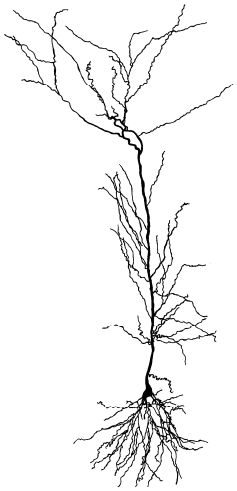
BIOLOGY 365L: Neurobiology Lab



Spring Semeseter 2011
Friday 1-6, PAI 1.04

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A Brief Course Description: This intensive laboratory course will introduce you the basic and essential skills of modern electrophysiology. You will learn to record the properties and electrical activity of single neurons in slices of living brain tissue, and to analyze interactions between neurons in these brain slices. The primary technique we will use is intracellular recording via patch clamp techniques, using state-of-the-art equipment.

The most important part of this course is your active participation through hands-on experiments. This course has minimal assigned reading and a minimal number of lectures, which serve only to review the key neurobiology concepts that you have learned before in BIO365R or other equivalent courses. These concepts include basics of electrical circuits, resting potentials and action potentials, ion channels and receptors, as well as synaptic integration. I strongly encourage you to review these concepts before each lab.

Class website: All course related materials will be posted on the class website: www.bio365L.net Posted materials include the assigned class readings and a great deal of supplemental materials (scientific papers, announcements, discussion questions, changes in scheduling, etc…)

Blackboard: We will use the Blackboard web-based instructional system for a number of course-related activities, including discussion boards, online collaboration, online quizzes, and weekly blog entries.

Lab Partners: Students will work together in groups of 3. I expect that students will remain in their groups at the same station for the entire semester. It makes sense to divide up laboratory duties among different members of a group, and I do not expect that each member of a group will perform each duty entirely evenly. However, each student should try as much as possible to participate in all aspects of experiments, keeping in mind that participation counts toward one's final grade.

Textbook: There will be no textbooks required for this course. Assigned readings will be posted on the course website.

The most important readings are the Lab Manual for this course. You must read and understand the assigned sections of the lab manual *before* attending the next week's lab. The procedures in the laboratory are not simple. Inadequate preparation for lab will substantially decrease the likelihood of success. I recommend accumulating the lab manual handouts in a three-ring binder that you bring to each class meeting.

Additional reading: *The Axon CNS Guide, 2nd edition* is an outstanding and freely available resource that explains in very clear terms many of the concepts we will cover during this lab. This document is posted on the course website for download. Some sections of this guide will be assigned as required reading. Other sections will be recommended as additional reading to aid your understanding of certain core concepts.

Articles from the primary scientific literature: For each section of the class, we will post a small number of scientific articles that are relevant for the ongoing class experiments.

Policy on missing class: Unless you have verifiable medical reasons or death in the immediate family, you are not allowed to miss any of the lab days. If a student cannot attend a lab, it is the student's responsibility to contact the instructor prior to the time of the lab and obtain permission to miss the lab. Only those students with a verifiable *medical* excuse, or death in the family, will be permitted to miss a lab. A written note of justification is required from the student to verify his/her absence in the lab. Students with medical or graduate school interviews are strongly urged to schedule them around class. In those cases where a conflict cannot be avoided, the student must contact the instructor at least 2 weeks prior to the interview for alternative arrangements. *Unexcused absences from lab will result in a 5% deduction in your final grade.*

Cheating: Cheating is (of course) against University rules and will not be tolerated. Any student caught cheating will be reported to the Dean's office and we will make all efforts to see that those students will receive the maximum penalty permitted under University regulations. Examples of cheating in a lab course include the altering of original data, the copying of another student's lab report (in the present year or previous years), and the copying of content directly from websites or any published material. Lab reports from prior years are maintained in a searchable archive.

Punctuality: You are expected to be at class on time. Students arriving late to lab will not be given additional time to complete the experiment. The instructor reserves the right to deduct up to 5% of the final grade in cases of repeated or excessive tardiness.

Conduct: A class that meets for five hours at a time calls for some flexibility and relaxation of typical expectations for classroom conduct. In general, this is what I expect of students:

1. During our lectures and briefings on lab procedures, please show the same courtesy you would in any lecture course. That is, no phone calls or text messaging, avoid activities that distract from the material presented during lectures, and no leaving or entering the classroom.

2. During the lab exercises, which will typically take up the majority of each class section, we can be a bit more relaxed in our behavior. In general, you will be working at your own pace during the lab activities. Accordingly, it is reasonable to periodically take *brief* breaks to visit the restroom, return phone calls, text messages, and check email. Please avoid answering incoming phone calls during the lab. If you absolutely must take a call, please step outside the classroom and keep it *short*. I reserve the right to take away these privileges if they become too disruptive to our lab work. *The guiding principle is that your behavior must not interfere with completing your lab exercises or interfere with other student's efforts.* Please remember that *active* participation in lab exercises is part of your grade.

Office hours: Due to the small size of the class, students can contact either the TA or the instructor for an individual appointment to discuss course content or any other issue.

Students with Disabilities: The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259 (voice), 471-4641 (TTY for users who are deaf or hard of hearing).

Grading: There will be no major exams for this course. Grades will be based primarily on three lab reports that explore the results and analyses of the experiments you did in the lab. In addition, you will be graded on homework assignments, prelab assignments, online quizzes, short in-class quizzes, and weekly blog entries. Relative contributions to the final grade are shown below:

Assignment	Points Possible	% of Final Grade
Prelab 1	10	2
Methods Test 1	10	2
Homework 1	10	2
E-Quiz 1	10	2
Quiz 1	10	2
Activity Blog	15	3
Lab Report 1	50	10
Prelab 2	10	2
Methods Test 2	10	2
Homework 2	10	2
E-Quiz 2	10	2
Quiz 2	10	2
Activity Blog	25	5
Lab Report 2	100	20
Prelab	10	2
Methods Test 3	10	2
E-Quiz 3	10	2
Quiz 3	10	2
Activity Blog	10	2
Homework 3	10	2
Lab Report 3	150	30
Totals:	500	100

The breakdown of contributions to the final grade are as follows:

Assignment Type	% of Final Grade
Prelabs	6%
Methods Tests	6%
Homeworks	6%
Equizzes	6%
Quizzes	6%
Blogs	10%
Lab Reports	60%

The final grade will be decided according to the following cutoff lines:

Grade A: 90% and above;
Grade B: 80-89;
Grade C: 70-79;
Grade D: 60-69;
Grade F: the rest.

Questions about grading must be taken up with the instructor *no later than one week after an assignment is returned*. If you wish to contest your grade, make sure you have ample justification. The reasons for contesting the grading *must be put in writing and submitted to your instructor.* The instructor will then consider whether your reason is sufficiently justified to warrant a change of grade. Any assignment

having changes of any sort that were not in the original assignment at the time it was returned will not be considered for a grade increase.

About the Assignments The major measure of your success in this course will be the quality of your lab reports. Other supporting course assignments are designed to facilitate the preparation of your lab reports.

Lab Reports

The primary objective for this course is the production of high-quality lab reports, and the majority of your grade will be determined by these lab reports. If you can produce a good lab report, it means that you have met all of the other course objectives. In order to produce a good lab report, you must have:

1) a solid understanding of the central theoretical concepts of each experiment
2) run the required experiments and collected appropriate data
3) analyzed and interpreted those data, demonstrating the ability to draw conclusions from experimental data
4) the ability to write clearly and concisely about the theoretical concepts, your data, and the implications of your data.

The purpose of the lab reports is to help you develop critical thinking about the significance of your experiments, as well as to guide you in the process of scientific writing. While it is important that students complete experiments and collect quality data, we will not be grading these reports based solely on how close your results come to the expected theory. We assure you that nobody will be punished for having obtained negative data. However, it is important that you realize why they are negative. We are more concerned with whether or not a report shows that the student understands the theory and methods of the experiments, and whether that student interprets his or her results in an intelligent and thoughtful manner. Obviously, though, there is a middle ground. It is difficult to generate a thoughtful discussion without a critical mass of results.

Note: Although performing experiments and analyzing data is to be done by all lab partners together, the writing of lab reports is to be done by each individual within a group for themselves. No part of a lab report, with the exception of figures is to be shared among lab partners.

In this course we will rely heavily on the LabWrite website to help you prepare your lab reports. We will provide extensive feedback on your lab reports, particularly on the first one, and students are encouraged to seek out additional help or discussion with instructors during office hours. Your lab reports will be evaluated according to a detailed and standardized grading system designed to complement the skills taught by the LabWrite website. The scoring system is posted on the course website.

Your lab report will consist of the following elements. *Please consult the course website (http://www.bio365L.net) and the LabWrite website for specific guidance on developing these sections of your lab report.*

Title: A concise title that reflects the content of the lab report

Abstract: A single-paragraph summary describing the point of the laboratory and the major finding(s) from your experiments.

Introduction: Briefly review the theory behind the experiments in the report. Descriptions should be in your own words, and you should take pains not to simply reiterate the lab manual.

Methods: A concise description of the methods used in your experiments. The methods should have enough detail to enable a capable scientist to replicate your experiments.

Results: This section should present the body of your experimental findings, including all data figures and tables. Figures and tables *must* have brief legends describing what is being plotted or tabulated. Include enough details to allow the reader to understand the figure without having to read through the main body of the text. In the text, you should describe your findings in a straightforward manner, and leave interpretation for the Discussion section. If measurements or calculations are made, you should describe how. In the past, some students simply listed all the figures in Results. *However, Results are not a simple collection of figures, and you must lead your readers through by briefly describing what you did and why you did it first.*

Discussion: The primary purpose of the discussion is to interpret and describe the significance of the data. You should address each result in turn, mentioning what the result was, and then providing detailed explanations. Bring in the theory from the introduction to help you provide mechanistic support for your conclusions. In some cases, results might deviate from theory. Here, you should be honest, and describe what you expected based on theory, and then do your best to explain what might be different in the actual experiment. Perhaps there were technical problems during the experiment that might have introduced complications. In these instances where there is no clear answer, the the "right" answer is a thoughtful discussion that details the possibilities

References: For Lab Report 1, no references are required. For the second and third lab reports you will be required to read and cite relevant scientific reports. Additional details will be provided at the time these reports are assigned.

Late lab reports will be marked down 5 points per day, no exceptions

Supporting Assignments: The remainder of your grade is determined by a large number of much smaller assignments. Each type of assignment has a specific role in contributing to your lab reports, as explained below:

Prelab assignments:

What are they? A brief (2-3 page) written presentation of the central theoretical concepts for the lab module, a description of the experiments you will run, your hypotheses for the experimental outcomes, and an explanation of how you arrived at those hypotheses.

Purpose: The purpose of the prelab assignment is to ensure that you have read the lab manual and understand what experimental procedures you will complete in class. Obtaining a good recording from a neuron is a time-intensive pursuit, and once you are recording from a cell, you usually will have a very limited time to conduct your experiments (20-40 minutes) before the recording becomes unstable. Accordingly, it is critical that you know what you need to do before you begin the experiments. Once you have a live cell online, you will not have time to start skimming through the lab manual trying to figure out what to do.

Added bonus: These are a low-stakes way to get feedback on your writing. Grading of prelab assignments will be very liberal, meaning that you will receive full credit as long as your prelab reflects a sincere effort. Best of all, a well written prelab assignment can be quickly converted into the Introduction of your lab report.

Methods Tests:

What are they? Short-answer or fill-in-the blank quizzes given in class near the beginning of each class module.

Purpose: The purpose of these tests is to ensure that you have a ready grasp of the methods and experimental procedures you will be conducting. As mentioned above – when you finally get a good recording to work, you do not have time to read the lab manual to learn on the fly. Be prepared!

Added bonus: If you have a good understanding of what you will be doing during each experiment, you will significantly increase your chances of success and decrease the amount of time required to complete the experiments.

E-quizzes:

What are they? These are online quizzes that you will complete through the Blackboard course site. These quizzes will consist of approximately 10 questions that must be completed within a time limit to yield a valid score.

Purpose: E-quizzes are designed to ensure that you have a working knowledge of important course concepts and procedures. Developing this knowledge through e-quizzes will make it easier to write the lab reports from your own knowledge base, rather than having to struggle to comprehend central concepts while you are writing your lab reports.

Added bonuses: You can re-take the e-quizzes as many times as you want until you earn the score that you want. Plus, the in-class quizzes will be drawn from the same question pool, so once you can ace the e-quiz, you should be able to ace the in-class quiz.

In-class quizzes:

What are they? A quiz consisting of 10 questions drawn from the same question pool as the e-quizzes. You will have 20 minutes to complete the in-class quiz.

Purpose: The in-class quizzes serve as an incentive to master critical course concepts and procedures. They also provide an important assessment of your mastery of this content.

Added bonus: If you can ace the in-class quiz, then you will be in a much better position to easily discuss the relevant concepts in your lab report.

Homework assignments:

What are they? Short written assignments that can be completed in an hour or two.

Purpose: Homeworks are designed to help clarify certain concepts and procedures necessary for successfully conducting experiments and interpreting your data.

Added bonus: Homework assignments are designed to help you gain insight into the data you collect from your experiments.

Activity blogs:

What are they? Using the blog feature in the Blackboard course site, on most weeks you will write up a blog entry that includes these elements:

1) What your group accomplished in lab that week
2) your contribution to those accomplishments
3) graphs/tables/pictures of the data you collected that week
4) a discussion of each graph/table/picture
5) if you have no data, explain what went wrong
6) any questions you have about class material or what happened during your experiments.

The instructor and TA will read and comment on your blog entries.

Purpose: The blogs have two important objectives. First, remember that active participation is a big part of the course requirements. The blog is where you will document your active participation in each class meeting. Second, a major portion of your lab reports involves describing your experimental procedures, presenting your data, explaining those data, and interpreting what those data mean. The blog is where you will hone these skills with the assistance of your instructor.

Added bonuses: 1) Like the prelab assignments, your blog scores will be determined primarily according to whether you have invested a sincere effort. This isn't exactly easy points here because it will take quite a bit of work. However, it is a low-stakes assignment where your score will be determined more by your effort than by whether what you have written is "correct". 2) Comments from the instructor and TA will help you in solving experimental problems and learning how to interpret and write about your data. Finally (and this is a ***big*** bonus) – when it comes time to write the methods, results, and discussion sections of your lab report, you will already have a significant head start because you can take material from your blog entries and easily adapt it for your lab report.

BIO 365L Semester Schedule: Fall 2011 Friday 1:00-6:00				
Week	**Date**	**Module**	**Activities**	**Assignments**
1	Jan 28	Passive Properties	Lecture: Introduction to course: Lab Reports & expectations Membrane biophysics, ohms law, RC circuits Intro to physiology rig & software Student training exercises: Recording from model cell. Student Exercises: Bridge balance and capacitance compensation with model cell.	Browse Class Website Read lab manual for Module 1
2	Feb 4		Lecture on patch clamp technique, microscopy, & slice prep Patch clamp demonstration Student Experiments	Blog 1 Due Wed Feb 2nd 8:00 am Prelab 1 Due Friday Feb 4th 8:00 am Methods Test 1 in class Friday Feb 4th
3	Feb 11		Student Experiments	Blog 2 Due Wed Feb 9th 8:00 am Homework 1 Due Fri Feb 11th before class Equiz 1 – completed *before* class Quiz 1- in class
4	Feb 18		Finish Experiments, Finalize Figures & Analysis Data presentations and discussions	Blog 3 Due Wed Feb 16th 8:00 am
5	Feb 25	Active Properties: Action Potential Generation	Lecture: electrochemical gradients Synaptic integration and AP mechanisms Begin Experiments	Lab Report 1 Due Wed Feb 23rd by end of day
6	Mar 4		Student Experiments	Blog 4 Due Wed March 2nd 8:00 am PreLab 2 Due Friday March 4th 8:00 am Methods Test 2 in class Friday March 4th
7	Mar 11		Student Experiments	Blog 5 Due Wed March 9th 8:00 am Homework 2 Due Friday Mar 11th 8:00 am Equiz 2 – completed *before* class Quiz 2 – in class
8	Mar 18		Spring Break	
9	Mar 25		Student Experiments	Blog 6 Due Wed Mar 23rd 8:00 am
10	Apr 1		Student Experiments	Blog 7 Due Wed Mar 30th 8:00 am
11	Apr 8		Finish Experiments , Finalize Figures & Analysis, data presentations & discussion	Blog 8 Due Wed Apr 6th 8:00 am
12	Apr 15	Synaptic Transmission	Lecture : synaptic transmission & plasticity / Begin experiments	Lab Report 2 Due Wed Apr 13th
13	Apr 22		Student Experiments	Blog 9 Due Wed Apr 20th 8:00 am PreLab 3 Due Friday Apr 22nd by 8:00 am Methods Test 3 in class Friday Apr 22nd
14	Apr 29		Student Experiments	Blog 10 Due Wed Apr 27th 8:00 am Homework 3 Due Friday April 29th in class Equiz 3 – completed *before* class Quiz 3 – in class
15	May 6		Last Day of Class: Course Evaluations & Feedback Module 3 Analysis Discussion and Presentations	Lab report 3 Due Friday March 13th By End of Day