

BIOL346 Molecular Neuroscience
Fall Semester 2006-2007
Shubhik K. DeBurman

FUNDAMENTALS

Library Reference Course Guide: <http://www.lib.lfc.edu/resource/bio.html>

Class Hours:

| | | | |
|-------------|--------------------|------|-------------|
| Lecture: | 9:30 am – 10:50 am | T-Th | Johnson 265 |
| Laboratory: | 12:00 pm- 3:50 pm | Th | Johnson 215 |

Instructor Office Hours:

| | | |
|--------------|-----|-------------|
| 9 am - 11 am | MWF | Johnson 201 |
|--------------|-----|-------------|

Dropping in: If I am in the office and free of other duties, I'll be happy to meet with you.

If I am busy in office or in lab, please respect my non-availability and instead schedule an appointment.

Phone: 735-6040 (office), 615-2647 (home); avoid calling after 9 pm unless its an emergency

email: debburman@lfc.edu

Peer Teacher (for labs and projects): Jenny Riddle'07 (riddljl@lfc.edu)

Peer Writing Consultant (Writing Center): For selected writing assignments.

Michael Zorniak'07 (zornim@lfc.edu)

GOALS

Mastering Neurobiology Content

1. Understand how the nervous system regulates most bodily functions in higher organisms
2. Develop broad neurobiology understanding: focus on the molecular basis of behavior
3. Develop insight into neurobiology's clinical face: How dysfunctional neurons cause disease

Strengthening Scientific Process

4. Improve abilities to understand and communicate neuroscience research, orally and in writing
5. Improve abilities to think like a scientist and to engage in scientific practice
6. Improve abilities to collaborate with peers and also perform independent research
7. Improve understanding of the scientist's diverse roles in society

PHILOSOPHY

Welcome to BIOL346 Molecular Neuroscience. You have elected a highly challenging, time-consuming writing and reading intensive, laboratory-based course targeted for upper level students (preferably seniors and highly motivated juniors). Studying neurobiology requires basic understanding of cell and molecular biology, physiology, evolution and genetics that is covered in BIOL210 (Organismal Biology), BIOL220 (Ecology and Evolution) and BIOL221 (Cell & Molecular Biology). Because of the high focus on writing, reading, communication, and library research, an academic maturity and self-motivation is desired that you as science juniors/seniors possess. I also hope psychology majors who have taken PSY370 (Neuroscience & Behavior) or will enroll in it this spring were naturally drawn to this course. Molecular Neuroscience is a very logical complement to your learning if you are interested about the biological basis of behavior.

The brain has often been proclaimed as biology's ultimate frontier. Understanding consciousness is surely one of the ultimate human holy grails. Today, the study of our nervous system (neuroscience) is at the very forefront of biomedical research witnessing extraordinary scientific advances in the 1990s (the so-called "Decade of the Brain"). Even ten years ago, only a handful of U.S. Universities had graduate programs in the neurosciences. Today, every major university boasts of such a program. In fact, an increasing number of undergraduate liberal arts colleges brag neuroscience majors or minors, With rapid technological advances and the blending of traditional disciplines, neuroscience has without doubt emerged as one of the leading research fields of the 21st century.

I use lectures and labs to provide you with a core understanding of neuroscience. A comprehensive discussion of nervous system function will involve topics that span from the cell and molecular biology of single neurons to the complex coordination of functions such as perception, language, affect, movement,

homeostasis, and thought. Throughout the course, we will also pay particular attention to the biological basis of several devastating human neurological diseases that arise when nervous system function goes awry. Laboratory is integral to the neurobiology experience. However, since this is a relatively new course, lab modules will necessarily have to be phased in slowly over the next few years. Lab time will focus on in depth gross anatomy and histology of the nervous system using sheep and human brains as models. You will become very familiar with all parts of the mammalian brain and will learn to appreciate the intimate connection between anatomy, physiology, and behavior.

In addition to core neuroscience, I will focus heavily on exposing you to a variety of experiences that are designed to help you understand the true nature and scope of neurobiology. I will strive to help you capture the excitement of breakthrough neuroscience discoveries and cutting edge hypotheses by extensive use of primary literature in writing assignments, by reading multiple non-fiction scientific books, and by inviting one or two noted neuroscientists to campus. Some of the most devastating human illnesses afflict the nervous system. Apart from covering some diseases in lectures and conducting a workshop on it, you will read Richard Rhodes' celebrated Deadly Feasts on prion diseases, one of the most unusual enigmas of modern biology. To delve into the most unusual neurological disorders today, you will read Ramachandran's The Emerging Mind. To explore the ideas about human cognition and emotions, you will read Antonio Damasio's provocative Descartes' Error. You will discuss and debate bioethical issues which neuroscientists constantly face, in our very own "*NeuroEthics Hour*".

For the first time in this course, you will be able to choose from a diverse variety of projects.

For those interested more in peer education and science outreach, you should consider TRACK I projects. If you are on track I, you will carefully mentor FIYS106 *Medical Mysteries* students in beginning neurobiology projects and help organize a campus-wide Brain Awareness Week, and in taking on the role as BIO346 instructor and leading classroom discussions on complex brain functions underlying gender difference, sleep, and drug action. For those interested more in scientific research and academic medicine careers, Track II will set your goals best. In this track, you will delve into a cutting edge question with a journal club of a 2006 paper, followed by reporting the findings to a non-scientist audience through a Nature-styled News & Views. To understand how new knowledge can be created, you will propose a testable hypothesis, establish specific, and design experiments to test out the hypothesis, by writing and NSF styled research proposal.

Finally, you will organize and participate in *NEUROFRONTIERS*, the seventh annual neurobiology research workshop (and the fourth one to be held at Lake Forest College), where you will pretend to be a real-life world expert on a particular nervous system function or disease and give a seminar and write a review paper to be published in an in-house journal. You will have opportunities to hear about current research in the labs of several visiting scientists.

Overall, I hope this class will get each of you thinking about what makes you human and you will be asked at the end of the semester to pen your thoughts on a more personal level on these central human issues.

In the words of past neuroscience students:

"One of the most important things that I learned was that the pursuit of scientific knowledge often has its roots in a genuine concern for humanity... Overall, I have learned an amazing amount of factual scientific knowledge, but I have learned even more about the benevolence of the human condition". – now in medical school

"Probably, the most useful course I've taken, and the most difficult. It is about teaching ideas and teaching us how to be effective scientists, as well as specifics. But, I think the ideas are the most important part." –now a research technician, planning to attend medical school

"Something unique happened to me in this class. At first, I couldn't believe the amount of work that had to be accomplished. I actually wasn't sure I could do it all. But the instructor's enthusiasm for biology and teaching seemed to transfer. Not just to me, but to others in the whole class. The "work" became less difficult and felt more like "independent learning". – now in law school

"I think the preparation for "real" science is great and realistic. The course and projects were all run with an enthusiasm for teaching that makes it worthwhile to go to college." –now doing PhD in neuroscience

"The part of the reason I decided to take neuro was he makes it different from the norm... he makes you really think and makes you work with your classmates". – now in medical school

"I loved this class! It was completely different from any other science class and I am taking not only knowledge but skills away with me. The workload was HUGE and at times overwhelming, but for some reason, it was OK. It was one of the few classes where the professor was pulling for the students, working with us, and not making a grade range. I worked only harder. I have never put this time, energy or heart into a class!" – now in healthcare industry

REQUIRED READINGS

1. **BIO346 Lecture Packet**. Pay Business Office, Give receipt to DebBurman, pick up packet
 2. **Neuroscience**, by Purves, et al
 3. **The Brain Atlas**, by Woosley
 4. **Deadly Feasts**, by Richard Rhodes.
 5. **The Emerging Mind**, by Ramachandran & Blakelee
 6. **The Feeling of What Happens**, by Antonio Damasio
 7. Individualized Readings on non-fiction popular neuroscience books
7. Several Textbooks and Brain Atlases will be placed in BIO346 DebBurman Informal Reserves (in J215).

PEER TEACHER

I am delighted that Jenny Riddle'07 will be your official peer teacher. Jenny took this class last fall and did very well in all aspects of the course. She was an collaborator in several group projects and helped BIO346 and FIYS106 groups produce top quality work. As peer teacher, her role is to help me get the best effort out of you and this help may turn out to be the single most important factor to your success this semester. Her specific tasks are:

1. Help me conduct neuroanatomy labs and design the mock practical exam
2. Conduct peer workshops for some experiential projects
3. Help with assessment of several projects
5. Organize and lead the NeuroFrontiers Workshop and Brain Awareness Week

NOTE: This is an advanced elective course. As students beyond BIO221, I expect you to master lecture content by engaging in either self-study or preferably group study. Unlike BIO221 peer teachers did, Jenny will not attend lectures, nor will she conduct weekly tutorials.

WRITING CONSULTANT

I am even more delighted that Michael Zorniak'07 will also be peer Writing Consultants you can go to for showing drafts of book reviews, reflection essays and medical journalism. It is your option to meet them before each assignment is due and consult them on early and final drafts. They will summarize your consultations and inform me of your progress and efforts, which will form the basis of my awarding you consultation points.

GRADING & ASSESSMENT

| | |
|--|--------------------|
| I. CORE NEUROSCIENCE (30%) | 300 |
| i. Midterm Lab & Viva | 125 |
| ii. Midterm Lecture | 125 |
| iii. Final Reflection | 50 |
| II. POPULAR NEUROSCIENCE (16%) | 160 |
| i. Deadly Feasts, <i>Exploring medical mysteries</i> | 40 |
| ii. The Emerging Mind, <i>Exploring the human condition essay</i> | 40 |
| iii. Decartes' Error, <i>Exploring a frontier hypothesis</i> | 40 |
| iv. Your Individualized Book, <i>Role-playing a book critic</i> | 40 |
| III. EXPERIENTIAL PROJECTS: (30%) | 300 |
| TRACK 1: Outreach and Peer Education | |
| A. NeuroEthics | 75 |
| i. Mentoring FIYS106 students | 25 |
| ii. Evaluating Neuroscience Research Practices | 50 |
| B. Science Journalism | 50 |
| i. Role-playing a New York Times Science Reporter | |
| C. Brain Awareness Campaign, <i>Art of Community Outreach</i> | 175 |
| i. Peer mentoring FIYS106 students | 25 |
| ii. Group Outreach Exhibit | 25 |
| iii. Group Anatomy Exhibit | 25 |
| iv. Group Teach-In | 100 |
| TRACK II: Exploring the Mind of a Scientist | |
| A. Neuroethics, Evaluating Neuroscience Research Practices | 50 |
| B. Discovering & Communicating the Edge of Knowledge | 100 |
| i. Action Potential Journal Club | 50 |
| ii. Science Journalism, <i>Role-playing a Nature Journalist</i> | 50 |
| C. Solving New Mysteries Research Proposal | 150 |
| i. Written Proposal | 75 |
| ii. Public Defense | 75 |
| IV. NEUROFRONTIERS WORKSHOP (20%) | 200 |
| i. Journal Review Manuscript | 100 |
| ii. Workshop Seminar | 100 |
| V. NEUROCOLLOQUIA (2%) | 20 |
| For attending guest lectures | |
| VI. YOUR PROCESS OF NEUROLEARNING (2%) | 20 |
| Total: | <u>1000</u> |

VII. NEUROBONUS

UP TO 25 POINTS MAX

| | |
|--------------|-----------------|
| SCALE | A = 90% or more |
| | B = 80-89% |
| | C = 70-79% |
| | D = 60-69% |

I reserve the right to introduce a curve at my discretion, but in three years of past teaching I have rarely deviated from the above scale. Importantly, I expect junior and senior students to approach this class from a more altruistic mindset. Use this course as an opportunity to exercise your mind and to learn something new yourself and not get “hung up” on how well your learning relates to a letter grade.

EXPECTATIONS

Academic Honesty:

I have zero tolerance for abuses. Please consult your student handbook regarding academic honesty and the honor system by which you should conduct yourself.

Relevant URL: <http://www.lakeforest.edu/academics/writing/plag.asp>

Attendance:

Philosophy: I will work hard to present to you the most up-to-date and complete information in neurobiology in a lucid and interesting manner. In return, I expect that you will regularly attend my lectures and actively participate in the classroom, lab, and assignments. Invariably, in each lecture, I will present material that textbooks and handouts may not cover. I will assume that you have read your assignments prior to class so that you can best engage in an informed classroom discussion and gain maximum benefit from my lectures. If you skip class, you will miss out both on valuable new information and possibly an interactive dialog.

Punctuality: My pet peeve is when students arrive late to class. Apart from being disruptive to my teaching efforts, it is also disrespectful of the class.

Absences: Unexcused absences from quizzes, exams, and labs will result in an appropriate loss in points. Health-related absences must be confirmed by student health services. Absences due to religious observations must also be made in advance. Family or other personal emergencies will require notification from the Dean of College's office. I will make every effort to reschedule a missed quiz/exam as a result of such excused absences.

Late Assignments: I strongly discourage of assignments being handed in late. **AVOID THIS INDULGENCE.** Each late day is a 25% deduction in points. No assignment will be accepted after the third day it is due.

Lastly, But Not In The Least:

While I never teach this course the same way twice, in all its variations, it has been tremendously successful at two liberal arts colleges, with a rich legacy of seventy-three graduates, the majority now pursuing successful post-graduate degrees and career paths. I am delighted that you are taking this course. Because I am always experimenting with new ways of teaching science to advanced undergraduates, I will push you more than you expected. But, I expect that you will push me just as hard! If you encounter problems understanding the material, please do not hesitate to talk with me. My job here is *to help you learn*. Your feedback and participation in class is very important. I welcome suggestions from you regarding every aspect of the course throughout the semester. Of course, at the end of the semester, the college will require you to formally evaluate my performance. I will look forward very much to that because your comments will help me improve in my quest to be the best teacher I can be and to engage you in superior learning. Remember also that I am here to learn from you. I have often found my students to be my most important teachers. So, I hope this course will be a rewarding experience for all.

ASSIGNMENTS IN DETAIL

I. CORE NEUROSCIENCE (30%)

A. Lecture

I always provide lecture packets for every lecture. They will be the primary source of information that I will test you on. You will benefit from consult appropriate texts for detailed information on each topic. I consult numerous sources for each lecture. I do not follow any one textbook strictly. The prescribed textbook is the one I use most often. For the semester's duration, I have put on informal reserve several copies of the acknowledged bible of all neurobiology textbooks—*Principles of Neuroscience* by *Kandel et al.* This reference should serve well, if your textbook falls short on specific information. The other textbooks that I routinely consult have been placed as part of the Informal BIO346 Reserves in the Johnson 215 for this semester. You are encouraged to consult portions of these other texts.

B. Neuroanatomy Lab

Laboratory access will be available to you from 8 am-10 pm throughout weeks 3-8. Neuroanatomy simply cannot be mastered in 3-hour lab sections. True mastery requires considerable exposure to the brain and individualized self-learning over a period of time. I will guide your learning of neuroanatomy but I insist that you walk this path of discovery semi-independently, using the Brain Atlas and the following sheep brain dissection website: <http://www.uofs.edu/sheep/>. This process of mastery can often be laborious and initially frustrating, but when learnt & understood the rewards are more than worth it.

TESTING CONTENT VIA EXAMS

You will be evaluated via one midterm that will be administered during two weeks before and after the midsemester break (30%). As of now, I hope to have no final exam in this class, and I hope for it to be that way. But, if you miss more than one lecture after the midterm, you will be required to take a final exam of 50 points instead that covers post-midterm of the handing in the 50 points final reflection essay. The midterm will have two parts. The first part (125 points) will cover neuroanatomy labs that run through weeks 3-7. The second part (125 points) will cover lecture materials from weeks 1-8. Material will cover lectures, textbooks, and any other assigned readings up to this point. Format will be a combination of objective and essay-type questions (just like BIO221 exams).

•Old lecture and lab midterms will be available as downloadable PDF documents via the forester pipeline page and studying them will definitely help you succeed in exams.

•I will design mock practical exam a week before the real midterm. Prepare for this mock test seriously and you will improve your chances considerably for the midterms.

C. Reflection Essay

This option is available only if you maintain perfect attendance/miss one lecture after midterms.

Instead of taking a final exam, I encourage you to put your thoughts together at the end of the semester and reflect on your learning the past 15 weeks. Simply by submitting your essay, you will receive full 50 points. I do not read your essays until after your grades are submitted. I also insist that you not sign your name on this essay. I do this in order to allow you be completely free to write without worrying about your grade. You will receive your final essay question soon after your midterm exams are over. It will require you to draw from your experiences from all aspects of this course, the core neuroscience, the popular neuroscience, the practice of science, probing mysteries of the mind, and your workshop and critique the value of such experiences to your academic and personal growth.

II. POPULAR NEUROSCIENCE (16%)

Textbooks are not the only sources of scientific “facts”, “theories”, and “hypotheses”. Science is conveyed to the public via many other formats: popular magazines, essays, nonfiction books, biographies, autobiographies, TV, and the movies. In fact, the public seldom appreciates the undeniable excitement underlying scientific discoveries from textbooks. Some of our deepest thinkers today are scientists and they have led truly extraordinary lives; many are also great writers and storytellers. The three non-fiction books assigned in this course will hopefully engage you in discovering the true essence of great scientists, and physicians, and the effects on families and caregivers: exciting lives, personal sacrifices, remarkable discoveries, brilliant minds, difficult societal issues.

A. DEADLY FEASTS, 40 points

Richard Rhodes wrote this extraordinary detective mystery of a book traces the history of one of the most biologically controversial, dogma-defying, tragic diseases of the 20th century: the prion diseases. It is compelling as much for its masterful account of the biomedical breakthroughs associated with the disease as it is for the human drama involving politics, egos, and the “name-of-the-game-is-fame” element that often pervades international science. These diseases are so unusual within biology that discoveries related to them have yielded two Nobel Prizes in the past 40 years. We will actively read and discuss this book during the week first day of class, during lab time.

B. THE EMERGING MIND, 40 points

The two movies (*Iris* and *Awakenings*) and the book *The Emerging Mind*, by V.S. Ramachandran, should be the fodder for a 1000-word reflection focused the human condition. In your essay, explore how by studying neurological syndromes, we acquire novel insights into the functions of the normal brain and how the functions of the brain are best understood from an evolutionary vantage point. Weave in the role of popular cinema in its ability and responsibility to provide to the public accurate insight into neurologies, the mysteries and known biology underlying, and empathy for the patient and families and the medical/care-giving professions. You are encouraged to get draft read by either writing tutor at the Writing Center.

C. DECARTES' ERROR, 40 points

My sense is that you will really enjoy this book. This masterpiece is regarded as a provocative hypothesis about the role of emotion in human reasoning, and the first of many subsequent books written by the author Antonio Damasio, one of the leading neurologists in the world. Your task will be to write a 1000-word essay on whether Damasio provides a compelling and logical case supporting his central premise: that emotions are not a luxury, they are essential to rational thinking. You are encouraged to get draft read by either writing tutor at the Writing Center.

D. YOUR INDIVIDUALIZED BOOK, 40 points

Your assignment is to take on the job of Science Book Critic for the *Scientific American* magazine and write a 1000-word review of this book. This opportunity allows you to critique a review in a lay style (for educated non-scientist) and summarize what’s refreshing, new, and important about this book. You are expected to consult *Scientific American* magazine for style of writing and encouraged to read samples of previously written reviews of other books in this magazine. But, you must completely avoid the temptation of consulting the web or print resources of previously written reviews of this same book. *Note:* I have a thorough library of past reviews found on the web and print resources on each of these books. You are encouraged to get draft read by either writing tutor at the Writing Center.

Your individualized assignments:

Seeing Voices, by Oliver Sacks (Lital)
Migraine, by Oliver Sacks (Mithaq)
Anthropologist in Mars, by Oliver Sacks (Sina)
The Man Who Mistook his Wife for a Hat, by Oliver Sacks (Lokesh)
A Leg to Stand On, by Oliver Sacks (Andrew)
Awakenings, by Oliver Sacks (Krista)
Island of the Colorblind, by Oliver Sacks (Josh)
A Beautiful Mind, by Sylvia Nasar (Ryan)
An Unquiet Mind, by Kay Jamieson (Stephanie)
Somebody Somewhere, by Donna Williams (Krista)

III. EXPERIENTIAL PROJECTS: CHOOSE EITHER TRACK I or TRACK II

TRACK I: Community Outreach and Peer Education

For all projects, form the same pair to carry out all three of them.

A. NEUROETHICS, The Discussion of Scientific Practice, 75 points

Neuroscientists are constantly faced with their own ethical dilemmas. Part of being a good scientist is being aware of such issues and knowing how to work with them. In this project, you have two roles.

First, each pair will serve as a peer leader for a group of 5 FIYS Medical Mysteries students. Each group will pick a topic from below. You will advise this group to prepare a one-hour class presentation during assigned lab hours that discusses the many issues that underlie your assigned problem, the choices a scientist faces, and steps to overcome the problem. Part of the group's presentation will also be to research real ethical problems that have been highlighted in science journals and the popular media in the last five years that resemble the problem you are discussing. The entire FIYS class should be involved in a 15-minute broader discussion of the same problem during or after the group's presentation. You should not play an active role during the presentation, instead you should seek to mentor them as an experienced peer behind the scenes and prepare them for this discussion.

Second, choose one topic from the topics that FIYS106 students did not pick (you will know what's left before the second week if over) and actively engage the BIOL346 in a discussion of this case study during BIOL346 class time.

I will reserve 10 points for your group to provide me a written summary of your ethics discussion and all consulted materials.

Ethics Topics:

Promotional Pressures
To be a Consultant ... or Not
A Political Power Keg
Concerning Confidentiality
Sound Practices
Cotter's Quandary
A Subject for Discussion

Ethics Dates

Week 5 (FIYS106 Lab Time) BIO346 Student will peer lead
Week 6 (FIYS106 Lab Time) BIO346 Student will peer lead
Week 6 (BIOL346 Lab Time) BIO346 Group Discussion

All scenarios have been adapted from cases described in *Fundamental Neuroscience* by Zigmond, Bloom, Landis, Roberts & Squire (1999, First edition, Academic Press).

•Please request from me additional handouts on "Sample Discussion Grid" and "Ethics Grading Protocol" to facilitate success

B. SCIENCE JOURNALISM, Communicating Medical Advances to the Public, 50 points

In this project, each pair plays the role of a medical journalist assigned to convey an exciting new biomedical discovery recently published as a primary article in the journal NEURON for the readership of journal *Nature* in the form of a *News and Views* article. The underlying goal is to learn skills to communicate the biological relevance of a primary article in simple, written language. You can choose any NEURON article that has a molecular biology approach and published in 2006. Students submit a 1000-word paper written in jargon-free language that captures the paper's medical relevance, describing results simply without compromising scientific content, and discussing how it advances biomedical knowledge. You must include a figure depicting a biological model at the cellular level that highlights the new discovery being reported. However, unlike in actual popular science journalism, you are required to cite primary articles, review articles, books, or other sources within the text (between 7-10 references is typical). Your best resource is to read example neuroscience-related News and Views articles in *Nature*. Peer teachers and I grade this project jointly using a detailed grading sheet that evaluates papers on both scientific content and journalistic storytelling.

C. LFC BRAIN AWARENESS WEEK, The Art of Public Outreach & Education, 150 points

This is a highly creative and collaborative project for BIO346. It is designed to provide you with an exciting opportunity to educate the LFC community about a neuroscience topic and to mentor freshmen as your collaborators. Pick one topic from among the following four areas of complex brain functions: **Sex and the Brain**, **Drugs and the Brain**, and **Sleep and the Brain**. You will work with a group of 4-5 FIYS106 Medical Mysteries students (the same that you worked with for the ethics Project) to design, research and conduct a Brain Awareness Campaign educating the community on the biology underlying this topic on our campus on the week of November 6-10 (2006).

i. Mentoring FIYS Outreach, 25 points: Your pair will be Peer Advisors of your FIYS106 team and help your group implement this project. Your role is to motivate, organize, educate, counsel, help plan, and serve as both a role model and an academic and campus resource. Help students translate creative ideas into reality. Remember they are freshmen—they may not know all the resources of our campus. The actual format of how your group decides to conduct outreach is completely open-ended. I encourage you to be highly creative and have a really enjoyable time with this project. Make it personal to you—invest in it. Remember, *I love being surprised!*

The bottom line for the group's outreach plan:

- educate the non-scientists about the topic in an interesting and effective way
- reach a significant proportion of the campus community (middle campus, peak time)
- combine visual with oral and written forms of communication with some hands-on exercise
- include a physical display of some kind that can later be showcased in Johnson Science Building)
- reflect the liberal arts (try and combine science with fine arts, theater, humanities, social sciences)
- use multiple resources (books, internet, research) and must connect with brain anatomy

Must address:

- why is this an important human behavior to study?
- what is the basic way our brain performs this activity?
- what are the current medical mysteries for this brain activity?

ii. BIO346 Outreach, 25 points: Think of the group outreach as the general background for your plan of action for outreach. Your outreach should strive to provide answers and explain current research to the medical mysteries that your team highlights. Your primary source of information should be primary articles and review papers on this topic from the past five years in the top science journals. You should select to highlight between 3-5 articles that say something new and interesting and extend knowledge beyond what's known in the textbook. Once you read these articles, your job is to then to communicate each of them as an answer to a previously unknown question. For each paper, design a single figure or visual diagram that captures the main result. This diagram must be easy to explain to a non-scientist. Next, design a single poster that combines each of these 3-5 diagrams into one coherent presentation.

You should work with your FIYS106 team to connect your poster effectively with their outreach plan. Both the team and individual efforts must be presented together at the same time.

iii. ANATOMY EXHIBIT, 25 points: Pick two topics from: any of the five senses or aspects of the motor system. Design an anatomy exhibit using sheep and human brains that helps a lay person understand how the brain perceives these senses by emphasizing the pathway and the functions of each part of that pathway. You will demonstrate the exhibit and teach the biology during the Brain Anatomy 101 lab held during FIYS106 lab time during Brain Awareness Week. This lab is open to the campus public and your presentation effort should reflect an ability to reach out to the public. If you have class during that time, make sure you make up for it by contributing significantly to helping your pair member create the exhibit and prepare the presentation to be delivered.

iv. TEACH IN, 100 points:

This project is designed to give you a first-hand experience in teaching undergraduates. In this case, your BIO346 peers and campus public community. I will release three topics of this course (**Sex and the Brain**, **Drugs and the Brain**, and **Sleep and the Brain**.) and class and lab periods during brain awareness week to accommodate the outcomes of this project. Your task is to become the expert of one of these topics (this is the same topic you and your FIYS peer group chose for the *Outreach* project and present a lecture on it to your classmates. Also integrate into your lesson the 3-5 current discoveries (the same papers you highlighted for your community outreach project).

I completely accept that teaching by lecture may not be the best method for you, as there all kinds of ways to effectively teach. You should think hard about how you want to teach your classmates. For inspiration, think of the teachers at LFC whose styles you like most and try and adapt their methods to your plan. Think of what you don't like about what I do when I teach, and try other things! I always look for ways to improve my classroom style, and I would be happy to pick some pointers from you.

To create your lesson plan in a timely manner, follow the suggested schedule I have developed (see Project Schedule). Make sure to include in your lesson plan, the use of multiple sources (including multiple textbooks) and the use of multiple communication styles (for example: chalk and board, overheads, PowerPoint, group discussion, props, others).

Make as many appointments with me as necessary, if you need my advice. I want you to succeed and feel confident. But, avoid last minute sessions. You must practice your class teaching presentation in front of your peer teachers at least two days before the presentation. This peer practice is all-important.

TRACK II: Exploring the Mind of a Scientist

For one group of 2-4 members and carry out each of these projects as a group

A. NeuroEthics, 50 points

Neuroscientists are constantly faced with their own ethical dilemmas. Part of being a good scientist is being aware of such issues and knowing how to work with them. In this project, choose one topic from the topics below that FIYS106 students did not pick for this same project (you will know what's left before the second week if over) and actively engage the BIOL346 in a discussion of this case study during BIOL346 class time.

Join hands with one of the pairs that form in Track 1 to carry out this project. You will conduct a one-hour class presentation during lab time that discusses the many issues that underlie your assigned problem, the choices a scientist faces, and steps to overcome the problem. Part of your group's presentation will also be to research real ethical problems that have been highlighted in science journals and the popular media in the last five years that resemble the problem you are discussing. The entire class should be involved in a 15-minute broader discussion of the same problem during or after your group's presentation.

I will reserve 10 points for your group to provide me a written summary of your ethics discussion and all consulted materials.

Ethics Topics:

Promotional Pressures
To be a Consultant ... or Not
A Political Power Keg
Concerning Confidentiality
Sound Practices
Cotter's Quandary
A Subject for Discussion

Ethics Dates

Week 5 (FIYS106 Lab Time) BIO346 Student will peer lead
Week 6 (FIYS106 Lab Time) BIO346 Student will peer lead
Week 6 (BIOL346 Lab Time) BIO346 Group Discussion

B. Discovering & Communicating the Edge of Knowledge, 100 points

I. ACTION POTENTIAL JOURNAL CLUB, 50 points

New science is communicated in a variety of ways, all of which are clumped together as “primary literature”. At first glance, reading such papers can be daunting and often discouraging, because they are highly technical and require extensive background information. A primary goal of this course is to help you overcome such initial barriers in reading primary papers. As you have already learnt from BIO221 or from other biology courses, a journal club is a presentation format in which primary literature is discussed with an informed audience in an exciting engaging informal manner. Your group must select two 2006 papers on the same molecular neuroscience topic which must have been published in *Science*, *Nature*, *Cell*, or *Neuron*. You are expected to read and understand these papers almost entirely on your own, with my minimal guidance. Then you must present these papers in a combined PowerPoint journal club that should take no more than 1.5 hours.

15 points are reserved for practicing journal club in front of peer teachers two days before presentation.

II. SCIENCE JOURNALISM, Role-playing a Nature Journalist, 50 points

In this project, each pair plays the role of a medical journalist assigned to convey an exciting new biomedical discovery recently published as a primary article. The underlying goal is to learn skills to communicate the biological relevance of a primary article in simple, written language. Pick any one of the two articles you presented for journal club. Students submit a 1000-word paper written in jargon-free language that captures the paper’s medical relevance, describing results simply without compromising scientific content, and discussing how it advances biomedical knowledge. You must include a figure depicting a biological model at the cellular level that highlights the new discovery being reported. However, unlike in actual popular science journalism, you are required to cite primary articles, review articles, books, or other sources within the text (between 7-10 references is typical). Your best resource is to read example neuroscience-related News and Views articles in *Nature*. Peer teachers and I grade this project jointly using a detailed grading sheet that evaluates papers on both scientific content and journalistic storytelling.

A. Solving New Mysteries: Research Proposal, 150 points

I. ORIGINAL RESEARCH PROPOSAL

Research is central to scientific exploration and discovery. A research proposal is a formal presentation of one’s ideas for future research. Such proposals are founded on past and present research. Most successful proposals have the following qualities: an exciting original idea, an ability to create new fields or integrate existing fields, logical and exceptional communication of ideas, a plausible experimental plan, and a clear relevance to the human condition. Proposals are usually written to attract funding to sustain one’s research; without funding, research is impossible.

In this project, you will seek to extend a field beyond what is already known. Your journal club articles took you to edge of knowledge in a given field. So now you sit on a gap of knowledge. What don’t we know? How do we pose questions and find answers? The first thing to do is to propose a testable hypothesis and develop specific aims to answer the questions that can help test the hypothesis. You will then need to develop an extensive bibliography on the topic and on the methodologies that will be used in the experimental approach section. You will present a 2-page outline by Week 5. A draft follows on Week 7 (a draft means that you have given it your best shot at writing this proposal and now you need my criticism so that you can turn in a final highly polished version; it’s a draft from my perspective, but really it’s your best attempt).

Your final proposal (due Week 10) should be 10 pages long single-spaced. It should contain the following sections: Summary, Hypothesis, Specific Aims, Background, Experimental Rationale/Methods, Expected Results, Biological Significance, Timeline, and References. Reference list should contain between 20-30 referenced papers. You will also be encouraged to provide figures of expected results. Ideally, an original proposal would be written individually. But, because of the limited time frame in which you have to accomplish this task and because this will be your first time writing a research proposal, it will be much more productive for you to attempt this in groups of three. Having said that, I expect members of each group to contribute fully and equally to each proposal.

25 points reserved for two consultations with writing consultant on proposal draft and final versions during the recommended weeks. Late consultations will not receive credit.

II. PUBLIC DEFENSE

One week after you have submitted your proposal (Week 12, during Brain Awareness Week), each group will present their proposal formally in front of peers and invited faculty in a public defense. You will use PowerPoint to deliver a 45-minute presentation followed by a 15 minute Q&A session, intended to be delivered in a language to be understood by an undergraduate audience at Lake Forest College. Your performance will be graded by your peers. You are expected to “defend” your proposal and explain your rationale, technique, and expected results. You are also expected to come up with alternate experiments and provide the pros and cons of such strategies.

15 points are reserved for practicing in front of peer teachers at least two days before defense.

- Follow the deadlines in the EXPERIENTIAL SCHEDULE attached to this syllabus
- Use Sample Research Proposal, Sample Defense PowerPoint, and Grading Sheets to guide your success
- Your peer teachers are your best resource for this project.

IV. NEUROFRONTIERS, Exploring Research Careers & Knowledge Building, 200 points

Role-Playing the World’s Leading Neuroscientists

i. NEUROFRONTIERS REVIEW MANUSCRIPT, 100 points

ii. NEUROFRONTIERS WORKSHOP SEMINAR, 100 points

This is your “experiential” capstone project, in lieu of a formal final exam. The disease workshop (to be held on November 30) is a “mock” scientific conference: a meeting of the minds representing the world’s top experts in neurobiology and neurological diseases. Your job will be to role-play an assigned real life scientist at the cutting edge of his/her field. The assignments will be made the first week of class. To do this effectively, you will need to become very familiar with your assigned scientist’s research and the broader context and impact in which his/her work is being performed. You will have to read, understand, and present many research articles from that scientist’s lab and show us logically the art of hypothesis building and testing that made these scientists celebrated leaders in their field. You will also have to give the state-of-the-art background on research done in your field by others.

- All participants will pre-submit a 200-word research summary and a 4000-word [journal review manuscript](#) that will be published in a special publication, also entitled NEUROFRONTIERS.
- At the NeuroFrontiers workshop, as the role-playing scientist, you will present your very exciting work in a 35-minute PowerPoint [workshop seminar](#) and answer questions about your work during a 5 minute Q&A session. This year’s workshop will highlight three frontiers in neuroscience research:
 - Mental Frontiers** featuring the most enigmatic psychiatric illnesses of our time;
 - Regeneration Frontiers** capturing the promise and challenges of repairing brain damage;
 - Degeneration Frontiers** highlighting advances in four brain and muscle degenerative diseases
 - Nobel Frontiers** highlighting the most recent Nobel Prize winning neuroscientists

I have invited two neuroscience educators and experts on neurodegeneration and neuropharmacology to be our guests for this workshop. They will attend this workshop along with you and be active participants in your seminars and engage in discussions. Most importantly, they will also present research seminars of their work during the workshop. On November 30th, you are required to attend all sessions as well as the seminars of the two guest speakers who will participate in your workshop, unless if you have a class in the E Slot. The entire class is encouraged to host your speakers for lunch at the Commons and attend a celebratory dinner at my home that evening.

*15 points reserved for consultation with your writing consultant on manuscript during recommended week.
15 points reserved for practicing in front of Dr. DebBurman two days before presentation.*

- Follow the deadlines in the PROJECT SCHEDULE attached to this syllabus.
- Attached also is the schedule of scientist assignments.

V. NEUROCOLLOQUIUM

Last year, more than 25,000 neuroscientists attended the 32nd annual meeting of the Society for Neuroscience, making it the largest annual scientific meeting in the world! You can only imagine the breadth and depth of neurobiology research that this meeting represented. My wish is to provide you with a glimpse of this exciting state of affairs, so I initiated a new course-related event in 2002: Colloquium. In this year's Colloquia, four neuroscientists will visit campus.

Fall 2006 Medical Colloquium Talks include:

September 27, 4 pm, Meyer Audi, Richard Morimoto, Northwestern University
October 25, 4 pm, Meyer Audi, Susan Leibman, University of Illinois Chicago
Nov 6, 4 pm, Meyer Audi, Dennis Molfese, University of Louisville
Nov 8, 4 pm, Meyer Audi, Susan Goldin Meadow, University of Chicago

VI. PROCESS OF NEUROLEARNING (2%)

How you learn is just as important as what you learn. You have been asked to master challenging projects in this course that requires you to develop abilities to work well each other and juggle several projects simultaneously. I have provided several teaching supports that should help you maximize your learning efficiently. If you demonstrate positive learning habits, good collaborative ability, and use the placed resources well, I will be happy to award you up to and all of 50 process points.

You have used resources effectively if you

Did not miss appointments with me and did not wait till the last minute to work on assignments and exams
Consulted regularly with peer teachers when you needed advice or help
Attended peer teacher initiated research skills workshops
Used Writing Center for feedback on all papers
Attended mock practical exam in preparing for midterms
Practiced your talks in front of peers

You have collaborated well if you

Contribute equally to developing each project from beginning till end
Participate equally in writing papers and in presenting each talk
Mentored FIYS students responsibly and behaved as peer leaders freshmen could look up to
Provided support for your group members if they needed it
Did not complain about each other and tried to solve conflicts by talking to each other
Maintained healthy collegiality and supported other groups by enthusiastic participation in their efforts

You have demonstrated positive intellectual attitude if you

Were attentive and participated actively in class and lab and pushed me to be even more effective
Were prepared ahead in readings and were not absent or late for class, labs, or meetings
Demonstrated curiosity and creativity in your assignments: stepped "out-of-the-box"
Showed personal initiative and leadership (plenty of scope to do so in this class)

VII. NEUROBONUS

1. Attend Brain Awareness week events outside of your class time
 - FIYS outreach booths (that are not assigned for you to grade)
 - Neurocinema III: A Beautiful Mind
 - Galileo Players
2. NeuroArt Contest
3. Other