Ecology and evolutionary biology deals with the establishment of adaptations over evolutionary time and with the organismal function in ecological time. Faculty in the Department of Ecology and Evolutionary Biology study questions pertinent at a variety of levels of biological organization, from molecular aspects of evolution, to organismal structure and performance, to the ecology of ocean ecosystems. Research is conducted in both the laboratory and field and includes work on a variety of organisms from phages and bacteria, to higher plants and animals. Primary attention is given to evolutionary, ecological, and functional questions rather than to particular habitats or taxa. Faculty and graduate student research is often collaborative and interdisciplinary in approach. Departmental research activities include physiological ecology energetics, plant-herbivore and plant-pollinator interactions, microbial ecology and coevolution, quantitative genetics, life history evolution, population and reproductive ecology, community ecology and biogeography. These research endeavors provide a balance between empirical and theoretical approaches to evolutionary, organismal, and ecological problems.

The graduate program offers both the Plan I M.S. and the Ph.D. in Biological Sciences.

Students are required to complete a minimum of five core courses during their first six academic quarters. Two of those courses are required graduate-level courses that all students must take:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO EVO 204</td>
<td>Writing Grant Proposals (typically in the second year)</td>
</tr>
<tr>
<td>ECO EVO 207</td>
<td>Quantitative Methods in Ecology and Evolutionary Biology (typically in the first year)</td>
</tr>
</tbody>
</table>

In addition students must take one course each in the areas of Physiology (P), Ecology (EC), and Evolution (EV). Although all three courses can be taken at the graduate level (G), one of the three courses may be taken as an upper-division undergraduate course (U). The list of acceptable courses is currently limited to:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO EVO 208</td>
<td>Ecological and Evolutionary Physiology (GP)</td>
</tr>
<tr>
<td>PHYSIO 206A</td>
<td>Introduction to Medical Physiology (GP)</td>
</tr>
<tr>
<td>PHYSIO 206B</td>
<td>Introduction to Medical Physiology (GP)</td>
</tr>
<tr>
<td>ANATOMY 201</td>
<td>Human Gross Anatomy (GP)</td>
</tr>
<tr>
<td>BIO SCI E109</td>
<td>Human Physiology (UP)</td>
</tr>
<tr>
<td>BIO SCI E127</td>
<td>Physiological Plant Ecology (UP)</td>
</tr>
<tr>
<td>BIO SCI E138</td>
<td>Comparative Animal Physiology (UP)</td>
</tr>
<tr>
<td>BIO SCI E145</td>
<td>Animal Coloration and Vision (UP)</td>
</tr>
<tr>
<td>BIO SCI E170</td>
<td>Mechanical Physiology (UP)</td>
</tr>
<tr>
<td>ECO EVO 205</td>
<td>Special Topics in Ecology (GEC)</td>
</tr>
<tr>
<td>ECO EVO 251</td>
<td>Population Dynamics in Ecology, Epidemiology, and Medicine (GEC)</td>
</tr>
<tr>
<td>BIO SCI E118</td>
<td>Ecosystem Ecology (UEC)</td>
</tr>
<tr>
<td>BIO SCI E151</td>
<td>Population Dynamics in Ecology, Epidemiology, and Medicine (UEC)</td>
</tr>
<tr>
<td>BIO SCI E166L</td>
<td>Field Biology (UEC)</td>
</tr>
<tr>
<td>BIO SCI E186</td>
<td>Population and Community Ecology (UEC)</td>
</tr>
<tr>
<td>ECO EVO 206</td>
<td>Special Topics in Evolution (GEV)</td>
</tr>
<tr>
<td>BIO SCI E135</td>
<td>Molecular Evolution (UEV)</td>
</tr>
<tr>
<td>BIO SCI E137</td>
<td>Genetics of Complex Traits (UEV)</td>
</tr>
<tr>
<td>BIO SCI E153</td>
<td>Functional and Structural Evolutionary Genomics (UEV)</td>
</tr>
<tr>
<td>BIO SCI E154</td>
<td>Genetics and Human History (UEV)</td>
</tr>
<tr>
<td>BIO SCI E168</td>
<td>Evolution (UEV)</td>
</tr>
</tbody>
</table>

If a student wishes to request an exception (an exemption or a substitution), the student must submit a written request justifying the reason to the Graduate Advisor. The Graduate Advisor and the student’s Advisory Committee (or prior to the formation of the Advisory Committee, the Prescription Committee) will decide whether to grant the request.

Students are required to maintain a grade point average of B or greater in the five core courses required for that student. The grade of B- is not considered a passing grade for a graduate student. Students must pass the five core courses by the end of their second academic year. Students failing
to meet this requirement may be asked to leave the program. In the event a student receives an Incomplete in any of the core courses, the deficiency must be cleared by the deadline specified by the Graduate Advisor. Any extensions of this deadline require approval by the Graduate Advisor.

Each entering graduate student chooses a faculty advisor and a three-person advisory committee for guidance, with whom the student meets at least twice each year. A comprehensive proposal is required before the end of the first year for M.S. students and before advancement to candidacy for Ph.D. students. The progress of each student is reviewed by the student’s advisory committee, together with the Graduate Advisor, twice each academic year.

The normative time for completion of the Ph.D. is five years, and the maximum time permitted is seven years. All requirements for the M.S. degree should be completed within two years, with a maximum of three years allowed for completion of the program. Advancement to doctoral candidacy by an oral examination is expected during the third year for students entering with a B.A. or B.S. or during the second year for those entering with an M.A. or M.S.

Applicants for this program should have a solid undergraduate program in biology and ecology, emphasizing both research and fieldwork. In addition, course work in statistics, mathematics, and physical and chemical sciences is expected. All applicants are required to submit GRE scores. The deadline for application is January 1.

Faculty
Nancy M. Aguilar-Roca, Ph.D. University of California, San Diego, Lecturer with Potential Security of Employment of Ecology and Evolutionary Biology
Steven D. Allison, Ph.D. Stanford University, Associate Professor of Ecology and Evolutionary Biology; Earth System Science
Peter R. Atsatt, Ph.D. University of California, Los Angeles, Professor Emeritus of Ecology and Evolutionary Biology
John C. Avise, Ph.D. University of California, Davis, UCI Distinguished Professor of Ecology and Evolutionary Biology
Francisco J. Ayala, Ph.D. Columbia University, Donald Bren Professor and University Professor of Ecology and Evolutionary Biology; Logic and Philosophy of Science
Manny Azizi, Ph.D. University of Massachusetts, Assistant Professor of Ecology and Evolutionary Biology
Alan G. Barbour, M.D. Tufts University, Professor of Microbiology and Molecular Genetics; Ecology and Evolutionary Biology; Medicine
Albert F. Bennett, Ph.D. University of Michigan, Professor Emeritus of Ecology and Evolutionary Biology
Rudi C. Berkelhamer, Ph.D. University of California, Berkeley, Senior Lecturer of Ecology and Evolutionary Biology
Peter A. Bowler, Ph.D. University of California, Irvine, Senior Lecturer of Ecology and Evolutionary Biology
Matthew E. Bracken, Ph.D. Oregon State University, Associate Professor of Ecology and Evolutionary Biology
Timothy J. Bradley, Ph.D. University of British Columbia, Professor of Ecology and Evolutionary Biology
Adriana D. Briscoe, Ph.D. Harvard University, Professor of Ecology and Evolutionary Biology
Nancy T. Burley, Ph.D. University of Texas at Austin, Professor of Ecology and Evolutionary Biology
Robin M. Bush, Ph.D. University of Michigan, Associate Professor of Ecology and Evolutionary Biology
Diane R. Campbell, Ph.D. Duke University, Professor of Ecology and Evolutionary Biology
F. Lynn Carpenter, Ph.D. University of California, Berkeley, Professor Emerita of Ecology and Evolutionary Biology
Michael T. Clegg, Ph.D. University of California, Davis, Donald Bren Professor and Professor of Ecology and Evolutionary Biology
James J. Emerson, Ph.D. University of Chicago, Assistant Professor of Ecology and Evolutionary Biology
Steven A. Frank, Ph.D. University of Michigan, Professor of Ecology and Evolutionary Biology; Logic and Philosophy of Science
Brandon S. Gaut, Ph.D. University of California, Riverside, Professor of Ecology and Evolutionary Biology
Donovan German, Ph.D. University of Florida, Assistant Professor of Ecology and Evolutionary Biology
Michael L. Goulden, Ph.D. Stanford University, Department Vice Chair and Professor of Earth System Science; Ecology and Evolutionary Biology
Bradford A. Hawkins, Ph.D. University of California, Riverside, Professor of Ecology and Evolutionary Biology
James W. Hicks, Ph.D. University of New Mexico, Professor of Ecology and Evolutionary Biology
Bradley S. Hughes, Ph.D. University of California, Irvine, *Lecturer with Security of Employment of Ecology and Evolutionary Biology; Education*

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

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

Mahtab F. Jafari, Ph.D. University of California, San Francisco, *Vice Chair of the Undergraduate Program in Pharmaceutical Sciences and Associate Professor of Pharmaceutical Sciences; Ecology and Evolutionary Biology; Pharmacology*

Keith E. Justice, Ph.D. University of Arizona, *Professor Emeritus of Ecology and Evolutionary Biology*

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

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

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

Catherine Loudon, Ph.D. Duke University, *Senior Lecturer of Ecology and Evolutionary Biology*

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

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

Jennifer Martiny, Ph.D. Stanford University, *Professor of Ecology and Evolutionary Biology*

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

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

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)

Jessica Pratt, Ph.D. University of California, Irvine, *Lecturer with Potential Security of Employment of Ecology and Evolutionary Biology*

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

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

Sergio Rasmann, Ph.D. U of Neuchatel, *Assistant Professor of Ecology and Evolutionary Biology*

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

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

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

Richard Symanski, Ph.D. Syracuse University, *Senior Lecturer of Ecology and Evolutionary Biology*

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

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

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

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

Dominik Franz X. Wodarz, Ph.D. Oxford University, *Professor of Ecology and Evolutionary Biology; Mathematics* (mathematical biology, infectious disease and cancer)

Guiyun Yan, Ph.D. University of Vermont, *Professor of Program in Public Health; Ecology and Evolutionary Biology; Program in Public Health*
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 218. Advanced Topics in Evolutionary Biology. 4 Units.
Content and instructor will vary from quarter to quarter. Possible topics include quantitative genetics, experimental methods of evolutionary studies, mathematical modeling in evolutionary studies, and the evolution of genetic systems.

Repeatability: May be repeated for credit unlimited times.

ECO EVO 219. Advanced Topics in Ecological Genetics. 4 Units.
Content and instructor will vary from year to year. Possible topics include coevolution, sex-ratio evolution, evolution senescence, plant population biology, and density-dependent selection.

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 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 228. Seminar in Conservation Biology. 2 Units.
Devoted to the application of basic ecological principles to the understanding and resolution of environmental problems of both local and global natures. Current problems approached through a combination of readings, group discussions, and visiting speakers.

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 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: Biological Sciences graduate students only.

ECO EVO 236. 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 251. Population Dynamics in Ecology, Epidemiology, and 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.

Restriction: Graduate students only.

Concurrent with BIO SCI E151.

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 272. Plant Diversity in a Changing World. 4 Units.
Investigation of plant diversity in California and throughout the world, including basic systematic concepts, introduction to major groups of flowering plants, and the effects of global biological change on plant diversity. Students carry out a phylogenetic analysis using appropriate software.

Concurrent with BIO SCI E172.

ECO EVO 273. Plant Systematics Laboratory. 4 Units.
Diversity of flowering plants is investigated in the laboratory and field. Familiarity with flowering plant families, particularly those prominent in the California flora, is emphasized.

Concurrent with BIO SCI E172L.

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 299. Independent Study. 1-4 Units.
Individual research or investigation under the direction of an individual faculty.

Grading Option: Satisfactory/unsatisfactory only.
ECO EVO 323. Curriculum and Methods for Elementary School Science. 4 Units.
Prospective elementary teachers learn how to teach science in grades K-8. Covers States science requirements, a variety of teaching methods, criteria for selecting science curriculum materials, and how to plan science lessons, units, experiments, projects, and demonstrations.

Same as EDUC 323.

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: Teacher Credential Program students only.

ECO EVO 344. Applied Instructional Strategies in Secondary School Sciences. 4 Units.
Application of pedagogy and research to practice science teaching experiences in the secondary schools. A continuation of the Education 340 series with an emphasis on the needs of students with culturally diverse backgrounds.

Repeatability: May be taken for credit 2 times.

Same as EDUC 344.

Restriction: Teacher Credential Program students only.

ECO EVO 398. Teaching Assistant Seminar. 2 Units.
Readings, lectures, workshops, and student presentations designed to help develop teaching skills of graduate students teaching university-level biology classes. Topics vary and may include: course organization, presentation styles, exam design, grading, motivating students, and commonly encountered problems.

Repeatability: May be repeated for credit unlimited times.

ECO EVO 399. University Teaching. 4 Units.
Limited to Teaching Assistants.

Repeatability: May be repeated for credit unlimited times.