Neuroscience

The Neuroscience Graduate Program at UC Berkeley is a unique, diverse PhD training program that offers intensive, integrated training in multiple areas of neuroscience research.

The program involves more than 45 faculty from different campus departments, with expertise ranging from molecular and cellular neuroscience, to developmental neuroscience, systems and computational neuroscience, and human cognitive neuroscience.

We provide a highly interdisciplinary, intellectually dynamic training environment of coursework, research training, and mentoring, within a strong research program that produces fundamental advances in knowledge and cutting-edge techniques.

Admission to the University

Uniform minimum requirements for admission

The following minimum requirements apply to all programs and will be verified by the Graduate Division:

1. A bachelor's degree or recognized equivalent from an accredited institution;
2. A minimum grade-point average of B or better (3.0);
3. If the applicant comes from a country or political entity (e.g. Quebec) where English is not the official language, adequate proficiency in English to do graduate work, as evidenced by a TOEFL score of at least 570 on the paper-and-pencil test, 230 on the computer-based test, 90 on the iBT test, or an IELTS Band score of at least 7 (note that individual programs may set higher levels for any of these); and
4. Enough undergraduate training to do graduate work in the given field.

Applicants who already hold a graduate degree

The Graduate Council views academic degrees as evidence of broad research training, not as vocational training certificates; therefore, applicants who already have academic graduate degrees should be able to take up new subject matter on a serious level without undertaking a graduate program, unless the fields are completely dissimilar.

Programs may consider students for an additional academic master's or professional master's degree if the additional degree is in a distinctly different field.

Applicants admitted to a doctoral program that requires a master's degree to be earned at Berkeley as a prerequisite (even though the applicant already has a master's degree from another institution in the same or a closely allied field of study) will be permitted to undertake the second master's degree, despite the overlap in field.

The Graduate Division will admit students for a second doctoral degree only if they meet the following guidelines:

1. Applicants with doctoral degrees may be admitted for an additional doctoral degree only if that degree program is in a general area of knowledge distinctly different from the field in which they earned their original degree. For example, a physics PhD could be admitted to a doctoral degree program in music or history; however, a student with a doctoral degree in mathematics would not be permitted to add a PhD in statistics.
2. Applicants who hold the PhD degree may be admitted to a professional doctorate or professional master's degree program if there is no duplication of training involved.

Applicants may only apply to one single degree program or one concurrent degree program per admission cycle.

Any applicant who was previously registered at Berkeley as a graduate student, no matter how briefly, must apply for readmission, not admission, even if the new application is to a different program.

Required documents for admissions applications

1. **Transcripts:** Upload unofficial transcripts with the application for the departmental initial review. Official transcripts of all college-level work will be required **if admitted**. Official transcripts must be in sealed envelopes as issued by the school(s) you have attended. Request a current transcript from every post-secondary school that you have attended, including community colleges, summer sessions, and extension programs.
   If you have attended Berkeley, upload unofficial transcript with the application for the departmental initial review. Official transcript with evidence of degree conferral ***will not*** be required if admitted.
2. **Letters of recommendation:** Applicants can request online letters of recommendation through the online application system. Hard copies of recommendation letters must be sent directly to the program, not the Graduate Division.
3. **Evidence of English language proficiency:** All applicants from countries in which the official language is not English are required to submit official evidence of English language proficiency. This requirement applies to applicants from Bangladesh, Burma, Nepal, India, Pakistan, Latin America, the Middle East, the People's Republic of China, Taiwan, Japan, Korea, Southeast Asia, and most European countries. However, applicants who, at the time of application, have already completed at least one year of full-time academic course work with grades of B or better at a U.S. university may submit an official transcript from the U.S. university to fulfill this requirement. The following courses will not fulfill this requirement: 1) courses in English as a Second Language, 2) courses conducted in a language other than English, 3) courses that will be completed after the application is submitted, and 4) courses of a non-academic nature. If applicants have previously been denied admission to Berkeley on the basis of their English language proficiency, they must submit new test scores that meet the current minimum from one of the standardized tests.

Admission to the Program

Applicants to the program should have a bachelor's degree in science from a four-year college and at least one year of laboratory experience. Applicants are required to submit Graduate Record Examination (GRE) General Test scores, and are strongly encouraged to submit one GRE Subject Test score (in biochemistry and cell biology, chemistry, psychology, biology, computer science, or physics).

Normative Time Requirements

Normative Time to Advancement

Step I: Lab Rotations and Presentations

During the first year of graduate study, each neuroscience graduate student spends three 10-week periods performing research projects 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 (Neuroscience First Year Research), designed to train students in clear, effective presentation of scientific findings.

Step II

All Neuroscience students take an Oral Qualifying Examination during the Spring semester of the second year. The exam is administered by four faculty members: three from within the Neuroscience Graduate Program, and a fourth from an outside department.

During the exam, students 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.

Normative Time in Candidacy

Step III

Students undertake research for the PhD dissertation under a four-person committee in charge of their research and dissertation. Students do original research using a wide variety of cutting-edge neuroscience methods. The students then write the dissertation based on the results of this research. On completion of the research and approval of the dissertation by the committee, the students are awarded the doctorate.

Total Normative Time

Total Normative time is 5.5 years.

Time to Advancement

Curriculum

One graduate course in each of the following three Foundational Areas:		
Cellular, Molecular & Developmental Neuroscience		
Systems and Computational Neuroscience		
Cognition, Brain, & Behavior		
Two graduate elective seminars or Courses, as per approved study list		
Pedagogy course		
NEUROSC 290	Neuroscience First Year Research	2
NEUROSC 294	Neuroscience Graduate Student Presentation Seminar	1

Time in Candidacy

Dissertation Presentation/Finishing Talk

There is no formal defense of the completed dissertation. Neuroscience students are required to publicly present a Thesis Seminar about their dissertation research in their final year.

Required Professional Development

Presentations

During their 4th year of study, students are required to make a presentation on the progress of their thesis work while enrolling in NEUROSC 294 (Neuroscience Graduate Student Presentation Seminar), a journal club, for a letter grade.

Teaching

Neuroscience students are required to serve as Graduate Student Instructors (GSIs) for two semesters. Whenever possible, GSI assignments are determined with an eye toward student research interests. Teaching occurs during Fall semester of the second year and Spring semester of the third. 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 evaluated by both supervising faculty and the students they teach. These evaluations become a permanent part of the student file. Deserving GSIs are nominated for the Outstanding Graduate Student Instructor Award.

Neuroscience

NEUROSC C217D Biological and Public Health Aspects of Alzheimer's Disease 3 Units
This course will survey the field of Alzheimer's disease (AD) from a biological and public health perspective by reading original research papers in the fields of medicine, neuroscience, and epidemiology. The course will begin with a historical survey of the concept of AD, followed by a description of clinical and neuropathological features. Subsequent classes will cover the genetics and molecular biology of the disease, as well as biomarkers, epidemiology, risk factors, treatment, development of new diagnostic approaches, and ethical issues. The course will also serve as a model for the analysis of complex diseases with multiple genetic and environmental causes, and late onset neurodegenerative diseases. The course will also serve as a model for the analysis of complex diseases with multiple genetic and environmental causes and late-onset neurodegenerative disease.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of seminar per week

Additional Details

Subject/Course Level: Neuroscience/Graduate

Grading: Letter grade.

Instructor: Jagust

Also listed as: PB HLTH C217D

NEUROSC C260 Introduction to Neurobiology 4 Units
An introductory course designed to provide a general understanding of the nervous system including how it functions, how it develops, and how it changes with learning and memory. Analysis from the level of molecules to cells to simple circuits to complex networks to higher brain functions.
Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Neuroscience/Graduate

Grading: Letter grade.

Also listed as: MCELLBI C260

NEUROSC C261 Advanced Cellular Neurobiology 3 Units
Physical-chemical basis of membrane potentials, electrotonus, action potential generation and propagation, synaptic transmission, sensory receptor function, and volume conductor potentials.
Rules & Requirements

Prerequisites: Molecular and Cell Biology 160

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Neuroscience/Graduate

Grading: Letter grade.

Also listed as: MCELLBI C261

NEUROSC C262 Advanced Topics in Systems Neuroscience 3 Units
Advanced coverage of current research problems in systems-level neuroscience, and experimental and computational techniques used for these studies.
Rules & Requirements

Prerequisites: 160 or equivalent

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Neuroscience/Graduate

Grading: Letter grade.

Formerly known as: IDS 200B

Also listed as: MCELLBI C262

NEUROSC C263 Advanced Developmental Neurobiology 3 Units
Advanced level coverage of current research problems in the embryonic and post-embryonic development of invertebrate and vertebrate nervous systems.
Rules & Requirements

Prerequisites: 162 or equivalent

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Neuroscience/Graduate

Grading: Letter grade.

Also listed as: MCELLBI C263

NEUROSC C265 Neural Computation 3 Units
This course provides an introduction to the theory of neural computation. The goal is to familiarize students with the major theoretical frameworks and models used in neuroscience and psychology, and to provide hands-on experience in using these models. Topics include neural network models, supervised and unsupervised learning rules, associative memory models, probabilistic/graphical models, and models of neural coding in the brain.
Rules & Requirements

Prerequisites: Calculus, differential equations, basic probability and statistics, linear algebra, and familiarity with high level programming languages such as Matlab

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Neuroscience/Graduate

Grading: Letter grade.

Instructor: Olshausen

Also listed as: VIS SCI C265

NEUROSC 290 Neuroscience First Year Research 2 Units
Seminar on the presentation and evaluation of research results for first-year neuroscience graduate students. During the first weeks, faculty present their research (FERPS); later, students present individual research results and evaluate their own and each other's work. Course enrollment limited to 15.
Rules & Requirements

Prerequisites: Graduate standing in Neuroscience Graduate Group; concurrent enrollment in 291A-291B

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of seminar per week

Additional Details

Subject/Course Level: Neuroscience/Graduate

Grading: Letter grade.

Instructor: Ngai

NEUROSC 291A Neuroscience Introduction to Research 4 - 12 Units
Closely supervised, intensive laboratory experimental research under the direction of an individual faculty member. For first-year neuroscience graduate students, this course will provide an introduction to experimental methods and research approaches in the different areas of neuroscience. Grade awarded on completion of sequence, which includes 3 ten-week laboratory rotations spread out over the fall and spring semesters.
Rules & Requirements

Prerequisites: Graduate standing in Neuroscience Graduate Group; consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 20-40 hours of laboratory per week

Additional Details

Subject/Course Level: Neuroscience/Graduate

Grading: Letter grade. This is part one of a year long series course. A provisional grade of IP (in progress) will be applied and later replaced with the final grade after completing part two of the series.

Instructor: Ngai

NEUROSC 291B Neuroscience Introduction to Research 4 - 12 Units
Closely supervised, intensive laboratory experimental research under the direction of an individual faculty member. For first-year neuroscience graduate students, this course will provide an introduction to experimental methods and research approaches in the different areas of neuroscience. Grade awarded on completion of sequence, which includes 3 ten-week laboratory rotations spread out over the fall and spring semesters.
Rules & Requirements

Prerequisites: Graduate standing in Neuroscience Graduate Group; consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 20-40 hours of laboratory per week

Additional Details

Subject/Course Level: Neuroscience/Graduate

Grading: Letter grade. This is part two of a year long series course. Upon completion, the final grade will be applied to both parts of the series.

Instructor: Ngai

NEUROSC 292 Neuroscience Graduate Research 3 - 12 Units
For graduate students in neuroscience in their second or later years. During the summer, the course will count for 3-6 units. Individual research under faculty supervision. In this course each graduate student conducts basic thesis and dissertation research after successful completion of the first-year laboratory rotation, Neuroscience 291A-291B. Laboratory work provides the basis for students' thesis research, preparation for the preliminary examination, and continued progress toward completion of Ph.D. dissertation.
Rules & Requirements

Prerequisites: Graduate standing in the Neuroscience Graduate Group; advanced approval from instructor

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 10-40 hours of laboratory per week

Summer: 10 weeks - 15-60 hours of laboratory per week

Additional Details

Subject/Course Level: Neuroscience/Graduate

Grading: Letter grade.

NEUROSC 293 Neuroscience Research Review 2 Units
For graduate students in neuroscience in their second or later years. Two hours of seminar per week which complements the individual laboratory work under faculty supervision. Seminar will review current scientific literature and discuss original research performed by faculty, postdoctoral fellows, scientists, and graduate students in individual faculty laboratories.
Rules & Requirements

Prerequisites: Concurrent enrollment in 292; graduate standing in the neuroscience program; consent of instructor

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of seminar per week

Summer:
6 weeks - 5 hours of seminar per week
8 weeks - 3.5 hours of seminar per week
10 weeks - 3 hours of seminar per week

Additional Details

Subject/Course Level: Neuroscience/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

NEUROSC 294 Neuroscience Graduate Student Presentation Seminar 1 Unit
This course will encompass three important facets of graduate education in the neurosciences: 1) Development of research presentation skills: fourth and fifth year graduate students will present seminars based on their ongoing dissertation research. Preparation and critiques of presentations will focus on organization of conceptual issues, data presentation, and summarization. 2) Exposure to current topics in neuroscience: faculty speakers will present on current issues and topics relevant to scientific development in the neurosciences, such as technical methods, application of analytical and statistical techniques, and organization and preparation of competitive fellowship and other grant applications. 3) Seminar preparation: a crucial aspect of graduate education is the interaction of students with invited seminar speakers - who are often leaders in their fields. A selected number of class meetings will be devoted to the review of scientific articles published by upcoming seminar speakers and/or other related articles in the field.
Rules & Requirements

Prerequisites: Graduate student standing

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details

Subject/Course Level: Neuroscience/Graduate

Grading: Letter grade.

NEUROSC 299 Seminars 1 - 3 Units
Course that focuses on topical subjects in specific fields of neuroscience.
Rules & Requirements

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1-3 hours of seminar per week

Additional Details

Subject/Course Level: Neuroscience/Graduate

Grading: Letter grade.