Syllabus for Biochemistry of the Brain (03-366)
Fall, 2016

Course Description:
This course is designed to give students a comprehensive understanding of the major neurotransmitter systems in the brain. Students will explore qualitative and quantitative approaches to understanding how various neurotransmitters function as well as how they are modulated by endogenous and exogenous agents. The qualitative exploration will include basic principles of neural communication, signal transduction and second messenger systems, main classes of neurotransmitters, and the effects of medications and drugs of abuse. Quantitatively, we will explore the kinetics of neurotransmitter binding, affinity of different receptors for their neurotransmitters, and apply concepts of competitive, uncompetitive, and mixed inhibition to understanding the effects of exogenous agonists and antagonists on these receptors. Students will learn how these qualitative and quantitative biochemical processes affect the endocrine system, neuroinflammatory responses, addictive behaviors, and neurotoxic or degenerative conditions.

Learning Objectives:
Students who successfully complete this course will be able to:
- Describe how neurotransmitters excite and/or inhibit postsynaptic neurons
- Distinguish the major chemical classes of neurotransmitters and their diverse functions, including: amino acids, monoamines, other small molecules, and neuropeptides
- Quantitatively describe the binding affinity for various different neurotransmitter receptors and explain how the different affinity can alter the behavior of these receptors when neurotransmitters are at different concentrations.
- Explain the chemical basis of major topics in neuroscience, such as sleep, neuroendocrinology, and addiction.
- Quantitatively describe the effects of exogenous medications and other drugs that act on neurotransmitter receptors.
- Describe the distinction between agonists, allosteric modulators, inverse agonists, competitive antagonists, uncompetitive antagonists, and mixed antagonists both qualitatively and quantitatively and relate these concepts to enzyme kinetics and modulation.

Prerequisites: 03-231 or 03-232 (Biochemistry)


Class times: TBD: proposed MWF 11:30 – 12:20

Instructor: Daniel (DJ) Brasier
dbrasier@cmu.edu
Office Hour: TBD & by appointment (Don’t be shy)
Office Location: WEH 4624
Office Phone: 412-268-3377 (or CMU extension 8-3377)

TA: TBA
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 biochemistry, neuroscience, and about science in general.
- Prepare you to be critical scientific thinkers.

How to succeed in Biochemistry of the Brain:
- **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).
- **Do the homeworks!** This is the best way to prepare for the exams.
- **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:

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% Class participation & homework (50 points)
5% Regionalization of neurotransmitters group presentation (25 points)
5% Written report (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](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. There will be some emphasis on the last unit.

- **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 November 9th). Students must then write a report on the paper. An outline of the report is due on November 27th. **The final report is due on December 1st.** More information will be given out during the second week of class.

- **Regionalization of neurotransmitters group presentation.** *Students need to find a group of 6-8 before the third class meeting.* At the third class meeting (September 9th), groups will be assigned a neuroanatomical structure. Each group will be required to present a **5-10 minute** presentation about the interaction between anatomy and biochemistry for their assigned topics on September 26th and September 28th.

- **Homeworks.** There will be regular homework assignments about the readings, due most Mondays. Watch blackboard for updates

- **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.
Class Policies

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 homeworks 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 anatomy presentation and written reports.

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.

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.