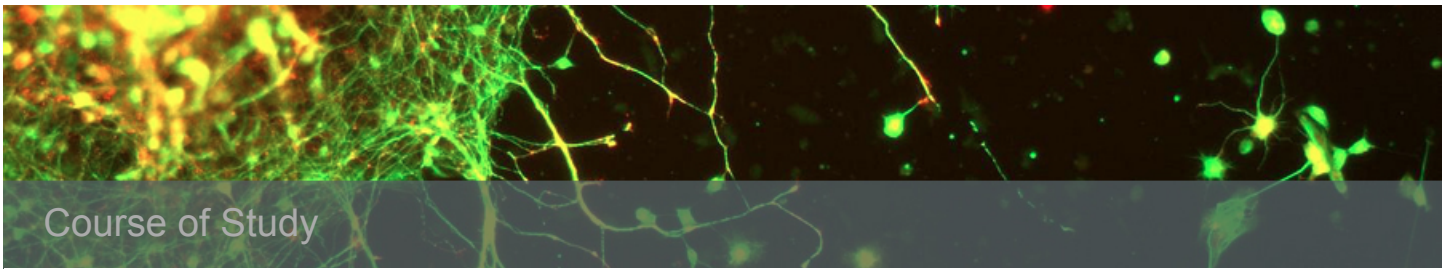

Course of Study

Student Advisory Committee
Course of Study
Preliminary Qualifying Exam
Links - Navigating Boston
Links - Arts & Entertainment
Career Resources

Course of Study - Year 1 | Course of Study - Year 2
Course of Study - Year 3 and beyond

Course of Study - Year 1

Advisory Meetings: Each first-year student meets individually with the Student Advisory Committee in early September, in December, and in May. The goal of these meetings are to discuss course choices (including any electives), review academic progress, consider rotation choices, and address any questions or concerns the student may have.

Rotations: Each student is expected to do at least two laboratory rotations of 8-12 weeks each. Students are expected to work part-time in lab when their classes are in session, and full-time during coursework breaks (January and the summer months). Students must complete and submit a Rotation Registration Form at the beginning of each rotation. A third rotation is optional, and additional rotations are permitted with the consent of the Student Advisory Committee.

Overview of Courses: In the fall term students are required to take Neurobiology 220 (Cellular Neurophysiology) and Neurobiology 327 (Rotations in Neuroscience). Apart from this, four additional full-semester courses are required, with coverage of three general fields: cellular/molecular, development, and systems. The Program offers three courses during the spring semester covering these fields (see below), but students may opt to take a different course or courses in consultation with the Student Advisory Committee or the Program Director. It is not required that all coursework be confined to the first year. As students embark on their dissertation research, they frequently discover holes in their backgrounds that need to be filled. The Program strongly encourages them to do so, and will continue to support and advise them in this process.

An equally important adjunct to the course curriculum consists of research seminars given by visiting scientists and other students. All PIN students are ***strongly encouraged*** to attend the Monday lunchtime seminar series (sponsored jointly by the Department of Neurobiology and the F.M. Kirby Neurobiology Center at Children's Hospital), the Wednesday lunchtime lab presentations, the biweekly Nocturnal Journal Club (run by fellow PIN students), and the Dissertation Seminars of their PIN colleagues.

Offered Courses – Fall Term:

Neurobiology 200. Introduction to Neurobiology
John Assad, David Corey, Matthew Frosch, Lisa Goodrich, and Rosalind Segal
Fall term – Mondays, Wednesdays, and Fridays 9 -12
Modern neuroscience from molecular biology to perception and cognition. Includes cell biology of neurons and glia; ion channels and electrical signaling; synaptic transmission; brain anatomy and development; sensory systems; motor systems; higher cognitive function.
Note: Nine hours of lecture or lab/conference weekly.
Jointly offered with the School of Medicine as HT 130. Will follow the medical school calendar.

Neurobiology 220. Cellular Neurophysiology
Bruce Bean, Wade Regehr, Gary Yellen, and Bernardo Sabatini
Fall term – Tuesday and Thursday 9 – 12, with weekly discussion session to be scheduled
Introduction to the physiology of neurons. Topics include structure and function of ion channels, generation and propagation of action potentials, and physiology of synaptic transmission. Includes problem sets and reading of original papers.
Note: Offered jointly with the Medical School as NB 714.0.
Prerequisite: Introductory neurobiology.

Neurobiology 327. Rotations in Neuroscience
Members of the Program in Neuroscience.

Timeline

Click here to view the timeline of G1 and G2 requirements.

For a detailed description please click here.

Forms

Dissertation Advisor Declaration Form
DAC Form - (Final Meeting Form)
Lab Rotation Registration
Preliminary Qualifying Exam
Student Lab Changing Form

Fridays in September, October and November, 2:00 to 6:00
This course is designed to introduce the faculty research activities to new students. The first semester consists of several poster sessions held at various central locations such as the Kirby Neurobiology Center at Boston Children's Hospital and the Center for Brain Science at Harvard University.

Offered Courses – Spring Term:

Neurobiology 204. Neurophysiology of Central Circuits
Rachel Wilson, Rick Born, John Assad, Michael Do, Chris Harvey, Gabriel Kreiman, Margaret Livingstone, and John Maunsell
Spring term – Monday and Wednesday 10-12
This course serves as an introduction to major themes in systems neuroscience. Our goal is to equip students with the knowledge they need to understand the fundamental concepts underlying current research in the neurophysiology of central circuits. Each week is dedicated to a different theme, and will draw on research from a variety of different sensorimotor modalities and model organisms.
Prerequisite: Neurobiology 220.

Neurobiology 207. Developmental Neurobiology
Lisa Goodrich, Chenghua Gu, Beth Stevens, and Michela Fagiolini
Spring term – Wednesday, 2 - 4; Friday, 10 - 12
Lectures cover nervous system development, including neural induction, neural patterning, nerve cell type specification, nerve cell migration, neurotrophin and neuronal cell survival, axon guidance and targeting, synaptogenesis and plasticity, adult neurogenesis and brain repair.
Note: Paper reading will allow students to learn how to identify interesting biological questions and feasible approaches to address the questions. Lectures will also be given about how to write a grant application, and proposal writing is served as the final exam.
Offered jointly with the Medical School as NB 720.0.
Prerequisite: Neurobiology 200 or permission of instructor.

Neurobiology 221. Molecular Neurobiology
Sandeep Datta, Jonathan Cohen, Josh Kaplan, and Pascal Kaeser
Spring term – Tuesdays and Thursdays, 10 - 12
Molecular biology and genetics of the nervous system. Emphasis on the importance of ligand-receptor interactions and receptor regulation for the function of the nervous system and on the mechanics of storage and release of neurotransmitters.
Prerequisite: Introductory neurobiology and molecular biology

Other Electives:

Note: Students may take any Harvard course as an elective. This is a partial list only, and includes some electives which are common choices for Program students.

Neurobiology 209. The Neurobiology of Disease
Ed Kravitz and Robert H. Brown
Spring term – Monday, 4 – 6:30; Wednesday, 7 – 9:30
Monday sessions involve patient presentations and “core” lectures describing clinical progression, pathology, and basic science underlying a major disease or disorder. Wednesdays, students present material from original literature sources, and there is general discussion.
Note: Given in alternate years; next offered in spring 2012. For advanced undergraduate and graduate students. Prerequisite: Introductory neurobiology, biochemistry, and genetics/molecular biology recommended.

Neurobiology 2XX. Visual Object Recognition
Gabriel Kreiman (Medical School)
Catalog Number: 8402
Fall Term (Half Course) - Monday, 3:30-5:30
Examines how neuronal circuits represent information and how they are implemented in artificial intelligence algorithms.
Topics covered: architecture of visual cortex, neurophysiological experiments in humans and animals, visual consciousness, computational models of pattern recognition and computer vision.
Prerequisites: Life Sciences 1a (or Life and Physical Sciences A) and Life Sciences 1b (or equivalent). Recommended: Math (Maa/Mab, Math1A,1B, Math19a or equivalent). Physical Sciences 1. MCB80.

Neurobiology 300. Advanced Topics in Neurobiology
David Lopes Cardozo and members of the Program in Neuroscience.
A series of reading and discussion seminars on selected topics in neuroscience. Seminars run for a half
semester (seven weeks). In recent years topics have included:
Molecular Mechanisms of Congenital Defects of the Brain and Nervous System
Tools for Statistical Inference in Neuroscience
Cellular and Molecular Repair in the mammalian CNS
Genetic Analysis of Nervous System Function
Mechanisms of Cell Death in Stroke and Trauma
Molecular basis of Neural Development and Neurodegeneration
Development and regeneration of the Visual System

New Biology through Physics; Molecular Discoveries with Light
Molecular Biology of Alzheimer's disease and Related Neurodegenerative Disorders
Hypothalamic Regulation of Motivated Behaviors
Neural Stem Cells
Of special note is the biostatistics course taught in the quarter course format. Students without strong prior training in biostatistics are advised to take this course in their first or second year.

Immunology 305qc. Neuro-immunology in development, regeneration and disease
(New Course) Catalog Number: 98545
Beth Stevens and Clifford Woolf
Quarter course (spring term). Th., 5–7.
It is increasingly clear that the nervous system and immune system share parallel molecular pathways, and communication between neurons and immune cells play significant roles in homeostasis and disease.
This course will investigate current topics in neuro-immunology: CNS development, chronic pain, neurodegeneration, aging, axon regeneration, auto-immunity and infection. We will focus our discussions on molecular mechanisms shared by the immune and nervous systems and the molecular cross-talk between these two systems. Each class will cover a specific topic in neuro-immunology. Students should be prepared to lead discussions on pre-selected papers for each session.

9.S94 – Connectomics Lab: Neural Circuits of the Retina
Sebastian Seung, Richard Masland, Jinseop Kim, Aleksandar Zlateski
Mondays, Tuesdays, Wednesdays, and Thursdays 2-3pm, beginning on Jan.
9 and concluding on Feb. 2. Students will also spend extensive time outside class doing research.
This intensive (6 unit) class will combine education and research in the emerging field of connectomics, focusing on the mouse retina.
Students will read and discuss recent scientific literature, and will collectively analyze data acquired with two advanced imaging technologies: two-photon microscopy and serial electron microscopy.
They will identify and reconstruct specific types of ganglion cells identified either by shape or visual response properties. The neural circuit for each ganglion cell type will be mapped by searching for its presynaptic amacrine and bipolar cells. Students will consider the implications of such connectivity maps for the visual functions of ganglion cells. (Those with programming skills may also help develop computational tools used by the class.) Ideally, the class will culminate in new discoveries (and publications) about the neural circuits of the retina. Further information at http://sightwire.org.

MCB 208. Talking About Science
Jeff W. Lichtman and Michael E. Greenberg (Medical School)
Half course (fall term). Wed., 7–8:30 p.m
Teaches advanced students how to give a good research talk while exposing them to seminal scientific discoveries. Emphasis will be on speaking style, lecture organization, and use of video projection tools.
Note: In addition to lecture material from the instructor, students will present experiments from Nobel Prize-winning work. The presentations will be critiqued in class by the participants. Open to second year graduate students or by permission of the instructor.

Organismic and Evolutionary Biology 223. Topics in Neurogenetics
Yun Zhang
Spring term - Mondays 2:30-4:30pm
This course entails a weekly discussion of current and classic literature in neurogenetics, including: (1) genetic contributions to mental illness; (2) underlying mechanisms of neurodegenerative diseases; (3) genes and behavior; (4) learning and memory.

Course of Study - Year 2

Advisory Meetings: Each student meets individually with the Student Advisory Committee in late September of their second year. The main goal of this meeting is to make sure all students have chosen a thesis lab or are on track to do so. Occasionally a student will decide to take a fourth rotation during the fall of their second year; such rotations must be approved in advance by the Program Director or the SAC.

Preliminary Exam:
Each student is required to take a Preliminary Examination (sometimes called "qualifying exam" or “PQE”) *on or before March 31 of his or her second year of graduate work*. The Preliminary Examination is a written and oral examination of a specific research proposal, which is typically written on the student's proposed dissertation topic. The purpose of the exam is to assess the student’s preparation and ability to embark on an original scientific investigation. The goals of the exam are to demonstrate that the student is able: (1) to define a question in a particular area of research, (2) to review the literature pertinent to that question with an emphasis on what makes the proposed experiments interesting and important, (3) to formulate an experimental plan that would address and answer the question, and (4) to interpret possible experimental outcomes in a manner that indicates awareness of the limitations of the methods used. It should be stressed that preliminary data are not required for the Preliminary Examination. (Any relevant data may of course be included.) The student may discuss the aims and the proposal in depth with his/her

advisor or other faculty members. The advisor may read and provide suggestions on drafts for the proposal, as long as the final document is the student's own work.

See below for detailed guidelines for the format and length of the Research Proposal. The student must deliver the research proposal to each of the Committee members and the Program Office at least 7 days prior to the Examination. If the proposal is late or too long, the Chair may request a postponement of the exam. The Examination is oral and will typically last about two hours.

The Research Proposal provides the focus of the Preliminary Exam, but students are also expected to demonstrate substantial knowledge and understanding in the field of the proposal and in scientific areas that relate to the proposal. Examiners may ask questions about actual or hypothetical results and their interpretation in order to probe the student's level of understanding.

The Preliminary Exam Committee

The Preliminary Exam Committee will be made up of three examiners. The student should select these examiners in consultation with the student's dissertation advisor. It is important for the student to obtain the Program Director's approval before the three proposed examiners are invited to join the committee. The Committee Chair and at least one other member of the committee must be affiliated with the Program in Neuroscience. These examiners may also serve subsequently on the Dissertation Advisory Committee. The Exam Committee Chair will serve as an examiner, oversee the administration of the exam, and be responsible for assuring that the student receives an oral summary of the outcome and evaluation at the end of the exam. The Chair will also be responsible for filing the Exam Report Form with the Neuroscience Program Office.

Approval of Exam Topic

Before writing the Research Proposal, the student should receive approval from the Exam Committee (and dissertation advisor) for the specific aims and overall direction of the proposal. This can be done by submitting to the Committee, generally by email, a one or two page description of the two to four specific experimental aims. This written description should be in the typical "Specific Aims" format of most NIH grant proposals, with a short introduction and a description of each aim. Committee members will either approve the aims or indicate appropriate changes in the aims or scope. If necessary, the student may arrange a meeting with the dissertation advisor and one or more examiners, to discuss the needed changes.

The Outcomes

The student will be asked to leave the room for the deliberations at the beginning and end of the exam. The Exam Committee will decide on one of two outcomes:

1. Pass. – This outcome indicates the Exam Committee's opinion that the student is fully ready to initiate work on the proposed projects. In the written report, the Exam Committee will comment on the student's strengths and weaknesses noted during the exam. At the end of the exam, it should be discussed whether the Exam Committee will serve as the Dissertation Advisory Committee. This is often the case, but the student is free to change the composition of the Committee with the approval of the Program Director. The Examining Committee should recommend the time frame for the first DAC meeting, which should not be later than 9 months after the Prelim Exam.

When giving a Pass grade, the Examining Committee may recommend work to correct minor deficiencies. This recommendation will be communicated to the advisor, who will supervise the student as appropriate. If the Committee feels that the problems are substantive enough to require re-review by the Committee, then the outcome of the exam should be "Special Committee Review" rather than "Pass".

2. Special Committee Review. – This means that the student's status will be reviewed within 3 months. The review will be performed by a special committee consisting of the members of the original Preliminary Exam committee, plus the Program Director or Associate Director. This outcome indicates substantive problems in the student's written proposal, oral presentation, laboratory work on the project prior to the PQE, or coursework. However, these problems may be the usual sorts of problems that ultimately successful students sometimes experience at this stage, and this outcome should not be viewed as a failure. Instead, it is a mechanism for helping to ensure that all students embarking on a Ph.D. thesis have a strong chance of succeeding in a reasonable amount of time.

If this is the outcome of the exam, the Program Director will send the student a letter describing the goals and expectations for the coming months. This letter will be written in consultation with the committee Chair and the student's Advisor. The letter may set goals relating to any of the following issues: the written proposal, the oral presentation, research activities, coursework, and professional conduct. The letter may request that the student repeat the exam; however, in some cases, this may not be indicated. Copies of the letter should be sent to the entire Special Committee.

The Special Committee Review meeting should focus on the issues described in the letter. The meeting may represent a "repeat" of the PQE. Alternatively, the meeting may take a

different format. The format and goals of the meeting should be tailored to the student's circumstances, but they should made clear to all participants in the letter.

After the Special Committee Review meeting, the Program Director will determine the student's status in the program. This decision will be made in consultation with the student's Advisor and the Associate Dean of Basic Graduate Studies, and it should be decided within 3 days of the meeting.

Proposal Guidelines

The written proposal should include the following sections (using these subheadings):

Specific Aims – 1 page – List succinctly the specific objectives of the proposed project. Two or three Specific Aims are suggested.

Background – 6 to 7 pages - Briefly sketch the background leading to the present application. Critically evaluate existing knowledge, and specifically identify the gaps that the project is intended to fill.

Significance – less than 1 page - Explain the importance of the problem that the proposed project addresses. Identify the gaps that the project is intended to fill. Explain how the proposed project will improve scientific knowledge or technical capability in one or more broad fields.

Approach – 4 to 5 pages - Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims of the project. Describe how the data will be collected, analyzed, and interpreted. Discuss potential problems, alternative strategies, and benchmarks for success anticipated to achieve the aims. If the project is in the early stages of development, describe any strategy to establish feasibility, and address the management of any high-risk aspects of the proposed work. Preliminary data is optional. Any figures and legends should be included within this page limit.

Bibliography – There is no length limit, but the student is expected to have read all the papers cited in this section.

The total document length should be 13 pages or less, including any figures and legends (optional) and excluding References. Use an Arial, Helvetica, Palatino Linotype, or Georgia typeface and a font size of 11 points or larger. Use at least one-half inch margins. Figure legends may use a smaller type size. (Note that sections 1, 3, and 4 conform to the revised NIH guidelines for F31 applications. In a F31 application, section 2 would be shortened and folded into section 3.)

Course of Study - Year 3 and beyond

Dissertation Advisory Committee: After completion of the Preliminary Examination, the student chooses a Dissertation Advisory Committee. This committee is often the same as the Preliminary Examination Committee but is not required to be so. The DAC will meet every 6 to 9 months. Before each meeting, the student should write a two-page summary of the work completed since the last meeting and submit it to the members of the committee no later than 72 hours before the meeting.. As a part of each meeting, the DAC will meet separately with the advisor and with the student to confidentially discuss any concerns. At the end of the meeting, the Chair of the committee will fill out the DAC Report. If there are major concerns about the student, the DAC can suggest review by the program. In a review, the program advisors will meet with the student and the PI to discuss the issues raised by the DAC, how to address the problems, and whether the student wants to continue in the program.

Dissertation Preparation: Once the student, advisor, and DAC have agreed that the thesis research is completed, the student should select a Dissertation Examination Committee after obtaining the approval of the Program Director. At that time, the student makes an appointment with the Division of Medical Sciences to go over administrative requirements for a dissertation. The Dissertation Examination Committee consists of three examiners, plus an alternate examiner and a chair. All must be an Assistant Professor or higher, and one examiner should be from outside Harvard. One person from the DAC is asked to stay on as Chair of the Dissertation Examination Committee. The student must bring the following forms to the Program office at least 3 weeks before the exam: Application for Degree, Program Approval, Proposed Examiners, and Dissertation Information Sheet. The completed dissertation must be submitted to the Dissertation Examination Committee at least two weeks before the examination.

Dissertation Defense: The student presents a one-hour public seminar immediately prior to the defense. The defense generally includes only the Committee and the advisor, and usually lasts about two hours.