The Biology Department and degree programs
(from the 2016 UCR General Catalog)

Biology
Subject abbreviation: BIOL
College of Natural and Agricultural Sciences

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Morris F. Maduro, Ph.D.
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Mary L. Droser, Ph.D (Earth Sciences)
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Major

The Department of 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, 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 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 05LB, 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 Biology (BIOL 100-199) and a limited number of courses in Biochemistry (BCH), and Cell Biology and Neurosciences (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, 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, BIOL 05LB, BIOL 005C
   b) CHEM 001A, CHEM 001B, CHEM 001C, CHEM 01LA, CHEM 01LB, CHEM 01LC
   c) CHEM 12A, CHEM 12B, CHEM 12C
   d) MATH 009A, 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 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 sciences. 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 Career Services (Veltch Student Center) and the Health Professions Advising Center (visit 1114 Pierce Hall or 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.
For more information about the CaTEACH-SMI program, please visit smi.ucr.edu, the Resource Center at 1315 Pierce Hall, or on Facebook at 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 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 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 of the quarter. Applicants for BIOL 194 and 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 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 of the quarter. Applicants for BIOL 194 and 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 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 of the quarter. Applicants for BIOL 194 and 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 Biology website.

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 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 Biology, 3318 Spieth Hall, (951) 827-4767, to obtain an application, map and list of rules and regulations.

Graduate Program

The Department of 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 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.

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 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 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.

Lower-Division Courses

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
<th>Description</th>
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<tbody>
<tr>
<td>BIOL 002</td>
<td>Cellular Basis of Life (4)</td>
<td>3 hours</td>
<td>Laboratory, 3 hours. Prerequisite(s): none. An introduction to the fundamentals of life processes at the cellular level. Topics include cell structure, chemical composition, metabolism, reproduction, genetics, and development with emphasis on humans. Not recommended for natural science majors. Either BIOL 002 or BIOL 003 may be taken as a breadth requirement in biology; together they provide a general introduction to the field of biology. Credit is not awarded for BIOL 002 if it has already been awarded for BIOL 005A, BIOL 05LA or BIOL 020.</td>
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<tr>
<td>BIOL 003</td>
<td>Organisms in Their Environment (4)</td>
<td>3 hours</td>
<td>Laboratory, 3 hours. Prerequisite(s): none. An introduction to the physiology, ecology, and evolution of living organisms with emphasis on humans. Not recommended for natural science majors. Either BIOL 002 or BIOL 003 may be taken as a breadth requirement in biology; together they provide a general introduction to the field of biology. Credit is not awarded for both BIOL 003 and BIOL 005B.</td>
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<tr>
<td>BIOL 005A</td>
<td>Introduction to Cell and Molecular Biology (4)</td>
<td>3 hours</td>
<td>Discussion, 1 hour. Prerequisite(s): BIOL 05LA (may be taken concurrently) or BIOL 020 (may be taken concurrently) with grades of “C-” or better; CHEM 01LA and CHEM 01LA with grades of “C-” or better or CHEM 01HA and CHEM 1HHA with grades of “C-” or better, consent of instructor is required for students repeating the course. An intensive course designed to prepare for upper-division courses in cell and molecular biology. Covers biochemical, structural, metabolic, and genetic aspects of cells. Required for Biology majors; recommended for science majors desiring an introduction to biology. Credit is not awarded for BIOL 005A if it has already been awarded for BIOL 002.</td>
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<tr>
<td>BIOL 005B</td>
<td>Introduction to Organismal Biology (4)</td>
<td>3 hours</td>
<td>Laboratory, 3 hours. Prerequisite(s): BIOL 005A and BIOL 05LA or BIOL 020 with grades of “C-” or better, CHEM 01HA or CHEM 01HA, CHEM 01LB or CHEM 01HB; consent of instructor is required for students repeating the course. An intensive course designed to prepare for upper-division courses in organismal biology. Covers developmental biology, physiology, and regulation at the level of the organism. Required for Biology majors; recommended for science majors desiring an introduction to biology. Credit is awarded for only one of BIOL 003 or BIOL 005B.</td>
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<tr>
<td>BIOL 005C</td>
<td>Introductory Evolution and Ecology (4)</td>
<td>3 hours</td>
<td>Laboratory, 3 hours. Prerequisite(s): BIOL 005A, BIOL 020 or BIOL 05LA, and BIOL 005B (or BIOL 002 and BIOL 003 for non-Biology majors) with grades of “C-” or better; MATH 009A with a grade of “C-” or better or equivalent; consent of instructor is required for students repeating the course. An intensive introduction to the subjects of evolution and ecology. Covers population dynamics, community ecology, population genetics, and evolutionary theory. Recommended for science majors desiring an introduction to biology. Students who take equivalent first-year biology at another institution may enter directly into BIOL 005C with critical handicap.</td>
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<tr>
<td>BIOL 010</td>
<td>Headlines in the History of Life (4)</td>
<td>3 hours</td>
<td>Laboratory, 3 hours. Prerequisite(s): none. Evolution of life beginning with precellular life. Topics include the origin of sex; multicellularity; vertebrate classes; morphological speciations; adaptive radiations; extinction dynamics; and the biology of dinosaurs. Cross-listed with GEO 003.</td>
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<tr>
<td>BIOL 020</td>
<td>Dynamic Genome (2)</td>
<td>Laboratory, 6 hours. Prerequisite(s): CHEM 001A or CHEM 01HA; MATH 009A (may be taken concurrently); freshman standing. Introduces computational and experimental approaches in investigating the genomes of plants and animals. Explores scientific discovery using the tools of bioinformatics and genomics. Includes participation in research projects being conducted on campus. Credit is not awarded for BIOL 020 if it has already been awarded for BIOL 002 or BIOL 05LA.</td>
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<tr>
<td>BIOL 030</td>
<td>Human Reproduction and Sexual Behavior (4)</td>
<td>3 hours, discussion, 1 hour. Prerequisite(s): none. A consideration of human anatomy, physiology and behavior as related to sexual reproduction, including discussion of fertility, pregnancy, childbirth and birth control. Consideration will also be given to homosexuality, venereal diseases, sex education, sexual intercourse and response.</td>
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<tr>
<td>BIOL 034</td>
<td>Human Heredity and Evolution (4)</td>
<td>3 hours</td>
<td>Discussion and problem solving, 1 hour; audio-visual aids plus discussion, 1 hour. Basic human genetics and evolution, emphasizing their relationship to physical and emotional health. Political, philosophical and ethical implications of human heredity and evolution.</td>
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<tr>
<td>BIOL 040</td>
<td>Disease and History: From the Bubonic Plague to AIDS (4)</td>
<td>3 hours</td>
<td>Discussion, 1 hour. Prerequisite(s): none. This lecture course for non-science majors will deal with the natural history of infectious diseases and how plagues have influenced the course of human history. It will cover the biology, pathology, epidemiology, and immunology of viruses, bacteria, and protozoan parasites causing smallpox, yellow fever, influenza, AIDS, syphilis, bubonic plague, tuberculosis, leprosy, malaria, and African sleeping sickness. The role of scientific inquiry in the conquest of human diseases will be emphasized.</td>
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<tr>
<td>BIOL 05LA</td>
<td>Introduction to Cell and Molecular Biology Laboratory (1)</td>
<td>Laboratory, 3 hours. Prerequisite(s): BIOL 005A (may be taken concurrently); consent of instructor is required for students repeating the course. An introduction to laboratory exercises on fundamental principles of and techniques in cell and molecular biology. Illustrates the experimental foundations of the topics covered in BIOL 005A. Credit is not awarded for BIOL 05LA if it has already been awarded for BIOL 002 or BIOL 020.</td>
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Upper-Division Courses

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<tr>
<td>BIOL 100</td>
<td>General Entomology (4)</td>
<td>3 hours</td>
<td>Laboratory, 3 hours. Prerequisite(s): BIOL 005B, BIOL 005C, or equivalents; or consent of instructor. Introductory study of insects, Earth’s most diverse group of animals (75 percent of animal species are insects). Lectures cover the anatomy, physiology, ecology, behavior, and diversity of insects. Laboratory focuses on insect identification. Cross-listed with ENTM 100.</td>
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<tr>
<td>BIOL 102</td>
<td>Introductory Genetics (4)</td>
<td>3 hours</td>
<td>Discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 020 or BIOL 05LA, and BIOL 005B with grades of “C-” or better. An introductory course that includes classical Mendelian genetics, linkage and recombination, sex-linked traits, cytogenetics, developmental genetics, and molecular genetics. Also includes some probability theory and statistics.</td>
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<tr>
<td>BIOL 104</td>
<td>Foundations of Plant Biology (4)</td>
<td>3 hours</td>
<td>Laboratory, 3 hours. Prerequisite(s): BIOL 005C. A study of the plant world from cells to ecosystems. Examines the structure and function of organisms from the major plant groups and their role in the biosphere. The laboratory explores the unique properties of plants. Cross-listed with BPSC 104.</td>
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<tr>
<td>BIOL 105</td>
<td>Evolution (4)</td>
<td>3 hours, discussion, 1 hour. Prerequisite(s): BIOL 005C with a grade of “C-” or better, BIOL 102, CHEM 12C or CHEM 12HC, MATH 009B or MATH 010B, PHYS 020C, PHYS 02LC, BCH 100 or BCH 110A, one course in statistics; or consent of instructor. Covers the causal interpretation of organic diversity and adaptation. Topics include inference of evolutionary change from the fossil record and from genomic and molecular patterns; microevolution and macroevolution; systematics and the species problem; and natural selection, drift, and other forces of evolution.</td>
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BIOI 105V Evolution Online (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C with a grade of "C-" or better; BIOL 102 with a grade of "D-" or better; CHEM 112C with a grade of "D-" or better. MATH 009B with a grade of "D-" or better; PHYS 002C with a grade of "D-" or better; PHYS 02LC with a grade of "D-" or better; BCH 100 with a grade of "D-" or better or BCH 110A with a grade of "D-" or better. Covers the causal interpretation of organic diversity and adaptation. Topics include inference of evolutionary change from the fossil record and from genomic and molecular patterns; microevolution and macroevolution; systematics and the species problem; and natural selection, drift, and other forces of evolution. Credit is awarded for only one of BIOL 105 or BIOL 105V.

BIOI 106 Biology of Human Variation (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 102; BIOL 105L or BIOL 105; STAT 100B (STAT 100B may be taken concurrently); or consent of instructor. A survey of variation within and among contemporary human populations arising from genetic and environmental factors. Covers single-locus and polygenic inheritance, developmental plasticity, and physiological acclimatization. Includes biogeographic and demographic influences; variation in pigmentation, stature, physiology, disease susceptibility, behavior, and IQ; and theoretical evaluation of racial and ethnic classifications.

BIOI 107A Molecular Biology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C; CHEM 001C or CHEM 01HC; CHEM 12C or CHEM 12HC; MATH 009B or MATH 09HB; PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A. The structure and function of the genetic material, including DNA structure, DNA replication and repair, and regulation of gene expression, and protein synthesis. Examines both prokaryotic and eukaryotic systems including contemporary recombinant DNA technology and applications of molecular cloning procedures.

BIOI 107B Advanced Molecular Biology (3) Lecture, 2 hours; discussion, 1 hour. Prerequisite(s): BIOL 107A or BCH 110C or equivalents. An advanced treatment of the functional architecture of genetic material. Topics include genome structure and chromosome organization, DNA replication and gene expression, cloning organisms, molecular medicine, protein engineering, and application of modern molecular biology to agricultural and medical problems. Coverage of each topic includes discussion of the impact of the emergent molecular technology on society.

BIOI 108 Introductory Population Genetics (4) Lecture, 3 hours; discussion and demonstration, 1 hour per week. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 009B or MATH 09HB, PHYS 002C, PHYS 02LC, one course in statistics. A study of the factors influencing the genetic structure of natural populations. Topics discussed include the incidence of genetic disease, inbreeding, conservation genetics, molecular evolution, adaptation in a changing environment, and how natural selection acts at different levels of organization.

BIOI 110 Biology of Human Problems (4) Seminar, 4 hours. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C; CHEM 001C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 009B or MATH 09HB; PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A; one course in statistics. Devoted to selected human problems that have a large biological component and relate to medicine, ethics, and human existence. Topics covered vary and include issues of major biological importance such as euthanasia, national health care, effects of industrial pollution on individuals and communities, population problems, abortion, and genetic engineering.

BIOI 111 Infectious Disease Epidemiology (4) S Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, and BIOL 005C with a grade of "C-" or better, BIOL 102 with a grade of "C-" or better, STAT 100A or equivalent (or consent of instructor) with a grade of "C-" or better. Introduces epidemiological methods used to investigate infectious diseases. Includes examples and case studies presented for a variety of human infectious diseases.

BIOI 112 Systematics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C or equivalent. Principles and philosophy of classification: phylogenetic and phenetic methods, species concepts, taxonomic characters, evolution, hierarchy of categories, and nomenclature. Cross-listed with BPS 112 and ENMT 112.

BIOI 113 Advanced Cell Biology: Membranes, Organelles, and the Cytoskeleton (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, CHEM 01C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 009B or MATH 09HB, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A, one course in statistics. An examination of the organization, function, and behavior of eukaryotic cells. Topics include membrane systems, protein targeting, the cytoskeleton, motility, and cell division. Emphasis is on those features that form the basis of the current understanding of the cell. The discussion section focuses on reading and analyzing original journal articles.

BIOI 114 Advanced Cell Biology: Cellular Reproduction and Signaling (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, BIOL 102, CHEM 01C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 009B or MATH 09HB, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A, one course in statistics. Examines organization, function, and behavior of eukaryotic cells. Explores the molecular mechanisms used by cells to control reproduction, growth, and responses to extracellular signals. Emphasizes those experiments that form the basis of the current understanding of the cell. The discussion section focuses on reading and analyzing original journal articles.

BIOI 116 Ecology and Conservation Biology (4) Lecture, 3 hours; discussion, 1 hour; field, 9 hours per quarter. Prerequisite(s): BIOL 005C with a grade of "C-" or better; CHEM 001C (or CHEM 01HC), MATH 009B or MATH 09HB, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A; one course in statistics. An introduction to the fundamental physiology and molecular biology of bacteria and viruses. Covers evolutionary origins of metabolic diversity, bacterial and viral molecular genetics, and an introduction to microbial pathogenesis. Cross-listed with MCBI 121.

BIOI 121L Microbiology Laboratory (3) Lecture, 1 hour; laboratory, 6 hours. Prerequisite(s): BIOL 121/MCBI 121 with a grade of "C-" or better. Laboratory exercises on diagnostic bacteriology, virology, and mycology. Includes fundamental quantitative and diagnostic microbiological procedures, basic mechanisms of microbial genetic exchange, and a project examining bacterial epidemiology. Cross-listed with MCBI 121.

BIOI 121L Microbiology Laboratory (3) Lecture, 1 hour; laboratory, 6 hours. Prerequisite(s): BIOL 121/MCBI 121 with a grade of "C-" or better. Laboratory exercises on diagnostic bacteriology, virology, and mycology. Includes fundamental quantitative and diagnostic microbiological procedures, basic mechanisms of microbial genetic exchange, and a project examining bacterial epidemiology. Cross-listed with MCBI 121.

BIOI 122 Lactic Acid Bacteria (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 122/MCBI 122. An intensive introduction to the fundamental physiology and molecular biology of bacteria and viruses. Covers evolutionary origins of metabolic diversity, bacterial and viral molecular genetics, and an introduction to microbial pathogenesis. Cross-listed with MCBI 121.

BIOI 123 Introduction to Comparative Virology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 009B or MATH 09HB, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A; one course in statistics. An introduction to the science of genomics and bioinformatics. Includes genome sequencing; database techniques; structural, comparative, and evolutionary genomics; and microarray analysis.

BIOI 124 Pathogenic Microbiology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 121/MCBI 121 with a grade of "C-" or better or consent of instructor. An intensive introduction to the fundamental physiology and molecular biology of bacteria and viruses. Covers research strategies for examining microbial pathogenic mechanisms. Cross-listed with MCBI 124.
BIOL 127 Insect Ecology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 055A, BIOL 055A, BIOL 055B, BIOL 055C, CHEM 001C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 009B or MATH 099B, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A, one course in statistics; or consent of instructor. Introduces principles of insect ecology with emphasis on the Arthropoda. Topics include factors governing population growth; ecological and evolutionary interactions with hosts, competitors, and natural enemies; structure of ecological communities; and adaptations to different environments. Cross-listed with ENMT 127.

BIOL 128 Immunology (3) Lecture, 3 hours. Prerequisite(s): BIOL 005C, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A. A study of humoral and cellular immunology. Topics include lymphoid systems, cells, antigens, antibodies, immune responses, cellular immunity, and tumor and transplantation immunology. Diseases and altered immune states associated with each topic are discussed in detail. Cross-listed with CBNS 128.

BIOL 132 Plant Anatomy (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A and BIOL 005B, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 009B or MATH 099B, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A, one course in statistics; or consent of instructor. Functional and developmental aspects of plant cell, tissue, and organ structure. Covers all aspects of the flowering plant life cycle from germination to polination and fruit and seed development. Cross-listed with BSCP 132.

BIOL 134 Introduction to Mycology (3) Lecture, 3 hours. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, BIOL 012LA, or equivalents; concurrent enrollment in BIOL 134/PLPA 134; or consent of instructor. Introduces fundamentals in the use of laboratory instruments and techniques for the isolation, cultivation, and identification of representatives of the major taxa of fungi. Cross-listed with PLPA 134L.

BIOL 138 Plant Developmental Morphology (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 12C, BCH 100 or BCH 110A (BCH 100 or BCH 110A may be taken concurrently), PHYS 002C, PHYS 02LC, or consent of instructor. An advanced study of the key areas of research in plant morphology and developmental biology. Emphasizes flowering plants (angiosperms). Cross-listed with BSCP 138.

BIOL 143 Plant Physiology (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 12C, BCH 100 or BCH 110A (BCH 100 or BCH 110A may be taken concurrently), PHYS 002C, PHYS 02LC, or consent of instructor. An advanced study of the key areas of research in plant morphology and developmental biology. Emphasizes flowering plants (angiosperms). Cross-listed with BSCP 143.

BIOL 148 Quantitative Genetics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, BIOL 102LA, CHEM 001C or CHEM 01HC, CHEM 12C, MATH 009B or MATH 099B, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A, STAT 100B; or consent of instructor. Examines topics covering the genetic basis of polygenic, metric traits. Includes types of gene action, partitioning of variance, response to selection, and inferring the number and location of quantitative trait loci. Cross-listed with BSCP 148.

BIOL 151 Invertebrate Zoology (5) Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, PHYS 002A with grades of "C-" or better. Structure, classification, and biology of the invertebrates.

BIOL 152 Principles of Invertebrate Paleobiology and Paleoecology (4) Lecture, 2 hours; laboratory, 3 hours; three 1-day field trips. Prerequisite(s): BIOL 005C with a grade of "C-" or better or BIOL 100G (or 0100G 003 with a grade of "C-" or better. Topics include evolution and the fossil record, paleoecology, classification theory, the nature of adaptive radiations, and extinctions. Cross-listed with GEO 152.

BIOL 153 Plant Genomics and Biotechnology Laboratory (4) F, Even Years Lecture, 1 hour; discussion, 1 hour; laboratory, 6 hours. Prerequisite(s): BCH 110C or BIOL 107A; upper-division standing; consent of instructor. An introduction to the morphology, taxonomy, genetics, physiology, ecology, and economic importance of the major groups of the fungi. Cross-listed with PLPA 133.

BIOL 155 Chromosomes (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 12C, MATH 009B or MATH 099B, PHYS 002C, PHYS 02LC, BCH 100 or BCH 110A (BCH 100 or BCH 110A may be taken concurrently); or consent of instructor. An examination of the structure, function, and behavior of eukaryotic chromosomes. Cross-listed with BSCP 155.

BIOL 157 Parasitology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 12C or CHEM 12HC, MATH 009B or MATH 099B, BCH 100 or BCH 110A (one course in statistics). Survey the biology of protozoan and helminth interactions with their human hosts.

BIOL 159 Medical Molecular Parasitology (4) Lecture, 3 hours; seminar, 1.5 hours. Prerequisite(s): BCH 110C or BIOL 107A. An overview of genomic organization and gene expression, with aspects of mechanism. Disease mechanisms, and treatment. Topics include helminth infections and protozoan infections.

BIOL 161A Functional Anatomy of the Vertebrates (5) Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 12A or CHEM 12HA, MATH 009B or MATH 099B, PHYS 002A, and one course in statistics with grades of "C-" or better. A study of the functional anatomy of vertebrates including humans. Examines each organ system from a developmental and evolutionary perspective. Topics include phylogeny, the skeleton, muscles, and the nervous system. BIOL 161A, BIOL 161B, and BIOL 171L provide a one-year sequence in vertebrate and human anatomy and physiology. Recommended for sophomores and juniors.

BIOL 161B Functional Anatomy of the Vertebrates (5) Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): BIOL 161A, CHEM 12B or CHEM 12HB, and PHYS 002B with grades of "C-" or better. A study of the functional anatomy of vertebrates, including humans. Examines each organ system from a developmental and evolutionary perspective. Topics include circulation, sense organs, the integument, and the respiratory, digestive, and urogenital systems. BIOL 161A, BIOL 161B, and BIOL 171L provide a one-year sequence in vertebrate and human anatomy and physiology. Recommended for sophomores and juniors.

BIOL 162 Insect Behavior (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 12A or CHEM 12HA, MATH 009B or MATH 099B, PHYS 002A. Topics include evolution, and behavior of birds, mammals, reptiles, and amphibians. Topics covered include systematics, morphology, and identification and includes indoor labs and field trips to local habitats.

BIOL 163 Evolutionary Ecology of Terrestrial Vertebrates (5) Lecture, 3 hours; laboratory, 6 hours. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 12A or CHEM 12HA, MATH 009B or MATH 099B, PHYS 002A. Topics include ecology, evolution, and behavior of birds, mammals, reptiles, and amphibians. Topics covered include systematics, morphology, and identification and includes indoor labs and field trips to local habitats.

BIOL 165 Restorati.on Ecology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C, CHEM 001C or CHEM 01HC, CHEM 12A or CHEM 12HC, MATH 009B or MATH 099B, PHYS 002A. A study of the functional anatomy of vertebrates including humans. Examines each organ system from a developmental and evolutionary perspective. Topics include phylogeny, the skeleton, muscles, and the nervous system. BIOL 161A, BIOL 161B, and BIOL 171L provide a one-year sequence in vertebrate and human anatomy and physiology. Recommended for sophomores and juniors.

BIOL 166 Developmental Biology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 010C, CHEM 101C or CHEM 101LA; a course in cell biology is recommended. An advanced description of the embryonic development of animals. Covers the basic concepts of fertilization, gastrulation, and neurulation. Analyzes topics in current developmental research, with an emphasis on the molecular mechanisms of pattern formation and differentiation.

BIOL 171 Human Anatomy and Physiology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 161A, CHEM 12C or CHEM 12HC, MATH 009B or MATH 099B, PHYS 002C, PHYS 02LC, BCH 100 or
BCH 110A; one course in statistics; concurrent enrollment in BIOL 171L is recommended. An analysis of cell, tissue, and organ structure and function in normal and diseased conditions. Topics include the molecular and cellular basis of normal and abnormal physiological systems; glands and hormones; body fluids and the kidney; digestion and absorption; and pharmacology and hematology. BIOL 161A, BIOL 161B, BIOL 171, and BIOL 171L provide a one-year sequence in vertebrate and human anatomy and physiology.

BIOL 171L Human Anatomy and Physiology Laboratory (1) Laboratory, 3 hours. Prerequisite(s): BIOL 161A (may be taken concurrently), CHEM 12C or CHEM 12HC, MATH 009B or MATH 009B, PHYS 002C, PHYS 002C, BCH 100 or BCH 110A, one course in statistics; BIOL 161B is recommended; concurrent enrollment in BIOL 171L. Involves laboratory experiments in physiology and study of human anatomy and histology. Traces the interaction of endocrine and nervous systems. Includes growth, development and hormones, cuticle, nervous system, circulation, respiration, digestion, nutrition, excretion, reproduction, water balance, and temperature relations. Prior knowledge of insects is not assumed. Cross-listed with ENTM 173.

BIOL 174 Ecological and Evolutionary Physiology (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A and BIOL 005B or equivalents; CHEM 12A or CHEM 12HA, CHEM 12B or CHEM 12HB, CHEM 12C or CHEM 12HC, or equivalents; consent of instructor. Introduction to physical principles, physiology, and ecology. Subjects include growth, development and hormones, cuticle, nervous system, circulation, respiration, digestion, nutrition, excretion, reproduction, water balance, and temperature relations. Prior knowledge of insects is not assumed. Cross-listed with ENTM 173.

BIOL 175 Comparative Animal Physiology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, CHEM 001C or CHEM 011C, CHEM 012C, MATH 009B or MATH 009B, PHYS 002C, PHYS 002C, BCH 100 or BCH 110A, one course in statistics. Examines the interactions between organisms and their environments, emphasizing coadaptation of physiological, morphological, and behavioral phenotypes. Includes allometry and scaling, metabolism and locomotion, heat and water exchange, evolution of endothermy, artificial selection experiments, and phylogenetically based statistical methods.

BIOL 176 Comparative Biomechanics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C or equivalent; PHYS 002C or PHYS 004C; BCH 100 or BCH 110A. Applies principles and engineering to the study of the relationship between organismal form and function. Covers examples from diverse plant and animal systems. Includes fundamental properties of solids and fluids, viscoelasticity, drag, biological pumps, locomotion, and muscle mechanics.

BIOL 178 Hormones and Behavior (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C or equivalent; PHYS 002C, PHYS 004C; BCH 100 or BCH 110A. One course in statistics. An examination of the interactions between hormones and behavior in animals, including humans. Provides an overview of endocrine physiology and examines the roles of hormones in sexual differentiation, sex differences in behavior, sexual behavior, parental behavior, affiliation, aggression, stress, and mood.

BIOL 190 Special Studies (1-4) Individual study, 3-12 hours. Prerequisite(s): consent of instructor and departmental chairperson. To be taken as a means of meeting special curricular needs. Grading basis to be selected in consultation with the instructor and departmental chairperson. Course is repeatable.

BIOL 191 Seminar in Biology (2-4) Seminar, 2-4 hours. Prerequisite(s): upper-division standing; consent of instructor. A critical study of selected topics in biology. Course is repeatable.

BIOL 194 Independent Reading (1-4) Consultation, 1-4 hours. Prerequisite(s): junior or senior standing and consent of instructor and departmental chairperson. Independent study under faculty supervision. Graded Satisfactory (S) or No Credit (NC). Course is repeatable to a maximum of 4 units.

BIOL 197 Introduction to Research (1-2) Consultation, 1-2 hours. Prerequisite(s): sophomores, junior or senior standing and consent of instructor and departmental chairperson. Reading, planning and preliminary laboratory work to develop a research project suitable for BIOL 199, Junior/Senior Research. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

BIOL 199 Junior/Senior Research (1-4) Laboratory, 1-4 hours. Prerequisite(s): junior or senior standing and consent of instructor and departmental chairperson. Special problems and research in biology performed under the supervision of the faculty of the Department of Biology. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

Graduate Courses

BIOL 200 Cell Biology (4) Lecture, 3 hours; seminar, 1 hour. Prerequisite(s): BCH 110A or BCH 110B or equivalent (may be taken concurrently); BIOL 102 or equivalent; BIOL 113 or BIOL 114 or CBNS 101 or equivalent. An introduction to the structure and function of eukaryotic cells and their components with emphasis on the key experiments that provide the foundation for our current knowledge. Covers topics such as cell membranes, intracellular trafficking, cell-to-cell interactions, motility, and the cytoskeleton. Cross-listed with CMDB 200.

BIOL 201 Molecular Biology (4) Lecture, 3 hours; seminar, 1 hour. Prerequisite(s): BCH 110A or BCH 110B or equivalent (may be taken concurrently); or BIOL 102 or equivalent; BIOL 107A or equivalent. Covers the structure and inheritance of genetic material, the regulation of gene expression at the cellular and molecular level including molecular mechanisms for regulation of gene expression, and regulation at the level of messenger RNA stability, processing, editing and translation, methods for gene mapping, and positional cloning. Cross-listed with CMDB 201.

BIOL 203 Cellular Biophysics (3) Lecture, 3 hours. Prerequisite(s): BIOL 200/CMDB 200; BIOL 201/ CMDB 201; CHEM 109 or equivalent; or consent of instructor. Biophysical principles that determine cellular structure and function including the cytoskeleton, electrochemical gradients, transport, macromolecular interactions, and genetic recombination. Illustrative examples are used to highlight the importance of these principles in modern cell biology and physiology.

BIOL 221 Microbial Genetics (4) W Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110C or BIOL 107A; BIOL 102. In-depth coverage of the genetics of microbes. Emphasis on the analysis of data and the foundation of modern techniques using viruses, archaea, prokaryotes, and eukaryotes. Includes genome sequences and organization, plasmids and other vectors, and mutation and genetic screens. Also covers transposable elements, recombination, and regulation of gene expression, development, and pathogenesis. Cross-listed with MCB 221 and PLPA 226.

BIOL 250 Special Topics in Biology (1-2) Seminar, 1-2 hours. Prerequisite(s): graduate standing and consent of instructor. Oral presentations and intensive small-group discussion of selected topics in the area of special competence of each staff member. Course content will emphasize recent advances in the special topic area and will vary accordingly. Graded Satisfactory (S) or No Credit (NC). May be repeated for credit.

BIOL 252 General Colloquium in Biology (1) Seminar, 1 hour; discussion, 1 hour. Prerequisite(s): graduate standing. Oral reports by visiting scholars on current biological research. Graded Satisfactory (S) or No Credit (NC). May be repeated for credit.

BIOL 261 Seminar in Genetics, Genomics, and Bioinformatics (1) Seminar, 1 hour. Prerequisite(s): graduate standing or consent of instructor. Oral reports by visiting scholars, faculty, and students on current research topics in genetics, genomics, and bioinformatics. Graded Satisfactory (S) or No Credit (NC). Course is repeatable. Cross-listed with BCH 261, BPS 261, ENTM 261, GEN 261, and PLPA 261.

BIOL 281 (E-2) Seminar in Cell Development, Structure, and Function (2) Seminar, 2 hours. Prerequisite(s): graduate standing; consent of instructor. Lectures, discussions, and demonstrations by students, faculty, and invited scholars on diverse subjects concerned with the principles of cell development, structure, and function. E. Cell Biology. F. Molecular Biology. G. Developmental Biology. Segments are repeatable. Cross-listed with CMDB 281 (E-2).

BIOL 284 Seminar in Biology (2-4) Seminar, 2-4 hours. Prerequisite(s): graduate standing; consent of instructor. Consists of lectures, discussions, and demonstrations by students, faculty, and invited scholars on selected topics concerned with the principles of biology. Course is repeatable.

BIOL 289 Special Topics in Neuroscience (2) Seminar, 2 hours. Prerequisite(s): graduate standing or consent of instructor. An interdisciplinary seminar consisting of student presentations and discussion of selected topics in neuroscience. Content and instructor(s) vary each time course is offered. Students who present a seminar receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. Course is repeatable. Cross-listed with BCH 289, CHEM 289, ENTM 289, NRSC 289, and PSYC 289.

EEOB 210 Organismal Biology (4) Lecture, 4 hours. Prerequisite(s): At least one upper-division undergraduate course that covers the principles of physiology (such as animal physiology, plant physiology, human physiology, or comparative anatomy and physiology), or consent of instructor. An interdisciplinary course that covers the principles of evolution, or a similar course, OR consent of instructor. Explores the historical development of modern ideas in organismal biology. Topics include homeostasis, scaling, energetics, structure-function relationships, control systems, and response systems. Examines recent research in the context of the classic studies.

EEOB 211 Foundations of Ecology (4) Lecture, 4 hours. Prerequisite(s): EEOB 116 or equivalent. An examination of the history, theory, and interrelationships of fundamental ecological principles through readings and discussions of classic and recent literature. Topics include quantitative, population, community, ecosystem, evolutionary, and conservation ecology.

EEOB 212 Ecological Systems in Space and Time (4) Lecture, 3 hours; field, 30 hours per quarter. Prerequisite(s): One upper-division undergraduate course in population or community ecology or paleoecology, or consent of instructor. Focuses on how ecological systems are integrated and reconciled at the community, landscape, and paleontological scales. Addresses the role of extrinsic factors operating at each of these scales. Also examines the historical development of our understanding of ecological systems at various scales. Cross-listed with ENTM 212 and GEO 212.
EEOB 213 Behavioral Ecology (4) Lecture, 4 hours. Prerequisite(s): BIOL 160 or consent of instructor. Examines animal behavior in an evolutionary context. Traces the historical development of the study of behavior, drawing from ethology, comparative psychology, and sociobiology. Topics include evolution of sociality, sexual selection, predator-prey behavior, and parental care.

EEOB 214 Evolutionary Genetics (4) Lecture, 4 hours. Prerequisite(s): BIOL 108 or consent of instructor. Traces the historical development of modern ideas in evolutionary genetics. Focuses on the influence of Fisher, Haldane, and Wright on current views of genetic variation in natural populations, by examining recent research in the context of their classic works.

EEOB 215 Advanced Methods of Data Analysis in Evolution, Ecology, and Behavior (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): PSYC 212 or STAT 100B or equivalent. Introduces students to new methods of data analysis in the fields of evolution, ecology, and behavior. Covers theory and practical application using relevant examples. Topics include maximum likelihood, randomization, the jackknife, bootstrapping, Monte Carlo approaches, and meta-analysis.

EEOB 216 The Theory of Evolution (4) Lecture, 4 hours. Prerequisite(s): BIOL 105 or consent of instructor. Traces the historical development of modern ideas in evolutionary theory. Focuses on the influence of Darwin and the various authors of the modern synthesis on current views of macroevolution by examining recent research in the context of their classic works.

EEOB 217 Advanced Population and Community Ecology (4) Lecture, 4 hours. Prerequisite(s): One upper-division undergraduate class in population or community ecology, or consent of instructor. Traces the development of the major concepts in ecology. Focuses on the influence of pioneers in the field, historical roots of key concepts, and key controversies. Evaluates current research with reference to these historical origins.

EEOB 219 Theory of Systematics (4) Lecture, 4 hours. Prerequisite(s): BIOL 112/PSG112/ENTMT 112 or equivalent or consent of instructor. Examines topics developed around a series of classical and recent papers on the principles, philosophy, and methodology of modern systematics and phylogenetic methods. Cross-listed with ENMT 219 and GEO 219.

EEOB 220 Evolutionary Physiology (4) S, Even Years Lecture, 4 hours. Prerequisite(s): An upper-division course in evolution and animal physiology or behavior, an upper-division course in statistics that covers analysis of variance, or consent of instructor. Covers evolutionary approaches to the study of animal physiology. Includes organismal and organ-system physiology, biomechanics and locomotor mechanisms; cell physiology; the development of physiological systems; and behavioral neuroscience.

EEOB 230 Analysis of Ecological Communities (5) Lecture, 3 hours; discussion, 2 hours. Prerequisite(s): PSYC 212 or STAT 231B or equivalent; consent of instructor. Covers multivariate statistics and its application to the interpretation of ecological community data. Topics include multiple and partial correlation and regression, canonical correlation, detrended and canonical correspondence analysis, multidimensional scaling, similarity indices and cluster analysis, and discriminant analysis.

EEOB 265 Advances in Population and Evolutionary Biology (1 or 2) Seminar, 1 hour; outside research, 0-3 hours. Prerequisite(s): graduate standing or consent of instructor. Presentations by visiting scholars, faculty, and students on current research topics in population and evolutionary biology. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

EEOB 282 Seminar in Genetics and Evolution (2-4) Seminar, 2-4 hours. Prerequisite(s): graduate standing; consent of instructor. Presentations by students, faculty, and invited scholars on selected topics concerned with the principles of genetics and evolution. Course is repeatable.

EEOB 283 Seminar in Organismal Biology (1-4) Seminar, 1-4 hours. Prerequisite(s): graduate standing; consent of instructor. Presentations by students, faculty, and invited scholars on selected topics concerned with the principles of organismal biology, including physiology, behavior, morphology, biomechanics, and related topics. Course is repeatable to a maximum of 18 units.

EEOB 290 Directed Studies (1-6) Individual study, 3-18 hours. Prerequisite(s): graduate standing; consent of instructor and graduate advisor. Individual studies in an upper-division course in statistics that covers research in an area selected for the advanced degree. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

EEOB 291 Individual Study in Coordinated Areas (1-6) Individual study, 3-18 hours. Prerequisite(s): graduate standing. Provides a program of study designed to advise and assist candidates who are preparing for examinations. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

Professional Courses

BIOL 301 Teaching of Biology at the College Level (1) Seminar, 1 hour. Prerequisite(s): graduate standing. A program of weekly meetings and individual formative evaluations required of new Biology Teaching Assistants. Covers instructional methods and classroom/section activities most suitable for teaching Biology. Conducted by the TA Development Program. Graded Satisfactory (S) or No Credit (NC).

BIOL 303 Philosophy and Pedagogy of Teaching Undergraduate Life Sciences (3) Lecture, 1 hour; laboratory, 3 hours; workshop, 1 hour. Prerequisite(s): graduate standing in life sciences. Explores the opportunities and challenges associated with developing an undergraduate course in the life sciences. Emphasizes determining how students learn, as well as exploring contemporary instruction methods that foster student engagement in the classroom. Graded Satisfactory (S) or No Credit (NC). Cross-listed with ENMT 303.

EEOB 400 Introduction to Graduate Study in Biology (2) Lecture, 1 hour; discussion, 1 hour. Prerequisite(s): graduate standing; consent of instructor. Introduces opportunities and requirements for successful graduate study. Emphasis is placed on effective strategies for developing and implementing a program of professional development and graduate research. Graded Satisfactory (S) or No Credit (NC).

Biomedical Sciences

Subject abbreviation: BMSC

Division of Biomedical Sciences

Deborah Deas, M.D., M.P.H., the Mark and Pam Rubin Dean, UCR School of Medicine; CEO, Clinical Affairs, UCR School of Medicine

Neal L. Schiller, Ph.D., Senior Associate Dean, Student Affairs, UCR School of Medicine; Director, Thomas Haider Program at the UCR School of Medicine; and Salma Haider Endowed Chair in Biomedical Sciences

David Lo, M.D., Ph.D., Senior Associate Dean, Research

Monica J. Carson, Ph.D., Chair Division of Biomedical Sciences

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Professors

Monica J. Carson, Ph.D. Neuroimmunology Iryna M. Ethell, Ph.D. Neuroscience Byron Ford, Ph.D. Stroke and Brain Injury David Lo, M.D., Ph.D. Distinguished Professor, Genetics and Mucosal Immunity Maurizio Pellecchia, Ph.D., Daniel Hays Endowed Chair in Cancer Research, Drug Discovery Paul M. Quinton, Ph.D. Physiology, Nancy MacCracken Chair in Pediatric Pulmonary Medicine, UCSD School of Medicine Neal L. Schiller, Ph.D. Distinguished Teaching Professor, Microbiology/Immunology Ameane M. Walker, Ph.D. Distinguished Teaching Professor, Microanatomy

Professors Emeriti

Mary Ann Baker, Ph.D. Neurosciences Craig V. Byus, Ph.D. Pharmacology (Biomedical Sciences/Biochemistry) David A. Johnson, Ph.D. Pharmacology Richard A. Luben, Ph.D. Endocrinology (Biomedical Sciences/Biochemistry) Anthony W. Norman, Ph.D. Endocrinology (Biomedical Sciences/Biochemistry) Michael B. Sterrmerman, M.D. Biomedical Sciences Daniel S. Straus, Ph.D. Human Genetics (Biomedical Sciences)

Associate Professors

Djurdjica Coss, Ph.D. Endocrinology, Neuroscience Kathryn DeFea, Ph.D. Cell Biology/Biochemistry Martin I. García-Castro, Ph.D. Biomedical Sciences Christian Y. Lylene, Ph.D. Physiology Declan McCole, Ph.D. Physiology, Pharmacology Ilhem Messaoudi, Ph.D. Immunology Microbiology/Aging Seema K. Tiwari-Woodruff, Ph.D. Neurodegenerative Diseases/Glia Biology Emma Wilson, Ph.D. Parasite Immunologist

Assistant Professor

Nicholas V. DiPatrizio, Ph.D. Biomedical Sciences Meera G. Nair, Ph.D. Infectious Diseases, Mucosal Immunology Sika Zheng, Ph.D. Neurobiology/Molecular Genetics

Associate Professor in Residence

Devin Binder, M.D., Clinical Neuroscience

Adjunct Professor

John Y.-J. Shyy, Ph.D. Pharmacology/Pathology

University Requirements

See Undergraduate Studies section.