School of Biological Sciences

On This Page:

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http://www.bio.uci.edu/

This is the ideal time to be studying biology. We are solving problems today whose solutions were unimaginable even a few years ago, and implications for our society, our health, and our environment are profound. The School of Biological Sciences is dedicated to providing students with a unique course of study that fosters a deep appreciation for the exciting facts and concepts in the field, an education that allows graduates to excel in their chosen careers.

The School has recently redesigned the curriculum to remain on the cutting edge of biological education. All first-year students are introduced to basic concepts in ecology and evolutionary biology, as well as cellular and molecular biology. The core set of courses in biology continues into the second year, featuring genetics, biochemistry, and molecular biology, followed in the third and fourth year by a choice of advanced courses in biology. Since biology is a laboratory discipline, students complete a series of laboratory courses in which they learn both the techniques and approaches needed to solve problems in biology.

Finally, the faculty expect that most students will engage in cutting-edge research in one of more than 250 laboratories and medical clinics in the School of Biological Sciences and the UCI School of Medicine. It is in these situations that faculty train students to think in a sophisticated way about real-world problems. There is also no feeling of excitement greater than finding out something about the world that no one has ever known before, a feeling afforded in biology only by participation in research. The Excellence in Research Program allows students to present their work and be recognized for their performance with a series of awards and publication of their reports in the School's online *Journal of Undergraduate Research.* The set of core classes that instructs students in the concepts of biology, the advanced classes that allow a deep understanding of specialized aspects of biology, the laboratory courses that convey the practical aspects of problem-solving in biology, and the research experiences that engage students in the real excitement in revealing new information about biology, come together to provide an extraordinary experience for students. The Honors Program in the School of Biological Sciences further enhances the educational experience for the best students.

Biology students with a broad interest in the area can opt to complete a major in Biological Sciences. Additionally, they have the option of specializing in areas of biology that best fit their interests, completing courses for degree programs in Biochemistry and Molecular Biology, Biology/Education, Developmental and Cell Biology, Ecology and Evolutionary Biology, Exercise Sciences, Genetics, Human Biology, Microbiology and Immunology, or Neurobiology.

Completion of any of these majors forms an excellent basis for application to either graduate or professional studies such as medical school, and graduates of the School of Biological Sciences are routinely accepted to the most prestigious programs in the country.

The quality of the faculty in the School of Biological Sciences has remained high while increasing steadily in number over the past few years, giving students a remarkable range of expertise in biology and with it, a large number of different advanced courses and research opportunities. In addition, their efforts have brought several high-impact research units to the campus, such as the Center for the Neurobiology of Learning and Memory, the Center for Virus Research, the Beckman Laser Institute, the Cancer Research Institute, the Developmental Biology Center, the Center for Immunology, the Institute for Memory Impairments and Neurological Disorders, the Macromolecular Structure Research Unit, the Organized Research Unit in Molecular and Mitochondrial Medicine and Genetics, the Institute for Genomics and Bioinformatics, the Center for Complex Biological Systems, and the Reeve-Irvine Research Center, all of which are accessible to undergraduates. The School of Biological Sciences also has close research and teaching collaborations with faculty in the Schools of Medicine, Physical Sciences, Social Ecology, and Social Sciences; the Donald Bren School of Information and Computer Sciences; and The Henry Samueli School of Engineering.

In addition to the regular University requirements for admission, students interested in the biological sciences should include in their high school curriculum, in addition to a course in biology, four years of mathematics, as well as courses in chemistry and physics, which are now an integral part of most contemporary biological work.

The School's professional counseling staff is always available for consultation to students regarding the many decisions in their academic program. They also are trained to provide guidance in the application process to both professional and graduate schools, a real advantage to the high proportion of students in the School of Biological Sciences who go on to pursue advanced degrees.

Opportunities are available at the graduate level to specialize in Developmental and Cell Biology, Ecology and Evolutionary Biology, Molecular Biology and Biochemistry, and Neurobiology and Behavior.

Change of Major

Students who wish to declare any major within the School of Biological Sciences should contact the Biological Sciences Student Affairs Office in 1011 Biological Sciences III for information about change-of-major requirements, procedures, and policies. Information can also be found at UC Irvine Change of Major Criteria website (http://www.changeofmajor.uci.edu/). Change of Major requests are accepted and reviewed by the School throughout the year.

Honors Programs

Honors Program in the School of Biological Sciences

The Honors Program in the School of Biological Sciences provides an opportunity for outstanding majors in the School to pursue advanced work in independent research via participation in the Excellence in Biological Sciences Research Program and earn Honors in Biological Sciences upon graduation. Admission to the program is based on an application to participate in the Excellence in Biological Sciences Research program filed during the middle part of the fall quarter of the year of the student's participation. Additionally, students must have a minimum overall 3.5 grade point average and a minimum 3.5 grade point average in all required Biological Sciences courses. The Program requires enrollment in research (BIO SCI 199) including successful completion of BIO SCI H195 and the Excellence in Biological Sciences Research program.

Graduation with Honors

Of the graduating seniors, no more than 16 percent will receive Latin honors: approximately 2 percent *summa cum laude,* 4 percent *magna cum laude,* and 10 percent *cum laude.* The selection for these awards is based on spring quarter rank-ordered grade point averages. To be eligible for honors at graduation, the student must, by the end of spring quarter of the senior year, be officially declared a Biological Sciences major; submit an Application to Graduate by the end of winter quarter of the senior year; have completed at least 72 units in residence at a UC campus by the end of the spring quarter of the academic year in which they graduate; have all corrections to the academic record processed by the University Registrar's Office by the end of spring quarter; if completing the Language Other Than English general education requirement with a language exemption test, pass the test by the end of spring quarter; and be able to verify completion of all course work by the end of the spring quarter of the senior year. Other important factors are considered visit at Honors Recognition (http://catalogue.uci.edu/honors/).

Campuswide Honors Collegium

The Campuswide Honors Collegium is available to selected high-achieving students from all academic majors from their freshman through senior years. For more information contact the Campuswide Honors Collegium, 1200 Student Services II; 949-824-5461; honors@uci.edu; or visit the Campuswide Honors Collegium website (http://honors.uci.edu/).

Dean's Honor List. The quarterly Dean's Honor List is composed of students who have received a 3.5 grade point average while carrying a minimum of 12 graded units.

Excellence in Research Program

The School of Biological Sciences believes that successful participation in creative research is one of the highest academic goals its undergraduates can attain. Students enrolled in Undergraduate Research (BIO SCI 199) and who meet the eligibility requirements have an opportunity to present the results of their research endeavors to peers and faculty. Those students awarded with "Excellence in Research" will then have their papers published in the School's online *Journal of Undergraduate Research in the Biological Sciences.*

The program begins each fall with a mandatory instructional workshop and continues through spring with students completing a scientific paper, poster presentation, and scientific talk. Contact the Biological Sciences Student Affairs Office, room 1011 Biological Sciences III, or visit the Excellence in Research website (https://www.bio.uci.edu/undergraduates/research/excellence-in-research/) for additional information.

Biological Sciences Honors, Scholarships, Prizes, and Awards

The following honors, scholarships, prizes, and awards are presented at the annual Biological Sciences Honors Convocation held in June.

Excellence in Research Award. Undergraduates who have successfully completed the requirements for this program are presented with Excellence in Research certificates.

Brian Atwood Scholarship. The Brian Atwood Scholarship is awarded to junior Biological Sciences majors who demonstrate outstanding achievement in both scholarship and service to the UCI community.

Robert H. Avnet Memorial Scholarship. The Robert H. Avnet Memorial Scholarship has been established to assist a student interested in becoming a physician. The student must be a Biological Sciences major and demonstrate financial need.

Carol Becker McGaugh Award. This award is given to a junior with outstanding research in the area of neurobiology of learning and memory.

Carol and James Becker McGaugh Award. This award is given to a junior with strong moral character, integrity, and demonstrated potential for making a difference in neuroscience.

Robert Ernst Prize for Excellence in Research in the Biological Sciences. This prize is awarded to a student for meritorious research conducted in the field of biology.

Robert Ernst Prize for Excellence in Student Research in Plant Biology. This prize is awarded to a student for meritorious research conducted in plant biology.

Kyle Farol Memorial Award. The Kyle Farol Memorial Award is presented to an outstanding undergraduate Biological Sciences major who has dedicated their time as a volunteer in a clinical setting.

M. Marlene Godoy Award. This award is given to support a graduating senior in the Biological Sciences who is pre-medical or pre-dental. The recipient is one who is *actively* involved with philanthropic community service, University service, and in undergraduate research.

James Tait Goodrich Award for Excellence in Neurobiology. In honor of James McGaugh, the award recognizes an undergraduate student completing his/her junior year, for outstanding achievement in neurobiology.

Dr. William F. Holcomb Scholarship. The intent of the Dr. William F. Holcomb Scholarship is to support biomedical or marine biological studies. The Scholarship is to be used to support continuing academic work over a specific period.

Laurence J. Mehlman Prize. The Laurence J. Mehlman Prize is awarded to an undergraduate student in the School of Biological Sciences who has demonstrated outstanding achievement in both scholarship and service to the School.

Edward Mittelman Memorial Fund Scholarship. The Edward Mittelman Memorial Fund Scholarship is presented to an outstanding Biological Sciences student who will pursue a career in the medical field.

Edward A. Steinhaus Memorial Award. The Edward A. Steinhaus Memorial Award is given to outstanding Biological Sciences graduate student teaching assistants who demonstrate promise as future educators.

Joseph H. Stephens Award for Outstanding Research in Ecology and Conservation. This award is granted to a graduate student who has demonstrated outstanding research in ecology and conservation.

Joseph H. Stephens Award for Outstanding Research in Biochemistry and Molecular Biology. This award is granted to a graduate student who has demonstrated outstanding research in biochemistry and molecular biology.

Krishna and Sujata Tewari Scholar Award. This award will be comprised of two distinct scholarships given annually to one graduate recipient from the School of Biological Sciences and one from the School of Medicine. The recipients have demonstrated proclivity and aspirations in science and medicine.

Jayne Unzelman Scholarship. The Jayne Unzelman Scholarship is presented to an undergraduate student who has shown academic excellence and been of service to the School of Biological Sciences and/or the University, and to the community.

Special Programs and Courses

Biological Sciences 199

The (BIO SCI 199) Undergraduate Research Training Program provides students the opportunity to pursue independent research. Students conduct experimental laboratory, field, or clinical research as an apprentice scientist under the supervision of a professor in the School of Biological Sciences or the School of Medicine. BIO SCI 199 research students experience the challenge and excitement of the world of science. Students develop new scientific skills and knowledge while training with professors who are on the cutting edge of research and discovery in the biological and medical sciences. The research training may commence as early as the sophomore year.

To participate in this unique research training program, students must be in good academic standing, and completion of BIO SCI 94 From Organisms to Ecosystems is mandatory prior to enrollment. Students are encouraged to investigate the possibilities for research early to assure that all requirements and deadlines are met. It is recommended that students contact a faculty sponsor at least one quarter in advance for (BIO SCI 199) enrollment. Once a faculty sponsor is acquired, the student must submit the proposal form and enrollment packet to Biological Sciences Student Affairs via the online Research Dashboard. At the end of each quarter a Summary Report is required.

Students cannot participate in research involving human blood, body fluids, or tissue, unless special approval is granted. The faculty sponsor must submit a request for exception to the Biological Sciences Student Affairs Office.

Students conducting research directly with patients or other human subjects must comply with special enrollment procedures and the additional safety training required at the clinical site. The (BIO SCI 199) Undergraduate Research Training Program standards, procedures, enrollment packets, and announcements are available at the Biological Sciences Undergraduate Research website (https://www.bio.uci.edu/undergraduates/research/).

The (BIO SCI 199) Undergraduate Research Training Program can provide experience that is beneficial for the future pursuit of graduate school. Information regarding research careers in the biological sciences is best obtained from a faculty research mentor.

Students should be aware that for any one quarter, a maximum of five units of independent study courses (BIO SCI 197, BIO SCI 198 or BIO SCI 199) may be taken within the School of Biological Sciences.

Minority Sciences Programs in Biological Sciences

The Minority Sciences Programs (MSP) in Biological Sciences is a UCI umbrella program that provides infrastructure and orchestration for the operation of minority research training grants supported by the National Institutes of Health (NIH) and other agencies. MSP seeks to increase the number of U.S. underrepresented groups in biomedical research careers. MSP participants benefit from early exposure, continuous research training, and faculty mentoring. Support is also provided through paid summer and year-round research internships, early research exposure, tutoring, academic advising, scientific writing, and participation at national conferences. Furthermore, MSP has established a campuswide, regional, national, and international network of committed faculty and resource programs to facilitate the transition from high school through community college, baccalaureate, and master's degrees to Ph.D. careers in biomedical research and related fields. Additional information is available from the MSP office, 1104 Biological Sciences III; 949-824-2589; or visit the Minority Sciences website (http://port.bio.uci.edu/).

Biological Sciences Tutoring Program

The Tutoring Program provides free tutoring for most Biological Sciences courses and is available to all students in any major. Weekly small group tutoring sessions, reviews for midterms and finals, and a growing online database of worksheets and review materials are provided. In the Tutoring Program, UCI students tutor other UCI students. For the student tutor, this program provides opportunities to develop their teaching abilities, to meet and interact with faculty, and to perform a worthwhile and necessary service. Tutors also receive academic credit. For more information, contact the Biological Sciences Student Affairs Office in 1011 Biological Sciences III or visit the Bio Sci Peer Tutoring website (https://sites.google.com/a/uci.edu/biotutor/).

UC Education Abroad Program

Upper-division students have the opportunity to experience a different culture while making progress toward degree objectives through the University's Education Abroad Program (UCEAP). UCEAP is an overseas study program which operates in cooperation with host universities and colleges throughout the world. Specifically, Biology majors should consider the UCEAP programs in the United Kingdom, Canada, Sweden, Australia, Denmark, and Costa Rica. Visit the Study Abroad Center website (http://www.studyabroad.uci.edu/) for additional information.

Students may wish to participate in the UCEAP Tropical Biology Quarter which is for undergraduates with at least one year of introductory biology, one quarter of upper-division biology, and a serious interest in biological studies. The program includes lectures, field laboratories, and independent research, with an emphasis on direct field experience. Students also take a course in Spanish language and Latin American culture.

Special Research Resources

Special research resources include the Beckman Laser Institute and Medical Clinic, a research, training, and service facility in the area of laser microbeam technology; the School of Biological Sciences Biohazard (P-3) Facility, which provides laboratory facilities for working with biological agents or biological molecules such as recombinant DNA which would be hazardous when used in open laboratories; the Developmental Biology Center, devoted to analyzing the cellular and genetic mechanisms underlying growth, development, and regeneration; the Center for the Neurobiology of Learning and Memory, a research center for studies of the brain mechanisms underlying learning and memory; the Institute for Memory Impairments and Neurological Disorders; the Center for Virus Research, which includes the Viral Vector Design research group; the Conservation Biology Project; the Cancer Research Institute; the Center for Immunology; the Macromolecular Structure Research Unit; the UCI Arboretum, a botanical garden facility; the San Joaquin Marsh Reserve, which supports controlled marsh biota; the Burns Piñon Ridge Reserve, a high-desert habitat in San Bernardino County; and the UCI Ecological Preserve, which includes coastal hills on the campus, once under heavy grazing, but now returning to a more natural state. It is important to note that the School of Biological Sciences collaborates with the School of Medicine, thereby providing an opportunity for the sharing of both teaching and research activities. These collaborative efforts include the Institute for Genomics and Bioinformatics; the Reeve-Irvine Research Center; and the Bio-Imaging Interest Group.

Advising: Academic, Career, Health Sciences

1011 Biological Sciences III
https://www.bio.uci.edu/undergraduates/

Academic Advising

The Biological Sciences Student Affairs Office coordinates the advising program and provides academic counseling as well as special services particularly in the area of pre-professional career counseling. Undergraduate Biological Sciences students should consult the Biological Sciences Student Affairs Office for information on academic requirements for the degree, career opportunities, the BIO SCI 199 Research Program, available tutoring for Biological Sciences courses, Biological Sciences student organizations, and scholarship information. Students can also come to the

Biological Sciences Student Affairs Office for questions regarding changing their major, applying for graduation, or for any other help they might need related to their academic career at UCI.

Peer Academic Advisors. The Peer Academic Advisors are upper-division Biological Sciences majors who bring with them valuable academic and social experiences. Their functions include counseling students in matters of major selection, program planning, petitioning, tutoring, learning skills problems, and participation in co-curricular and extracurricular activities.

The Peer Advisors are located in the Biological Sciences Student Affairs Office. Office hours are posted at the beginning of each quarter.

Career Advising

Information on graduate and professional schools in the health sciences can be obtained from the Biological Sciences Student Affairs Office. The UCI Career Center provides services to students and alumni including career counseling, information about job opportunities, a career library, and workshops on resume preparation, job search, and interview techniques. See the Division of Career Pathways section (http://career.uci.edu/) for additional information.

Areas of opportunity open to those with a Bachelor of Science degree include laboratory technology, publishing, technical editing, pharmaceutical sales, and training programs in county, state, and federal agencies. The bachelor's degree is necessary to pursue studies leading to the M.S. and Ph.D. degrees.

The B.S. degree, plus short training periods, may prepare students for employment in education, medical technology (usually one year), allied health positions, and various other areas.

Education (community colleges, state colleges, or private schools), medical illustration, and public health (which includes hospital administration, biostatistics, epidemiology, environmental health sciences, social work, public health education, maternal and child health, and infectious and tropical diseases) are fields in which opportunities are available upon completion of a master's program.

The Ph.D. may lead to research in many areas, among them biochemistry, biometeorology, botany, cytology, ecology, evolutionary biology, fishery biology, genetics, microbiology, molecular biology, pathology, physiology, psychobiology, public health, range management, soil conservation, and zoology.

Other areas where advanced degrees are necessary include medicine, dentistry, law, optometry, podiatry, osteopathy, physical therapy, and veterinary medicine.

Health Sciences Advising

Advising for careers in the health sciences is a specialty of the Biological Sciences Student Affairs Office. Students desiring to enter the health sciences should have their programs checked in the Office and should plan to enroll in BIO SCI 3A. Admissions tests for medical, dental, pharmacy, and other allied health programs should be taken in the spring, one and a half years before the student plans to enter.

Leaders in nearly all health professional schools recommend that students preparing to seek admission to their schools plan to obtain a bachelor's degree. Students who plan to enter a school of dentistry, medicine, or other areas of the health sciences may receive the required pre-professional training at UCI. This pre-professional training may be accomplished by (1) completing the major in Biological Sciences or (2) majoring in any school or department *and* fulfilling concurrently the specific course requirements of the dental, medical, or other professional school the student expects to attend.

Students interested in the health sciences should choose electives in the social sciences, possibly a foreign language, physical chemistry, or other specific courses required or recommended by graduate schools. See the Pre-Health Professional Advising website (https://www.bio.uci.edu/undergraduates/careers/) for additional information

Student Participation

A wide variety of student associations, clubs, and groups provide opportunities for School of Biological Sciences students to participate in different types of activities and events. The groups are wide ranging and include nationally recognized honors societies such as Alpha Epsilon Delta, volunteer service organizations such as the Flying Sams, specialized groups such as the UCI Sports Medicine Club, and more. Detailed information about the numerous options is available at Biological Sciences Student Involvement Opportunities (https://www.bio.uci.edu/undergraduates/events-deadlines/).

Interdisciplinary Graduate Programs

The School is structured in a manner that encourages an interdisciplinary approach to scientific problems. Interaction and cooperative efforts across traditional institutional boundaries are especially evident in the School's participation in various organized research units (described in the Office of Research section (http://catalogue.uci.edu/officeofresearch/)) and in the interdepartmental/interschool graduate programs described below.

Graduate Program in Cellular and Molecular Biosciences

Peter J. Donovan, Director
Administrative Contact Information: Gary Roman
4145 Natural Sciences II
949-824-6226

http://cmb.uci.edu

The combined graduate program in Cellular and Molecular Biosciences (CMB) provides the first year of instruction for graduate students entering Ph.D. programs in six departments within the School of Biological Sciences and the School of Medicine. Applicants should have significant laboratory experience and be well prepared in biochemistry, molecular biology, cell biology, and genetics with appropriate course work in organic chemistry, calculus, and physics.

Requirements

During the first year, students will select one of five focus areas: “Immunology and Microbiology,” Cancer and Cell Biology,” "Structural Biology, Biochemistry, and Biophysics,” “Developmental and Stem Cell Biology,” or “Genetics, Epigenetics and Genomics.” Students will select three didactic courses, one each quarter, from a menu of course options recommended for their focus area. Students with more general interests will be allowed to substitute courses to gain knowledge in different areas of biomedical science. Furthermore, any student may switch focus areas during the first year. Changes to course work or Focus Area can be achieved by simple petition to the CMB director. During the first year the students also complete three required 2-unit S/U courses (Ph.D. Fundamentals, Biomedical Research Methods, and Responsible Conduct of Research) that develop knowledge and skills not necessarily covered in the didactic courses. Students may take additional elective courses relevant to their area of specialization although this is not encouraged. Each Focus Area recommends elective courses for students in years two or later, to be taken after transfer to a departmental Ph.D. program.

The students also undertake introductory research in at least two laboratories during their first year. Students can select a laboratory rotation from over 100 faculty laboratories in the departments of Biological Chemistry, Developmental and Cell Biology, Microbiology and Molecular Genetics, Molecular Biology and Biochemistry, Pathology and Laboratory Medicine, and Physiology and Biophysics. Each faculty member’s area of research is described on the department websites. Faculty also are associated with research areas that span departments, as shown on the CMB website (http://cmb.uci.edu). The year culminates in a comprehensive preliminary examination and evaluation.

At the end of the first academic year, students will select a thesis advisor in one of the departments. Students who select a thesis advisor in the School of Biological Sciences (Department of Developmental and Cell Biology or Molecular Biology and Biochemistry) will complete the doctoral degree in Biological Sciences. Students who select a thesis advisor in the School of Medicine (Departments of Biological Chemistry, Microbiology and Molecular Genetics, Pathology and Laboratory Medicine, and Physiology and Biophysics) will complete the doctoral degree in Biomedical Sciences.

During the second year and beyond, students participate in the departmental doctoral program. Students are required to meet all doctoral degree requirements associated with the thesis advisor’s department or program, and may be required to take additional course work, and participate in journal club and seminar series. The normative time for completion of the Ph.D. is five years, and the maximum time permitted is seven years. Further information is available in the *Catalogue* sections of the participating departments and through the CMB program office.

Graduate Program in Mathematical, Computational, and Systems Biology

The graduate program in Mathematical, Computational, and Systems Biology (MCSB) is designed to meet the interdisciplinary training challenges of modern biology and to function in concert with existing departmental programs or as an individually tailored program leading to an M.S. or Ph.D. Detailed information is available at the Mathematical, Computational, and Systems Biology website (http://mcsb.uci.edu/) and in the Interdisciplinary Studies section (http://catalogue.uci.edu/interdisciplinarystudies/mathematicalcomputationalandsystemsbiology_phd/) of the *Catalogue*.

Interdepartmental Neuroscience Program

Christie D. Fowler, Director
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http://www.inp.uci.edu;
gary.roman@uci.edu (%20gary.roman@uci.edu)

The Interdepartmental Neuroscience Program (INP) is a first-year graduate program that brings together more than 90 faculty from the School of Biological Sciences and the School of Medicine, including participation from the Departments of Anatomy and Neurobiology, Developmental and Cell Biology, Molecular Biology and Biochemistry, Neurobiology and Behavior, Pathology and Laboratory Medicine, and Physiology and Biophysics. INP faculty have broad research interests in behavioral neuroscience, brain aging, developmental neurobiology, genetics, learning and memory, molecular neurobiology, cellular neurobiology, neural injury/disorders/repair, neuropharmacology, plasticity, and sensory neuroscience. Neuroscience as a discipline requires scientists to have a detailed understanding of at least one field, and a broad understanding of many other fields. INP provides breadth early on, followed by specialization across the remainder of the predoctoral training years. The normative time for degree completion is five years.

INP organizes and coordinates a core curriculum that provides a foundation in neuroscience and forms the basis of future specialized instruction in a participating departmental degree-granting program. This curriculum includes course work and laboratory rotations. Each trainee is individually mentored in tailoring an appropriate course of study based on academic background, interests, and research foci. After successfully completing the academic requirements of the program, students identify a thesis advisor who is willing to accept them into their laboratory, and the student will transfer to the doctoral program in their advisor’s home department. In this way, INP serves not as a degree-granting program, but as a gateway to further graduate training. Students are required to meet all doctoral degree requirements associated with the thesis advisor’s department or program.

In particular, the program provides trainees with an opportunity: (1) to begin training in neuroscience with a broad academic introduction, (2) to receive individualized attention to curricular needs, (3) to conduct initial research projects with a large and diverse group of faculty in a wide variety of departments, and (4) to conduct dissertation research in any of a large and diverse group of laboratories in a wide variety of departments.

Requirements

In the first year of study, students must successfully complete one course from each of the molecular, systems, and cellular neuroscience categories. All trainees also participate in a two-unit course called Foundations of Neuroscience (NEURBIO 202A-NEURBIO 202B). This mandatory course is intended to expose students to research in neuroscience and critical reading and analysis of the primary literature. Students are encouraged to carry out three laboratory rotations of 10 weeks each. With permission from the director and the dean, students may carry out fewer rotations. Rotations are graded on a Satisfactory/Unsatisfactory Only scale. Trainees are judged as having successfully completed the program provided that they have: (1) achieved at least a B+ (3.3) average in the core courses, (2) achieved a satisfactory grade in each quarter of Foundations of Neuroscience, (3) achieved satisfactory grades in all rotations, and (4) identified a participating faculty member who has agreed to serve as their thesis advisor.

Competitive INP candidates will have had a substantial subset of courses covering the following topic areas: neuroscience, biology, biochemistry, psychology, physics, calculus, and genetics. Preference will be given to applicants who have had laboratory research experience.

Following completion of the INP and selection of a thesis mentor, students will become members of the faculty member's participating department. In addition to the INP course work requirements, each department has specific requirements to be fulfilled, indicated below. Students who select a thesis advisor in the School of Biological Sciences (Department of Developmental and Cell Biology, Molecular Biology and Biochemistry, or Neurobiology and Behavior) will complete the doctoral degree in Biological Sciences. Students who select an advisor in the School of Medicine (Department of Anatomy and Neurobiology, Pharmacology, or Physiology and Biophysics) will complete the doctoral degree in Biomedical Sciences.

Developmental and Cell Biology (https://devcell.bio.uci.edu/?utm_source=uci-biosci&utm_medium=organic&utm_campaign=departmentspage&utm_content=learn-more) (School of Biological Sciences): Students entering the Developmental and Cell Biology program are required to enroll in and attend the weekly Department seminar series (DEV BIO 290A-DEV BIO 290B-DEV BIO 290C) and Developmental and Cell Biology journal club (DEV BIO 206A-DEV BIO 206B-DEV BIO 206C). Two quarters of teaching under the supervision of Departmental faculty are required. Student training will also be individually assessed for possible courses with an emphasis in molecular, developmental biology, or genetics as deemed necessary for successful completion of the thesis research project.

Molecular Biology and Biochemistry (https://mbb.bio.uci.edu/?utm_source=uci-biosci&utm_medium=organic&utm_campaign=departmentspage&utm_content=learn-more) (School of Biological Sciences): Students entering the Molecular Biology and Biochemistry program are required to enroll in and attend the weekly Department seminar series (MOL BIO 201A-MOL BIO 201B-MOL BIO 201C) and the Research in Progress Seminar (MOL BIO 229), where they will present their own work annually. Students will enroll in University Teaching (DEV BIO 399) and teach (TA) beginning in their second year for at least two quarters. Student training will also be individually assessed to include at least one formal graduate course in each of the second through fifth years with an emphasis in molecular biology or biochemistry as deemed necessary for successful completion of the thesis research project. Necessary courses will include two core classes (MOL BIO 203-MOL BIO 204).

Neurobiology and Behavior (https://neurobiology.uci.edu/?utm_source=uci-biosci&utm_medium=organic&utm_campaign=departmentspage&utm_content=learn-more) (School of Biological Sciences): Neurobiology and Behavior accepts any of the INP core courses toward the requirement of one each from Cellular, Molecular, Systems, and Behavioral categories. INP students who enter Neurobiology and Behavior in their second year must complete the fourth category if they only fulfilled three as INP students. In addition, they will fulfill the requirements met by all continuing students, including teaching (TA) beginning in their second year for at least two quarters, advancing to candidacy in their third year, annual meetings with an advisory committee, and completing four advanced courses prior to defending their dissertation in their fifth year. They also participate in the regular Department colloquia. Students also present their research annually in the graduate student NeuroBlitz colloquium series.

Anatomy and Neurobiology (https://www.anatomy.uci.edu/) (School of Medicine): Students entering the Anatomy and Neurobiology program are required to participate in the Current Topics in Neuroscience journal club (ANATOMY 227A-ANATOMY 227B-ANATOMY 227C) and attend all Department-sponsored seminars. They are also required to meet once each year with an advisory committee to monitor their progress and present their research at the annual "Grad Day" meeting. Individual advisors may require students to take other courses depending on their interests and research program.

Pathology and Laboratory Medicine: Students entering the Ph.D. program in Experimental Pathology through the INP must take one didactic graduate course each year; senior graduate students (year 4 and beyond) may waive this requirement with approval from the graduate advisor. To satisfy this requirement, students may take PATH 221, other approved courses offered by other departments, or any other relevant coursework with approval from the graduate advisor. In addition, students must attend weekly seminars and are encouraged to participate in the Experimental Pathology Journal Club. Graduate students in the program are also required to present in the seminar series, usually during the spring quarter; these oral presentations are an important part of the graduate training. Second year students are required to give a 30-minute "research in progress" talk. In the third year and beyond, students are required to present research as formal one-hour seminars.

Physiology and Biophysics (https://www.physiology.uci.edu/) (School of Medicine): Students entering the Physiology program through the INP are required to enroll each quarter in Topics in Physiology (PHYSIO 290), which is graded by attendance and participation, and to attend all meetings of the Physiology and Biophysics journal club, all Physiology and Biophysics Departmental seminars and lunch meetings with the seminar speaker,

and the Research in Progress seminars. All students are required to present their research once a year at the Research in Progress program. Students are encouraged, but not required, to enroll in Physiology of Ion Channels (PHYSIO 232) and Proteomics (PHYSIO 252). All students are required to hold meetings with their thesis committee annually, beginning in their second year. The Department has no formal teaching requirements, but students who wish to gain experience as Teaching Assistants (TA) can make arrangements to do so in coordination with the director of Graduate Studies for the Department of Physiology and Biophysics.

- Department of Developmental and Cell Biology
- Department of Ecology and Evolutionary Biology
- Department of Molecular Biology and Biochemistry
- Department of Neurobiology and Behavior

Requirements for the Bachelor's Degree

All School of Biological Sciences students must complete the following requirements.

All students must meet the University Requirements (http://catalogue.uci.edu/informationforadmittedstudents/requirementsforabachelorsdegree/).

All students must meet the School Requirements, as shown below:

Complete:	
BIO SCI 2A	Freshman Seminar
or BIO SCI 190	Transfer Student Seminar
Biological Sciences Core:	
BIO SCI 93	From DNA to Organisms
or BIO SCI H93	Honors From DNA to Organisms
BIO SCI 93L	DNA to Organisms - Introduction to Biology Research
BIO SCI 94	From Organisms to Ecosystems
or BIO SCI H94	Honors From Organisms to Ecosystems
BIO SCI 94L	Organisms to Ecosystems - Introduction to Biology Research Analysis
BIO SCI 97	Genetics
or BIO SCI H97	Honors Genetics
BIO SCI 98	Biochemistry
BIO SCI 99	Molecular Biology
BIO SCI 100	Scientific Writing
Select one of the following General Chemistry sequences:	
CHEM 1A- 1B- 1C	General Chemistry and General Chemistry and General Chemistry
and accompanying labs:	
CHEM 1LC- 1LD	General Chemistry Laboratory and General Chemistry Laboratory
or	
CHEM H2A- H2B- H2C	Honors General Chemistry and Honors General Chemistry and Honors General Chemistry
and accompanying labs:	
CHEM H2LA- H2LB	Honors General Chemistry Laboratory and Honors General Chemistry Laboratory
Select one of the following Organic Chemistry sequences:	
CHEM 51A- 51B- 51C	Organic Chemistry and Organic Chemistry and Organic Chemistry
and accompanying labs:	
CHEM 51LB- 51LC	Organic Chemistry Laboratory and Organic Chemistry Laboratory

CHEM H52LA- H52LB	Honors Organic Chemistry Laboratory and Honors Organic Chemistry Laboratory
Complete:	
MATH 5A	Calculus for Life Sciences I
MATH 5B	Calculus for Life Sciences II
Select one of the following:	
STATS 7	Basic Statistics
STATS 8	Introduction to Biological Statistics
MATH 2D	Multivariable Calculus I
MATH 3A	Introduction to Linear Algebra
Select one of the following Physics Series:	
Series A	
PHYSICS 3A- 3B- 3C	Basic Physics I and Basic Physics II and Basic Physics III
PHYSICS 3LB- 3LC	Basic Physics Laboratory and Basic Physics Laboratory
Series B	
PHYSICS 7C- 7D- 7E	Classical Physics and Classical Physics and Classical Physics
PHYSICS 7LC- 7LD	Classical Physics Laboratory and Classical Physics Laboratory
Prerequisites for all Biological Sciences Core courses are rigorously enforced. Students must have a 2.0 cumulative grade point average in the Biological Sciences Core Curriculum, four upper-division elective courses, and three upper-division laboratories.	
Upper-Division Writing Requirement	
Students in the School of Biological Sciences have the option to satisfy the upper-division writing requirement by completing BIO SCI 100 with a minimum grade of C-, followed by the completion of two upper-division laboratories selected from the following:	
BIO SCI D111L	Developmental and Cell Biology Laboratory
BIO SCI E106L	Habitats and Organisms
BIO SCI E112L	Physiology Laboratory
BIO SCI E115L	Evolution Laboratory
BIO SCI E131L	Image Analysis in Biological Research
BIO SCI E140L	Evolution and the Environment Laboratory
BIO SCI E160L	Biology of Birds Lab
BIO SCI E166L	Field Biology
BIO SCI E179L	Field Freshwater Ecology
BIO SCI E186L	Population and Community Ecology Lab
BIO SCI M114L	Biochemistry Laboratory
BIO SCI M116L	Molecular Biology Laboratory
BIO SCI M118L	Experimental Microbiology Laboratory
BIO SCI M121L	Advanced Immunology Laboratory
BIO SCI M130L	Advanced Molecular Lab Techniques
BIO SCI N113L	Neurobiology Laboratory
BIO SCI N123L	Human Neuroimaging Lab
Students must earn a grade of C- or better in each of the two laboratories selected. Completion of BIO SCI 199W or Excellence in Research in Biological Sciences program may count as one of the two upper-division labs.	
School Residence Requirement	
After matriculation, all courses required for the major must be successfully completed at UCI. Students must be a major in the School of Biological Sciences for the 3 academic quarters (excluding summer session) immediately preceding degree certification.The School of Biological Sciences strictly enforces the UCI residence requirement. At least 36 of the final 45 units completed by a student for the bachelor's degree must be earned in residence at the UCI campus. (The School considers courses taken in the UC Education Abroad Program to be in-residence courses.)	

- Biochemistry and Molecular Biology, B.S.
- Biological Sciences, B.S.
- Biological Sciences, M.S.
- Biological Sciences, Minor
- Biological Sciences, Ph.D.
- Biology/Education, B.S.
- Biotechnology Management, M.S.
- Developmental and Cell Biology, B.S.
- Ecology and Evolutionary Biology, B.S.
- Ecology and Evolutionary Biology, Graduate Program
- Exercise Sciences, B.S.
- Genetics, B.S.
- Human Biology, B.S.
- Master of Conservation and Restoration Science
- Microbiology and Immunology, B.S.
- Neurobiology and Behavior, Graduate Program
- Neurobiology, B.S.

Faculty

Nancy M. Aguilar-Roca, Ph.D. University of California, San Diego, *Associate Professor of Teaching of Ecology and Evolutionary Biology*

Lauren Albrecht, Ph.D. Northwestern University, *Assistant Professor of Pharmaceutical Sciences; Developmental and Cell Biology*

Steven D. Allison, Ph.D. Stanford University, *Professor of Ecology and Evolutionary Biology; Earth System Science*

Joseph Arditti, Ph.D. University of Southern California, *Professor Emeritus of Developmental and Cell Biology* (developmental physiology of orchids)

Kavita Arora, Ph.D. University of Bombay, *Department Chair and Professor of Developmental and Cell Biology* (Drosophila development; TGF-ß signal transduction; cell signaling)

Dana W. Aswad, Ph.D. University of California, Berkeley, *Professor Emeritus of Molecular Biology and Biochemistry*

Peter R. Atsatt, Ph.D. University of California, Los Angeles, *Professor Emeritus of Ecology and Evolutionary Biology*

Scott Atwood, Ph.D. University of Oregon, *Assistant Professor of Developmental and Cell Biology*

John C. Avise, Ph.D. University of California, Davis, *Professor Emeritus of Ecology and Evolutionary Biology*

Manny Azizi, Ph.D. University of Massachusetts, *Associate Professor of Ecology and Evolutionary Biology*

Alan G. Barbour, M.D. Tufts University, *Distinguished Professor of Microbiology and Molecular Genetics; Ecology and Evolutionary Biology; Medicine*

Lee Bardwell, Ph.D. Stanford University, *Professor of Developmental and Cell Biology* (intracellular signaling in development and disease)

Rachael M. Barry, Ph.D. Princeton University, *Assistant Professor of Teaching of Molecular Biology and Biochemistry*

Kevin T. Beier, Ph.D. Harvard University, *Assistant Professor of Physiology and Biophysics; Biomedical Engineering; Neurobiology and Behavior; Pharmaceutical Sciences* (neuroscience, neural circuits, neural plasticity, molecular neuroscience, behavior, technique development, viral-genetic)

Claudia Benavente, Ph.D. University of Arizona, *Associate Professor of Pharmaceutical Sciences; Developmental and Cell Biology* (genetics, epigenetics, cancer, pediatric cancer, retinoblastoma, osteosarcoma)

Albert F. Bennett, Ph.D. University of Michigan, *Professor Emeritus of Ecology and Evolutionary Biology*

Rudi C. Berkelhamer, Ph.D. University of California, Berkeley, *Professor of Teaching Emerita of Ecology and Evolutionary Biology*

Hans-Ulrich Bernard, Ph.D. University of Goettingen, *Professor Emeritus of Molecular Biology and Biochemistry; Population Health and Disease Prevention*

Elizabeth Bess, Ph.D. University of Utah, *Assistant Professor of Chemistry; Molecular Biology and Biochemistry* (chemical biology)

Bruce Blumberg, Ph.D. University of California, Los Angeles, *Professor of Developmental and Cell Biology; Biomedical Engineering; Environmental Health Sciences; Pharmaceutical Sciences* (gene regulation by nuclear hormone receptors in vertebrate development physiology, endocrine disruption)

Mathew M. Blurton-Jones, Ph.D. University of California, San Diego, *Professor of Neurobiology and Behavior*

Hans R. Bode, Ph.D. Yale University, *Professor Emeritus of Developmental and Cell Biology* (molecular basis of pattern formation in Hydra)

Suzanne Bohlson, Ph.D. University of Notre Dame, *Professor of Teaching of Molecular Biology and Biochemistry*

Peter A. Bowler, Ph.D. University of California, Irvine, *Professor of Teaching Emeritus of Ecology and Evolutionary Biology*

Matthew E. Bracken, Ph.D. Oregon State University, *Professor of Ecology and Evolutionary Biology*

Timothy J. Bradley, Ph.D. University of British Columbia, *Professor Emeritus of Ecology and Evolutionary Biology*

Adriana D. Briscoe, Ph.D. Harvard University, *Professor of Ecology and Evolutionary Biology*

Peter J. Bryant, Ph.D. University of Sussex, *Research Professor and Professor Emeritus of Developmental and Cell Biology* (tumor-suppressor genes of Drosophila and humans)

Susan V. Bryant, Ph.D. University of London, *Professor Emerita of Developmental and Cell Biology* (molecular basis of limb development and regeneration)

Michael J. Buchmeier, Ph.D. McMaster University, *Professor Emeritus of Medicine; Microbiology and Molecular Genetics; Molecular Biology and Biochemistry*

Nancy T. Burley, Ph.D. University of Texas at Austin, *Professor of Ecology and Evolutionary Biology*

Jorge A. Busciglio, Ph.D. Universidad Nacional de Córdoba, *Professor of Neurobiology and Behavior*

Robin M. Bush, Ph.D. University of Michigan, *Professor Emeritus of Ecology and Evolutionary Biology*

Lawrence F. Cahill, Ph.D. University of California, Irvine, *Professor of Neurobiology and Behavior; Psychological Science*

Anne L. Calof, Ph.D. University of California, San Francisco, *Professor of Anatomy and Neurobiology; Developmental and Cell Biology*

Diane R. Campbell, Ph.D. Duke University, *Distinguished Professor of Ecology and Evolutionary Biology*

Richard D. Campbell, Ph.D. The Rockefeller University, *Professor Emeritus of Developmental and Cell Biology* (Morphogenesis; biology of Hydra; fractal geometry of biological forms)

F. Lynn Carpenter, Ph.D. University of California, Berkeley, *Professor Emerita of Ecology and Evolutionary Biology*

John Charles Chaput, Ph.D. University of California, Riverside, *Professor of Pharmaceutical Sciences; Chemical and Biomolecular Engineering; Chemistry; Molecular Biology and Biochemistry* (chemical and synthetic biology)

Ken W. Cho, Ph.D. University of Pennsylvania, *Professor of Developmental and Cell Biology* (TGF-ß signaling, gene regulatory networks in development)

Elizabeth Chrastil, Ph.D. Brown University, *Assistant Professor of Neurobiology and Behavior; Cognitive Sciences*

Olivier Cinquin, Ph.D. University College London, *Associate Professor of Developmental and Cell Biology* (mathematical modeling of networks, systems biology)

Olivier Civelli, Ph.D. Swiss Federal Institute of Technology in Zurich, *Distinguished Professor of Pharmaceutical Sciences; Developmental and Cell Biology* (novel neuroactive molecules, molecular neuropharmacology)

Michael T. Clegg, Ph.D. University of California, Davis, *Donald Bren Professor and Professor Emeritus of Ecology and Evolutionary Biology*

Melanie Cocco, Ph.D. Pennsylvania State University, *Associate Professor of Molecular Biology and Biochemistry; Pharmaceutical Sciences*

Susana Cohen-Cory, Ph.D. The Rockefeller University, *Professor of Neurobiology and Behavior*

Kwasi M. Connor, Ph.D. University of Southern California, *Assistant Professor of Ecology and Evolutionary Biology*

Karina S. Cramer, Ph.D. California Institute of Technology, *Professor of Neurobiology and Behavior*

Michael G. Cumsky, Ph.D. University of California, Berkeley, *Professor Emeritus of Molecular Biology and Biochemistry*

Monica A. Daley, Ph.D. Harvard University, *Professor of Ecology and Evolutionary Biology*

Michelle Digman, Ph.D. University of Illinois at Chicago, *Associate Professor of Biomedical Engineering; Developmental and Cell Biology* (biophotonics, fluorescence Spectroscopy and microscopy, nano-scale imaging, mechanotransduction, cancer cell migration, fluorescence lifetime and metabolic mapping)

Fangyuan Ding, Ph.D. École Normale Supérieure de Paris, *Assistant Professor of Biomedical Engineering; Developmental and Cell Biology; Pharmaceutical Sciences* (quantitative single molecule biology and engineering, systems biology, nucleic-acid based therapies, single cell research tool developments)

Peter J. Donovan, Ph.D. University College London, *Professor of Biological Chemistry; Developmental and Cell Biology*

Aimee Lara Edinger, Ph.D. University of Pennsylvania, *Professor of Developmental and Cell Biology* (cancer biology and metabolism, growth control, protein trafficking)

James J. Emerson, Ph.D. University of Chicago, *Associate Professor of Ecology and Evolutionary Biology*

German A. Enciso Ruiz, Ph.D. Rutgers, the State University of New Jersey, *Professor of Mathematics; Developmental and Cell Biology* (applied and computational mathematics, mathematical and computational biology)

Dae Seok Eom, Ph.D. The University of Texas at Austin, *Assistant Professor of Developmental and Cell Biology* (cellular projection mediated long-range cell-to-cell communication)

Celia Faiola, Ph.D. Washington State University, *Associate Professor of Ecology and Evolutionary Biology; Chemistry*

Hung Y. Fan, Ph.D. Massachusetts Institute of Technology, *Professor Emeritus of Molecular Biology and Biochemistry*

Donald N. Forthal, M.D. University of California, Irvine, *Professor of Medicine; Molecular Biology and Biochemistry; Pathology and Laboratory Medicine*

Norbert Fortin, Ph.D. Boston University, *Associate Professor of Neurobiology and Behavior*

Donald E. Fosket, Ph.D. University of Idaho, *Professor Emeritus of Developmental and Cell Biology* (regulation of cytoskeleton formation and function)

Christie Fowler, Ph.D. Florida State University, *Associate Professor of Neurobiology and Behavior*

Steven A. Frank, Ph.D. University of Michigan, *Distinguished Professor and Donald Bren Professor of Ecology and Evolutionary Biology; Logic and Philosophy of Science*

Ron D. Frostig, Ph.D. University of California, Los Angeles, *Professor of Neurobiology and Behavior; Biomedical Engineering*

David A. Fruman, Ph.D. Harvard University, *Professor of Molecular Biology and Biochemistry*

Christine M. Gall, Ph.D. University of California, Irvine, *Department Chair and Distinguished Professor of Anatomy and Neurobiology; Neurobiology and Behavior*

Sunil P. Gandhi, Ph.D. University of California, San Diego, *Professor of Neurobiology and Behavior*

Ana E. Garcia Vedrenne, Ph.D. University of California, Santa Barbara, *Assistant Professor of Teaching of Ecology and Evolutionary Biology*

David M. Gardiner, Ph.D. University of California, San Diego, *Professor Emeritus of Developmental and Cell Biology* (limb development and regeneration)

Brandon S. Gaut, Ph.D. University of California, Riverside, *Distinguished Professor of Ecology and Evolutionary Biology*

Donovan German, Ph.D. University of Florida, *Associate Professor of Ecology and Evolutionary Biology*

Paul David Gershon, Ph.D. University of Liverpool, *Professor of Molecular Biology and Biochemistry*

Charles Glabe, Ph.D. University of California, Davis, *Professor of Molecular Biology and Biochemistry*

Shane Gonen, Ph.D. University of Washington, *Assistant Professor of Molecular Biology and Biochemistry*

Michael L. Goulden, Ph.D. Stanford University, *Professor of Earth System Science; Ecology and Evolutionary Biology*

Celia Goulding, Ph.D. King's College London, *Chair and Professor of Molecular Biology and Biochemistry; Pharmaceutical Sciences*

Enrico Gratton, Ph.D. University of Rome, *Distinguished Professor of Biomedical Engineering; Developmental and Cell Biology; Physics and Astronomy* (design of new fluorescence instruments, protein dynamics, single molecule, fluorescence microscopy, photon migration in tissues)

Kim Green, Ph.D. University of Leeds, *Department Vice Chair and Professor of Neurobiology and Behavior*

Michael T. Green, Ph.D. University of Chicago, *Vice Chair and Professor of Molecular Biology and Biochemistry; Chemistry* (chemical, biology, inorganic and organometallic, physical chemistry and chemical physics, theoretical and computational)

Steven P. Gross, Ph.D. University of Texas at Austin, *Professor of Developmental and Cell Biology; Physics and Astronomy* (force generation by molecular motors in living cells)

John F. Guzowski, Ph.D. University of California, Irvine, *Associate Professor of Neurobiology and Behavior*

Christopher J. Halbrook, Ph.D. Stony Brook University in New York, *Assistant Professor of Molecular Biology and Biochemistry*

Barbara A. Hamkalo, Ph.D. University of Massachusetts, *Professor Emerita of Molecular Biology and Biochemistry*

Tobin J. Hammer, Ph.D. University of Colorado Boulder, *Assistant Professor of Ecology and Evolutionary Biology*

Bradford A. Hawkins, Ph.D. University of California, Riverside, *Professor Emeritus of Ecology and Evolutionary Biology*

Patrick L. Healey, Ph.D. University of California, Berkeley, *Professor Emeritus of Developmental and Cell Biology* (plant cellular differentiation and morphogenesis, ultrastructure and histochemistry of secretory systems, early reproductive development)

L. R. Herman, B.S. University of California, Irvine, *Academic Coordinator of Biological Sciences*

James W. Hicks, Ph.D. University of New Mexico, *Professor of Ecology and Evolutionary Biology*

Allon Hochbaum, Ph.D. University of California, Berkeley, *Associate Professor of Materials Science and Engineering; Chemical and Biomolecular Engineering; Chemistry; Molecular Biology and Biochemistry* (biological materials, protein materials, electronic conductivity in proteins, materials and methods to study microbes and microbial communities)

Franz J. Hoffmann, Ph.D. University of Hohenheim, *Professor of Teaching Emeritus of Developmental and Cell Biology* (regeneration of cultured plant cells, somatic cell genetics)

Yilin Hu, Ph.D. Loma Linda University, *Professor of Molecular Biology and Biochemistry*

Bradley S. Hughes, Ph.D. University of California, Irvine, *Associate Professor of Teaching of Ecology and Evolutionary Biology; Education*

Christopher C. Hughes, Ph.D. University of London, *Director of Edwards Lifesciences Center for Advanced Cardiovascular Technology and Professor of Molecular Biology and Biochemistry; Biomedical Engineering* (tissue engineering, growth and patterning of blood vessels)

George L. Hunt, Jr., Ph.D. Harvard University, *Professor Emeritus of Ecology and Evolutionary Biology*

Travis E. Huxman, Ph.D. University of Nevada, *Department Chair and Professor of Ecology and Evolutionary Biology*

Matthew Inlay, Ph.D. University of California, San Diego, *Associate Professor of Molecular Biology and Biochemistry*

Autumn S. Ivy, M.D., Ph.D. University of California, Irvine, *Assistant Professor of Pediatrics; Anatomy and Neurobiology; Neurobiology and Behavior; Neurology; Physiology and Biophysics* (early-life exercise, epigenetics, neurology, learning and memory, developmental disorders)

Mahtab F. Jafari, Pharm.D. University of California, San Francisco, *Director of the Center for Healthspan Pharmacology and Professor of Pharmaceutical Sciences; Clinical Pharmacy Practice; Ecology and Evolutionary Biology* (anti-aging pharmacology and preventive medicine)

Anthony A. James, Ph.D. University of California, Irvine, *Distinguished Professor and Donald Bren Professor of Microbiology and Molecular Genetics; Molecular Biology and Biochemistry*

C. Sunny Jiang, Ph.D. University of South Florida, *Professor of Civil and Environmental Engineering; Ecology and Evolutionary Biology; Environmental and Occupational Health* (water pollution microbiology, environmental technology, aquatic microbial ecology)

Pavan Kadandale, Ph.D. Rutgers, The State University of New Jersey, *Associate Professor of Teaching of Molecular Biology and Biochemistry*

Claudia H. Kawas, M.D. University of Louisville, *Nichols Term Endowed Chair in Neuroscience and Professor of Neurology; Epidemiology and Biostatistics; Neurobiology and Behavior*

Sarah Kimball, Ph.D. University of California, Irvine, *Associate Professor in Residence of Ecology and Evolutionary Biology*

Natalia Komarova, Ph.D. University of Arizona, *UCI Chancellor's Professor of Mathematics; Ecology and Evolutionary Biology* (applied and computational mathematics, mathematical and computational biology, mathematics of complex social phenomena)

Mei Kong, Ph.D. McGill University, *Professor of Molecular Biology and Biochemistry*

Harold Koopowitz, Ph.D. University of California, Los Angeles, *Professor Emeritus of Ecology and Evolutionary Biology*

Evgeny Kvon, Ph.D. University of Vienna and Institute of Molecular Pathology (IMP), *Assistant Professor of Developmental and Cell Biology* (transcriptional regulation, mouse genomics, cis-regulatory elements, evo-devo)

Young Jik Kwon, Ph.D. University of Southern California, *Professor of Pharmaceutical Sciences; Biomedical Engineering; Chemical and Biomolecular Engineering; Molecular Biology and Biochemistry* (gene therapy, drug delivery, cancer-targeted therapeutics, artificially-induced cellular vesicles, multi-modal therapies)

Albert R. La Spada, M.D., Ph.D. University of Pennsylvania, *Associate Dean for Research Development and Distinguished Professor of Biological Chemistry; Neurobiology and Behavior; Neurology; Pathology and Laboratory Medicine*

Frank M. LaFerla, Ph.D. University of Minnesota, *Dean of the School of Biological Sciences and Professor of Neurobiology and Behavior; Neurology*

Joleah B. Lamb, Ph.D. James Cook University, *Assistant Professor of Ecology and Evolutionary Biology*

Arthur D. Lander, Ph.D. University of California, San Francisco, *Donald Bren Professor and Professor of Developmental and Cell Biology; Biomedical Engineering; Logic and Philosophy of Science* (systems biology of development, pattern formation, growth control)

Thomas E. Lane, Ph.D. University of California, Los Angeles, *Chancellor's Professor of Neurobiology and Behavior*

Pablo Lara Gonzalez, Ph.D. The University of Manchester, *Assistant Professor of Drama* (cell division, development and cancer, genomic editing, CRISPR-Cas9, biochemistry, cell culture and fuorescence microscopy)

Grace Yuh Chwen Lee, Ph.D. University of California, Davis, *Assistant Professor of Ecology and Evolutionary Biology*

Star Lee, Ph.D., *Assistant Professor of Teaching of Developmental and Cell Biology* (culturally responsive pedagogy, biology education)

Michael Leon, Ph.D. University of Chicago, *Professor Emeritus of Neurobiology and Behavior*

Audrey Chen Lew, Ph.D. University of California, Los Angeles, *Assistant Professor of Teaching of Neurobiology and Behavior*

Shin Lin, Ph.D. University of California, Los Angeles, *Professor Emeritus of Developmental and Cell Biology* (combined use of biochemistry, cell biology, molecular biology, molecular biophysics to study the structure and function of proteins involved in cytoskeletal/contractile functions and signal transduction in muscle and nonmuscle cells)

Chang C. Liu, Ph.D. Scripps Research Institute, *Professor of Biomedical Engineering; Chemistry; Molecular Biology and Biochemistry* (genetic engineering, directed evolution, synthetic biology, chemical biology)

Wendy F. Liu, Ph.D. Johns Hopkins University, *Professor of Biomedical Engineering; Chemical and Biomolecular Engineering; Molecular Biology and Biochemistry; Pharmaceutical Sciences* (biomaterials, microdevices in cardiovascular engineering, cell-cell and cell-micro-environment interactions, cell functions and controls)

Melissa Lodoen, Ph.D. University of California, San Francisco, *Vice Chair and Professor of Molecular Biology and Biochemistry*

Anthony D. Long, Ph.D. McMaster University, *Professor of Ecology and Evolutionary Biology*

Catherine Loudon, Ph.D. Duke University, *Professor of Teaching of Ecology and Evolutionary Biology*

Ulrike Luderer, M.D., Ph.D. Northwestern University, *Professor of Medicine; Developmental and Cell Biology; Environmental and Occupational Health; Population Health and Disease Prevention*

Ray Luo, Ph.D. University of Maryland, College Park, *Professor of Molecular Biology and Biochemistry; Biomedical Engineering; Chemical and Biomolecular Engineering; Materials Science and Engineering* (protein structure, noncovalent associations involving proteins)

Andrej Luptak, Ph.D. Yale University, *Department Chair and Professor of Pharmaceutical Sciences; Chemistry; Molecular Biology and Biochemistry* (chemical biology)

Gyorgy Lur, Ph.D. University of Liverpool, *Assistant Professor of Neurobiology and Behavior*

Deborah I. Lutterschmidt, Ph.D. Oregon State University, *Associate Professor of Ecology and Evolutionary Biology*

Grant R. MacGregor, Ph.D. University of Sussex, *Professor of Developmental and Cell Biology* (mouse reproduction, development, homeostasis)

Richard E. MacMillen, Ph.D. University of California, Los Angeles, *Professor Emeritus of Ecology and Evolutionary Biology*

Katherine Mackey, Ph.D. Stanford University, *Associate Professor of Earth System Science; Ecology and Evolutionary Biology*

Stephen V. Mahler, Ph.D. University of Michigan, *Associate Professor of Neurobiology and Behavior*

Jerry E. Manning, Ph.D. University of Utah, *Professor Emeritus of Molecular Biology and Biochemistry*

J. Lawrence Marsh, Ph.D. University of Washington, *Professor Emeritus of Developmental and Cell Biology* (mechanisms of neurodegeneration and molecular genetics of development)

John F. Marshall, Ph.D. University of Pennsylvania, *Professor Emeritus of Neurobiology and Behavior*

Rachel Martin, Ph.D. Yale University, *Professor of Chemistry; Molecular Biology and Biochemistry* (analytical, chemical biology, physical chemistry and chemical physics)

Christopher M. Martinez, Ph.D. Stony Brook University, *Assistant Professor of Ecology and Evolutionary Biology*

Adam Martiny, Ph.D. Technical University of Denmark, *Professor of Earth System Science; Ecology and Evolutionary Biology*

Jennifer Martiny, Ph.D. Stanford University, *UCI Chancellors' Fellow and Professor of Ecology and Evolutionary Biology*

Debra K. Mauzy-Melitz, Ph.D. Marquette University, *Assistant Professor of Teaching Emeritus of Developmental and Cell Biology* (role of writing in scientific teaching)

James L. McGaugh, Ph.D. University of California, Berkeley, *Research Professor and Professor Emeritus of Neurobiology and Behavior*

Matthew J. McHenry, Ph.D. University of California, Berkeley, *Professor of Ecology and Evolutionary Biology*

Bruce L. McNaughton, Ph.D. Carleton University, *UCI Distinguished Professor of Neurobiology and Behavior*

Reginald McNulty, Ph.D University of California, Irvine, *Assistant Professor of Molecular Biology and Biochemistry*

Alexander McPherson, Ph.D. Purdue University, *Professor Emeritus of Molecular Biology and Biochemistry*

Raju Metherate, Ph.D. McGill University, *Associate Dean and Professor of Neurobiology and Behavior*

Ronald L. Meyer, Ph.D. California Institute of Technology, *Professor Emeritus of Developmental and Cell Biology* (development of nerve connections, nerve injury, and regeneration)

John Middlebrooks, Ph.D. University of California, San Francisco, *Professor of Otolaryngology; Biomedical Engineering; Cognitive Sciences; Neurobiology and Behavior*

Edwin S. Monuki, M.D., Ph.D. University of California, San Diego, *Department Chair and Warren L. Bostick Endowed Chair in Pathology and Professor of Pathology and Laboratory Medicine; Developmental and Cell Biology*

Kailen Mooney, Ph.D. University of Colorado Boulder, *Professor of Ecology and Evolutionary Biology*

Naomi Morrissette, Ph.D. University of Pennsylvania, *Associate Professor of Molecular Biology and Biochemistry*

Seyed Ali Mortazavi, Ph.D. California Institute of Technology, *Professor of Developmental and Cell Biology; Biological Chemistry; Pharmaceutical Sciences* (functional genomics to study transcriptional regulation in development)

Laurence D. Mueller, Ph.D. University of California, Davis, *Professor of Ecology and Evolutionary Biology*

R. Michael Mulligan, Ph.D. Michigan State University, *Professor of Developmental and Cell Biology; Ecology and Evolutionary Biology* (RNA editing in plant mitochondria and chloroplasts)

Edward L. Nelson, M.D. University of Oregon, *Professor of Medicine; Molecular Biology and Biochemistry*

Andrea C. Nicholas, Ph.D. University of Chicago, *Associate Professor of Teaching of Neurobiology and Behavior*

Dequina Nicholas, Ph.D. Loma Linda University, *Assistant Professor of Molecular Biology and Biochemistry*

Qing Nie, Ph.D. Ohio State University, *Director of the NSF-Simons Center for Multiscale Cell Fate Research and Distinguished Professor of Mathematics; Biomedical Engineering; Developmental and Cell Biology* (applied and computational mathematics, mathematical and computational biology)

Diane K. O'Dowd, Ph.D. University of California, San Diego, *Professor of Developmental and Cell Biology; Anatomy and Neurobiology* (regulation of activity in developing and adult nervous systems)

Sean B. Ostlund, Ph.D. University of California, Los Angeles, *Associate Professor of Anesthesiology and Perioperative Care; Neurobiology and Behavior*

Michael J. Parsons, Ph.D. University of London, *Associate Professor of Developmental and Cell Biology* (development and regeneration of the endocrine pancreas)

Maksim Plikus, Ph.D. University of Southern California, *Professor of Developmental and Cell Biology* (mechanisms of regeneration, stem cell control)

Thomas L. Poulos, Ph.D. University of California, San Diego, *UCI Distinguished Professor of Molecular Biology and Biochemistry; Chemistry; Pharmaceutical Sciences* (chemical biology)

Jessica Pratt, Ph.D. University of California, Irvine, *Associate Professor of Teaching of Ecology and Evolutionary Biology*

Jennifer A. Prescher, Ph.D. University of California, Berkeley, *Professor of Chemistry; Molecular Biology and Biochemistry; Pharmaceutical Sciences* (chemical biology, organic and synthetic)

James T. Randerson, Ph.D. Stanford University, *UCI Chancellor's Professor of Earth System Science; Civil and Environmental Engineering; Ecology and Evolutionary Biology*

Jose Maria Ranz Navalpotro, Ph.D. Universidad Autónoma de Barcelona, *Associate Professor of Ecology and Evolutionary Biology*

Olga Razorenova, Ph.D. Institute of Molecular Genetics, *Associate Professor of Molecular Biology and Biochemistry*

Maria Rebolleda-Gomez, Ph.D. University of Minnesota, *Assistant Professor of Ecology and Evolutionary Biology*

Markus W. Ribbe, Ph.D. University of Bayreuth, *UCI Chancellor's Professor of Molecular Biology and Biochemistry; Chemistry* (chemical biology, inorganic and organometallic)

Alejandra Rodriguez-Verdugo, Ph.D. University of California, Irvine, *Assistant Professor of Ecology and Evolutionary Biology*

Michael R. Rose, Ph.D. University of Sussex, *Distinguished Professor of Ecology and Evolutionary Biology*

Ann K. Sakai, Ph.D. University of Michigan, *Professor Emerita of Ecology and Evolutionary Biology*

Brian Sato, Ph.D. University of California, San Diego, *Professor of Teaching of Molecular Biology and Biochemistry; Education*

Eitan Schechtman-Drayman, Ph.D. Hebrew University of Jerusalem, *Assistant Professor of Neurobiology and Behavior*

Thomas F. Schilling, Ph.D. University of Oregon, *Department Chair and Professor of Developmental and Cell Biology* (zebrafish development, vertebrate genetics, craniofacial development)

Donald F. Senear, Ph.D. University of Washington, *Professor Emeritus of Molecular Biology and Biochemistry*

Xiaoyu Shi, Ph.D. University of California, Davis, *Assistant Professor of Chemistry; Biomedical Engineering; Developmental and Cell Biology* (super-resolution microscopy)

Albert Siryaporn, Ph.D. University of Pennsylvania, *Associate Professor of Physics and Astronomy; Molecular Biology and Biochemistry*

Cascade J. Sorte, Ph.D. University of California, Davis, *Associate Professor of Ecology and Evolutionary Biology*

Robert Spitale, Ph.D. University of Rochester, *Director of the UCI Transcriptomics Core and Associate Dean of Research and Professor of Pharmaceutical Sciences; Chemistry; Molecular Biology and Biochemistry* (chemistry, chemical biology, RNA biology)

Craig Stark, Ph.D. Carnegie Mellon University, *James L. McGaugh Chair in the Neurobiology of Learning and Memory and Professor of Neurobiology and Behavior; Cognitive Sciences*

Oswald Steward, Ph.D. University of California, Irvine, *Director, Reeve-Irvine Research Center and Reeve-Irvine Endowed Chair in Spinal Cord Injury Research and Distinguished Professor of Anatomy and Neurobiology; Neurobiology and Behavior*

Georg F. Striedter, Ph.D. University of California, San Diego, *Professor of Neurobiology and Behavior*

Christine Suetterlin, Ph.D. University of Basel, *Professor of Developmental and Cell Biology* (centrosome and cilia regulation, Golgi, host-pathogen interaction)

Katumi Sumikawa, Ph.D. Imperial College London, *Professor of Neurobiology and Behavior*

Sha Sun, Ph.D. University of Chicago, *Assistant Professor of Developmental and Cell Biology* (long noncoding RNAs in epigenetic programming)

Vivek Swarup, Ph.D. University of Laval, *Assistant Professor of Neurobiology and Behavior*

Richard Symanski, Ph.D. Syracuse University, *Professor Emeritus of Teaching of Ecology and Evolutionary Biology*

Celia Symons, Ph.D. University of California, San Diego, *Assistant Professor of Ecology and Evolutionary Biology*

Andrea Tenner, Ph.D. University of California, San Diego, *Professor of Molecular Biology and Biochemistry; Neurobiology and Behavior; Pathology and Laboratory Medicine*

Leslie M. Thompson, Ph.D. University of California, Irvine, *Chancellor's Professor and Donald Bren Professor of Psychiatry and Human Behavior; Biological Chemistry; Neurobiology and Behavior*

Katherine L. Thompson-Peer, Ph.D. Harvard Medical School, *Assistant Professor of Developmental and Cell Biology* (investigating how neurons respond and recover after injury)

Kevin Thornton, Ph.D. University of Chicago, *Professor of Ecology and Evolutionary Biology*

Roberto Tinoco, Ph.D. University of California, San Diego, *Assistant Professor of Molecular Biology and Biochemistry*

Kathleen K. Treseder, Ph.D. Stanford University, *UCI Chancellor's Fellow and Professor of Ecology and Evolutionary Biology*

Shiou-Chuan (Sheryl) Tsai, Ph.D. University of California, Berkeley, *Professor of Molecular Biology and Biochemistry; Chemistry; Pharmaceutical Sciences*

Luis P. Villarreal, Ph.D. University of California, San Diego, *Professor Emeritus of Molecular Biology and Biochemistry*

Craig Walsh, Ph.D. University of California, Los Angeles, *Associate Dean of Graduate Studies and Professor of Molecular Biology and Biochemistry*

Wenqi Wang, Ph.D. Shanghai Institutes for Biological Sciences, *Associate Professor of Developmental and Cell Biology* (the signaling networks underlying tissue homeostasis and organ size control)

Rahul Warrior, Ph.D. Yale University, *Associate Professor of Developmental and Cell Biology* (developmental genetics of transcription and proteoglycan synthesis)

Arthur Weis, Ph.D. University of Illinois at Urbana-Champaign, *Professor Emeritus of Ecology and Evolutionary Biology*

Gregory A. Weiss, Ph.D. Harvard University, *Department Vice Chair and Professor of Chemistry; Molecular Biology and Biochemistry; Pharmaceutical Sciences* (analytical, chemical biology, organic and synthetic, polymer, materials, nanoscience)

Stephen G. Weller, Ph.D. University of California, Berkeley, *Professor Emeritus of Ecology and Evolutionary Biology*

Katrine Whiteson, Ph.D. University of Chicago, *Associate Professor of Molecular Biology and Biochemistry*

Travis Wiles, Ph.D. University of Utah, *Assistant Professor of Molecular Biology and Biochemistry*

Adrienne Williams, Ph.D. University of California, Irvine, *Assistant Professor of Teaching of Developmental and Cell Biology* (biology education, equity in STEM education, learning assistants)

Marcelo A. Wood, Ph.D. Princeton University, *UCI Chancellor's Fellow and Department Chair and Professor of Neurobiology and Behavior*

Xaiohui Xie, Ph.D. Massachusetts Institute of Technology, *Professor of Computer Science; Developmental and Cell Biology* (computational biology, bioinformatics, genomics, neural computation, machine learning)

Guiyun Yan, Ph.D. University of Vermont, *Professor of Population Health and Disease Prevention; Ecology and Evolutionary Biology; Epidemiology and Biostatistics*

Michael Yassa, Ph.D. University of California, Irvine, *UCI Chancellor's Fellow, and Associate Dean of Diversity, Equity, and Inclusion and Director of the Center for the Neurobiology of Learning and Memory and Professor of Neurobiology and Behavior; Psychological Science*

Biological Sciences Courses

BIO SCI 1A. Life Sciences. 4 Units.
Designed to introduce nonmajors to the basic concepts of modern biology. Discussion of evolutionary biology, ecology, molecular biology, and genetics.

(II)

BIO SCI 2A. Freshman Seminar. 2 Units.
Weekly meetings consisting of presentations by faculty, professional staff, and Peer Academic Advisors provide information about the School of Biological Sciences, campus resources, learning skills, and special programs/opportunities.

Grading Option: Pass/no pass only.

Restriction: Freshmen only. School of Biological Sciences students only.

BIO SCI 2B. Freshman Seminar . 1 Unit.
Faculty presentations and readings focused on the structure, function, opportunities, and current issues in the biological sciences.

Grading Option: Pass/no pass only.

Restriction: Freshmen only. School of Biological Sciences students only.

BIO SCI 2C. Solutions in Science. 1 Unit.
Students will be introduced to approaches that can be used to solve scientific problems. These methods can be utilized in introductory to advanced classes and will allow students to become independent thinkers.

BIO SCI 2D. EASE Seminar. 1 Workload Unit.
Seminars designed to help students achieve success in STEM courses. Provides collaborative learning environment facilitated by undergraduate mentor. Students develop critical thinking and study skills. Also receive guidance to campus resources that assist acclimation to University.

Grading Option: Pass/no pass only.

Repeatability: May be taken for credit 3 times.

BIO SCI 2E. Topics and Careers in Ecology and Evolution. 1 Unit.
Introduces students to topics, research opportunities, and career options in ecology and evolutionary biology.

Grading Option: Pass/no pass only.

Restriction: School of Biological Sciences students have first consideration for enrollment.

BIO SCI 3A. Career Decision-Making. 1 Workload Unit.
An introductory course designed to facilitate the career decision-making process. Decision-making processes, values, and standardized tests of aptitudes, interests, and values are utilized with non-test data in appraising biological sciences career options.

Grading Option: Workload Credit P/NP Only.

BIO SCI 3B. Non-Health Sciences Career Exploration. 1 Workload Unit.
A survey course designed to assist students in exploring non-health science career options. Lectures by professionals in various fields.

Grading Option: Workload Credit P/NP Only.

BIO SCI 4B. Introduction to Field Biology. 1 Unit.
Field excursions to introduce students to local field sites and resources.

Grading Option: Pass/no pass only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Ecology and Evolutionary Biol Majors have first consideration for enrollment.

BIO SCI 6. Tropical Biology: Race to Save the Tropics. 4 Units.
Population growth combines with tropical resource consumption by industrialized nations to cause high rates of deforestation, pollution, habitat fragmentation, and extinction of species. Discusses tropical biomes, their population, community, ecosystem processes, and possible means of conservation of biodiversity.

(II)

BIO SCI 8. Evolution and the Modern World. 4 Units.
Pandemics, disease, antibiotic resistance, your pets, the food you eat: evolution has shaped our world. Discusses the intellectual development of evolution and illustrates, with current events, that evolution is happening all around us, all the time.

Overlaps with BIO SCI 94, BIO SCI E106.

(II)

BIO SCI 9A. Nutrition Science. 4 Units.
An introduction to nutrition science, integrating concepts from biology, biochemistry, microbiology, physiology, and psychology to explain the interaction between nutrients and the human body. Biological basis of nutrient standards is analyzed. Effects of nutrition, behavior, exercises on health/disease.

(II)

BIO SCI 9B. Biology and Chemistry of Food and Cooking . 4 Units.
The kitchen is used as a laboratory to introduce fundamental principles of biology, chemistry, and physics. A molecular/cellular analysis of cooking, including concepts such as protein structure, browning reactions, colloids, emulsions, carbohydrate metabolism, and development of flavor/texture through biochemical transformations.

(II)

BIO SCI 9E. Horticulture Science . 4 Units.
Scientific principles of horticulture at the UCI Arboretum. Taxonomy, plant life history strategies; experiments with seed dormancy; morphological adaptations for specialized sexual and clonal reproduction; basics of plant propagation and ecological restoration. Materials fee.

(II)

BIO SCI 9J. Biology of Oriental Medicine. 4 Units.
With lectures, demonstrations, and hands-on learning, the theory and practice of herbal medicine, acupuncture, qigong, and manipulative therapies are explained in Western biomedical terms. The latest basic and clinical research advances in each area are also described.

Overlaps with BIO SCI 9N, BIO SCI D124.

(II)

BIO SCI 9K. Global Change Biology. 4 Units.
Field trips and lectures that address ways in which humans are altering the global environment, with consequences for the ecology of animals, plants, and microbes.

(II)

BIO SCI 11. Topics in Biological Sciences. 4 Units.
Studies in selected areas of biological sciences.

Repeatability: May be taken for credit 3 times.

BIO SCI 12. Molecular Basis of Human Disease. 4 Units.
Describes the cause and treatment of human diseases at the cutting edge of modern molecular understanding for non-science majors, including history, interviews, and stories.

(II)

BIO SCI 14. California Teach 1: Introduction to Science and Mathematics Teaching. 3 Units.
First in a series for students interested in becoming middle or high school teachers of mathematics or science. Students gain an understanding of effective, research-based teaching strategies. Includes supervised field experience in a K-12 classroom.

Same as PHY SCI 5.

Restriction: School of Biological Sciences students have first consideration for enrollment. School of Physical Sciences students have first consideration for enrollment. School of Engineering students have first consideration for enrollment. School of Info & Computer Sci students have first consideration for enrollment.

BIO SCI 17. Evolutionary Psychology. 4 Units.
Introductory overview of the field of evolutionary psychology. Surveys topics operating at the interface of social sciences, i.e. behavioral psychology and evolutionary biology, while developing select aspects of the history of this developing field.

(II)

BIO SCI 23. Sustainable Landscaping: Design and Practices. 4 Units.
Through lectures and hands-on work, students learn how to design habitats around dwellings, within cities, and in rural environments. These include traditional/sustainable landscaping, restoration, stormwater/wastewater treatment, xeriscaping, and low impact development design. Sustainable landscape plant materials emphasized.

(II)

BIO SCI 25. Biology of Cancer. 4 Units.
Biological, clinical, and psychosocial nature of cancer through the perspectives of medical researchers, biologists, physicians, and health educators. For students of all majors, designed so that each can increase personal awareness of the biology of cancer.

Restriction: BIO SCI 25 may not be taken for credit if taken after BIO SCI M125.

BIO SCI 35. The Brain and Behavior. 4 Units.
Introduction to how the brain works. Biological processes underlying perception, movement, sleep-wake cycles, motivation, language, learning, and memory. Changes in the brain associated with sex differences, drug use, aging, seasons, and time of day. Fundamental properties of the nervous system.

(II)

BIO SCI 36. Drugs and the Brain. 4 Units.
Introduction to the actions of drugs on the brain. How studying drug action helps reveal normal functions of neurons. How drugs can correct neural disorders or disrupt neural function. Biological issues related to drug abuse, drug addiction, and drug seeking.

(II)

BIO SCI 37. Brain Dysfunction and Repair . 4 Units.
Introduction to the disruptions in brain function that underlie disorders such as Alzheimer's disease, Parkinsonism, schizophrenia, and depression, and the basis for drug therapies. The brain's ability to repair itself after damage and the pros and cons of that repair.

(II)

BIO SCI 38. Mind, Memory, Amnesia, and the Brain. 4 Units.
Introduction to neural mechanisms underlying learning and memory. Emphasis on molecular changes that mediate memory as well as structures involved in different forms of memory. Additionally, examines the biology of memory phenomena, from extraordinary memory to false memory to amnesia.

(II)

BIO SCI 41. Aspects of Mood Disorder. 4 Units.
There are significant differences in response to psychiatric illness across cultures. Delves into the neuroscience underlying mood disorder, investigating current pharmacological treatments and sociocultural influences on treatment outcomes.

(II)

BIO SCI 44. Stem Cells and Brain Repair. 4 Units.
Students introduced to the field of regenerative neurobiology. Both basic stem cell discoveries and their potential clinical application to brain disorders examined. Discussion of opportunities, challenges, and implications of this research.

Overlaps with BIO SCI N172.

(II)

BIO SCI 45. AIDS Fundamentals. 4 Units.
Considers the biological and sociological bases of the AIDS epidemic. Topics include the history of AIDS, current medical knowledge, transmission, risk reduction, and how the community can respond.

Same as PUBHLTH 80.

(II)

BIO SCI 46. Discussion and Literature Research in AIDS. 2-4 Units.
Students carry out two activities: (1) leading discussions about HIV/AIDS (predominantly regarding sociological and personal reactions) among students taking the AIDS Fundamentals course and (2) literature research about biomedical aspects of AIDS.

Prerequisite: BIO SCI 45 or PUBHLTH 80

BIO SCI 47. Stress. 4 Units.
Investigates stress at a psychological, physiological, and molecular level, and provides a current overview of the field of stress research.

(II)

BIO SCI 48. The Mind-Body Connection in the Neuroscience of Well-Being. 4 Units.
Explores research that provides insight into how exercise, diet, sleep, contemplative practices such as mindfulness and meditation, and contemporary psychological therapeutic approaches alter brain function in beneficial ways to promote positive mental health well-being.

(II and III).

BIO SCI 55. Introduction to Ecology. 4 Units.
Principles of ecology; application to populations, communities, ecosystems, and humans.

Restriction: No Biological Sciences Majors. BIO SCI 55 may not be taken for credit if taken after BIO SCI 96 or BIO SCI E106.

(II)

BIO SCI 56. Life Sciencing from Aristotle to Venter. 4 Units.
History of biology from Aristotle through to the scientific revolutions precipitated by Darwin, geneticists, molecular biologists, and now genomics. Introduces the practices and achievements of biological research to both beginning biology students and non-majors.

Overlaps with BIO SCI H90, BIO SCI H90B.

(II)

BIO SCI 70. Introduction to Vaccines. 4 Units.
Focus on introducing vaccines, covering how vaccines work, as well as how they are tested. Introduction to the immune system, to facilitate understanding how vaccines function. Also covers types of vaccines, clinical trials, and vaccine hesitancy.

(II)

BIO SCI 75. Human Development. 4 Units.
Processes leading to the birth of a healthy child and the avoidance of birth defects. Male and female reproductive systems, hormonal control of egg-sperm formations, sexual intercourse, contraception, venereal diseases, fertilization, cell division, embryonic development, fetal physiology.

(II)

BIO SCI H90. The Idiom and Practice of Science. 4 Units.
The importance of biological sciences in our world is discussed. Topics may include brain and behavior, health and disease, genetics and society, and conservation biology. Primary goal is to encourage students to understand better the world in which they live.

Restriction: Campuswide Honors Collegium students only.

(II)

BIO SCI 92. Curriculum. 1-4 Units.
Initiation, planning, and coordination of student-run courses.

Grading Option: Pass/no pass only.

Repeatability: May be taken for credit 12 times.

Restriction: School of Biological Sciences students only.

BIO SCI 93. From DNA to Organisms. 3 Units.
Cell biology, biochemistry, genetics, and the biology of organ systems. Covers concepts of building blocks (nucleotides, amino acids, and cells) and of information flow (DNA to proteins, receptors to nuclei, the blood to distant organs, and DNA to offspring).

Corequisite: BIO SCI 93L

Restriction: Nursing Science Majors have first consideration for enrollment. Pharmaceutical Sciences Majors have first consideration for enrollment. Public Health Sciences Majors have first consideration for enrollment. Unaffiliated Majors have first consideration for enrollment. School of Biological Sciences students have first consideration for enrollment. BIO SCI 93 may not be taken for credit if taken after BIO SCI 97 or BIO SCI 98.

(II)

BIO SCI 93L. DNA to Organisms - Introduction to Biology Research. 2 Units.
Focuses on the development of quantitative reasoning and science inquiry skills. Helps students learn how to use the scientific method, ask questions, and develop professional skills applicable to any major or career. Materials fee.

Corequisite: BIO SCI 93 and BIO SCI H93

Restriction: Nursing Science Majors have first consideration for enrollment. Pharmaceutical Sciences Majors have first consideration for enrollment. Public Health Sciences Majors have first consideration for enrollment. Unaffiliated Majors have first consideration for enrollment. School of Biological Sciences students have first consideration for enrollment.

(II)

BIO SCI H93. Honors From DNA to Organisms. 4 Units.
Cell biology, biochemistry, genetics, and the biology or organ systems. Covers concepts of building blocks (nucleotides, amino acids, and cells) and of information flow (DNA to proteins, receptors to nuclei, the blood to distant organs, and DNA to offspring).

Restriction: BIO SCI H93 may not be taken for credit if taken after BIO SCI 97 or BIO SCI 98.

(II)

BIO SCI 94. From Organisms to Ecosystems. 3 Units.
Patterns of diversity, ecology, and evolutionary biology. Emphasis is on the Tree of Life and how its members are distributed and interact.

Corequisite: BIO SCI 94L
Prerequisite: BIO SCI 93 or BIO SCI H93

Restriction: Pharmaceutical Sciences Majors have first consideration for enrollment. Public Health Sciences Majors have first consideration for enrollment. Unaffiliated Majors have first consideration for enrollment. School of Biological Sciences students have first consideration for enrollment. BIO SCI 1A may not be taken for credit if taken after BIO SCI 94.

(II)

BIO SCI 94L. Organisms to Ecosystems - Introduction to Biology Research Analysis. 2 Units.
Helps students learn how to use the scientific method, ask and answer questions about environmental DNA, and develop professional skills. Students learn how to design and conduct experiments, analyze data, interpret graphs, and communicate their findings. Materials fee.

Corequisite: BIO SCI 94 and BIO SCI H94
Prerequisite: BIO SCI 93L

Restriction: Pharmaceutical Sciences Majors only. Public Health Sciences Majors only. Unaffiliated Majors only. School of Biological Sciences students only.

(II)

BIO SCI H94. Honors From Organisms to Ecosystems. 4 Units.
Patterns of diversity, ecology, and evolutionary biology. Emphasis is on the Tree of Life and how its members are distributed and interact.

Prerequisite: BIO SCI 93 or BIO SCI H93

Restriction: BIO SCI 1A may not be taken for credit if taken after BIO SCI H94.

(II)

BIO SCI 97. Genetics. 4 Units.
Introduction to genetics. Basic features of replication and expression of DNA, cell division, and gene transmission. Recombination and mutation in diploid organisms.

Prerequisite: BIO SCI 94

Restriction: Pharmaceutical Sciences Majors have first consideration for enrollment. Public Health Majors have first consideration for enrollment. Nursing Science Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment. School of Biological Sciences students have first consideration for enrollment.

BIO SCI H97. Honors Genetics. 4 Units.
Introduction to genetics. Basic features of replication and expression of DNA, cell division, and gene transmission. Recombination and mutation in diploid organisms.

Restriction: Campuswide Honors Collegium students only. BIO SCI H97 may not be taken for credit if taken after BIO SCI 97.

BIO SCI 98. Biochemistry. 4 Units.
Structure and properties of proteins; major biochemical pathways and mechanisms for their control.

Prerequisite: BIO SCI 97 or BIO SCI H97

Restriction: Biomedical Engr: Premedical Majors have first consideration for enrollment. Nursing Science Majors have first consideration for enrollment. Pharmaceutical Sciences Majors have first consideration for enrollment. Public Health Majors have first consideration for enrollment. School of Biological Sciences students have first consideration for enrollment.

BIO SCI 99. Molecular Biology. 4 Units.
Biochemistry and replication of nucleic acids; molecular genetics; protein biosynthesis; genetic code; regulation of expression of genetic information; biochemical evolution.

Prerequisite: BIO SCI 98

Restriction: Pharmaceutical Sciences Majors have first consideration for enrollment. Public Health Majors have first consideration for enrollment. Nursing Science Majors have first consideration for enrollment. Biomedical Engr: Premedical Majors have first consideration for enrollment. School of Biological Sciences students have first consideration for enrollment.

BIO SCI 100. Scientific Writing. 3 Units.
Designed to give an overview of the basic aspects of scientific writing relevant to reporting research in the Biological Sciences.

Corequisite: BIO SCI 190
Prerequisite: BIO SCI 99 or BIO SCI 190. Satisfactory completion of the Lower-Division Writing requirement.

Restriction: Biomedical Engr: Premedical Majors have first consideration for enrollment. Pharmaceutical Sciences Majors have first consideration for enrollment. School of Biological Sciences students have first consideration for enrollment.

BIO SCI 101. California Teach 2: Middle School Science and Mathematics Teaching. 3 Units.
Second in a series for students interested in becoming middle or high school teachers of mathematics or science. Students gain an understanding of effective, research-based teaching strategies for grades 6-8. Includes supervised field experience in a middle school classroom.

Prerequisite: PHY SCI 5

Same as PHY SCI 105.

Restriction: School of Physical Sciences students have first consideration for enrollment. School of Biological Sciences students have first consideration for enrollment. School of Info & Computer Sci students have first consideration for enrollment. School of Engineering students have first consideration for enrollment.

BIO SCI D103. Cell Biology. 4 Units.
Analysis of the basic structure and function of animal cells, with an emphasis on the regulation of cellular processes. The basic features of membranes, cellular compartmentalization, protein trafficking, vesicular transport, cytoskeleton, adhesion, signal transduction, and cell cycle are covered.

Prerequisite: BIO SCI 99

Restriction: Students who require this class for completion of their degree have first consideration for enrollment.

BIO SCI D104. Developmental Biology. 4 Units.
Cellular and molecular analysis of how a fertilized egg develops into an organism consisting of complex structures such as the eye, arms, and brain. Emphasis is on the key concepts of developmental processes underlying pattern formation, growth, and regeneration.

Prerequisite: BIO SCI 99

Restriction: Students who require this class for completion of their degree have first consideration for enrollment.

BIO SCI 105. Introduction to STEM Education Research. 4 Units.
Introduces students to education research and topics studied in STEM education. Enables students to develop research questions, participate in research projects, design and utilize research tools, and contribute to STEM education research products.

Same as ENGR 113.

Restriction: Upper-division students only. School of Engineering students have first consideration for enrollment.

BIO SCI D105. Cell, Developmental, and Molecular Biology of Plants . 4 Units.
Emphasizes the special features of plant cells and plant development as compared to animals. Two central topics: plants' ability to fuel our planet through photosynthesis, and the interactions of plants with microorganisms in making nitrogen available to other life forms.

Prerequisite: BIO SCI 97 or BIO SCI H97

Restriction: Students who require this class for completion of their degree have first consideration for enrollment.

BIO SCI E106. Processes in Ecology and Evolution. 4 Units.
An in-depth study of the mechanisms that drive evolution and ecology including: natural selection, mutation, genetic drift, speciation, extinction, life history patterns, population dynamics, ecosystem and community structure, predator-prey and host pathogen interactions, and social behavior.

Prerequisite: BIO SCI 94

Restriction: Students who require this class for completion of their degree have first consideration for enrollment.

BIO SCI E106L. Habitats and Organisms. 4 Units.
Introduces students to local habitats and organisms through required field trips and applies ecological and evolutionary principles from BIO SCI E106. Students also explore related literature.

Prerequisite: (BIO SCI 100 or BIO SCI 108) and BIO SCI E106. Satisfactory completion of the Lower-Division Writing requirement.

Restriction: Seniors only. BIO SCI E106L may not be taken for credit concurrently with or after taking BIO SCI E166. Students who require this lab for completion of their degree have first consideration for enrollment.

(Ib)

BIO SCI E107. Seminar in Ecology and Evolutionary Biology. 2 Units.
Invited speakers, graduate students, and faculty present current research in ecology and evolutionary biology.

Grading Option: Pass/no pass only.

Restriction: Upper-division students only. Ecology and Evolutionary Biol Majors only.

BIO SCI 108. Research Methods. 4 Units.
Explores tools of inquiry for developing and implementing science research projects. Students undertake independent projects requiring data collection, analysis, and modeling, and the organization and presentation of results. Additional topics include ethical issues and role of scientific literature.

Prerequisite: BIO SCI 14 or PHY SCI 5

Same as PHYSICS 193, CHEM 193.

BIO SCI E109. Human Physiology. 4 Units.
Functional features of the major organ systems in the human body. Emphasis on homeostasis and the interactions of organ systems in health and disease. (Discussion of behavior and brain function deferred to BIO SCI N110.).

Prerequisite: (BIO SCI 93 or BIO SCI H93) and CHEM 1C

Overlaps with PHRMSCI 120.

Restriction: Students who require this class for completion of their degree have first consideration for enrollment.

BIO SCI N110. Neurobiology and Behavior. 4 Units.
Consideration of the evolution of behavior, including ethological and psychological aspects and analysis of neuroanatomical, neurochemical, neurophysiological, and neuroendocrine systems underlying basic behavioral processes.

Prerequisite or corequisite: BIO SCI 99

Restriction: Students who require this class for completion of their degree have first consideration for enrollment.

BIO SCI D111L. Developmental and Cell Biology Laboratory. 4 Units.
Covers the division of cells, isolate cellular organelles (chloroplasts, mitochondria, nuclei), and follows changes in cells undergoing programmed cell death. Development is demonstrated in experiments showing cooperation of individual cells in forming a multicellular organism. Materials fee.

Corequisite: BIO SCI D103 or BIO SCI D104 or BIO SCI D105
Prerequisite: (BIO SCI 100 or BIO SCI 108) and (BIO SCI D103 or BIO SCI D104 or BIO SCI D105)

Restriction: Seniors only. Students who require this lab for completion of their degree have first consideration for enrollment.

(Ib)

BIO SCI E112L. Physiology Laboratory. 4 Units.
Laboratory with a focus on the whole organism and its organ systems. Examples of structure-function relationships are drawn from both animal and human physiology. Cellular and molecular aspects are introduced as required. Materials fee.

Prerequisite: (BIO SCI 100 or BIO SCI 108) and (BIO SCI E109 or (BME 120 and BME 121)).

Overlaps with PHRMSCI 120L.

Restriction: Seniors only. Students who require this lab for completion of their degree have first consideration for enrollment.

(Ib)

BIO SCI D113. Genetics Majors Seminar. 1 Unit.
Genetics majors attend a weekly seminar to discuss current research techniques and career opportunities in the field. Students have the opportunity to present their own independent research.

Repeatability: May be taken for credit 2 times.

Restriction: Genetics Majors only.

BIO SCI N113L. Neurobiology Laboratory. 4 Units.
An in-depth exploration into biology and physiology of the nervous system. Labs include neuroanatomy, electrophysiology, pharmacology, behavior, experimental design, EEG, and scientific writing. Materials fee.

Prerequisite or corequisite: (BIO SCI 100 or BIO SCI 108) and (BIO SCI N110 or BIO SCI N115A)

Restriction: Seniors only. Students who require this lab for completion of their degree have first consideration for enrollment.

(Ib)

BIO SCI D114. Developmental and Cell Biology Majors Seminar. 1 Unit.
Developmental and Cell Biology majors attend a weekly seminar to discuss current research techniques and career opportunities in the field. Students have the opportunity to present their own independent research.

Grading Option: Pass/no pass only.

Repeatability: May be taken for credit 2 times.

Restriction: Developmental and Cell Biology Majors only.

BIO SCI M114. Advanced Biochemistry. 4 Units.
Physical-chemical properties of macromolecules. Structure-function relationships in nucleic acids, protein, carbohydrates, and lipids. Integration and regulation of metabolism. Biochemistry of organs and biochemistry of diseases.

Prerequisite: BIO SCI 99

BIO SCI M114L. Biochemistry Laboratory. 5 Units.
Properties of enzymes and the culture and isolation of mutants of microorganisms. Materials fee.

Prerequisite: BIO SCI 99 and (BIO SCI 100 or BIO SCI 108)

Restriction: Seniors only. Students who require this lab for completion of their degree have first consideration for enrollment.

(Ib)

BIO SCI E115L. Evolution Laboratory. 4 Units.
Students perform experiments which illustrate important concepts in evolutionary biology such as natural selection, random genetic drift, inbreeding, age-specific selection, sexual selection, and phylogenetic reconstruction. Materials fee.

Prerequisite: (BIO SCI 100 or BIO SCI 108) and BIO SCI E106. Satisfactory completion of the Lower-Division Writing requirement.

Restriction: Seniors only. Students who require this lab for completion of their degree have first consideration for enrollment.

(Ib)

BIO SCI M115. Allied Health Microbiology. 5 Units.
Introductory microbiology lecture and laboratory with an emphasis on microbial growth control and the relationship between microbes and human health.

Prerequisite: (BIO SCI 93 or BIO SCI H93) and CHEM 1C. CHEM 1C with a grade of C- or better

Overlaps with BIO SCI M122, BIO SCI M118L.

Restriction: Program in Nursing Science students have first consideration for enrollment.

BIO SCI N115A. Advanced Neurobiology I. 4 Units.
In-depth coverage of neurobiology, ranging from molecular neurobiology to functional brain imaging. Discussion of molecular, cellular, and developmental neurobiology.

Prerequisite: BIO SCI 99

Restriction: Neurobiology Majors only.

BIO SCI N115B. Advanced Neurobiology II . 4 Units.
In-depth coverage of neurobiology, ranging from molecular neurobiology to functional brain imaging.

Prerequisite: BIO SCI N115A

Restriction: Neurobiology Majors only.

BIO SCI M116. Advanced Molecular Biology. 4 Units.
Mechanisms of gene expression; special emphasis on regulatory events that occur in Eukaryotic organisms other than initiation of transcription. Chromatin structure and rearrangement, RNA polymerases, cis- and trans-acting elements, RNA processing, transport and stability, protein synthesis, trafficking, and turnover.

Prerequisite: BIO SCI 99 and (BIO SCI M114L or BIO SCI M116L)

BIO SCI M116L. Molecular Biology Laboratory. 5 Units.
Students perform experiments which illustrate the chemical and biological properties of nucleic acids. Emphasis is placed on recent techniques in recombinant DNA technology including gene isolation and characterization. Materials fee.

Prerequisite: BIO SCI 99 and (BIO SCI 100 or BIO SCI 108)

Restriction: Seniors only. Students who require this lab for completion of their degree have first consideration for enrollment.

(Ib)

BIO SCI E117A. Exercise Sciences Seminar. 3 Units.
Students are introduced to fundamental concepts and topics in exercise sciences with an emphasis on developing innovative approaches for exploring the biological response to physical activity/inactivity. Interactive course with robust discussion amongst faculty and students.

Prerequisite: (BIO SCI E109 or PHRMSCI 120) and BIO SCI E112L and BIO SCI E183

BIO SCI E117B. Exercise Sciences Seminar. 3 Units.
Students are introduced to fundamental concepts and topics in exercise sciences with an emphasis on developing innovative approaches for exploring the biological response to physical activity/inactivity. Interactive course with robust discussion amongst faculty and students.

Prerequisite: BIO SCI E117A

Restriction: Exercise Sciences Majors only.

BIO SCI E117C. Exercise Sciences Seminar. 3 Units.
Students are introduced to fundamental concepts and topics in exercise sciences with an emphasis on developing innovative approaches for exploring the biological response to physical activity/inactivity. Interactive course with robust discussion amongst faculty and students.

Prerequisite: BIO SCI E117B

Restriction: Exercise Sciences Majors only.

BIO SCI N117. Introduction to Neuroscience Clinical Trials. 4 Units.
Provides an overview of the science of clinical development of treatments for neurological disease and injury.

Prerequisite: BIO SCI 99

BIO SCI E118. Ecosystem Ecology. 4 Units.
A mechanistic perspective on ecosystem processes. Covers ecosystem development, element cycling, and interactions with plants and microbes. The role of ecosystems in environmental change is also addressed.

Prerequisite: BIO SCI E106 or EARTHSS 51 or EARTHSS 60A or CHEM 51C

Same as EARTHSS 164.

Restriction: Earth System Science Majors have first consideration for enrollment. Ecology and Evolutionary Biol Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment.

BIO SCI M118L. Experimental Microbiology Laboratory. 5 Units.
Introductory general microbiology designed for preprofessional biology majors. Includes microscopy, cultivation of bacteria, morphological and biochemical characterization of bacteria, microbial metabolism, growth and genetics, microorganisms and human disease, and interactions of microorganisms with the environment. Materials fee.

Prerequisite: BIO SCI 99 and (BIO SCI 100 or BIO SCI 108)

Restriction: Seniors only. Students who require this lab for completion of their degree have first consideration for enrollment.

(Ib)

BIO SCI N118. Clinical Psychophysiology. 4 Units.
Psychophysiology investigates the relationships between physiological processes and psychological phenomena. Technologies examined include reaction times, heart rate variability, EEGs, ERPs, magnetoencephalography, and eye tracking. Applications include diagnosis, the longitudinal assessment, and the identification of individuals at risk of disease onset.

Prerequisite: BIO SCI N110 or BIO SCI N115A or PSYCH 9A or PSCI 11A

Same as PSYCH 122P.

(II)

BIO SCI E119. Selfish DNA. 4 Units.
Focuses on the genetics and evolution of selfish DNA, and introduces necessary background knowledge from molecular biology, cytogenetics, and bioinformatics.

Prerequisite: BIO SCI 94 or BIO SCI 97 or BIO SCI H94 or BIO SCI H97

BIO SCI M119. Advanced Topics in Immunology. 4 Units.
Literature-based, interactive discussions focused on review of seminal historic and recent immunology literature. Student responsibilities include reading, critical evaluation, and discussion of manuscripts.

Prerequisite: BIO SCI M121

Restriction: Microbiology and Immunology Majors have first consideration for enrollment.

BIO SCI N119. History of Neuroscience. 4 Units.
An overview of the conceptual and technical foundations of contemporary neuroscience from ancient times to the present. The subjects include synapses, neurons, brain organization, sensory, motor and regulatory systems, learning and memory, human brain function and dysfunction.

Prerequisite: BIO SCI 35 or BIO SCI N110 or BIO SCI N115A or PSY BEH 115D or (PSYCH 9A and PSYCH 9B and PSYCH 9C)

Restriction: Upper-division students only.

Concurrent with NEURBIO 255.

BIO SCI E120. Marine Biology . 4 Units.
Examines the biotic and abiotic factors influencing the physiology, distribution, abundances, interactions, and evolution of marine organisms and the roles of those organisms in mediating ecosystem services and functions. A field trip is required. Materials fee.

Prerequisite: BIO SCI 94 or BIO SCI H94

BIO SCI N120A. Human Biology I. 4 Units.
Provides an in-depth look at cutting-edge topics in physiology and epidemiology as they relate to global issues of ethics, anthropology, and socioeconomics, providing the student with an understanding of human health beyond basic biological function.

Prerequisite: BIO SCI 99

Restriction: Human Biology Majors only.

BIO SCI N120B. Human Biology II. 4 Units.
Provides an in-depth look at cutting-edge topics in physiology and epidemiology as they relate to global issues of ethics, anthropology, and socioeconomics, providing the student with an understanding of human health beyond basic biological function.

Prerequisite: BIO SCI 99

Restriction: Human Biology Majors only.

BIO SCI N120C. Human Biology III. 4 Units.
Provides an in-depth look at cutting-edge topics in physiology and epidemiology as they relate to global issues of ethics, anthropology, and socioeconomics, providing the student with an understanding of human health beyond basic biological function.

Prerequisite: BIO SCI 99

Restriction: Human Biology Majors only.

BIO SCI M121. Immunology with Hematology. 4 Units.
Antibodies, antigens, antigen-antibody reactions, cells and tissues of lymphoreticular and hematopoietic systems, and individual and collective components of cell-mediated and humoral immune response.

Prerequisite: BIO SCI 98

BIO SCI M121L. Advanced Immunology Laboratory. 4 Units.
Emphasis is placed on learning modern techniques in immunology such as ELISAs, western blotting, and immunofluorescent staining assays. Materials fee.

Prerequisite: (BIO SCI 100 or BIO SCI 108) and BIO SCI M121

Restriction: Seniors only. Students who require this lab for completion of their degree have first consideration for enrollment.

Concurrent with MOL BIO 221L.

(Ib)

BIO SCI N121. Drug Addiction. 4 Units.
Provides a comprehensive overview of topics in the addiction field, including drug pharmacology, models/approaches to investigate addiction, brain circuits, genetics, epigenetics, and the cellular and molecular biology of drug addiction.

Prerequisite: BIO SCI 99

Concurrent with NEURBIO 233.

BIO SCI E122. Physiology and Pathology of the Kidney. 4 Units.
Examines the structure, function, and pathology of the kidney. Topics include anatomy of the kidney, cellular function, urine formation, and disease states of the kidney.

Prerequisite: BIO SCI E109 or PHRMSCI 120

BIO SCI M122. General Microbiology. 4 Units.
Comparative metabolism of small molecules and cell structure and relationship to microbial classification. Macromolecule synthesis and regulation, sporulation, cell division, growth, and effect of antibiotics.

Prerequisite: BIO SCI 98

BIO SCI N122. Scientific Argumentation and Critical Thinking. 4 Units.
Explicitly teaches argument structure, deductive logic, inductive logic, and common fallacies in the biology context. Students identify assumptions and fallacies in faulty arguments and data figures and learn to compose sound arguments.

Prerequisite: BIO SCI 93. Satisfactory completion of the Lower-Division Writing requirement.

BIO SCI M123. Introduction to Computational Biology. 4 Units.
The use of theories and methods based on computer science, mathematics, and physics in molecular biology and biochemistry. Basics in biomolecular modeling. Analysis of sequence and structural data of biomolecules. Analysis of biomolecular functions.

Prerequisite: MATH 2D or MATH 3A or STATS 7 or STATS 8

Same as BME 132, COMPSCI 183.

Concurrent with MOL BIO 223 and BME 232.

BIO SCI N123L. Human Neuroimaging Lab. 3 Units.
Hands-on laboratory course in human neuroimaging, with particular emphasis on using MRI to understand brain function and how it changes over the course of the lifespan and with disease.

Prerequisite: BIO SCI 93 and (BIO SCI 100 or BIO SCI 108). Satisfactory completion of the Lower-Division Writing requirement.

Restriction: Seniors only. Students who require this lab for completion of their degree have first consideration for enrollment.

(Ib)

BIO SCI D124. Biology of Integrative Medecine. 4 Units.
Presentation of biological principles and the latest clinical and basic research on complementary and alternative therapies (e.g., mind-body medicine, energy medicine, herbal medicine, acupuncture, manipulative therapies) and their integration with Western medicine. Lectures supplemented by demonstrations and hands-on learning sessions.

Overlaps with BIO SCI 9J, BIO SCI 9N.

BIO SCI M124A. Virology. 4 Units.
Replication of viruses in populations, animals, and the host cell. The effects of viral infection on populations, individuals, and specific molecular effects on the target cell. Role of viral infections in cancer and degenerative diseases.

Prerequisite: BIO SCI 99

Restriction: School of Biological Sciences students only.

BIO SCI M124B. Viral Pathogenesis and Immunity. 4 Units.
The mechanisms of viral pathogenesis and of host resistance to viruses are explored in detail. HIV-1 and Influenza-A are used as examples. In each case, viral replication, cytopathic effects, immune response, and viral evasion are discussed.

Prerequisite: BIO SCI M121 or BIO SCI M124A. Recommended: BIO SCI M122.

BIO SCI N124. Model Systems in Biology. 4 Units.
On the use of animal and in vitro models in biomedical research, focusing on assumptions, promises, limitations, and compromises.

Prerequisite: BIO SCI 93

BIO SCI M125. Molecular Biology of Cancer. 4 Units.
Molecular mechanisms of carcinogenesis. Consideration of transformation by DNA tumor viruses, RNA tumor viruses, and chemical carcinogens.

Prerequisite: BIO SCI 99

BIO SCI E126. Parasitology. 4 Units.
Parasitism is the most common animal lifestyle. Yet, because parasites are invisible, they are often overlooked. Explore parasite diversity, disease dynamics, and more with an emphasis on the influential roles that parasites play on ecosystem structure and function.

Prerequisite: BIO SCI 94 or BIO SCI H94

Restriction: School of Biological Sciences students have first consideration for enrollment.

BIO SCI M126. Learning to Read Primary Literature in Biochemistry and Molecular Biology. 4 Units.
An introduction to primary literature focusing on methods to approach, understand, and analyze scientific papers.

Prerequisite: BIO SCI 99

BIO SCI E127. Physiological Plant Ecology. 4 Units.
An examination of the interactions between plants and their environment. Emphasis on the underlying physiological mechanisms of plant function, adaptations and responses to stress, and the basis of the distribution of plants and plant assemblages across the landscape.

Prerequisite: EARTHSS 51 or BIO SCI 94 or (EARTHSS 60A and EARTHSS 60C)

Same as EARTHSS 168.

Restriction: Biological Sciences Majors have first consideration for enrollment. Environmental Science Majors have first consideration for enrollment. Earth System Science Majors have first consideration for enrollment.

BIO SCI N127. Foundations in Neuroimmunology. 4 Units.
The immune system supports normal brain development as well as controls central nervous system (CNS) infections and augments neurodegenerative and neurological diseases. Assesses how the immune system contributes to both host defense and disease.

Prerequisite: BIO SCI M121

BIO SCI E128. Chemical Ecology. 4 Units.
An introduction to the unspoken chemical language of nature. Emphasis on interactions between insects, plants, and microbes including plant defense, pollination, and microbial warfare.

Corequisite: BIO SCI 94
Prerequisite: (BIO SCI 94 or BIO SCI H94) and CHEM 51A. CHEM 51A with a grade of C- or better

BIO SCI N129. The Transparent Brain. 5 Units.
Teaches students how to perform new 3-D histology techniques that reveal the complex circuitry of the brain in unprecedented detail. Students work with real brain samples as part of ongoing neuroscience research projects. Materials fee.

Prerequisite: BIO SCI 93 or BIO SCI H93

Restriction: Students who require this course for completion of their degree have first consideration for enrollment.

BIO SCI D130. Photomedicine. 4 Units.
Studies the use of optical and engineering-based systems (laser-based) for diagnosis, treating diseases, manipulation of cells and cell function. Physical, optical, and electro-optical principles are explored regarding molecular, cellular, organ, and organism applications.

Prerequisite: PHYSICS 3C or PHYSICS 7D

Same as BME 135.

Restriction: Biomedical Engineering Majors have first consideration for enrollment.

BIO SCI M130L. Advanced Molecular Lab Techniques. 6 Units.
Discovery-driven experimentation in the fields of molecular biology, biochemistry, and cell biology. Also involves other aspects of the lab experience including group discussion of results, scientific paper analysis, and student presentations. Materials fee.

Prerequisite: BIO SCI 100 and (BIO SCI D111L or BIO SCI M114L or BIO SCI M116L or BIO SCI M118L)

Repeatability: May be taken for credit 3 times.

Restriction: Students who require this lab for completion of their degree have first consideration for enrollment.

(Ib)

BIO SCI E131L. Image Analysis in Biological Research. 4 Units.
Introduction to scientific image analysis including techniques such as high-speed, time-lapse, thermal imaging, and flow visualization. Students make movies using cameras, edit and analyze images using computers, and do a writing project.

Prerequisite: (BIO SCI E106 or PHRMSCI 120 or BIO SCI E109) and (BIO SCI 100 or BIO SCI 108)

Restriction: Seniors only.

(Ib)

BIO SCI M131. Innate Immunity, Infection, and Pathogenesis. 4 Units.
Role of the innate immune system in health and disease. Molecular pathways of innate immune recognition, expression, and regulation of immune receptors, signal transduction, pathogen sensors, and detection of microbial ligands. Lecture and discussion of primary research articles.

Prerequisite: BIO SCI M121 or BIO SCI M122 or BIO SCI M124A or BIO SCI M124B or BIO SCI M143

BIO SCI N131. Human Neurodegenerative Diseases. 4 Units.
Clinical and epidemiological aspects of neurodegenerative diseases causing dementia are reviewed, including Alzheimer's disease, Parkinson's disease, Huntington's disease, and Frontotemporal Dementia. Seminar format includes student presentation and group discussion.

Prerequisite: BIO SCI 99

BIO SCI D132. Introduction to Precision Medicine. 4 Units.
Introduction to the use of genomic techniques for the study of individual genomes and transcriptomes in healthy and diseased samples. Covers GWAS, current sequencing techniques, cancer genomics, and biomarker discovery.

Prerequisite: BIO SCI 99

BIO SCI E132. Diversity of Fishes. 4 Units.
A survey of the many dimensions of diversity existing across fishes, the largest group of vertebrate organisms (over 30,000 species). Covers systematics, functional anatomy, development, physiology, biogeography, behavior, and more.

Prerequisite: BIO SCI 94 or BIO SCI H94

BIO SCI D133. Advances in Regenerative Medicine. 4 Units.
Introduces the rapidly growing field of regenerative medicine. New developments in stem cell research are discussed. Cellular, molecular, and engineering aspects of stem cell-based organ replacement strategies are examined, with emphasis on specific regenerative therapies.

Prerequisite: BIO SCI D103 or BIO SCI D104

Overlaps with BIO SCI N172.

BIO SCI E133. Environmental Microbiology. 4 Units.
Focuses on non-pathogenic microbes within all habitats (soils, oceans, associated with animals and plants) and their essential functions for ecosystems. Their applied importance for agriculture, bioremediation, energy and food production are also discussed.

Prerequisite: BIO SCI E106

BIO SCI M133. Structural Biology. 4 Units.
Basic principles of magnetic resonance, X-ray crystallography, and CryoEM toward the determination of high-resolution biomolecular structures.

Prerequisite: MATH 2B or MATH 5B

Restriction: Upper-division students only.

Concurrent with MOL BIO 211.

BIO SCI E134. Microbiomes. 4 Units.
Students develop an understanding of microbiomes in the context of both their environment and their impact on host physiology. Discussions on how microbiomes interact with the human body.

Prerequisite: BIO SCI M122

BIO SCI D135. Cell Biology of Human Disease. 4 Units.
Builds on prior biology courses about the underlying cell biological mechanisms and recent treatment advances of several model diseases. Emphasizes literature searches, reading primary literature, and student group work.

Prerequisite: BIO SCI D103

BIO SCI D136. Human Anatomy. 4 Units.
Presents a systems approach to the analysis of human structure. Molecular, cellular, tissue, organ, and organ system levels of structure and organization are integrated throughout.

Prerequisite: BIO SCI 99

Overlaps with BIO SCI D170.

BIO SCI E136. The Physiology of Human Nutrition . 4 Units.
Examines the biochemical basis of energy metabolism, physiological processes in digestion and uptake, and the biochemical transformation of carbohydrates, fats, and proteins in the human body. The emphasis is on expanding the students' understanding of physiology.

Prerequisite: BIO SCI 98 and (BIO SCI E109 or PHRMSCI 120)

BIO SCI D137. Eukaryotic and Human Genetics. 4 Units.
Structure and function of genes in eukaryotes with emphasis on special problems of genetic studies in humans. Molecular methods of genetic analysis and gene transfer are discussed. Practical applications and ethical and social issues raised by genetic studies are addressed.

Prerequisite: BIO SCI 97 or BIO SCI H97

BIO SCI M137. Microbial Genetics. 4 Units.
Basic principles of microbial genetics are presented as lectures for the first half of the course. The second half is devoted to applications of these principles and requires reading review and original research papers and interactions with guest lecturers.

Prerequisite: BIO SCI 98

BIO SCI E138. Comparative Animal Physiology. 4 Units.
Maintenance aspects of physiology: water balance; feeding and digestion; metabolism; respiration and circulation.

Prerequisite: BIO SCI E109 or PHRMSCI 120

BIO SCI N138. Sex Differences in the Brain. 4 Units.
Explores the neural bases of sex influences on brain function.

Prerequisite: BIO SCI 99

BIO SCI D139. Intercellular Signaling and Disease. 4 Units.
Introduces cell-to-cell communication mechanisms, which are fundamentally essential but still not well understood. From well-established to cutting-edge, researches of intercellular communication and how its malfunction leads to diseases are discussed.

Prerequisite: BIO SCI D103 or BIO SCI D104

BIO SCI E139. Animal Locomotion. 4 Units.
The physiology, biomechanics, and neuroscience that determines how animals propel themselves and navigate through the world. Considers the principles that govern the walking, running, flying, and swimming of animals, including exercising humans.

Prerequisite: BIO SCI E109 or PHRMSCI 120

BIO SCI E140L. Evolution and the Environment Laboratory. 4 Units.
Explores basic topics in ecology and evolutionary biology and applications to agriculture, conservation, environmental issues, and public health. Format involves lab activities and discussion of scientific journal articles, with focus on learning to evaluate scientific evidence.

Corequisite: BIO SCI E106
Prerequisite: (BIO SCI 100 or BIO SCI 108) and BIO SCI E106

Restriction: Seniors only. Students who require this lab for completion of their degree have first consideration for enrollment.

(Ib)

BIO SCI E142W. Writing/Philosophy of Biology. 4 Units.
Philosophy of biology, e.g., scientific method in biology, the structure of evolutionary theory, teleology, ethics, and evolution. Course work includes one 4,000-word and four 1,000-word papers.

Prerequisite: Satisfactory completion of the Lower-Division Writing requirement.

Same as LPS 142W, PHILOS 142W.

Restriction: Juniors only.

(Ib)

BIO SCI M143. Human Parasitology. 4 Units.
Introduction to human animal-parasitic diseases including worms and protozoan infections.

Prerequisite: BIO SCI 99

BIO SCI M144. Cell Organelles and Membranes. 4 Units.
Structure, function, and biogenesis of biological membranes and membrane-bound organelles.

Prerequisite: CHEM 51A

BIO SCI D145. Genomics, Development, and Medicine. 4 Units.
Focuses on the applications of genomics and proteomics to problems in genetics, cell, and developmental biology. Students will gain a comprehensive understanding of the techniques currently used for genomics analysis and how best to apply these tools to solve problems.

Prerequisite: BIO SCI 99

BIO SCI E145. Animal Coloration and Vision. 4 Units.
Physiological and behavioral mechanisms of color production and vision including crypsis, mimicry, aposematism, masquerade, sexual dimorphism, and predator-prey interactions through the lens of signals, receivers, and receptors; color and polarization vision in mate choice and visual adaptations to aquatic environments.

Prerequisite or corequisite: BIO SCI E106

BIO SCI E147. Behavioral Endocrinology. 4 Units.
Comparative examination of the major hormone systems that regulate behavior across animals. Emphasizes the reciprocating nature of hormone-behavior interactions and seeks to understand how natural selection drives the evolution of hormone structure and function.

Prerequisite: BIO SCI E109 or PHRMSCI 120

Concurrent with ECO EVO 247.

BIO SCI N147. Hearing and the Brain. 4 Units.
An overview of brain mechanisms of hearing, including perception of simple sounds, speech, and music. Begins with sound itself, and looks at processing by the ear, auditory pathways, auditory cortex, and beyond. Also auditory development, learning, and clinical issues.

Prerequisite: PSYCH 160A or BIO SCI 93 or BIO SCI H93

Same as PSYCH 161H.

Restriction: Cognitive Sciences Majors have first consideration for enrollment. Biological Sciences Majors have first consideration for enrollment. Psychology Majors have first consideration for enrollment.

Concurrent with NEURBIO 260.

BIO SCI E150. Conservation Biology. 4 Units.
Genetic and ecological issues in conservation biology, including effects of human population growth, the value of biodiversity, conservation genetics, demography, metapopulation dynamics, community and ecosystem processes, species invasions, global climate change, and reserve design and management.

Prerequisite: BIO SCI E106

BIO SCI E151. Evolutionary and Ecological Principles in Medicine. 4 Units.
Explore the dynamics of populations on an ecological, epidemiological, and medical level. Considers the dynamics of competition, predation, and parasitism; the spread and control of infectious diseases; and the in vivo dynamics of viral infections and the immune system.

Prerequisite: BIO SCI 93 or BIO SCI H93

Same as PUBHLTH 182.

Concurrent with ECO EVO 251.

BIO SCI N151. Neurobiology of Aging. 4 Units.
Multidisciplinary overview of the functional capacity of the aging brain, its structural changes and the mechanisms underlying function and structure. Emphasis is on successful brain aging and those mechanisms which lead to the development of Alzheimer's disease.

Prerequisite: BIO SCI N110 or BIO SCI N115A

BIO SCI N152. Developmental Neurobiology. 4 Units.
The development of the nervous system is discussed with emphasis on the processes that underlie the appearance of complex and highly ordered neural circuits. Topics include neural induction, specification, migration and death; axon growth, and neural circuit formation.

Prerequisite: BIO SCI 93 or BIO SCI H93

BIO SCI E153. Functional and Structural Evolutionary Genomics. 4 Units.
Function and organization of genomes analyzed from an evolutionary perspective. Review of some of the most recent experimental approaches in genome analysis and comparative genomics. Relevant software to analyze DNA and expression data is used.

Prerequisite: BIO SCI 97 or BIO SCI H97

Concurrent with ECO EVO 253.

BIO SCI M153. Vascular Biology: Blood Vessels in Health and Disease. 4 Units.
Every cell in the body is within a half hair’s width of a blood vessel. As such, we cannot understand the body, in health or disease, without understanding the vasculature. Mixes lectures and primary literature reviews.

Prerequisite: BIO SCI 99

BIO SCI N153. Neuropharmacology. 4 Units.
Survey of neurotransmitter systems, focusing on how transmitters are made, how they interact with their receptors, and how drugs can influence these processes to alter neural function and behavior.

Prerequisite: BIO SCI N110 or BIO SCI N115A

BIO SCI E154. Genetics and Human History. 4 Units.
Explores topics in human health/history from an evolutionary perspective, with emphasis on genetics. Topics include the relationship between genetics and human disease as an evolutionary question, and how modern genetic techniques are used to study the history of human populations.

Prerequisite or corequisite: BIO SCI E106

BIO SCI N154. Molecular Neurobiology. 4 Units.
Provides a fundamental understanding of how the brain works at the molecular level. Topics include nature and actions of molecules that regulate the functioning of the brain and cellular mechanisms underlying learning and memory.

Prerequisite: BIO SCI 99

BIO SCI E155. Physiology in Extreme Environments. 4 Units.
An in-depth look at the physiological mechanisms that allow animals, including humans, to be physically active and survive in extreme environments. Physiological responses to high altitude, diving, microgravity, deserts, and extreme cold are examined.

Prerequisite: BIO SCI 94 or BIO SCI H94

BIO SCI N155. Wiring the Developing Brain . 4 Units.
The development of the nervous system is discussed with particular emphasis on the processes that underlie the appearance of complex and highly ordered neural circuits. Basic neurodevelopmental processes are discussed and correlated with normal brain function/dysfunction.

Prerequisite: BIO SCI N110 or BIO SCI N115A or BIO SCI N152

BIO SCI N156. Molecular Mechanisms of Memory. 4 Units.
Current topics focused on understanding the molecular mechanisms that contribute to synaptic plasticity, learning, and memory. Primary literature is used to explore the variety of molecular mechanisms underlying these processes.

Prerequisite: BIO SCI 99

BIO SCI N158. Neurobiology of Learning and Memory. 4 Units.
How the brain and behavior change as a result of experience, with an emphasis on identifying the neurochemical processes through which memory is stored and the parts of the brain that are involved.

Prerequisite: BIO SCI 35 or BIO SCI N110 or BIO SCI N115A

BIO SCI E160. Biology of Birds. 4 Units.
A thorough introduction to the biology of birds, covering topics ranging from avian anatomy and physiology to behavior, natural history, ecology, genetics, evolution, systematics, and conservation. Examples from both local and global avifauna.

Corequisite: BIO SCI E160L
Prerequisite: BIO SCI 94

BIO SCI E160L. Biology of Birds Lab. 4 Units.
The companion to Biology of Birds (E160). Consists primarily of field trips to identify local birds and study avian natural history. Students must provide their own transportation to field sites, some with entrance fees. Students must have field binoculars.

Corequisite: BIO SCI E160
Prerequisite: (BIO SCI 100 or BIO SCI 108)

Restriction: Seniors only. Students who require this lab for completion of their degree have first consideration for enrollment.

(Ib)

BIO SCI N160. Language and the Brain . 4 Units.
Research analysis on biological bases of human linguistic capacity. Development, focusing on hemispheric specialization, plasticity; localization of specific linguistic functions in adults, with emphasis on study of aphasias; relation of linguistic capacity to general cognitive capacity, considering research on retardation.

Prerequisite: (PSYCH 7A or PSY BEH 9 or PSYCH 9A or PSY BEH 11A) and (PSYCH 9B or PSY BEH 11B or BIO SCI 35 or BIO SCI N110 or BIO SCI N115A)

Same as LSCI 158, PSYCH 161.

Restriction: Cognitive Sciences Majors have first consideration for enrollment. Biological Sciences Majors have first consideration for enrollment. Psychology Majors have first consideration for enrollment.

BIO SCI N164. Functional Neuroanatomy. 4 Units.
How neuroscience uses tools of many disciplines, from imaging to behavior, to develop and test hypotheses about functions of specific parts of the brain. Basic organization of nerve cells/vertebrate nervous system; methods of visualizing nerve cells; neural connections/activity patterns.

Prerequisite: BIO SCI 99

BIO SCI N165. Brain Disorders and Behavior. 4 Units.
Examines the localization of human brain functions and the effects of neurological disorders on psychological functions such as perception, motor control, language, memory, and decision-making.

Prerequisite: (PSYCH 7A or PSCI 9) or ((PSYCH 9A or PSCI 11A) and (PSYCH 9B or PSCI 11B)) or BIO SCI 35 or BIO SCI N110 or BIO SCI N115A

Same as PSYCH 160D, COGS 160D.

Restriction: Biological Sciences Majors have first consideration for enrollment. Cognitive Sciences Majors have first consideration for enrollment. Psychology Majors have first consideration for enrollment.

BIO SCI E166L. Field Biology. 4 Units.
Conducting group and independent studies in Southern California ecosystems, this course covers the fundamentals of experimental design, statistical analysis, communicating scientific findings (orally, visually, in writing), and other skills necessary for the scientific investigation of biological processes in the field. Materials fee.

Prerequisite: (BIO SCI 100 or BIO SCI 108) and BIO SCI E106. Satisfactory completion of the Lower-Division Writing requirement.

Restriction: Seniors only.

(Ib)

BIO SCI E168. Evolution. 4 Units.
An integrative treatment of evolutionary biology that covers evolutionary processes, basic research methods, and the history of life.

Prerequisite: BIO SCI E106

BIO SCI D170. Applied Human Anatomy. 5 Units.
Systems approach to analyze the form and function of the human body with an emphasis on applying anatomical concepts to evaluate clinical cases. The laboratory uses human models and a simulated cadaver dissection for structure. Materials fee.

Prerequisite: BIO SCI E109 or PHRMSCI 120. BIO SCI E109 with a grade of C or better. PHRMSCI 120 with a grade of C or better

Overlaps with BIO SCI D136.

BIO SCI N170. Clinical Neuroscience. 4 Units.
An introduction to the neuroclinical bases of human behavior, including neuropsychological approaches to mental disorders. Also includes case formulations, research articles, therapeutic approaches, and other discussions related to select psychopathology and other neurobehavioral topics.

Prerequisite: Recommended: PSCI 9 or PSYCH 7A or PSCI 11A or PSYCH 9A or BIO SCI 99.

Same as PSCI 160C.

Restriction: Psychological Science Majors have first consideration for enrollment. Biological Sciences Majors have first consideration for enrollment. Psychology and Social Behavior Majors have first consideration for enrollment. Social Ecology Majors have first consideration for enrollment.

BIO SCI N172. Regenerative Neurobiology. 4 Units.
Explores the field of regenerative neurobiology. Both basic stem cell discoveries and their potential clinical application to brain disorders examined. Opportunities, challenges, and implications of this research also discussed.

Prerequisite: BIO SCI N110 or BIO SCI N115A

Overlaps with BIO SCI 44, BIO SCI D133.

BIO SCI N173. Human Neuropsychology. 4 Units.
A survey of human brain disorders using a clinical case study approach to illustrate fundamental issues in studying brain and behavior. Topics include sensory deficits, attentional neglect, amnesia, cortical organization, clinical psychopathology, and more.

Prerequisite: BIO SCI N110 or BIO SCI N115A or PSYCH 9A or PSCI 11A

Same as PSCI 163C, PSYCH 162N.

Restriction: School of Biological Sciences students have first consideration for enrollment. Cognitive Sciences Majors have first consideration for enrollment. Psychological Science Majors have first consideration for enrollment. Psychology and Social Behavior Majors have first consideration for enrollment. Psychology Majors have first consideration for enrollment.

BIO SCI N174. Principles of Neural Computation. 4 Units.
Introduction to the theoretical principles and biological mechanisms underlying how brains acquire, assimilate, store, and retrieve information, and how they compute adaptive responses to external inputs.

Prerequisite: BIO SCI N110 or BIO SCI N115A

Concurrent with NEURBIO 220.

BIO SCI N176. Cerebral Cortex: Structure, Function, and Plasticity. 4 Units.
The cerebral cortex is highly developed in mammals and is responsible for higher perceptual and cognitive functions. Explores some amazing aspects of cortical structure, function, and plasticity emphasizing primary literature.

Prerequisite: BIO SCI N110 or BIO SCI N115A

BIO SCI E179. Limnology and Freshwater Biology. 4 Units.
Biology of freshwater environments: lakes, ponds, rivers, their biota, and the factors which influence distribution of organisms.

Prerequisite: BIO SCI 94

BIO SCI E179L. Field Freshwater Ecology. 4 Units.
Analytical techniques for common water-quality variables of lakes, streams, and rivers. Benthic fauna, vertebrates and invertebrates, algae, and aquatic plants. Emphasis on field methods with an experimental approach; laboratory exercises. Field trips to marshes, vernal pools, rivers, and streams. Materials fee.

Corequisite: BIO SCI E179
Prerequisite: (BIO SCI 100 or BIO SCI 108) and BIO SCI E179

Restriction: Seniors only. Students who require this lab for completion of their degree have first consideration for enrollment.

(Ib)

BIO SCI M180. Biotechnological Applications of Energy and Environmental Research. 4 Units.
Covers microbiological and biochemical background related to current biotechnological applications, case studies of biotech-companies, and basic information related to patents and start-up companies. Topics include biofuel, bioremediation, agricultural, and environmental applications.

Prerequisite: BIO SCI 98

BIO SCI E182. Mediterranean Ecosystems: Biodiversity and Conservation. 4 Units.
Biodiversity, history of human impacts, and conservation efforts are examined in the five Mediterranean-type ecosystems. Remaining natural habitat, approaches to ecological habitat restoration, control of exotic species, and predicted consequences of global climate change are described. Field trip required.

Prerequisite: BIO SCI 94

BIO SCI N182. Vision. 4 Units.
Visual perception and the anatomy and physiology of the visual system. Topics include the retina and the visual pathway; visual sensitivity; color vision; spatial vision; motion perception; and the development of the visual system.

Same as PSYCH 131A, COGS 131A.
Overlaps with PSYCH 130A.

Restriction: Upper-division students only. School of Biological Sciences students have first consideration for enrollment. Cognitive Sciences Majors have first consideration for enrollment. Psychology Majors have first consideration for enrollment.

BIO SCI E183. Exercise Physiology. 4 Units.
Focus upon critical topics in the area of exercise biology using the comparative physiological approach. Specifically examine the physiological factors that limit the capacity of an organism to sustain high levels of aerobic metabolism.

Prerequisite: BIO SCI 98 and (BIO SCI E109 or PHRMSCI 120)

BIO SCI E184. Ecology and Diversity of Insects. 4 Units.
Insects—representing two-thirds of all species—play fundamental roles in human health, agriculture, and natural ecosystems. Topics include insect morphology, development, physiology, taxonomy, ecology, and insects in human affairs. Lecture includes interactive demonstrations and an optional weekend trip. Materials fee.

Prerequisite: BIO SCI E106

BIO SCI E186L. Population and Community Ecology Lab. 4 Units.
Covers processes specific to groups of the same species (populations) and multiple species (communities). Includes growth, regulation, dynamics, and persistence of populations and community interactions, development, diversity, and macroecology. Lab activities focus on application of population prediction and biodiversity assessment.

Prerequisite: BIO SCI E106 and (BIO SCI 100 or BIO SCI 108). Satisfactory completion of the Lower-Division Writing requirement.

Restriction: Seniors only.

(Ib)

BIO SCI E187. Exercise as Medicine. 4 Units.
Explores the link between regular physical activity and health, focusing on mechanistic insights into how regular exercise improves overall health and alters disease trajectories of cancer, type-II diabetes, depression, and other chronic illnesses.

Prerequisite: BIO SCI E109 or PHRMSCI 120

BIO SCI E188. Introduction to Insect Physiology. 4 Units.
Physiology of insects. Insect respiration, digestion, excretion, and neurobiology, including sensory systems and effectors.

Prerequisite: BIO SCI E109 or PHRMSCI 120

BIO SCI E189. Environmental Ethics. 4 Units.
History of evolution of environmental ethics in America. Management problems in national parks, wilderness areas, wild and scenic rivers, national forests. Contemporary and historical aspects/contributors to the field. Mitigation, endangered species, habitat restoration, biodiversity, and environmental activism. Field trips required.

Restriction: Upper-division students only.

BIO SCI 190. Transfer Student Seminar. 1 Unit.
Weekly meetings consisting of presentations by faculty, professional staff, and New Student Peer Academic Advisors provide information about the School of Biological Sciences, campus resources, and special programs/opportunities.

Grading Option: Pass/no pass only.

Restriction: New transfer students only.

BIO SCI D190. Topics in Developmental and Cell Biology. 4 Units.
Studies in selected areas of developmental and cell biology.

Prerequisite: BIO SCI 99

Repeatability: May be taken for credit 3 times as topics vary.

Restriction: Upper-division students only. School of Biological Sciences students only.

BIO SCI E190. Topics in Ecology and Evolutionary Biology. 2-4 Units.
Studies in selected areas of ecology and evolutionary biology.

Prerequisite: BIO SCI E106

Repeatability: May be taken for credit 3 times as topics vary.

BIO SCI M190. Topics in Molecular Biology and Biochemistry. 2-4 Units.
Studies in selected areas of Molecular Biology and Biochemistry.

Prerequisite: BIO SCI 98

Repeatability: May be taken for credit 3 times as topics vary.

BIO SCI N190. Topics in Neurobiology and Behavior. 2-4 Units.
Studies in selected areas of neurobiology and behavior.

Prerequisite: BIO SCI N110 or BIO SCI N115A

Repeatability: May be taken for credit 3 times as topics vary.

BIO SCI 191A. Senior Seminar on Global Sustainability I. 2 Units.
Students attend weekly seminar to discuss current issues in global sustainability. Weekly attendance at Global Sustainability Forum is also required. Seminar utilized to analyze forum presentations. Prepare bibliography.

Same as SOCECOL 186A, EARTHSS 190A.

Restriction: Seniors only. Global Sustainability Minors have first consideration for enrollment.

BIO SCI 191B. Senior Seminar on Global Sustainability II. 2 Units.
Students attend weekly seminar to discuss current issues in global sustainability. Weekly attendance at Global Sustainability Forum is also required. Seminar utilized to analyze forum presentations. Prepare research proposal.

Prerequisite: BIO SCI 191A or SOCECOL 186A or EARTHSS 190A

Same as SOCECOL 186B, EARTHSS 190B.

Restriction: Seniors only.

BIO SCI 191CW. Writing/Senior Seminar on Global Sustainability III. 4 Units.
Students attend weekly seminar to discuss current issues in global sustainability. Weekly attendance at Global Sustainability Forum also is required. Seminar utilized to analyze Forum presentations and to prepare senior research paper. Prepare/write research paper under direction of faculty member.

Prerequisite: BIO SCI 191B or EARTHSS 190B or SOCECOL 186B. BIO SCI 191B or EARTHSS 190B or SOCECOL 186B. Satisfactory completion of the Lower-Division Writing requirement.

Same as EARTHSS 190CW, SOCECOL 186CW.

Restriction: Seniors only.

(Ib)

BIO SCI 192. Topics in Biological Sciences Tutoring . 1-3 Units.
Tutoring programs with biological sciences student peers.

Repeatability: May be taken for credit for 12 units.

Restriction: Students tutoring under School of Biological Sciences programs only.

BIO SCI 193A. Campus as a Living Lab I. 2-4 Units.
Students study sustainability concepts and theories and how they apply to our most pressing environmental, social, and economic challenges. Concurrently, they work on hands-on projects to improve the sustainability of campus operations and systems.

Grading Option: In Progress (Letter Grade with P/NP).

Restriction: Upper-division students only.

BIO SCI 193B. Campus as a Living Lab II. 2-4 Units.
Students study sustainability concepts and theories and how they apply to our most pressing environmental, social, and economic challenges. Concurrently, they work on hands-on projects to improve the sustainability of campus operations and systems.

Prerequisite: BIO SCI 193A

Restriction: Upper-division students only.

BIO SCI 193C. Campus as a Living Lab III. 2-4 Units.
Students study sustainability concepts and theories and how they apply to our most pressing environmental, social, and economic challenges. Concurrently, they work on hands-on projects to improve the sustainability of campus operations and systems.

Prerequisite: BIO SCI 193B

Restriction: Upper-division students only.

BIO SCI 194S. Safety and Ethics for Research. 1 Unit.
Introduces students to the concepts, techniques, and ethics involved in biological sciences laboratory work.

Grading Option: Pass/no pass only.

BIO SCI H195. Honors Topics in Biological Sciences. 4 Units.
Varied course topics in Biological Sciences designed for students in Honors in Biological Sciences.

Repeatability: May be taken for credit 2 times.

Restriction: Biological Sciences Honors students only.

BIO SCI 197. Special Study in Biological Sciences. 1-5 Units.
Individualized instruction dealing with conceptual or theoretical problems in the biological sciences, rather than technical problems.

Prerequisite: BIO SCI 94

Repeatability: May be repeated for credit unlimited times.

Restriction: Maximum of 5 units (per quarter) between BIO SCI 197, BIO SCI 198, and BIO SCI 199.

BIO SCI 198. Directed Group Studies. 1-5 Units.
Small group experimental laboratory or field work performed under the direction of a faculty member.

Prerequisite: BIO SCI 94

Repeatability: May be repeated for credit unlimited times.

BIO SCI 199. Independent Study in Biological Sciences Research. 1-5 Units.
Individual experimental laboratory or field research under a professor's direction. Required for participation in the Excellence in Research Program.

Prerequisite: BIO SCI 94

Repeatability: Unlimited as topics vary.

BIO SCI 199W. Research Writing. 1 Unit.
Development of research skills such as learning how to plan and conduct research experiments, read and analyze scientific journal articles, and practice presenting the data experiments and journal articles with an emphasis on scientific writing.

Prerequisite or corequisite: BIO SCI 199

(lb)

BIO SCI 285. Topics in Allied Health Microbiology. 4 Units.
Basic microbiology with emphasis for allied health professions such as nursing. Emphasis is on micro-organisms involved in human health, disease and food safety.

Prerequisite: BIO SCI 98

Repeatability: May be taken for credit for 4 units as topics vary.

Overlaps with BIO SCI M122, BIO SCI M118L.

Restriction: Program in Nursing Science students only. Master of Nursing Degree students only.

Developmental and Cell Biology Courses

DEV BIO 200A. Research in Developmental and Cell Biology. 2-12 Units.
Independent research with Developmental and Cell Biology faculty.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

DEV BIO 200B. Research in Developmental and Cell Biology. 2-12 Units.
Independent research with Developmental and Cell Biology faculty.

Prerequisite: DEV BIO 200A. DEV BIO 200A with a grade of B- or better

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

DEV BIO 200C. Research in Developmental and Cell Biology . 2-12 Units.
Independent research with Developmental and Cell Biology faculty.

Prerequisite: DEV BIO 200B. DEV BIO 200B with a grade of B- or better

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

DEV BIO 200R. Research in Developmental & Cell Biology for First-year Students. 2-12 Units.
Independent research within the laboratories of graduate training faculty in the Department of Developmental and Cell Biology for first-year Ph.D. students.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be taken for credit 3 times.

DEV BIO 203A. Graduate Tutorial in Developmental and Cell Biology. 4 Units.
Advanced study in areas not represented by formal courses. May involve individual or small group study through discussion, reading, and composition. Time and subject matter arranged individually.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

DEV BIO 203B. Graduate Tutorial in Developmental and Cell Biology. 4 Units.
Advanced study in areas not represented by formal courses. May involve individual or small group study through discussion, reading, and composition. Time and subject matter arranged individually.

Prerequisite: DEV BIO 203A. DEV BIO 203A with a grade of B- or better

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

DEV BIO 203C. Graduate Tutorial in Developmental and Cell Biology. 4 Units.
Advanced study in areas not represented by formal courses. May involve individual or small group study through discussion, reading, and composition. Time and subject matter arranged individually.

Prerequisite: DEV BIO 203B. DEV BIO 203B with a grade of B- or better

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

DEV BIO 206A. Developmental and Cell Biology Journal Club. 2 Units.
Advanced study of various topics in cell biology.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

DEV BIO 206B. Developmental and Cell Biology Journal Club. 2 Units.
Advanced study of various topics in cell biology.

Prerequisite: DEV BIO 206A. DEV BIO 206A with a grade of B- or better

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

DEV BIO 206C. Developmental and Cell Biology Journal Club. 2 Units.
Advanced study of various topics in cell biology.

Prerequisite: DEV BIO 206B. DEV BIO 206B with a grade of B- or better

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

DEV BIO 207. Mouse Developmental Genetics. 4 Units.
Introduction to using the mouse in contemporary biomedical research. The biology and development of the laboratory mouse, methods for manipulation of the mouse genome and embryos, and examples of application of these methods to understand mammalian development and homeostasis.

Same as BIOCHEM 215.

Restriction: Graduate students only.

DEV BIO 210. Developmental Genetics and Genomics. 4 Units.
Focuses on critical concepts in developmental genetics and genomics, emphasizing primary literature and new cutting edge approaches in genetic model organisms such as worms, flies, fish, and mice, with relevance for human genetics and disease.

Repeatability: May be taken for credit 2 times.

Restriction: Graduate students only.

DEV BIO 212. Topics in Systems Biology. 2 Units.
Studies in selected areas of Systems Biology.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.

DEV BIO 212A. Data Science Topics in Systems Biology. 2 Units.
A journal club examining data science and machine learning applications in systems biology.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.

DEV BIO 214. Principles of Genomics. 4 Units.
A survey course of the principal subfields of genomics and their applications to biological and health sciences that will cover genome assembly and annotation, genome structure, comparative genomics, population genomics, functional genomics, and medical genomics.

Same as MOL BIO 244.

Restriction: Graduate students only.

DEV BIO 231B. Cell Biology. 4 Units.
A broadly based course including topics in extracellular matrix, cytoskeleton, organelle biogenesis, receptor-mediated endocytosis, signal transduction, cell cycle, and developmental biology.

Concurrent with BIO SCI D154.

DEV BIO 232. Systems Cell and Developmental Biology. 4 Units.
Introduces concepts needed to understand cell and developmental biology at the systems level, i.e., how the parts (molecules) work together to create a complex output. Emphasis on using mathematical/computational modeling to expand/modify insights provided by intuition.

Same as BME 213.

Restriction: Graduate students only.

DEV BIO 245. Stem Cell Biology. 4 Units.
The basic characteristics and development roles of embryonic, adult, and cancer stem cells in the human body and in model systems and the use of experimental and genetic methods to analyze and manipulate their properties.

Restriction: Graduate students only.

DEV BIO 290A. Colloquium in Developmental and Cell Biology. 2 Units.
Contemporary research problems. Research students, faculty, and other invited speakers introduce research and review topics.

Restriction: Graduate students only.

DEV BIO 290B. Colloquium in Developmental and Cell Biology. 2 Units.
Contemporary research problems. Research students, faculty, and other invited speakers introduce research and review topics.

Prerequisite: DEV BIO 290A. DEV BIO 290A with a grade of B- or better

Restriction: Graduate students only.

DEV BIO 290C. Colloquium in Developmental and Cell Biology. 2 Units.
Contemporary research problems. Research students, faculty, and other invited speakers introduce research and review topics.

Prerequisite: DEV BIO 290B. DEV BIO 290B with a grade of B- or better

Restriction: Graduate students only.

DEV BIO 292A. Scientific Communication. 2 Units.
Small group meetings for graduate students to practice scientific writing, debate, and presentation skills.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

DEV BIO 292B. Scientific Communication. 2 Units.
Small group meetings for graduate students to practice scientific writing, debate, and presentation skills.

Prerequisite: DEV BIO 292A. DEV BIO 292A with a grade of B- or better

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

DEV BIO 292C. Scientific Communication. 2 Units.
Small group meetings for graduate students to practice scientific writing, debate, and presentation skills.

Prerequisite: DEV BIO 292B. DEV BIO 292B with a grade of B- or better

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

DEV BIO 399. University Teaching. 4 Units.
Limited to Teaching Assistants.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.

Ecology and Evolutionary Bio Courses

ECO EVO 200A. Research in Ecology and Evolutionary Biology. 2-12 Units.
Individual research with Ecology and Evolutionary Biological faculty.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

ECO EVO 200B. Research in Ecology and Evolutionary Biology. 2-12 Units.
Individual research with Ecology and Evolutionary Biological faculty.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

ECO EVO 200C. Research in Ecology and Evolutionary Biology. 2-12 Units.
Individual research with Ecology and Evolutionary Biological faculty.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

ECO EVO 201. Seminar in Ecology and Evolutionary Biology. 2 Units.
Invited speakers, graduate students, and faculty present current research in ecology and evolutionary biology.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.

Concurrent with BIO SCI E107.

ECO EVO 203A. Graduate Tutorial in Ecology and Evolutionary Biology. 2-12 Units.
Advanced study in areas not represented by formal courses. May involve individual or small group study through reading, discussion, and composition.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

ECO EVO 203B. Graduate Tutorial in Ecology and Evolutionary Biology. 2-12 Units.
Advanced study in areas not represented by formal courses. May involve individual or small group study through reading, discussion, and composition.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

ECO EVO 203C. Graduate Tutorial in Ecology and Evolutionary Biology. 2-12 Units.
Advanced study in areas not represented by formal courses. May involve individual or small group study through reading, discussion, and composition.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

ECO EVO 204. Writing Grant Proposals. 4 Units.
Provides students with hands-on experience writing proposals in the research areas of ecology, evolution, or physiology.

Restriction: Graduate students only.

ECO EVO 205. Special Topics in Ecology. 4 Units.
Survey of special topics in Ecology.

Restriction: Graduate students only.

ECO EVO 206. Special Topics in Evolution. 4 Units.
Extensive introduction to the primary literature of evolutionary biology. Topics include population genetics, quantitative genetics, neutralism, molecular evolution, evolution of genetic systems, genetic architecture of fitness, speciation, and macroevolution.

Restriction: Graduate students only.

ECO EVO 207. Quantitative Methods in Ecology and Evolutionary Biology. 4 Units.
Statistics for ecologists and evolutionary biologists. Emphasis on specific applications and underlying assumptions rather than on methods of calculation. Topics include experimental design, parametric and nonparametric methods, analysis of variance and covariance, and multiple regression.

Prerequisite: Completion of at least one quarter of statistics including regression and analysis of variance.

Restriction: Graduate students only.

ECO EVO 208. Ecological and Evolutionary Physiology. 4 Units.
A summary of information in organismal biology, comparative and ecological physiology, and the biophysical basis of organismal function. Course offered every other fall.

Restriction: Graduate students only.

ECO EVO 210. Foundations of Physiology. 4 Units.
Physical and functional principles common to many living forms. Course forms a basis for subsequent specialization in any of the subdisciplines of physiology. Course offered in even years.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.

ECO EVO 221. Advanced Topics in Ecology. 2-4 Units.
Weekly discussion of current topics in ecology at the graduate level.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: Unlimited as topics vary.

ECO EVO 222. Statistical Learning in Ecology and Evolution. 4 Units.
Reviews basic principals of variance/bias trade-offs. Topics include models for prediction and classification, variable selection methods, cross-validation, tree based methods, unsupervised learning. Applications in ecology and evolution using R.

Prerequisite: ECO EVO 207. ECO EVO 207 with a grade of B or better

Restriction: Graduate students only.

ECO EVO 227. Plant Physiological Ecology. 4 Units.
Provides a summary of information on plant organismal biology, comparative and ecological physiology, and functional ecology. Offered every other fall.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.

ECO EVO 230. Topics in Microbial Ecology. 2-4 Units.
Weekly discussion of current topics in ecology, biogeochemistry, evolution, and physiology of microbial organisms.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

ECO EVO 231. Communication Skills for Environmental Scholars. 4 Units.
Students learn to communicate with non-specialist audiences about climate and environmental issues. Hands-on activities build technical, presentation, and contextual skills required for effective communication across a range of media types and careers.

ECO EVO 235. Experimental Evolution. 2 Units.
Explores experimental evolution, which is now a well-established part of evolutionary biology. With the advent of genomics, it is now one of the most powerful tools for studying the genetic foundations of biology.

Prerequisite: BIO SCI E106

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only. School of Biological Sciences students only.

ECO EVO 236. Human Dimensions in Conservation and Restoration. 4 Units.
The non-human “environment” we know today is the result of past social, political, scientific, and economic forces. Examines the forces that drove environmental conservation efforts, which often sought progress at the expense of local cultures.

Restriction: Graduate students only.

ECO EVO 237. Marine Conservation Ecology. 4 Units.
Theory-based seminar tackles pressing issues in marine ecology, conservation, and restoration. Focuses on the science of marine ecosystems, resources and tools for their conservation, and management and the socioeconomic and policy dimensions.

Restriction: Graduate students only.

ECO EVO 246. Seminar in Ecology and Evolution Education. 2 Units.
Weekly discussion of teaching techniques and challenges that are specific to courses in ecology and evolutionary biology. Emphasis will be on using evidence-based pedagogy techniques. There will be a combination of readings, group discussions and speakers.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.

ECO EVO 247. Behavioral Endocrinology. 4 Units.
Comparative examination of the major hormone systems that regulate behavior across animals. Emphasizes the reciprocating nature of hormone-behavior interactions and seeks to understand how natural selection drives the evolution of hormone structure and function.

Restriction: Graduate students only.

Concurrent with BIO SCI E147.

ECO EVO 253. Functional and Structural Evolutionary Genomics. 4 Units.
Function and organization of genomes analyzed from an evolutionary perspective. Review of some of the most recent experimental approaches in genome analysis and comparative genomics. Relevant software to analyze DNA and expression data is used.

Concurrent with BIO SCI E153.

ECO EVO 261. Advanced Quantitative Methods. 4 Units.
Covers advanced analytical techniques used by conservation biologists. Methods include generalized linear models, community analysis using multivariate analyses, analysis of spatial/GIS data using R, time-series analysis, and meta-analysis.

Prerequisite: Recommended: ECO EVO 207.

Restriction: Graduate students only.

ECO EVO 262. Professional Workshop. 2 Units.
Identify and attend professional or technical skill workshops to gain professional knowledge and certifications related to conservation and restoration science.

Repeatability: May be taken for credit 4 times.

Restriction: Graduate students only.

ECO EVO 264. Conservation Biology. 4 Units.
Explores concepts in ecology with potential for conserving biological diversity. Identifies creative applications of ecological research that mitigate impacts of rapid human population growth and habitat destruction on biodiversity.

Restriction: Graduate students only.

ECO EVO 265. Restoration Ecology. 4 Units.
Study of principles and practices that help recover degraded ecosystems including restoration in different ecological systems, restoration motives and intensities, implementation and monitoring, and scope and success of case studies.

Restriction: Graduate students only.

ECO EVO 266L. Field Methods in Restoration. 4 Units.
Laboratory experience performing field methods that help recover degraded ecosystems in different ecological systems. Emphasis on the plant community composition, soil, irrigation, maintenance, and monitoring of a project.

ECO EVO 267. Science Communication. 2 Units.
Develops students' abilities to convey information related to conservation and restoration in a way that has broad appeal and/or effective messaging for non-scientific audiences by assessing the audience, developing effective storytelling, and deploying a persuasive information campaign.

Repeatability: May be taken for credit 2 times.

ECO EVO 268. Technical Writing. 2 Units.
Practice developing key documents for restoration projects including a response to a request for proposal (RFP), a restoration project plan, and a monitoring and maintenance plan.

ECO EVO 269. Project Management. 2 Units.
Discover the planning, design, implementation, and aftercare phases of managing a conservation or restoration project. Students will project cost, manage risk, analyze sites, evaluate and review projects, and become familiar with common permitting and consultation requirements.

ECO EVO 270. GIS for Environmental Science. 4 Units.
Introduction to the fundamental principles of GIS. Topics include cartography, creating/editing GIS data, georeferencing, map projections, geospatial analysis, spatial statistics, and development of GIS models. Focuses on theory and practice.

Restriction: Graduate students only.

ECO EVO 271. Marine Research and Conservation Methods. 4 Units.
Field-based introduction to marine ecology and conservation management through the study of the ecology, resource management, and conservation of marine habitats and species, and the use of a variety of marine field research methods.

Restriction: Graduate students only.

ECO EVO 275. Wildlife Ecology and Sampling. 4 Units.
Field-based introduction to wildlife management through the study of the ecology, physiology, population biology management, and conservation of vertebrate wildlife species, and the use of a variety of different wildlife sampling techniques.

Restriction: Graduate students only.

ECO EVO 276. Environmental Education and Outreach. 4 Units.
Prepares students to develop tailored education programs for conservation and restoration projects. Students engage in activities that foster innovative approaches and solutions to different education and outreach needs for conservation and restoration projects.

Overlaps with ECO EVO 200B.

Restriction: Graduate students only.

ECO EVO 278. Evolution and Conservation. 4 Units.
Examines evolution applications to conservation biology in three parts: processes of evolution within populations, conservation of species, and assessing evolutionary responses to environmental change.

Restriction: Graduate students only.

ECO EVO 279. Site Development. 4 Units.
Students learn about plan review and the permitting processes as they relate to site development. Explores how a site is developed from application to building permits, and all the steps in between.

Overlaps with UPPP 272.

Restriction: Graduate students only.

ECO EVO 282. Fundamentals of Informatics for Biologists. 4 Units.
Students learn the fundamentals of bioinformatics and the unix operating system (including the shell and Sun Grid Engine) in order to assemble a eukaryotic genome.

Restriction: Graduate students only.

ECO EVO 283. Advanced Informatics for Biologists. 4 Units.
Students learn advanced informatics including the analysis of: Poolseq, RNAseq, ATACseq, and ChiPseq datasets using programs such as bwa, tophat, cufflinks, DEseq, Trinity, Agustus, etc., in a unix high-performance computing environment. Statistical tests carried out and publication quality.

Prerequisite: ECO EVO 282. ECO EVO 282 with a grade of B- or better

Restriction: Graduate students only.

ECO EVO 285. Topics in Evolutionary Genetics. 2 Units.
Weekly discussion of recent research on evolutionary genetics.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.

ECO EVO 286. MCRS Capstone. 2-12 Units.
Apply knowledge and skills in a practical professional setting, working with practitioners to identify a conservation or management problem and then to plan, implement, and evaluate a solution.

Repeatability: May be taken for credit for 12 units.

Restriction: Graduate students only.

ECO EVO 341. Teaching Science in Secondary School. 4 Units.
Prospective secondary science teachers learn how to teach science in grades 7-12. Covers State science requirements, a variety of teaching methods, criteria for selecting science curricular materials, and how to plan science lessons, units, experiments, projects, and demonstrations.

Same as EDUC 341.

Restriction: Master of Arts in Teaching Degree students only.

ECO EVO 399. University Teaching. 4 Units.
Mandatory course for Ecology and Evolutionary Biology Teaching Assistants, required in each quarter in which student has a Teaching Assistant position. Limited to Teaching Assistants.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Molecular Biology and Biochem Courses

MOL BIO 200A. Research in Molecular Biology and Biochemistry. 2-12 Units.
Individual research with Molecular Biology and Biochemistry faculty.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

MOL BIO 200B. Research in Molecular Biology and Biochemistry. 2-12 Units.
Individual research with Molecular Biology and Biochemistry faculty.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

MOL BIO 200C. Research in Molecular Biology and Biochemistry. 2-12 Units.
Individual research with Molecular Biology and Biochemistry faculty.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only.

MOL BIO 200R. Research in Developmental & Cell Biology for First-year Students. 2-12 Units.
Independent research within the laboratories of graduate training faculty in the Department of Molecular Biology and Biochemistry for first-year Ph.D. students.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be taken for credit 3 times.

MOL BIO 201A. Seminars in Molecular Biology & Biochemistry. 2 Units.
Presentation of research from department laboratories or, when pertinent, of other recent developments.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

MOL BIO 201B. Seminars in Molecular Biology & Biochemistry. 2 Units.
Presentation of research from department laboratories or, when pertinent, of other recent developments.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

MOL BIO 201C. Seminars in Molecular Biology & Biochemistry. 2 Units.
Presentation of research from department laboratories or, when pertinent, of other recent developments.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

MOL BIO 202A. Tutorial in Molecular Biology and Biochemistry. 2 Units.
Tutorials in the area of research of a particular professor which relate current research to the literature. May be conducted as journal clubs.

Repeatability: Unlimited as topics vary.

MOL BIO 202B. Tutorial in Molecular Biology and Biochemistry. 2 Units.
Tutorials in the area of research of a particular professor which relate current research to the literature. May be conducted as journal clubs.

Repeatability: Unlimited as topics vary.

MOL BIO 202C. Tutorial in Molecular Biology and Biochemistry. 2 Units.
Tutorials in the area of research of a particular professor which relate current research to the literature. May be conducted as journal clubs.

Repeatability: Unlimited as topics vary.

MOL BIO 203. Nucleic Acid Structure and Function. 4 Units.
Structure and chemistry of nucleic acids. Relationship between these properties and the mechanisms of fundamental processes such as replication and repair, RNA-mediated catalysis, formation and regulation of higher order chromatin structure and recombination.

Prerequisite: BIO SCI 98 and BIO SCI 99 and CHEM 51A and CHEM 51B and CHEM 51C

MOL BIO 204. Protein Structure and Function. 4 Units.
The structure and properties of proteins, enzymes, and their kinetic properties.

Prerequisite: BIO SCI 98 and BIO SCI 99 and CHEM 51C

MOL BIO 205. Molecular Virology. 4 Units.
Primary research data on the major DNA and RNA viruses emphasizing strategies of regulation of gene expression. Utilization of viruses as molecular biological tools. Graduate-level knowledge of the biochemistry and molecular biology of macromolecules is required.

Prerequisite: MOL BIO 203 and MOL BIO 204. MOL BIO 203 with a grade of B- or better. MOL BIO 204 with a grade of B- or better

Restriction: Graduate students only.

MOL BIO 211. Structural Biology. 4 Units.
Basic principles of magnetic resonance, Xray crystallography, and CryoEM toward the determination of high-resolution biomolecular structures.

Prerequisite: MATH 2B

Restriction: Graduate students only.

Concurrent with BIO SCI M133.

MOL BIO 214. Literature in Protein Structure and Function. 2 Units.
Exploration and critical analysis of recent primary scientific literature in structure and properties of proteins, enzymes, and their kinetic properties.

Corequisite: MOL BIO 204

Grading Option: Satisfactory/unsatisfactory only.

MOL BIO 215B. Integrative Immunology II. 4 Units.
Lectures and student presentations of primary literature. Focuses on advanced topics and cutting edge technologies in modern immunology. Combination of didactic lectures and student-led journal article discussion.

Prerequisite: PHYSIO 215. PHYSIO 215 with a grade of B+ or better

Same as M&MG 215B, PHYSIO 215B.

Restriction: Graduate students only.

MOL BIO 217A. Principles of Cancer Biology I. 4 Units.
Oncogenes and tumor suppressor genes are studied from molecular viewpoints. Also studies their role in cancer; viral carcinogenesis. Designed for graduate students interested in cancer research. Format includes lectures and student-led discussions.

Prerequisite: MOL BIO 203 and MOL BIO 204. MOL BIO 203 with a grade of B- or better. MOL BIO 204 with a grade of B- or better

Restriction: Graduate students only.

MOL BIO 217B. Principles of Cancer Biology II. 4 Units.
Topics include cancer cell growth and metastasis, chemical carcinogenesis, and cancer genetics and epidemiology. Designed for graduate students interested in cancer research. Format includes lectures and student-led discussions.

Prerequisite: MOL BIO 203 and MOL BIO 204. MOL BIO 203 with a grade of B- or better. MOL BIO 204 with a grade of B- or better

Restriction: Graduate students only.

MOL BIO 218. Clinical Cancer. 3 Units.
Designed to acquaint students in basic life science with clinical cancer.

Restriction: Graduate students only.

MOL BIO 220. Structure & Synthesis of Biological Macromolecules Journal Club. 2 Units.
Advanced topics in macromolecular struture and synthesis as related to biological problems.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.

MOL BIO 221. Advanced Topics in Immunology. 4 Units.
Literature-based, interactive discussions focused on review of seminal historic and recent immunology literature. Student responsibilities include reading, critical evaluation, and discussion of manuscripts.

Prerequisite: M&MG 215. M&MG 215 with a grade of B- or better

Restriction: Graduate students only.

MOL BIO 221L. Advanced Immunology Laboratory. 4 Units.
An advanced course in immunology for graduate students enrolled in the Biotechnology master's program. Emphasis is placed on learning modern techniques in immunology such as ELISAs, western blotting, immunofluorescent staining assays.

Restriction: Graduate students only.

Concurrent with BIO SCI M121L.

MOL BIO 223. Introduction to Computational Biology. 4 Units.
The use of theories and methods based on computer science, mathematics, and physics in molecular biology and biochemistry. Basics in biomolecular modeling. Analysis of sequence and structural data of biomolecules. Analysis of biomolecular functions.

Same as BME 232.

Restriction: Graduate students only.

Concurrent with BIO SCI M123 and COMPSCI 183 and BME 132.

MOL BIO 227. Immunlology Journal Club. 2 Units.
Advanced topics in immunology as related to an understanding of human disease.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be taken for credit 15 times.

Restriction: Graduate students only.

MOL BIO 229. Research-in-Progress Seminars. 1 Unit.
Two half-hour presentations by graduate students and postdoctorals to the department on their current research projects.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be taken for credit 15 times.

Restriction: Graduate students only.

MOL BIO 235. Literature in Chemical and Structural Biology. 1 Unit.
Exploration and critical analysis of recent primary scientific literature in chemical and structural biology.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

MOL BIO 243. Topics in Stem Cells. 2-4 Units.
Presentation by participating faculty or guest lecturer that is open to the science community, followed by discussion of the lecture topic or a related topic. Students are responsible for presentations and readings.

MOL BIO 244. Principles of Genomics. 4 Units.
A survey course of the principal subfields of genomics and their applications to biological and health sciences that will cover genome assembly and annotation, genome structure, comparative genomics, population genomics, functional genomics, and medical genomics.

Same as DEV BIO 214.

Restriction: Graduate students only.

MOL BIO 248. Metallobiochemistry . 4 Units.
A review of the biochemistry of metallic elements emphasizing: methods for studying metals in biological systems; the chemical basis for nature's exploitation of specific elements; structures of active sites; mechanisms; solid-state structures and devices; metals in medicine.

Prerequisite or corequisite: CHEM 131C or CHEM 132C

Same as CHEM 218.

MOL BIO 250. Advanced Topics in Biotechnology - Nucleic Acids. 2 Units.
Supplements laboratory curriculum with scientific background behind experimental methods. Format consists of lectures and the presentation and analysis of relevant papers from the scientific literature.

Corequisite: MOL BIO 250L

Restriction: Graduate students only. Biotechnology Majors only.

MOL BIO 250L. Biotechnology Laboratory - Nucleic Acids. 8 Units.
Nucleic acid techniques and recombinant DNA technology. Extraction and purification of nucleic acids, cloning and subcloning, PCR, site-directed mutagenesis, nucleic acid hybridization, additional associated procedures. Students must demonstrate accurate documentation of data (laboratory notebook) detailing experience and results.

Corequisite: MOL BIO 250

Restriction: Graduate students only. Biotechnology Majors only.

MOL BIO 251. Advanced Topics in Biotechnology - Protein Purification and Characterization. 2 Units.
Supplements laboratory curriculum with scientific background behind experimental methods. Format consists of lectures and the presentation and analysis of relevant papers from the scientific literature.

Corequisite: MOL BIO 251L
Prerequisite: MOL BIO 250L and MOL BIO 250. MOL BIO 250L with a grade of B- or better. MOL BIO 250 with a grade of B- or better

Restriction: Graduate students only. Biotechnology Majors only.

MOL BIO 251L. Biotechnology Laboratory - Protein Purification and Characterization. 8 Units.
Major techniques of handling proteins and antibodies. Protein engineering, expression and large-scale purification of recombinant proteins from bacteria, HPLC, antibody purification, western blotting, additional associated procedures. Students must demonstrate accurate documentation of data (laboratory notebook) detailing experience and results.

Corequisite: MOL BIO 251
Prerequisite: MOL BIO 250L and MOL BIO 250. MOL BIO 250L with a grade of B- or better. MOL BIO 250 with a grade of B- or better

Restriction: Graduate students only. Biotechnology Majors only.

MOL BIO 252L. Biotechnology Management Laboratory. 8 Units.
Overview of current methods in biotechnology, designed specifically for biotechnology graduate students. Organized into four distinct sections (nucleic acids, proteins, virology, and immunology). Students must demonstrate accurate documentation of data (laboratory notebooks) detailing experience and results.

Restriction: Graduate students only. Biotechnology Majors only.

MOL BIO 253. Biotech Management . 5 Units.
Taught jointly by Bio Sci and Merage School faculty, the course addresses fundamental aspects within, and associated with, the biotechnology industry. Curriculum is focused largely on management issues, including finance, product development, pharmaceuticals, project management, regulatory affairs, and ethics.

Same as MGMTMBA 293.

Restriction: Graduate students only. Biotechnology Majors only.

MOL BIO 268. Seminar in Systems Microbiology Research. 1 Unit.
A research and journal club seminar that covers topics on bacteria and phage using approaches and principles from biology, engineering, and physics.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Same as PHYSICS 268, ENGRMSE 267.

Restriction: Upper-division students only. Graduate students only.

MOL BIO 270. Science Communication Skills. 2 Units.
Development of effective communication skills, oral and written presentations. Topics range from the art of creating keynote slides to strategically crafting a personal story, culminating in a live presentation to an invited audience.

MOL BIO 291. Graduate School Fundamentals. 2 Units.
Lectures and discussions providing basic skills needed for success in Ph.D. graduate studies. Topics include formulating a hypothesis, experimental design, literature review, grant writing, oral communication, biostatistics, time management, and professional development.

Grading Option: Satisfactory/unsatisfactory only.

Restriction: Graduate students only. Cellular and Molecular Biosci Majors only.

MOL BIO 292A. Scientific Communication. 2 Units.
Small group meetings for graduate students to practice scientific writing, debate, and presentation skills.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

MOL BIO 292B. Scientific Communication. 2 Units.
Small group meetings for graduate students to practice scientific writing, debate, and presentation skills.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

MOL BIO 292C. Scientific Communication. 2 Units.
Small group meetings for graduate students to practice scientific writing, debate, and presentation skills.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

MOL BIO 293A. Cancer Biology Journal Club. 1 Unit.
Focuses on molecular mechanisms that underlie the development and progression of cancers. Covers a variety of cancer-related research areas, such as cell cycle control, apoptosis, DNA repair, metastasis, angiogenesis, and others.

Grading Option: Satisfactory/unsatisfactory only.

Restriction: Graduate students only.

MOL BIO 293B. Cancer Biology Journal Club. 1 Unit.
Focuses on molecular mechanisms that underlie the development and progression of cancers. Covers a variety of cancer-related research areas, such as cell cycle control, apoptosis, DNA repair, metastasis, angiogenesis, and others.

Grading Option: Satisfactory/unsatisfactory only.

Restriction: Graduate students only.

MOL BIO 293C. Cancer Biology Journal Club. 1 Unit.
Focuses on molecular mechanisms that underlie the development and progression of cancers. Covers a variety of cancer-related research areas, such as cell cycle control, apoptosis, DNA repair, metastasis, angiogenesis, and others.

Grading Option: Satisfactory/unsatisfactory only.

Restriction: Graduate students only.

MOL BIO 295. Biomedical Research Methods. 2 Units.
Lectures and interactive discussions of research methods in modern biomedical science. Each week will focus on a different class of techniques, including molecular, biochemical, immunological, genomic, bioinformatics, microscopy, cancer biology, genome editing. One hour per week, grading based on attendance.

Grading Option: Satisfactory/unsatisfactory only.

Restriction: Graduate students only. Cellular and Molecular Biosci Majors only.

MOL BIO 399. University Teaching. 4 Units.
Limited to Teaching Assistants.

Grading Option: Satisfactory/unsatisfactory only.

Restriction: Graduate students only.

Neurobiology and Behavior Courses

NEURBIO 200A. Research in Neurobiology and Behavior. 2-12 Units.
Individual research with Neurobiology and Behavior faculty.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 200B. Research in Neurobiology and Behavior. 2-12 Units.
Individual research with Neurobiology and Behavior faculty.

Prerequisite: NEURBIO 200A. NEURBIO 200A with a grade of B- or better

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 200C. Research in Neurobiology and Behavior. 2-12 Units.
Individual research with Neurobiology and Behavior faculty.

Prerequisite: NEURBIO 200B. NEURBIO 200B with a grade of B- or better

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 201A. Research in Neurobiology and Behavior. 2-12 Units.
Individual research with Neurobiology and Behavior faculty.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 201B. Research in Neurobiology and Behavior. 2-12 Units.
Individual research with Neurobiology and Behavior faculty.

Prerequisite: NEURBIO 201A. NEURBIO 201A with a grade of B- or better

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 201C. Research in Neurobiology and Behavior. 2-12 Units.
Individual research with Neurobiology and Behavior faculty.

Prerequisite: NEURBIO 201B. NEURBIO 201B with a grade of B- or better

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: Unlimited as topics vary.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 202A. Foundations of Neuroscience. 2 Units.
Intended to expose students to critical reading and analysis of the primary neuroscience literature. Instructors from departments associated with the Interdepartmental Neuroscience Program participate and discuss topics of current interest.

Grading Option: Satisfactory/unsatisfactory only.

NEURBIO 202B. Foundations of Neuroscience. 2 Units.
Intended to expose students to critical reading and analysis of the primary neuroscience literature. Instructors from departments associated with the Interdepartmental Neuroscience Program participate and discuss topics of current interest.

Prerequisite: NEURBIO 202A. NEURBIO 202A with a grade of B- or better

Grading Option: Satisfactory/unsatisfactory only.

NEURBIO 206. Molecular Neuroscience. 5 Units.
Surveys molecular and cellular mechanisms involved in neuronal function, including control of gene expression, post-transcriptional and post-translational processing, RNA and protein targeting, cell death mechanisms, and molecular genetic basis of neurological disorders. Overview of the molecular aspects of developmental neurobiology.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 207. Cellular Neuroscience. 5 Units.
Neurophysiological and neurochemical mechanisms of electrical and chemical signaling in neurons. Topics include generation of resting- and action-potentials, voltage- and ligand-gated ion channels, second messenger systems, and synaptic transmission and integration.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 207L. Cellular Neuroscience Laboratory. 2 Units.
Intensive hands-on laboratory experience of contemporary techniques for studying ion channels and synaptic function. Experiments include microelectrode recording, patch clamp, quantal analysis of synaptic transmission, heterologous expression of genes for channels and receptors, brain slice, and fluorescence calcium imaging.

Grading Option: Satisfactory/unsatisfactory only.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 208. Systems Neuroscience. 5 Units.
Study of the mammalian nervous system at the systems level. Anatomy and physiology of sensory, motor, and integrative functions.

Repeatability: May be taken for credit 2 times.

Same as ANATOMY 210A.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 209. Behavioral Neuroscience. 5 Units.
Overview of fundamental conceptual and experimental issues in the neurobiology of learning and memory. The approach is a cross-level integration of research in molecular-genetic, cellular, circuit, systems, and behavioral analyses.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 217. Foundations in Neuroimmunology II. 4 Units.
The immune system supports normal brain development as well as controls central nervous system (CNS) infection, and neurodegenerative and neurological diseases. Assesses how the immune system contributes to both host defense and disease.

Prerequisite: Undergraduate- or graduate-level immunology experience is required.

Restriction: Graduate students only.

Concurrent with BIO SCI N127.

NEURBIO 220. Neural Coding, Computation, and Dynamics. 4 Units.
Theoretical principles and biological mechanisms underlying how brains acquire, assimilate, store, and retrieve information, compute adaptive responses to external inputs, and how knowledge is extracted from experience to generate an internal model of the world.

Prerequisite: At least one upper-division course in the field of Neuroscience or one upper-division course in Cognitive Science or Machine Learning.

Concurrent with BIO SCI N174.

NEURBIO 227. Bioinformatics and Systems Biology. 4 Units.
Students learn the fundamentals of bioinformatics, genomic approaches, and Linux and R program in order to analyze RNA-sequencing data.

Overlaps with ECO EVO 282, ECO EVO 283.

Restriction: Graduate students only.

NEURBIO 228. Psychophysiological Methods in Clinical Research . 4 Units.
Introduces the principal signals of psychophysiology and outlines how measures calculated from these signals can be applied in clinical research and practice.

Prerequisite: One graduate or undergraduate course in statistics.

Restriction: Graduate students only.

NEURBIO 230. Epigenetics in Health and Disease . 4 Units.
Focuses on the role of chromatin/nuclear structure organization (histone and DNA modification, chromatin remodeling, higher order chromatin structure and nuclear organization) on gene regulation, DNA replication and repair, relevant to development, metabolism, learning and memory, and human disease.

Prerequisite: MOL BIO 203 or MOL BIO 204 or NEURBIO 206. MOL BIO 203 with a grade of B- or better. MOL BIO 204 with a grade of B- or better. NEURBIO 206 with a grade of B- or better

Same as BIOCHEM 225.

Restriction: Graduate students only.

NEURBIO 231. Clinical and Epidemiological Aspects of Neurodegenerative Diseases. 4 Units.
Clinical and epidemiological aspects of neurodegenerative disorders causing dementia will be reviewed, including AD, PD, FTD, HD and cerebrovascular disease. Seminar format will include student presentations and group discussion.

Restriction: Graduate students only.

NEURBIO 232. Regenerative Neurobiology. 4 Units.
Surveys the latest research on regenerative neurobiology. Both basic stem cell discoveries and their potential clinical application to brain disorders will be examined.

NEURBIO 233. Neurobiology of Drug Addiction. 4 Units.
Provides a comprehensive overview of topics in the addiction field, including drug pharmacology, models/approaches to investigate addiction, brain circuits, genetics, epigenetics, and the cellular and molecular biology of drug addiction.

Restriction: Graduate students only.

Concurrent with BIO SCI N121.

NEURBIO 236. Cortex: Structure, Function, and Plasticity. 4 Units.
Structured to include lectures and presentation of papers about cortex with emphasis on sensory-motor cortex. Both historical and current perspectives on cortical structure-function relationship will be critically evaluated.

NEURBIO 237. Neurobiology of Aging and Alzheimer's Disease. 4 Units.
Outlines changes occurring in aging and Alzheimer’s disease, and clinical manifestations of those changes. Emphasis on genetic and lifestyle risk factors, molecular mechanisms that are basis for detrimental and protective responses, diagnosis, and developing therapies for aging and Alzheimer's disease.

Prerequisite: NEURBIO 209. NEURBIO 209 with a grade of B- or better

NEURBIO 239. Functional Imaging of the Nervous System. 4 Units.
Overview of technical and applied aspects of imaging techniques available for studying the nervous system. The areas emphasized are cellular and subcellular imaging of neural function, systems-level imaging of brain function, and imaging of the human brain.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 240. Advanced Analysis of Learning and Memory. 4 Units.
Advanced analysis of contemporary research concerning the nature and neurobiological bases of learning and memory. Special emphasis is given to time-dependent processes involved in memory storage.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 247. Programming for Neuroscience Research . 4 Units.
A neuroscience-specific introduction to programming and data analysis using either MATLAB or Scientific PYTHON. Students will learn general programming skills and effective use of programming for data management, statistical analysis, and image analysis.

Overlaps with PSYCH 205A.

NEURBIO 248. Topics in Neurobiology and Behavior. 4 Units.
Studies in selected areas of Neurobiology and Behavior. Topics addressed vary each quarter.

Repeatability: May be taken for credit 3 times.

NEURBIO 249. Electronics for Biologists. 4 Units.
Basic principles of electricity; properties and use of discrete components and integrated circuits; circuit analysis and design. Intended for advanced students in the life sciences.

Same as PHYSIO 205.

NEURBIO 254. Molecular Neurobiology. 4 Units.
The application of genetic and recombinant DNA technology to neurobiology. Topics include the study of neuronal proteins which play important roles in the formation of synapses and synaptic transmission.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 255. Perspectives in Neuroscience: Past, Present, and Future. 4 Units.
An overview of the conceptual and technical foundations of contemporary neuroscience from ancient times to the present. The subjects include synapses, neurons, brain organization, sensory, motor and regulatory systems, learning and memory, human brain function and dysfunction.

Repeatability: May be taken for credit 2 times.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

Concurrent with BIO SCI N119.

NEURBIO 257. Statistics for Neurobiologists. 4 Units.
Introduction to common methods for statistical analysis used in neurobiology. Topics covered include t-tests, ANOVAs, correlations and regressions, general linear model, power analysis, and non-parametric tests.

Restriction: Graduate students only.

NEURBIO 260. Auditory Neuroscience. 4 Units.
Multidisciplinary overview of brain mechanisms of hearing. Emphasizes breadth of auditory function and research: single neurons to psychoacoustics, the chochlea to the cortex, and basic science to clinic.

Concurrent with BIO SCI N147.

NEURBIO 290. Colloquium in Neurobiology and Behavior. 1.3 Unit.
Presentation of contemporary research problems in neurobiology and behavior and related areas by invited speakers.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 291. Neuroscience Journal Club. 1-3 Units.
Covers emerging topics in addiction neuroscience research in a journal club format. Students discuss recent articles and may present an article of their choosing. Students gain skills in critical thinking and scientific communication.

Repeatability: May be taken for credit 6 times as topics vary.

NEURBIO 292. Scientific Proposals for Neuroscience Trainees. 4 Units.
Students learn how to effectively communicate scientific ideas and results. Activities include learning how to effectively write a scientific proposal, how to perform a coherent, persuasive slide presentation, and how to give meaningful, constructive review critiques.

Restriction: Graduate students only. Neurobiology and Behavior Majors only.

NEURBIO 399. University Teaching. 1-4 Units.
Limited to Teaching Assistants.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

Restriction: Graduate students only.