015

Course Description:

This course is designed to be an introduction to systems neuroscience. 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 systems 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.

Prerequisites: 03-121 (Modern Biology) or a university-level neurobiology course

Course Text: *Neuroscience*, (2012, 5th Edition by Purves et al. ISBN: 978-0-87893-695-3)

Recommended texts: *Spikes*, by Rieke, et al., 1997, ISBN: 978-0262681087
Theoretical Neuroscience, by Dayan & Abbot, 2001, ISBN: 978-0262541855

Class times: 03-363: TR 9:00 – 10:20 SH 125
03-763: TR 9:00 – 10:20 SH 125 & R 4:30 – 5:50 MI 355

Instructors:

TR am: Daniel (DJ) Brasier
dbrasier@cmu.edu
Office Hour: Monday 3:30 pm to 4:30 pm & by appointment (*Don't be shy*)
Office Location: WEH 4624 (through the scary metal doors, follow signs for Gelfand)
Office Phone: 412-268-3377 (or CMU extension 8-3377)

03-736 (pm): Sandra Kuhlman
skuhlman@andrew.cmu.edu
Office Hours, etc. will be announced at the first Thursday class

TA (03-363): Amanda Willard
awillard@andrew.cmu.edu
Office Hour: by appointment. *Don't be shy about asking.*

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, and labeled lines.
- Understand the methods and approaches used to analyze neural systems.
- Understand the biological bases of some brain disorders.
- Understand how movements are generated.
- Learn to explore, read, and evaluate primary scientific literature.
- Learn to develop testable hypotheses and to propose appropriate experiments.
- Be able to assess scientific data and draw appropriate conclusions from it.

How to succeed in Systems 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 textbook & 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.
- **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. Students who do not have confidence in their note taking skills should consider audio taping the lectures or reviewing their notes with the TA. Classroom activities may be taped or recorded by a student for the personal use of that student or for all students presently enrolled in the class only, but may not be further copied, distributed, published, or otherwise used for any other purpose without express consent of Dr. Brasier.
- **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.
- **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. 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 TA or 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 and to understand generally how biology & science work. This will serve you well long after you stop caring about your transcript.

Evaluation (03-363):

- 20% Highest mid-term (100 points)
- 20% Second-highest mid-term (100 points)
- 10% Lowest mid-term (100/2 = 50 points)
- 30% Final Exam (150 points)
- 10% Written report (50 points)
- 5% Neuroanatomy group presentation (25 points)
- 5% Class participation, homework, & quizzes (25 points)

- **Exams.** Each individual student's lowest mid-term grade will be cut in half to minimize the effect of a bad day on your final grade. Please plan ahead on your exams. I only give make up exams with documented illness or in accordance with other CMU exam policies (<http://www.cmu.edu/policies/documents/Exams.htm>). The mid-term exams will only *explicitly* test material in that unit of the course (they are not explicitly cumulative). However, many of the questions will *assume* a basic understanding of the concepts from earlier units.
- **The final.** The final is cumulative for the entire course. It will be during finals week. Last year it was on the last day of finals, do not book travel for before May 11th!
- **Exam re-grades.** We are committed to grading as fairly as possible. If you think a mistake was made in grading your exam, you can submit your exam and a written explanation of why you think you deserve more points than you were given and your exam will be re-graded. Re-grades must be submitted **no more than one week** after exams have been returned. The instructors reserve the right to re-grade the entire exam in addition to the disputed question, and add or subtract points.
- **Primary literature paper report.** Students are advised to read as many of the supplementary scientific literature papers as possible. Each student must choose one primary scientific paper (topic choice is due on April 9th). Students must then write a report on the paper. An outline of the report is due on April 27th. **The final report is due on May 1st.** More information will be given out during the second week of class.
- **Neuroanatomy presentation.** *Students need to find a group of 6-8 before the second class meeting.* At the second class meeting (January 15th), groups will be assigned a neuroanatomical structure. Each group will be required to present a **5 minute** creative presentation about that structure on January 27th.
- **Homeworks.** There will be regular homework assignments about the readings, due most Tuesdays. Watch blackboard for updates. You are encouraged to work in groups during homework assignments. Most assignments will have the option to turn in one assignment for a group.
- **Class participation.** Students are expected to participate actively in class discussions. Your participation in small group and class-wide discussions during the semester is required. Extraordinary participation may make up for some lost points on homework assignments.
- **Pop quizzes.** There will be occasional pop quizzes at the beginning of class that may cover ANY material, including: material since the last exam/quiz, reading/homework due that day, and/or old material from earlier in the course. The purpose of this is to ensure students stay on top of the course material and to encourage reviewing material regularly.

Evaluation (03-763): Students in 03-763 have the same Tuesday/Thursday morning lectures as 03-363, and additionally have afternoon sections on Thursdays. Details of grading and course work will be made available at the first Thursday afternoon session.

Other policies

Academic Integrity

- **Cheating.** Cheating of any sort will not be tolerated. For example, if exam answers are copied from another student, both students will receive zeros; if graded exams 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. Collaboration on homeworks is acceptable (encouraged, in fact).
- **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 anatomy presentation and written reports.

Technology use policy

The use of cell phones is strictly prohibited in class. Computers are permitted, but only if you are using them to take notes. Multi-tasking on computers (having multiple windows open including class materials) is prohibited.

The first time the instructors or TA observe you violating the technology use policy, you will get a verbal and/or written warning. **Further violations will cause you to be penalized points.**

Students with Disabilities:

If you wish to request an accommodation due to a documented disability, please inform your instructor and contact Disability Resources as soon as possible.

They can be reached at access@andrew.cmu.edu or 412-268-2013.

Classroom citizenship

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. This means you should 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.

Systems Neuroscience Schedule

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

<u>Date</u>	<u>Required Reading</u>	<u>Lecture Topic</u>
<u>Unit 1: Neurons, circuits, and brain structures</u>		
1/13	Purves Ch14&20	Introduction, Eye movements, & Vestibular control
1/15	Purves Ch2	Electrical signaling in neurons
1/20	Purves Ch5	Synaptic transmission
1/22	Purves Ch1	Neural Circuits
	<i>Videos & art projects due on 1/26</i>	
1/27	Purves Appendix & self-directed	Neuroanatomy student presentations in groups
1/29	Purves Ch8	Plasticity of synapses and circuits
2/3	TBA	Plasticity research
2/5	Purves Ch31	Memory
2/10	Exam I	
<u>Unit 2: Touch, motor control, and information encoding/decoding</u>		
2/12	Purves Ch9	Somatosensory processing
2/17	TBA	Somatosensory research
2/19	Purves Ch10	Pain
2/24	TBA	Pain research
2/26	Purves Ch16	Spinal cord
3/3	TBA	Spinal cord research
3/5	Purves Ch17	Central motor pathways
3/17	Purves Ch15	Olfaction and information theory
3/19	TBA	Neural prosthetics
3/24	Exam II	
<u>Unit 3: Modulation of behavior and other senses</u>		
3/26	Purves Ch18	Basal ganglia
3/31	TBA	Basal ganglia research
4/2	Purves Ch11	The retina
4/7	TBA	Retina research
	<i>Report topic due 4/9</i>	
4/9	Purves Ch12	Central visual pathways
4/14	TBA	Vision research
4/21	Purves Ch23	Circuit development (intrinsic mechanisms)
4/23	Exam III	
	<i>Report outline due 4/27</i>	
4/28	Purves Ch24	Circuit reorganization & experience
4/30	TBA	Experience-dependent plasticity research
	<i>Final report due 5/1</i>	
TBA	Final Exam (Location & time TBA)	
	*** CUMULATIVE ***	
	<i>Optional report rewrite due 5/11</i>	