

# **NEUROSCIENCE**



# **AT LAFAYETTE**

**Course/Research Handbook  
2009-2010**

# Majoring in Neuroscience at Lafayette

Neuroscience is an interdisciplinary field exploring the development, structure, and behavioral consequences of nervous systems. The B.S. Program in Neuroscience at Lafayette educates students to understand nervous systems from a variety of scientific perspectives. Within the major program, students have the freedom to create their own combination of electives that reflect their particular interests (e.g., behavioral neuroscience or cellular/molecular neuroscience). The major consists of 17 courses distributed among foundation, core, and elective courses (curriculum effective with the class of 2010).

## FOUNDATION COURSES

- BIOL 101 (General Biology I w/ lab)
- PSYC 110 (Introduction to Psychological Science w/ lab)
- PSYC 120 (Quantitative Methods in Psychology)
- CHEM 121 (Introductory Chemistry I w/ lab)
- CHEM 122 (Introductory Chemistry w/ lab)
- CHEM 221 (Organic Chemistry I w/ lab)<sup>1</sup>
- PHYS 111 (Mechanics & Thermodynamics, w/ lab)
- PHYS 112 (Electricity, Magnetism, & Optics, w/ lab)

(Note: As part of the Common Course of Study, Neuroscience Majors *must*

## CORE COURSES

- NEUR 201 (Intro to Neuroscience)
- PSYC 323 (Physiological Psychology w/ lab)
- BIOL 256 (Neurobiology w/ lab)
- NEUR 401 (Advanced Neuroscience)

## MAJOR ELECTIVES

5 total courses, at least 2 from each category below

### Category A

PSYC 203 (Design & Analysis w/ lab)<sup>2</sup>  
PSYC 225 (Psychopharmacology)  
PSYC 232 (Abnormal Psychology)  
PSYC 234 (Adult Development and Aging)  
PSYC 255 (Memory)  
PSYC 321 (Learning)  
PSYC 322 (Perception w/ lab)  
PSYC 324 (Comparative Psychology: Animal Behavior w/ lab)  
PSYC 325 (Cognitive Psychology w/ lab)  
PHIL 250 (Philosophy of Mind)  
NEUR 351 (Neurophysiology)

One Independent Study (NEUR 391/392), Advanced Research (491/492), or Honors (NEUR 495/496) course may also be used as an elective. A Neuroscience research course does not count towards either category.

### Category B

BIOL 212 (Developmental Biology w/ lab)  
BIOL 214 (Neuroanatomy w/ lab)  
BIOL 241 (Genetics)  
BIOL 245 (Immunology w/lab)\*  
BIOL 251 (Human Physiology w/ lab)\*  
BIOL 261 (Molecular Biology w/ lab)  
BIOL 310 (Developmental Neurobiology)  
BIOL 312 (Cell Biology)  
BIOL 314 (Anatomy of Vision)  
CHEM 351 (Biochemistry Survey)  
CM 151 (Computational Methods w/lab)

\*requires Biol 102 or equivalent AP credit

<sup>1</sup>Students interested in pursuing medical school or graduate school in neuroscience are encouraged to take Chem 222.

<sup>2</sup>Students interested in graduate school in neuroscience are encouraged to take Psyc 203 as one of their Category A electives.

## **Research Opportunities in Neuroscience**

Hands-on involvement in research is considered a central component of the Neuroscience Program at Lafayette College. This research serves many purposes: it offers you unparalleled opportunities to understand an aspect of neuroscience; you will experience what neuroscience research actually entails; and you may even get to present your work at local or national meetings, or possibly publish your work in a refereed scientific journal. It is never too early for you to begin to garner the benefits of direct involvement in neuroscience research.

Neuroscience majors interested in gaining a research experience may enroll in either Independent Study (Neur 391, 392), Advanced Research (Neur 491,492), or Thesis (Neur 495-496). In any case, the student works individually with a faculty mentor on a specific research project. Independent Study (Neur 391,392) is normally taken by students interested in exploring a topic not available through regularly offered courses. Independent Study may include library or laboratory research; the nature of the course is decided through discussions between the interested student and the faculty member. Advanced Research and Thesis are reserved for projects which emphasize original research. Depending on the scope of the research project, students will enroll in Advanced Research for either one or two semesters. No more than four credits of Advanced Research may be applied toward graduation or fulfillment of the degree requirements. Frequently, students will use Advanced Research as preparation for enrolling in Thesis (Neur 495-496).

Neuroscience research is an exciting way to expand on your education. It will likely form a valuable capstone experience to your undergraduate education, and may play a major part in helping you develop and achieve your future goals. Indeed, a recent survey by the Association of Neuroscience Departments and Programs found that approximately 80% of the students pursuing advanced degrees in neuroscience had undergraduate research experience.

### **Getting Involved in Research**

The most important step in starting your research experience is to discuss your interests with a faculty member from the Neuroscience Program. Ideally, you should seek out the faculty member whose research work is most similar to your own interests. Don't be dissuaded if you can not pinpoint your exact area of interest; any faculty member from the Neuroscience Program will be happy to talk with you and help you explore what type of research would be best for you. A faculty member may request that you enroll in a specific upper-level course; this is done to ensure that your motivation is genuine, that you have an essential base of information, and to acquaint you with some fundamental laboratory techniques. Approval for you to pursue research must be gained from the Chair of the Neuroscience Program.

Once you and the faculty member have agreed to work together, you will begin to explicitly define the research project. One critical first step in this process is to conduct an extensive literature search. Your specific obligations will be determined by the nature of the research project. In any case, we expect a research student to be reliable, enthusiastic, and hard working, and to appreciate the ethical and moral responsibilities that come with research. As a general guideline you should plan on spending ten hours a week working on your research project.

### **Requirements for Honors**

Students who participate in the Honors Thesis program must have a 3.0 GPA overall and a 3.2 GPA in the Neuroscience Program. Eligible students may enroll in Honors only with the permission of the Chair of the Neuroscience Program. Students may begin their Honors research during the Spring semester of their Junior year. During the first semester the student develops a research proposal, and presents this proposal in front of the Thesis Committee. Students who earn an "A" in Thesis their first semester are eligible to continue with Honors their second semester. During the second semester the student will complete the research, write the Thesis, and defend the Thesis in front of the Thesis Committee. Students whose work warrants an "A" grade both semesters will graduate with "Honors in Neuroscience" and this honor will be noted on their diploma and transcript.

## Schedule For Honors Students

The following is a summary of the events, which must take place in order to graduate with Honors in Neuroscience.

Sophomore or Junior Year: Discuss your research with a Neuroscience faculty member. You will want to do this early enough that you have time to enroll in an upper-level elective prior to your senior year. You may choose to do a semester or year of Advanced Research at this time, but this is not required to pursue Honors. Prior to enrolling in Honors you must have the permission of both the faculty mentor and the Chair of the Neuroscience Program.

First Semester of Honors (Fall semester Senior year or Spring semester Junior year):

- A) In consultation with your faculty mentor, you must use your time judiciously to formalize your research plans. Approval of your thesis proposal must be obtained before the research is begun. To ensure that you have adequate time to complete your research, you should draft your research proposal as quickly as possible.
- B) You need to compose your Thesis Committee. For conducting Honors in Neuroscience, the three-member Thesis Committee must first include your thesis advisor. The second member should be from a different department from your thesis advisor; for example, if your thesis advisor is a member of the Biology Department then your second member needs to be a faculty member from the Psychology Department and vice versa. At least one of these two faculty members needs to be a current member of the Neuroscience Advisory Committee. The third member of your Thesis Committee needs to be a faculty member from outside biology and psychology. All members from the Neuroscience Advisory Committee will be encouraged to attend your defenses. Members of the Biology and Psychology Departments will also be invited.
- C) The thesis proposal must be submitted to the Thesis Committee prior to the end of the first semester; the exact submission date is dependent on the nature of the thesis project, and will be decided through consultation with your faculty mentor. This proposal must include a detailed introduction, a clear and concise statement of the problem being investigated, details of the experimental design and analysis, and a reference list reflecting the literature searches performed. Within two weeks of its submittal, the Honors candidate will present the proposal to the Thesis Committee. This presentation, which generally lasts around one hour, is an opportunity to discuss the proposed project with the Thesis Committee. The presentation serves as a valuable opportunity for you to get feedback on the details of your proposed experimental design and analysis. Careful attention must be paid to the issues raised; seemingly minor points can have a profound impact on the quality of your final Thesis.
- D) Based on the quality of your thesis proposal and presentation, the Thesis Committee will approve, approve with modifications, or decline the thesis proposal. The Thesis Committee will also assign you a grade for the first semester, again based on the quality of your proposal and presentation. Only students awarded an "A" will be allowed to continue on in Thesis for the second semester.
- E) Immediately upon final approval of your thesis proposal (if modifications were required), you will need to apply to the Institutional Animal Care and Use Committee (if your project involves vertebrate animals) or the Institutional Review Board (if your project involves human subjects). Research involving humans or vertebrate animals can not be conducted without prior approval from the appropriate body.

Second Semester of Honors (Fall or Spring of the Senior year):

- A) The collection and analysis of your data must be a high priority during the first half of this semester. Unexpected difficulties and delays are the norm during this stage of scientific research; care must be taken to give yourself enough time to overcome these obstacles. Concurrent with the data collection and analysis, you should be preparing the first draft of your Honors Thesis.
- B) No later than three weeks before the end of the semester you must submit a complete final draft of the Thesis to your Thesis Committee. It is expected that this draft will include all of the data, data analysis, discussion, and figures. Samples of earlier Honors Theses are available for your inspection at Skillman Library, or from the Chair of the Neuroscience Program.

- C) No later than two weeks prior to the end of the semester you will make a formal presentation and defense of your Thesis to your Thesis Committee. The presentation consists of a fairly short (around 20 minutes) overview of the methods, results, and significance of your results presented for a general audience. The presentation will be followed by questions from the Thesis Committee members. Following the defense the Thesis Committee will discuss your performance and vote on whether you have earned Honors in Neuroscience, or some grade less than an "A." You will be informed immediately of the Thesis Committee's decision.
- D) A final copy of the Thesis, incorporating the revisions and/or corrections suggested by the Thesis Committee, is submitted to the Chair of the Neuroscience Program prior to the end of the final examination period. A second final copy of the thesis is submitted to Skillman library.

Submission of an acceptable final Thesis prior to the end of the final examination period completes the requirements for Honors in Neuroscience. During the last faculty meeting of the academic year, the Faculty Academic Progress Committee moves that the faculty recommend to the Board of Trustees that successful Honors candidates be allowed to graduate with Honors and, unless there are objections, the faculty passes the motion. When the Trustees accept this recommendation at their last meeting of the academic year, a notation of "Graduation with Honors" is made on the transcript of each student so designated; students graduating with Neuroscience Honors have this noted on the commencement Program.

## **Research Interests of the Neuroscience Faculty**

**These are the principle faculty in neuroscience. Faculty in Biology and Psychology and other disciplines can also supervise neuroscience research or you can get credit for other departmental research by petition. See the pertinent departmental web pages for details on research opportunities.**

**Wendy L. Hill** (Ph.D., University of Washington). William C. '67 & Pamela H. Rappolt Professor of Neuroscience.

My research seeks to understand the physiological mechanisms that mediate behaviors as well as the evolutionary processes that select for certain behaviors because they are more adaptive than others. I conduct both field research (when evolutionary selection pressures are typically examined) and laboratory experiments (when physiological mechanisms are usually explored). I am especially interested in the role of neurotransmitters and hormones to the social behaviors of animals. I also explore the adaptive significance of reproductive behaviors, especially the behaviors of birds.

**Elaine R. Reynolds** (Ph.D., Carnegie Mellon University). Associate Professor of Biology and Chair of the Neuroscience Program

Research in the laboratory centers on problems in the development and physiology of the nervous system. Using behavioral mutants in *Drosophila melanogaster*, projects in the laboratory involve techniques from the fields of genetics, biochemistry, molecular biology, pharmacology, physiology and behavior. These mutations serve as models to help us understand the causes and mechanisms of various human diseases, including epilepsy, alcoholism, Parkinson's and chronic pain.

**James R. Dearworth** (Ph.D., University of Delaware) Assistant Professor of Biology

I direct student-based research that examines the anatomy of vertebrates focusing on the functional anatomy of vision. Students in my laboratory investigate the functional anatomical mapping of the turtle retina to address how the vertebrate retina processes color and motion. In addition to the functional morphology of the turtle retina, other brain areas are examined to investigate reflexive eye movements: the pupillary response to light and the response to rapidly approaching targets. Student projects also examine the control of eye movements for tracking targets moving in depth.

**Lisa Gabel** (Ph.D., University of Connecticut) Assistant Professor of Psychology

My research focuses on how synapses are modified (strengthened and/or weakened) in response to sensory experience particularly on examining the molecular mechanisms which underlie neurodevelopmental disorders, such as Fragile-X mental retardation, and epilepsy.

**Luis F. Schettino** (Ph.D., Rutgers University) Assistant Professor of Psychology

My research focuses on motor cognition, more specifically, on how action is represented in the nervous system. My recent work includes hand preshaping during grasping in both normal populations and Parkinson's disease patients.