

**Professors**

Richard A. Cardullo, Ph.D.  
Mark A. Chappell, Ph.D.  
Theodore Garland, Jr., Ph.D. *Distinguished Professor*  
Kimberly A. Hammond, Ph.D.  
Morris F. Maduro, Ph.D.  
Dmitri Maslov, Ph.D.  
Leonard P. Nunney, Ph.D.  
Helen M. Regan, Ph.D.  
David N. Reznick, Ph.D. *Distinguished Professor*  
Derek A. Roff, Ph.D.  
Wendy G. Saltzman, Ph.D.  
Mark S. Springer, Ph.D.

**Professors Emeriti**

Michael F. Allen, Ph.D.  
Carlton R. Bovell, Ph.D.  
Daphne Fairbairn, Ph.D.  
Roger D. Farley, Ph.D.  
Leah T. Haimo, Ph.D.  
Bradley C. Hyman, Ph.D.  
Edward G. Platzer, Ph.D. (Biology/Nematology)  
Mary V. Price, Ph.D.  
John T. Rotenberry, Ph.D.  
Clay A. Sassaman, Ph.D.  
Irwin W. Sherman, Ph.D.  
Nickolas M. Waser, Ph.D.

**Associate Professors**

Kurt Anderson, Ph.D.  
Timothy E. Higham, Ph.D.  
Joel L. Sachs, Ph.D.

**Assistant Professors**

Alan Brelsford, Ph.D.  
Christopher Clark, Ph.D.  
Nicole Rafferty, Ph.D.  
Marko Spasojevic, Ph.D.

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**Adjunct Faculty**

John Gatesy, Ph.D.  
Cheryl Y. Hayashi, Ph.D.  
Marlene Zuk, Ph.D.

**Lecturer**

Tracy L. Kahn, Ph.D.

**Cooperating Faculty**

Edith B. Allen, Ph.D. (Botany and Plant Sciences)  
Emma Aronson, Ph.D. (Plant Pathology & Microbiology)  
Matthew Daugherty, Ph.D. (Entomology)  
Jeff Diez, Ph.D. (Botany and Plant Sciences)  
Mary L. Droser, Ph.D. (Earth Sciences)  
Norman C. Ellstrand, Ph.D. (Botany and Plant Sciences)  
Marilyn Fogel, Ph.D. (Earth Sciences)  
J. Daniel Hare, Ph.D. (Entomology)  
John M. Heraty, Ph.D. (Entomology)  
Nigel C. Hughes, Ph.D. (Earth Sciences)  
Darrel Jenerette, Ph.D. (Botany and Plant Sciences)  
Amy Litt, Ph.D. (Botany and Plant Sciences)  
Timothy D. Paine, Ph.D. (Entomology)  
Erin Rankin, Ph.D. (Entomology)  
Khaleel A. Razak, Ph.D. (Psychology)  
Richard A. Redak, Ph.D. (Entomology)  
Louis Santiago, Ph.D. (Botany and Plant Sciences)  
Jason Stajich, Ph.D. (Plant Pathology & Microbiology)  
William E. Walton, Ph.D. (Entomology)  
Emma Wilson, Ph.D. (Plant Pathology & Microbiology)  
Hollis Woodard, Ph.D. (Entomology)

## Biology

**Subject abbreviation: BIOL**  
**College of Natural and Agricultural Sciences**

Helen Regan, Ph.D., Department Chair  
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Psychology Bldg.  
(951) 827-5903; [biology.ucr.edu](http://biology.ucr.edu)

## Major

The Department of Evolution, Ecology, and Organismal Biology offers B.A. and B.S. degrees in Biology. Both programs are based on the conviction that broad undergraduate training in biology, mathematics and the physical sciences, together with study in the humanities and social sciences, are fundamental to the education of a biologist. In addition to English composition, humanities,

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social sciences and the Life Sciences core curriculum (see below, Major Requirements), both degrees require 36 units of upper-division (numbered 100-199) biology courses. The degrees differ in the humanities and social sciences requirements; also 16 units of a foreign language are required for the B.A., whereas the B.S. requires 16 additional units in substantive courses in biology or related fields.

The research and teaching of the Department of Evolution, Ecology, and Organismal Biology includes different levels (e.g., molecules, cells, organisms, populations, communities) and processes (e.g., development, evolution) of biological organization. An overview is presented in the introductory courses (BIOL 005A, BIOL 05LA, BIOL 005B, and BIOL 005C), and emphasis is placed on the unifying principles of the discipline.

Because of the diversity within biology and the wide range of career options, much latitude is allowed in selecting upper-division biology courses for the 36 units required for the major. Each student can select courses and plan a program of study to meet her/his specific interests and career goals. For assistance with this, academic advisors are available in the CNAS Academic Advising Center (1223 Pierce Hall, (951) 827-7294). The section below, Programs of Specialization, is provided as a guide for course selection for graduate schools, medical and health science professional schools and the broad range of careers that are possible with the Biology major.

The 36 upper-division units are selected from a list which includes courses offered by the Department of Evolution, Ecology, and Organismal Biology (BIOL 100-199) and a limited number of courses in Biochemistry (BCH), and Cell Biology and Neuroscience (CBNS). Qualified undergraduates (GPA 3.0 or above) may participate in graduate-level biology seminar courses with consent of the instructor, and up to 4 units (with letter grade) may be included in the major.

Those who choose to obtain a B.S. degree have as a college requirement an additional 16 units in upper-division biology courses and/or substantive courses in a field or fields related to the major. The purpose of this related area is to add strength and breadth to the major and to meet specific requirements for postgraduate study or a chosen career. The substantive courses in fields related to the major may be lower or upper division, but they usually have science or mathematics prerequisites (e.g., CBNS 120/PSYC 120, CHEM 005, STAT 100A, STAT 100B, MATH 009C).

**The Thomas Haider Program at the UCR School of Medicine** Students in the Biology major and all others at UCR are eligible to complete admission requirements and apply for up to 24 positions reserved for UCR students in the UCR School of Medicine. Students eligible to apply to this unique pathway into the UCR medical school, called the Thomas Haider Program at the UCR School of Medicine, are those who attend UCR for at least six consecutive quarters and complete their bachelor's degree at UCR. Information on this program and general admission to the UCR medical school

is provided at [medschool.ucr.edu](http://medschool.ucr.edu), in the school's section of this catalog, in the medical school Student Affairs Office (1682A School of Medicine Education Building, (951) 827-4334), and at orientation meetings held at UCR.

## University Requirements

See Undergraduate Studies section.

## College Requirements

See College of Natural and Agricultural Sciences, Colleges and Programs section.

## Major Requirements

Some of the following requirements for the major in Biology may also fulfill the College's breadth requirements. Consult with an academic advisor for course planning.

1. Life Sciences core curriculum (68-72 units)
  - a) BIOL 005A, BIOL 05LA or BIOL 020, BIOL 005B, BIOL 005C
  - b) CHEM 001A, CHEM 001B, CHEM 001C, CHEM 01LA, CHEM 01LB, CHEM 01LC
  - c) CHEM 008A and 08LA or CHEM 08HA and CHEM 8HLA, CHEM 008B and CHEM 08LB or CHEM 08HB and CHEM 8HLB, CHEM 008C and CHEM 08LC or CHEM 08HC and CHEM 8HLC
  - d) MATH 007A or MATH 009A, MATH 007B or MATH 009B
  - e) PHYS 002A, PHYS 002B, PHYS 002C, PHYS 02LA, PHYS 02LB, PHYS 02LC
  - f) STAT 100A
  - g) BCH 100 or BCH 110A

The core curriculum must be completed with a grade point average of 2.0 or better and no grade lower than "C-." If a grade of D or F is received in two core curriculum courses, either in separate courses or repetitions of the same course, the student will not be permitted to continue in the major.

2. Upper-division requirements (36 units)

- a) BIOL 102
- b) Thirty-two (32) additional Biology units to be taken in consultation with a faculty advisor

3. Other requirements

**For the Bachelor of Arts only** (0-16 units): The foreign language requirement may be fulfilled by completing level four or the demonstration of equivalent proficiency in one foreign language.

**For the Bachelor of Science only** (16 units): An additional 16 units in upper-division biology courses and/or substantive courses in a field or fields related to the major. A list of acceptable courses is available in the CNAS Academic Advising Center.

## Programs of Specialization

The Life Sciences core curriculum (item 1 above) fulfills many of the requirements for admission to graduate schools in biology or professional schools in the medical and health

science fields. In addition to Introductory Genetics (BIOL 102, 4 units), a wide choice is available for the remaining 32 upper-division units required for the Biology major (item 2.b) above) and the 16 additional units related to the field of the major (B.S. degree, item 3 above). Each student selects upper-division and related courses depending on the type of school and career chosen (e.g., education, medicine, pharmacy, dentistry, optometry, veterinary medicine, nursing, physical therapy, public health, graduate school in one of the fields below).

In planning an academic program to prepare for teaching or one of the medical fields, present and prospective Biology majors are referred to relevant topics in the Biological Sciences section of this catalog. That section has information for those planning to attend graduate school in education to obtain a teaching credential (subsection, Teaching Credential) and/or a master's or Ph.D. degree in education (subsection, Preparation for Graduate School). Also included are guidelines to help students select courses to prepare for admission to professional schools in the medical field (subsections, Medical Biology, Suggestions for Elective Units for Medical/Health Professions, Admission Requirements for Medical and Health Professional Schools). Additional information about required course work and admission tests (MCAT, OAT, VCAT, PCAT, GRE) can be obtained from (Veitch Student Center) and the Health Professions Advising Center (visit 1114 Pierce Hall or [hpac.ucr.edu](http://hpac.ucr.edu)).

Suggested courses of study are provided below for those interested in various biological fields. These programs meet most of the requirements for admission to corresponding graduate schools for those students who wish to pursue a master's and/or Ph.D. degree. The faculty advisor assists in selecting combinations of courses appropriate for advanced study in the fields below and others. Students considering graduate study are encouraged to do undergraduate research and take courses in computer science and statistics.

In some cases, a course of study differing substantially from the examples given below will best meet the needs of the student. In consultation with a faculty advisor, a student may prepare a program in some other biological specialization such as animal behavior, evolution/development or developmental biology.

**Cell and Molecular Biology** BIOL 102, BIOL 105, BIOL 107A, BIOL 107B, BIOL 109 or BIOL 153/BCH 153/BPSC 153, CBNS 101 or BIOL 113 and BIOL 114, BIOL 119, BIOL 121/MCBL 121, BIOL 121L/MCBL 121L, BIOL 122/MCBL 122, BIOL 123/MCBL 123/PLPA 123, BIOL 124/MCBL 124, BIOL 128/CBNS 128, BIOL 155/BPSC 155, BIOL 168, BCH 100 or the BCH 110A, BCH 110B, and BCH 110C sequence, BCH 102, CBNS 108, CBNS 150/ENTX 150, CHEM 005, CHEM 109, STAT 100A and STAT 100B

**Ecology and Population Biology** BIOL 102, BIOL 104/BPSC 104, BIOL 105, BIOL 108, BIOL 116, BIOL 116L, BIOL 117, BIOL 160, BIOL 160L, BIOL 174, either BIOL 175 or BIOL 143/BPSC 143, the MATH 007A or

MATH 009A, MATH 007B or MATH 009B, and MATH 009C sequence, STAT 100A and STAT 100B.

Also recommended: BIOL 151, BIOL 161A, BIOL 163, BPSC 146, MATH 046, BIOL 165/BPSC 165, BIOL 166

**Molecular Genetics** BIOL 102, BIOL 105, BIOL 107A, BIOL 107B, BIOL 108, BIOL 109 or BIOL 153/BCH 153/BPSC 153, BIOL 115, BIOL 121/MCBL 121, BIOL 121L/MCBL 121L, BIOL 122/MCBL 122, BIOL 123/MCBL 123/PLPA 123, BIOL 128/CBNS 128, BIOL 155/BPSC 155, BIOL 168, CBNS 108, CBNS 150/ENTX 150, CBNS 169

**Zoology and Physiology** BIOL 100/ENTM 100, BIOL 102, BIOL 105, CBNS 101 or BIOL 113 and BIOL 114, BIOL 151, BIOL 152/GEO 152, BIOL 157, BIOL 159, BIOL 160, BIOL 160L, BIOL 161A, BIOL 161B, BIOL 162/ENTM 162, BIOL 168, BIOL 171, BIOL 171L, BIOL 173/ENTM 173, BIOL 174, BIOL 175, BIOL 178, BCH 100, CBNS 106, CBNS 108, CBNS 116, CBNS 169. Students are also encouraged to take laboratory courses (e.g., BCH 102). Also recommended: a course in ecology (e.g., BIOL 116, BIOL 116L), STAT 100A and STAT 100B

**California Teach-Science/Mathematics Initiative (CaTEACH-SMI)** California Teach-Science Mathematics Initiative (CaTEACH-SMI) has a goal of addressing the critical need of highly qualified K-12 science and mathematics teachers in California. With an economy increasingly reliant on science, technology, engineering, and mathematics (STEM) and the anticipated large scale retirement of qualified teachers, this is an essential time to explore and prepare for a career in teaching science or mathematics.

CaTEACH-SMI at UCR offers undergraduate students paid/unpaid opportunities, such as the SMI & Alpha Center Apprentice Programs, to explore STEM teaching as a career option. Through CaTEACH-SMI, students receive advising and mentoring to prepare for entrance into an intern teaching credential program while diligently coordinating with academic advisors to ensure completion of STEM degree requirements. The CaTEACH-SMI Resource Center provides future STEM teachers with material and financial resources which includes the National Science Foundation (NSF) Noyce Scholarship Program to promote planning and professional development towards a science/mathematics education career.

For more information about the CaTEACH-SMI program, please visit [smi.ucr.edu](http://smi.ucr.edu), the Resource Center at 1315 Pierce Hall, or on Facebook at [facebook.com/ScienceMathInitiativeAtUcr](https://www.facebook.com/ScienceMathInitiativeAtUcr).

## Additional Curricular and Advising Information

This catalog has sections applicable for all students at UCR (Finances and Registration, Academic Regulations), and a specific section for students in this college (College of Natural and Agricultural Sciences). Present and prospective students are referred to those sections for enrollment policies and procedures and curricular and advising information for the

campus and college.

For Biology majors, information regarding the following topics can be obtained from the CNAS Undergraduate Academic Advising Center in 1223 Pierce Hall:

Student Academic Advising

Grading Basis: Letter Grade or S/NC

Full or Part-time Study

Transfer Students

Minor

Double Major

Internships

Preparation for Graduate School

Education and Research Centers, Institutes and Resources

## Independent Study and Research

The Department of Evolution, Ecology, and Organismal Biology offers courses in which students can enroll to do independent laboratory research or an in-depth library study of a topic of special interest.

Students desiring to do Independent Reading (BIOL 194), Introduction to Research (BIOL 197) or Junior/Senior Research (BIOL 199) should consult with a professor who is willing to supervise the project. The student may suggest a specific question or formulate a project after consultation with the instructor. Information about the research fields of the professors is available on the Department of Evolution, Ecology, and Organismal Biology website.

To enroll in these Independent Study and Research courses students should first contact the associated instructor for approval and proceed with enrolling through the CNAS Enrollment Management Center, preferably before the first day of instruction but no later than the end of the second week of the quarter.

Applicants for BIOL 194 and BIOL 199 should ordinarily be juniors or seniors with a GPA of 3.00 or higher. Sophomore students with a GPA of 3.00 or higher may apply to enroll in BIOL 197 (Introduction to Research), since the purpose of this course is to enable the student to do preliminary reading and laboratory research to explore with the professor the feasibility of undertaking a project for later enrollment in BIOL 199. Enrollment in BIOL 197 is not required before enrollment in BIOL 199, but the former course is available for those situations where preliminary work will be helpful.

For BIOL 194 and BIOL 199, the student writes a report of the library study or laboratory results for the quarter, which is reviewed by the sponsoring professor and submitted to the CNAS Academic Advising Center by the last day of instruction of the quarter.

BIOL 194, BIOL 197, and BIOL 199 are graded "S/NC", and up to 9 units of credit may be counted as part of the 16 substantive units related to the major for the B.S. degree.

## Natural Reserve System

This system was formed by the UC in 1965 to preserve for study a series of undisturbed natural areas representing the state's vast ecological diversity. Since then the system has grown to include thirty-seven reserves, eight of them administered by the UCR campus. See Research Opportunities in this catalog.

Most of the reserves are undeveloped except for fencing, roads and trails, but laboratory facilities, housing and campgrounds for class use are available at some sites. The reserves are used as outdoor classrooms and laboratories by students, teachers and researchers from educational institutions, public and private, throughout the state, across the nation and around the world. Some of the courses offered by the UCR Department of Evolution, Ecology, and Organismal Biology include field trips and overnight camping trips to the reserves. In the field, students are introduced to the great diversity of plant and animal organisms in Southern California, and to the effect of environmental factors on this diversity.

Undergraduate and graduate students who wish to use the reserves in their individual research projects should contact Dr. Kim Hammond, Department of Evolution, Ecology, and Organismal Biology, 3318 Spieth Hall, (951) 827-4767, to obtain an application, map and list of rules and regulations.

## Graduate Program

The Department of Evolution, Ecology, and Organismal Biology administers programs leading to the M.S. and Ph.D. degrees in Evolution, Ecology, and Organismal Biology, with specializations in Evolutionary Biology, Ecology, and Physiology and Biophysics.

**Admission** Applicants are strongly advised to contact potential faculty advisor prior to applying to the program. Applicants must submit GRE scores for the General Test (verbal, quantitative, and analytical). In addition, submission of the Subject Test score may improve chances of admission and is recommended.

All graduate students entering the department meet with a guidance committee during the first quarter of enrollment so that their educational background can be addressed. Considering the requirements of the student's specialization, the committee recommends a program of study to be followed in pursuit of graduate work. Because of the diversity among the specializations, course requirements for advanced degrees are specified by the student's guidance committee.

## Doctoral Degree

The Department of Evolution, Ecology, and Organismal Biology offers the Ph.D. degree in Evolution, Ecology, and Organismal Biology. In addition to the general requirements of the Graduate Division, students intending to become candidates for the Ph.D. degree in Evolution, Ecology, and Organismal Biology must complete the following.

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**Course Work** Course requirements are determined in consideration of the requirements of the student's area of specialization. Selection of specific courses is done by the guidance committee in consultation with the student.

All students are required to take EEOB 400, at least one of EEOB 210, EEOB 216 or EEOB 217 and at least one other four-unit graduate level course from an approved list. Students also are required to take two current research topics courses (BIOL 252 or another disciplinary colloquium and EEOB 265) for a minimum of 5 quarters prior to advancement to candidacy and 12 quarters prior to completion of the doctoral degree.

**Professional Development** One unit of coursework in professional development, which is satisfied by EEOB 400.

### **Written and Oral Qualifying Examinations**

Students must pass a written examination in their specialized field of interest not later than the end of the second year of residence. Written Qualifying Examinations must be completed by the eighth week of the sixth quarter in residence. Upon successful completion of the Written Qualifying Examination, an Oral Qualifying Examination is administered wherein students defend a proposal detailing the rationale, specific aims, and approaches to be undertaken for their proposed dissertation research.

**Dissertation** Candidates may be required to successfully defend their dissertation research in a public oral presentation.

**Teaching Requirement** Students must have at least one year of approved teaching experience.

**Normative Time to Degree** 18 quarters

## **Master's Degree**

The Department of Evolution, Ecology, and Organismal Biology offers the M.S. degree in Evolution, Ecology, and Organismal Biology, with specializations in Evolutionary Biology, Ecology, and Physiology & Biophysics. To qualify for the M.S. degree in Evolution, Ecology, and Organismal Biology, candidates must meet the requirements of the Department of Evolution, Ecology, and Organismal Biology.

These requirements are as follows:

**Plan I (Thesis)** Thirty-six (36) quarter units of approved courses in the 100 or 200 series, of which at least 24 units must be in the 200 series courses in the biological sciences. Not more than 12 units of EEOB 299 may be applied to the degree. A minimum of 12 units of course work other than courses in the 290 series must be completed in fulfillment of the requirement for 24 units of graduate courses. Students must present an acceptable thesis and undergo a final oral examination in defense of the thesis.