The Neuroscience Graduate Program is a Ph.D. program with a standard completion time of 5.0 to 5.5 years. The program offers broad-based neuroscience training with an emphasis on research. *We do not admit students who wish to pursue a Master’s degree.* However, when a student experiences a significant change in career orientation, after successful completion of the qualifying exam, a Masters degree may be awarded.

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<th>Standard Course of Study, By Year</th>
<th>First</th>
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<td>Neuroscience Boot Camp</td>
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<td>Lab Rotations (3 rotations, 10 weeks each) (NEUROSC 291A/291B)</td>
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<td>Formal Rotation Presentations (NEUROSC 290)</td>
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<td>Foundational Graduate Courses (3 courses)</td>
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<td>Teaching (2 semesters total)</td>
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<td>Qualifying Examination</td>
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<td>Seminar Courses (2 courses)</td>
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<td>4th year Research Presentation (NEUROSC 294)</td>
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<td>Statistics or Quantitative Methods (1 course or demonstrated expertise)</td>
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The program provides a great degree of flexibility for students as they cultivate their scientific interests. Individual curricula and research are arranged in consultation with the student’s Thesis Mentor and Graduate Advisers. Most formal coursework is completed during the first two academic years. The primary focus thereafter is on thesis research. Mentoring on scientific and career development is integrated throughout the program.

I. **Neuroscience Boot Camp**

The program begins with an intensive 10-day course that includes lectures on foundational topics in cellular, systems and cognitive neuroscience, and hands-on laboratory exercises using a wide range of modern neuroscience techniques. These include whole-cell patch clamp
recording, synaptic physiology, genetics, extracellular spike recording, calcium imaging, microscopy and immunohistochemistry, animal behavioral methods, computational methods, analysis of functional MRI data, and human psychophysics. The course also includes research presentations on current projects in faculty laboratories. All Neuroscience PhD students must attend Boot Camp.

II. Lab Rotations and Presentations

During Year 1, students perform three 10-week research rotations in different faculty laboratories. The goal is to expose students to different techniques and approaches in neuroscience and to provide training in experimental design, critical analysis of data, and presentation of research findings. Performance in rotations is evaluated and graded. Rotations also allow students to identify the laboratory in which their thesis research will be performed. During the Spring semester, students formally present results from the laboratory rotations in a dedicated course – NEUROSC 290 – designed to train students in clear, effective presentation of scientific findings.

Detailed rules and guidelines for laboratory rotations:

1. Rotations are assigned based on student preferences and space availability in faculty laboratories. Students submit a rotation request form ranking their laboratory choices prior to each rotation. Official rotation assignments are made by the Graduate Advisers Committee. Historically, most students are assigned their top rotation choices. Students and faculty are encouraged to discuss rotation availability and potential rotation projects, but cannot make private agreements about rotation assignments.

2. Students may perform an early rotation starting in July of the entering year. This must be pre-approved by both the rotation faculty mentor and the head graduate adviser. At the beginning of the fall semester the student can request either to continue in the same laboratory through the first rotation, or alternatively to rotate in another laboratory. Regardless of summer rotations, all students are required to rotate in 3 different laboratories during the regular school year.

3. Students who were undergraduate or research assistants in a Berkeley faculty laboratory cannot rotate in that faculty lab. The aim of this rule is to maximize exposure to new scientific opportunities during rotations. However, a student in this situation is free to choose to join this laboratory for thesis dissertation research after rotations are complete.

4. A student may elect to perform a 4th laboratory rotation if the first 3 rotations do not result in a suitable laboratory for his/her thesis dissertation research.

Rotation research is graded and receives academic credit. This is accomplished by enrolling in NEUROSC 291A-B, a year-long course, during the rotation year. Grades and evaluations are collected from rotation mentors, and used to assign an overall grade in the course at the end of the Spring semester.
Students present scientific results of their rotations during a Spring semester class in the first year, NEUROSC 290: SERPS (Student Evening Research Presentations). This course teaches best practices in constructing and presenting scientific talks, and is led by a faculty instructor. Students present short, formal talks based on their rotation projects. Students must enroll for a letter grade in NEUROSC 290.

III. Thesis Lab Placement
After completion of the third rotation, students meet with rotation advisers to select their thesis research laboratory. (If needed, this takes place after the fourth rotation.) The faculty member commits to accepting the student in his or her laboratory, and to provide mentorship and research support necessary to pursue a thesis project. Thesis research begins at this time, which is Spring of Year 1. All students must be accepted in a thesis lab, and be actively engaged in research, in order to continue in the program.

IV. Coursework
The program has a flexible curriculum of graduate coursework in neuroscience and related disciplines. The curriculum is designed to provide a balance between broad training in all areas of neuroscience (cellular/molecular, circuits/systems, computational, and cognitive), plus deeper focus in the area of primary research interest. Broad training in neuroscience is a central feature of the program.

Course requirements

1. Foundational courses. Students must take 3 foundational courses distributed among three broad areas: (A) Cellular, Molecular & Developmental Neuroscience; (B) Circuits, Systems and Computational Neuroscience; and (C) Cognition, Brain and Behavior. Students can either take one graduate level course from each category, or three graduate level courses chosen from two areas, plus a selected advanced undergraduate course from the third area. These are taken in Years 1-2.

For the list of courses that satisfy the foundational course requirement, please see the “Neuroscience Course Curriculum” document. There are 3-7 approved course choices in each category. These are all 200-level graduate classes. You can choose the courses that best complement your interests and your prior academic background. At least one choice in each category is a broad survey class.

2. Additional elective courses. In addition, students must take 2 additional elective courses. These can be either graduate-level seminars or graduate-level lecture courses, and can be 1 unit or more. These are usually taken after passing the qualifying examination, typically in Years 3 and 4. Electives can be chosen from any relevant graduate-level class in any department. These courses promote deeper expertise in chosen areas of neuroscience. You can also take any of the Foundation Courses as an elective.
3. **Training in statistics and quantitative methods.** Beginning with the entering class of 2014, all students must complete a one semester course on statistical analysis or quantitative methods. This course is chosen from a large number of appropriate classes at Berkeley, and can be completed at any time prior to the semester of graduation. This class counts as one of the ‘additional elective courses’. Students with prior appropriate coursework or whose thesis research uses substantial quantitative methods can use that prior experience to fulfill this requirement, subject to approval by the Head Graduate Adviser.

4. **Fourth-year research presentation.** During the 4th year of study, students must enroll in NEUROSC 294 and make a formal presentation of their ongoing thesis research.

Coursework Notes:

1. All required courses must be taken for a letter grade and passed with a grade of B or higher.

2. Students without prior undergraduate coursework in general neurobiology are strongly encouraged to take MCB 260 (Graduate Cellular/Molecular Neurobiology) in the first semester of study.

3. You should have finished, or be close to finishing, your Foundational Courses prior to the Qualifying Examination in Spring of Year 2. These will provide you with the general knowledge in Neuroscience needed for the Qualifying Exam.

4. NEUROSC 290 (SERPs) cannot be taken to satisfy the Elective Course requirement. It is a separate, required first-year course for rotation presentations.

5. MCB 293C (Ethics in Research) is required in Spring of the first year for all students who are appointed as trainees on NIH Training Grants. This course cannot be taken to satisfy the Elective Course requirement.

6. NEUROSC 294 (Student Journal Club). This course can be taken any number of times for a Satisfactory/Unsatisfactory (S/U) grade. However, it cannot be taken to satisfy the Elective Course requirement. This course is the forum for 4th year thesis research presentations. Fourth-year students must enroll in NEUROSC 294 for a letter grade during the semester they make their presentation.

V. **Scientific research seminars and Neuroscience Retreat**

UC Berkeley hosts a wide array of research seminar series, in which national and international scientists present current research results. These include the MCB/HVNI Neuroscience Seminar Series, Psychology Colloquia, Redwood Center for Theoretical Neuroscience Weekly Seminars, Oxyopia Vision Science Seminars, and more. These are an invaluable resource for students to gain depth of knowledge in their specific field and broad knowledge of modern
research problems across neuroscience. There is no formal requirement to attend seminars. However, students are strongly encouraged to attend relevant seminar series, to the extent that their research allows.

Students are required to attend the yearly UC Berkeley Neuroscience Retreat.

VI. Training in Teaching
Neuroscience students are required to serve as Graduate Student Instructors (GSIs) for two semesters. GSI is the UC Berkeley term for teaching assistants. Teaching occurs during Fall semester of the second year and Spring semester of the third year. (One GSIship can be delayed to Year 4 if necessary to meet requirements of outside fellowships.) Teaching affords students supervised experience in a variety of educational situations, including labs, discussion sections, and demonstrations. GSIs also participate in record-keeping, grading, advising, and student consultations.

GSIs are matched to courses using an application process. Whenever possible, students are assigned to courses related to research interests. GSIs are evaluated by both supervising faculty and the students they teach. These evaluations become a permanent part of the student file. Top-performing GSIs are nominated for the Outstanding Graduate Student Instructor Award, which has been won by many Neuroscience PhD Program students.

VII. Qualifying Examination
All students must take a Qualifying Examination during the Spring semester of the second year. The QE is an oral exam, designed to ensure that students have in-depth knowledge within their thesis research area and in closely related, complementary research areas; that students can design and interpret experiments, can propose research in a written grant format, and can reason scientifically at a high level. In addition, the exam is used to confirm that within the overall field of Neuroscience, students have a basic graduate-level understanding of important concepts. The exam is administered by a committee of four faculty members: three from within the Neuroscience Graduate Program, and a fourth from an outside department.

The examination has three parts: Thesis Proposal, Related Research Areas, and Foundational Questions in Neuroscience. The thesis proposal is in the form of a written, NIH-style grant proposal, which is turned in to the committee, and then defended orally. Related Research Areas are identified cooperatively by the student and his/her committee prior to the exam, and are chosen to be complementary to the main thesis research subject. These areas are examined orally. The Foundational Questions in Neuroscience are designed to test broad knowledge in Neuroscience. These are a published list of questions, the same for all students, that are available upon entry to the program. These questions are designed to test basic common knowledge of neuroscience facts and principles, and a subset of them are examined orally during the qualifying exam.

During the exam, students must demonstrate the ability to recognize fundamentally important
research problems, propose relevant experimental approaches, and display comprehensive knowledge of appropriate disciplinary areas and related subjects. All students are required to pass the qualifying examination before advancing to doctoral candidacy.

Please see QE Description and Student Guide for important details regarding Qualifying Examination preparation, timeline, and format. The QE must be taken prior to the end of Spring Semester, Year 2.

**VIII. Thesis Committee, Thesis Research, and the Dissertation**

After passing the Qualifying Examination, students establish a Thesis Committee and advance to [Doctoral Candidacy](#).

Thesis committees are comprised of four faculty members: the thesis mentor, two members of the Neuroscience Graduate Program, and one from an outside department. Students assemble their committees in consultation with their thesis mentor(s) and the Graduate Adviser.

Once students have advanced to Doctoral Candidacy, they are required to meet with the thesis committee at least once yearly. The Annual Thesis Committee Meeting is a time to discuss dissertation progress, review experimental results, set goals, and ensure students are adhering to appropriate timelines to completion.

The Thesis Committee meetings must be scheduled as follows:

- **6th year students:** between September 1st to October 1st
- **5th year students:** between September 1st to October 1st
- **4th year students:** between October 1st to November 1st
- **3rd year students:** between November 1st to December 1st

Years three through five are spent primarily on dissertation research. At this stage, students are encouraged to present posters or speak at scientific meetings and conferences whenever possible. During the fifth year, students are advised to start arranging postdoctoral training. In addition to help from the thesis mentor, the thesis committee members and other neuroscience faculty members, students can also consult with counselors at the [Career Center](#) to aid them in searches, portfolios, and more.

The written PhD dissertation must comprise one or more complete research projects that are determined to be publication quality by the PhD thesis committee. The written dissertation must be completed according to UC Berkeley campus rules. The thesis committee must sign the finished dissertation.

**IX. Academic and Professional Mentoring**

Academic mentoring is provided in the first two years of the program by a group of 1st and 2nd year faculty advisers. These advisers provide input on course selection, choice of rotation labs,
and preparation for the Qualifying Exam. After joining a thesis lab, the primary scientific and academic mentor is the thesis adviser, as well as the PhD thesis committee.

Mentoring on professional development is provided to all students periodically by the Head Graduate Adviser and the faculty advising committee. Topics include grant writing, professional ethics, information on academic and non-academic careers, how to select a postdoctoral laboratory, etc. Students will conduct individual development plans (IDPs) to help self-evaluate career goals and directions for professional growth.

X. Exit Seminar
In lieu of a thesis defense, students must present a thesis seminar to the neuroscience community during the semester they file their dissertation. UC Berkeley does not conduct thesis defenses with committee examination.