

Department of **Biology**

College of Science

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Professors Anne J. Anderson, plant pathology; Kandy D. Baumgardner, genetics; William A. Brindley, entomology and toxicology; E. W. "Ted" Evans, insect ecology; James A. Gessaman, vertebrate physiological ecology; James W. Haefner, systems analysis; Joseph K.-K. Li, virology; James A. MacMahon, community ecology; Keith A. Mott, plant physiology; William J. Pependorf, industrial hygiene; Peter C. Ruben, neurobiology; Jon Y. Takemoto, microbial physiology; Sherman V. Thomson, plant pathology; **Associate Professors** Diane G. Alston, integrated pest management; Mary E. Barkworth, plant systematics; Daryll B. DeWald, plant molecular biology; Bradley R. Kropp, ecology, genetics, and systematics of fungi; Gregory J. Podgorski, developmental biology; Kimberly A. Sullivan, behavioral ecology; Dennis L. Welker, molecular biology; Paul G. Wolf, systematics and molecular biology; **Assistant Professors** Brett A. Adams, neurobiology; Michelle A. Baker, ecology, hydrology; Timothy A. Gilbertson, neurobiology; Joseph R. Mendelson, III, vertebrate systematics; Michael E. Pfrender, evolutionary quantitative genetics; Carol D. von Dohlen, insect biology; **Professors Emeriti** Thomas L. Bahler, histology, human physiology and anatomy; Donald W. Davis, entomology and pest management; Keith L. Dixon, ornithology and mammalogy; LeGrande C. Ellis, endocrinology and reproductive physiology; B. Austin Haws, entomology and pest management; Ting H. Hsiao, insect physiology and biochemistry; Gene W. Miller, plant biochemistry and physiology; Ivan G. Palmblad, evolutionary ecology; Frederick J. Post, aquatic microbiology and microbial ecology; Reed S. Roberts, entomology; Richard J. Shaw, vascular plant taxonomy; John R. Simmons, biochemical genetics; John J. Skujins, soil biochemistry and microbial ecology; Nabil N. Youssef, cellular biology and parasitology; **Associate Professors Emeriti** David B. Drown, environmental health; Wilford J. Hansen, systematic entomology; Raymond I. Lynn, algology and microbial ecology; George W. Welkie, plant physiology and virology; **Research Professor** Donald W. Roberts, insect pathology; **Research Assistant Professors** Jordi Bosch, bee biology; Michelle A. Grilley, molecular biology; Charles D. Miller, plant pathology; Yuriy Y. Vilin, neurobiology; **Adjunct Professors** James H. Cane, bee biology; Noelle E. Cockett, biotechnology; William P. Kemp, insect ecology; J. Russell Mason, predation, ecology, and behavior; Darwin L. Sorensen, aquatic microbiology; Rex S. Spendlove, virology; **Adjunct Associate Professors** John C. Bailey, public health; Jay B. Karren, entomology; Vincent J. Tepedino, entomology; Anthony R. Torres, immunology; **Adjunct Assistant Professor** Terry Griswold, bee biology; **Clinical Assistant Professor** Daniel A. Boston, DDS, dentistry; **Principal Lecturer** David M. "Andy" Anderson, medical technology; **Lecturers** Alice Lindahl, invertebrate biology; David O. Wallace, public health, industrial hygiene

Degrees offered: Bachelor of Science (BS), Bachelor of Arts (BA), Master of Science (MS), and Doctor of Philosophy (PhD) in Biology; BS and BA in Composite Teaching—Biological Science; BS in Public Health; MS and PhD in Ecology; MS and PhD in Toxicology is available through the Interdepartmental Program in Toxicology.

Undergraduate emphases: *Biology BS, BA*—Biology, Cellular/Molecular, Ecology/Biodiversity, Environmental; *Public Health BS*—Industrial Hygiene, Environmental Health, Public Health Education

Undergraduate Programs

Objectives

Biology. The Department of Biology offers programs leading to a Bachelor of Science or Bachelor of Arts degree. Majors will complete a core of courses which provide an understanding of biological principles. Upper-division courses provide integration, in-depth study, and an opportunity for specialization within the different degree emphases. Additional coursework in chemistry, physics, statistics, and mathematics provides knowledge and analytical skills in these important related fields. Most biology de-

grees provide a foundation for graduate work. Biology majors can add a minor area of study, such as business or chemistry, to enhance their employment opportunities.

Prehealth Professions Programs. The Department of Biology supervises premedical, pre dental, and other health professions. These programs satisfy entrance requirements for most medical and dental schools in the United States and Canada and are recognized for the high quality preprofessional preparation they provide. After four years, the student receives a BS degree in Biology or another major. **Coordinator:** Susan Haddock, BNR 101. **Advisor:** Andy Anderson, VSB 231.

Composite Teaching—Biological Science. This major combines content training in biology and related fields (including chemistry, physics, geology, mathematics, and statistics) with education courses. Graduates are licensed to teach at the secondary level.

Public Health. The Department of Biology offers preprofessional training in public health. Individuals completing the BS degree have employment opportunities in such areas as environmental health, industrial hygiene, public health education, administration, nursing, nutrition, mental health, and social work. **Advisor:** David O. Wallace, BNR 333.

The Department Head, the Director of Undergraduate Studies, and advisors in the Department of Biology are available to provide undergraduate majors with additional information regarding specific programs and career opportunities. The Biology Advising Center and the Director of Undergraduate Studies are located in BNR 101. Program requirements, advising information, and an “Ask an Advisor” e-mail service are on the Department of Biology web page at <http://www.biology.usu.edu>.

Students with majors in the Department of Biology should consult with their advisors regularly as they plan their course of study. Students have the responsibility to keep themselves aware of major requirements and course prerequisites. General requirements, specific course offerings, and the semesters that courses are taught may change.

Mathematics is an important and required skill to enhance one's success in the sciences. Proper course level placement in mathematics at the beginning of the degree program is essential. Students should consult with an advisor to determine the appropriate level to begin their mathematics studies for meeting requirements and completion of their major. For detailed information, obtain an official Major Requirement Sheet from the Biology Advising Center.

Requirements

University Requirements. Students are responsible for meeting all University requirements for total credits, upper-division credits, credits of C- or better, and the University Studies Program. (See pages 53-63 in this catalog.)

College of Science Requirements. All college requirements are met by completing the departmental degree requirements; no additional coursework is required.

Departmental Admission Requirements. New freshmen admitted to USU in good standing qualify for admission to the Biology and Public Health majors. Transfer students from other institutions need a 2.25 transfer GPA, and students transferring from other USU majors need a 2.25 total GPA for admission to the Biology and Public Health majors in good standing. Admission requirements differ for the Composite Teaching—Biological Science Major, as explained below.

Admission Requirements for the Composite Teaching—Biological Science Major. New freshmen admitted to USU in good standing qualify for admission to this major. To qualify for admission to the Secondary Teacher Education Program (STEP), new freshmen must acquire a cumulative 2.75 GPA and 60 credits of coursework. Transfer students from other institutions or other USU majors need a cumulative 2.75 GPA and 60 credits of

coursework to be admitted to the major and the STEP. For information on additional admission criteria, students should contact the Department of Secondary Education.

GPA Requirement. To graduate, a candidate for any bachelor's degree offered by the Department of Biology must maintain a grade point average of 2.25 in all Department of Biology (Biol or PubH prefix) courses required for the major (Composite Teaching also requires a 2.75 cumulative GPA) and a grade of C- or better in Biol 1210 and 1220. The *Pass-Fail* option is not acceptable for any course required for the degree, but *D* grades are permitted within the restrictions of the 2.25 GPA. The Composite Teaching—Biological Science Major requires a cumulative overall GPA of 2.75 for admission and graduation. The 2.25 GPA requirement applies to the Biology, Public Health, and BioMath minors.

BS Degree in Biology. Four different emphases are available within the Biology degree. The **Biology Emphasis** is the most flexible option. Electives may be selected in any subdiscipline the student wishes to emphasize (e.g., botany, ecology, zoology, entomology, microbiology, etc.). The **Cellular/Molecular and Ecology/Biodiversity** emphases provide more directed training that is appropriate for research or other technical employment in academic institutions, government agencies, and the private sector. They also provide excellent preparation for graduate work. The **Environmental Emphasis** prepares students in the biological and physical sciences as they relate to environmental problems and concerns. This degree serves as a foundation for graduate work and provides practical training for employment at the bachelor's degree level. Emphases will be listed on transcripts to indicate the student's specialization. The course requirements are as follows:

Biology Emphasis: Biol 1210, 1220, 2220, 3200; Biol 3300 or 4200; Biol 5250; one of Biol 2410, 3050, 3220, 4500, 5400, 5530, 5550, 5560, or 5570; a physiology course with a lab selected from: Biol 4400 or 5300 or 5540; or Biol 5600 and 5610; 10 credits of 4000-level and above Biol prefix courses as electives. In addition, students must complete: Chem 1210, 1220, 1230, 1240, 2300, 2330, 3700, 3710; Phyx 2110 and 2120, or Phyx 2210 and 2220; Math 1210; and Stat 3000.

Cellular/Molecular Emphasis: Biol 1210, 1220, 2220, 3200, 4100, 4200, 5190, 5250; a physiology course with a lab selected from: Biol 4400 or 5300 or 5540; or Biol 5600 and 5610; one of Biol 5160, 5240, or 5260; nine credits of 4000-level and above Biol prefix courses as electives. In addition, students must complete: Chem 1210, 1220, 1230, 1240, 2310, 2320, 2330, 2340, 5700, 5710, 5720; Phyx 2110 and 2120, or Phyx 2210 and 2220; Math 1210; and Stat 3000.

Ecology/Biodiversity Emphasis: Biol 1210, 1220, 2220, 3200, 3220, 3300, 5250; a physiology course with a lab selected from: Biol 4400 or 5300 or 5540; or Biol 5600 and 5610; one of Biol 2410, 3400, or 5400; one of Biol 4500, 5530, 5550, 5560, 5570 or 5580; one of Biol 5170, 5200, or 5590; an additional course from one of the three previous groups or the following list: Biol 4100, 4410, 5280, 5310, 5350 or 5800. In addition, students must complete: Chem 1210, 1220, 1230, 1240, 2300, 2330, 3700, 3710; Phyx 2110 and 2120, or Phyx 2210 and 2220; Math 1210; Stat 3000; Soil 3000; and Geol 1150.

Environmental Emphasis: Biol 1210, 1220, 2220, 3200, 3220, 3300, 5250; a physiology course with a lab selected from: Biol 4400 or 5300 or 5540; or Biol 5600 and 5610; one of Biol 2410, 3400, or 5400; twelve elective credits from: Biol 4500, 5050, 5200, 5310, 5320, 5410, 5800; PubH 3610; CEE 5620; ADVS 5400; Geol 1150; Soil 3000. In addition, students must complete: Chem 1210, 1220, 1230, 1240, 2310, 2320, 2330, 2340, 3600, 3610, 3700, 3710; Phyx 2110 and 2120, or Phyx 2210 and 2220; Math 1210; and Stat 3000.

BS Degree in Composite Teaching—Biological Science. The Composite Teaching—Biological Science Major leads to licensure to teach in secondary schools. The course requirements are as follows: Biol 1210, 1220, 2000, 2220, 3200, 3220, 3300, 4100, 5250; a physiology course with a lab selected from: Biol 4400 or 5300 or 5540; or Biol 5600 and 5610; Geol 1150; Sci 4300; Math 1210; Stat 3000; Phyx 2110, 2120; Chem 1110, 1120, 1130. In addition, students must be accepted into the Secondary Teacher Education Program (STEP) and complete the following: InsT 5200; SpEd 4000; ScEd 3100, 3210, 3300, 3400, 4200, 4210, 4300, 4400, 5300, 5500, and 5600.

BA Degrees in Biology and Composite Teaching—Biological Science. The student must complete the requirements for the BS (above) plus two years of a foreign language. (See page 53 of this catalog.)

BS Degree in Public Health. A four-year program leading to the Bachelor of Science in Public Health is offered by the Department of Biology with options in the following areas: environmental health, industrial hygiene, and public health education. Individuals completing the environmental health option are qualified to take the Registered Sanitarian's Examination. Those completing the industrial hygiene option qualify to sit for examination by the American Board of Industrial Hygiene following one year of professional experience. The Public Health degree requires a core of biology courses similar to that required for the biology degrees; additional biology and public health courses; and chemistry, physics, mathematics, statistics, and allied science and engineering courses appropriate to each emphasis. Three different emphases are available. The course requirements are as follows:

Industrial Hygiene Emphasis: Biol 1210, 1220, 2000, 2220, 3200, 3300; PubH 3310, 3610, 5020, 5310, 5320, 5330, 5350, 5500; ADVS 5400; one of CEE 5730, CEE 5790, or SW 4900. In addition, students must complete: Chem 1210, 1220, 1230, 1240, 2310, 2320, 2330, 2340, 3600, 3610, 3700, 3710; Phyx 2110 and 2120, or Phyx 2210 and 2220; Math 1210, 1220; and Stat 3000.

Public Health Education Emphasis: Biol 1210, 1220, 2000, 2220, 3200, 3300; PubH 3120, 3610, 4000, 5000, 5010, 5020, 5500; Spch 1050; NFS 1020, 5210; Soc 3330, 3500; HEP 2000, 2500, 3000, 4000, 4400. In addition, students must complete: Chem 1120, 1210, 1220, 1230, 1240; Phyx 1200; Math 1210; and Stat 3000.

Environmental Health Emphasis: Biol 1210, 1220, 2000, 2220, 3200, 3300, 5050; PubH 3310, 3610, 4000, 5000, 5010, 5020, 5310, 5500; NFS 5110; one of CEE 5730, CEE 5790, or SW 4900; ten elective credits from: Biol 3050, 3220, 3400, 5550; Soil 3000; Spch 1050; ADVS 5400; and Chem 3700, 3710. In addition, students must complete: Chem 1210, 1220, 1230, 1240, 2310, 2320, 2330, 2340; Phyx 2110 and 2120, or Phyx 2210 and 2220; Math 1210; and Stat 3000.

Biology Minor. The Biology minor requires completion of the following: Biol 1210, 1220; and 12 credits of upper-division (3000-level and above) Biol prefix courses.

BioMath Minor. This minor requires mathematics and quantitative biology courses beyond those required for the basic biology degrees. It is an excellent option for students considering graduate work. Biology majors may take this minor through the Mathematics and Statistics Department. For details, contact the Biology Advising Center (BNR 101) or James Haefner (BNR 233).

Public Health Minor. The Public Health minor requires completion of the following: Biol 1210, 1220; and 12 credits of upper-division (3000-level and above) Public Health elective courses.

Honors. An Honors Plan is available for students desiring a BS or BA degree "with Honors" in Biology. Departmental Honors requires the completion of a research-based Bachelor's Thesis. For details, students should contact Richard Mueller (BNR 101).

Field Trips. Many biology courses require field trips. Those enrolled are expected to dress appropriately for the conditions and observe any safety precautions issued by instructors. Many courses require modest laboratory fees.

Undergraduate Research— Bachelor's Thesis in Biology

Students may do undergraduate research work under the supervision of selected faculty members. To participate and receive academic credit, a student must enroll in Biol 5800, Undergraduate Research. To complete the research project and write a thesis, a student must be enrolled in Biol 5810, Bachelor's Thesis, for 3 credits. A thesis supervisory committee must be organized, consisting of an approved biology faculty member and at least one other faculty member. The supervisory committee is subject to the approval of the Director of Undergraduate Studies. Three credits of Biol 5800 or 5810 may be applied toward elective requirements in some degree programs. Contact the Director of Undergraduate Studies, BNR 101, for assistance.

Financial Support

Scholarships, assistantships, grants-in-aid, and work-study programs are available from the University. Both the College of Science and the Department of Biology offer scholarships. Contact the College of Science office (SER 101) and the Biology Advising Center (BNR 101) for details.

Graduate Programs

Admission Requirements

See general admission requirements on pages 72-73. To be recommended for matriculated status, an applicant must have earned a bachelor's degree (or equivalent) from an accredited institution, and a Biology faculty member must have agreed to serve as major professor for that applicant. The Department of Biology also considers these guidelines for admission: (1) the transcript should show a minimum GPA of 3.0 (*B*); and (2) the scores on the verbal, quantitative, and analytical portions of the GRE should be above the 50th percentile. Advanced GREs (especially biology) are also recommended. Applicants for whom English is not the

primary language must have scored at least 575 on the TOEFL. The applicant's undergraduate program should be similar to that offered by the Department of Biology at Utah State University, which includes the following and their prerequisites: general biology, microbiology, genetics, ecology, physiology, cell biology, developmental biology, and evolution; general and organic chemistry; calculus; statistics; and physics. Other preparatory courses may be specified by the student's supervisory committee.

Degree Programs

For those who have demonstrated strong academic capability as well as research interest, the Department of Biology offers the **Master of Science Degree** and the **Doctor of Philosophy Degree** in either Biology or Ecology. Graduate degrees in **Toxicology** are available through the Interdepartmental Program in Toxicology.

Undergraduate majors in Biology at USU with especially strong backgrounds and interest in research may apply for study of the Master of Science degree as **transitional students**. Acceptance as a transitional student allows undergraduates with advanced standing to integrate up to 9 credits of graduate work into the final semesters of their Bachelor of Science study. Acceptance into this program, as into all graduate programs in Biology, is closely regulated. Formal application through the School of Graduate Studies is required.

Course Requirements

Biology MS and PhD Degrees. Course requirements are determined by the student's supervisory committee. They will vary depending on the research emphasis selected and the background of the student.

Ecology MS and PhD Degrees. For specific requirements, see the description of the Ecology Interdepartmental Program (pages 202-203).

Research

The Department of Biology provides a dynamic and broad base for research and graduate study through a balanced program of basic and applied studies at ecosystem, population, organismal, cellular, and molecular levels. An outstanding variety of field sites; animal, plant, and microbe growth facilities; and modern well-equipped laboratories are available. Also, the Intermountain Herbarium, an excellent insect collection, the USDA/ARS U.S. National Pollinating Insects Collection, a state-of-the-art electron microscope facility, a stable isotope laboratory, and the Biotechnology Center exist as research and support facilities.

Faculty members participate in and are supported by several interdepartmental programs, including the Ecology Center and the Center for Environmental Toxicology. In addition, many less formal contacts and interactions exist with colleagues in the colleges of Agriculture, Natural Resources, and Science.

Students are encouraged to carefully consider how their career goals match the faculty's research interests. Prospective students are strongly encouraged to contact faculty members with whom they are interested in working. Because of the combination of a diverse interdisciplinary base and excellent focused research programs, students have an opportunity to learn the philosophies and methods of many branches of biology.

Financial Assistance

Research assistantships are available from the grants of major professors and from Utah Agricultural Experiment Station funds. Teaching assistantships are awarded annually. All awards are made on a competitive basis and specific teaching needs are considered in awarding teaching assistantships. Given satisfactory performance, MS students are supported for at least two years and PhD candidates for at least four years on teaching assistantships. The department may also recommend particularly qualified students for College of Science or University fellowships. Admission to the graduate program of the Department of Biology does not guarantee financial support; however, applicants will not normally be admitted without financial support.

Career Opportunities

Completion of graduate degrees in Biology prepares students for careers in teaching and research in universities and colleges. Many graduates also find employment with private industry and state and national governmental agencies. Specific employment possibilities will depend on the nature of the graduate program pursued. The extensive background provided by a graduate degree also prepares students for eventual administrative responsibilities.

Research Emphases

Research areas of departmental faculty are diverse. Areas of research currently include: **Cellular and Molecular Biology:** plant-microbial interactions; molecular neurobiology and biophysics; gene regulation and signal transduction; membrane transport; molecular virology; **Ecology and Behavior:** insect ecology and behavior; pollination biology; plant-insect interactions; vertebrate behavioral ecology; mathematical and computer modeling; community and ecosystem ecology; soil microbiology; fungal ecology; biological control; integrated pest management (IPM); **Physiological and Developmental Biology:** toxicology and industrial hygiene; avian ecophysiology; insect toxicology and pathology; plant physiology, pathology, morphology, and anatomy; and **Systematics and Evolution:** systematics and evolution of plants, fungi, insects, reptiles, and amphibians; evolutionary quantitative genetics; biogeography; evolution of chemical defenses and resistance in microorganisms, insects, reptiles, and amphibians.

Research and Teaching Facilities

Herbarium. Graduate study in plant taxonomy offered in the Department of Biology utilizes the extensive facilities of the Intermountain Herbarium. The collection includes over 220,000 research specimens. About 50 percent are from the Intermountain Region, while most of the remainder are from North America.

Insect Collection. Comprising over a million specimens, the insect collection is available to scientists and graduate students involved in taxonomic research and to those requiring identification of insects in various research projects. The collection primarily covers the Intermountain Region, but it also contains species from nearly all areas of the world. The BNR Building also houses the USDA/ARS U.S. National Pollinating Insect Collection.

Electron Microscopy Facility. A state-of-the-art teaching and research electron microscope laboratory is located in the VSB Building. This facility has four electron microscopes, with two for

electron transmission microscopy, including a Zeiss CEM902 with electron energy loss elemental analysis capability. There are two scanning electron microscopes, including a Hitachi S4000 field emission SEM with analytical elemental analysis capability. In addition, a complete electron microscopy preparation laboratory is available.

Laser Scanning Confocal Microscope. The Department of Biology has a BioRad 1024 Laser Scanning Confocal Microscope. This state-of-the-art technology utilizes highly tuned lasers to give detailed sectional views of the interior of intact structures such as cells and tissues, and greatly extends the advantages of fluorescence microscopy. This microscope is utilized by researchers campuswide, and is an indispensable tool for molecular and cellular studies.

Biotechnology Center. The Biotechnology Center operates three service laboratories and a variety of research projects. The service laboratories provide essential biological resources for biotechnology research and development including: DNA synthesis, peptide synthesis, protein sequencing, antibodies, and fermentation.

Biology Courses (Biol)

Biol 1010 (BLS). Biology and the Citizen. Principles and methods of biology and how they impact the daily life and environment of the individual. (3 cr) (F,Sp,Su) ©

Biol 1020. Biological Discovery: A Lab Course. Field and laboratory investigative exercises. Emphasizes observation, hypothesis formulation and testing, data analysis, and writing. (1 cr) (F,Sp)

Biol 1100. Introduction to Microbiology. Biology and the role of microorganisms in the world around us, with emphasis on their contributions to human disease. Offered only through Independent Study. No laboratory component. Not open to students with credit in Biol 1110. (3 cr) (F,Sp,Su) ©

Biol 1110. Elementary Microbiology. Biology and role of microorganisms in the world around us, with emphasis on their contributions to human disease. Not intended for biology majors. (4 cr) (F) ©

Biol 1210 (BLS). Biology I. Principles of cell biology, energetics, and genetics. Plant structure, function, and development. Three lectures and one lab. To receive Breadth Life Sciences credit, students must complete *both* Biol 1210 *and* either Biol 1220 or 3300. (4 cr) (F)

Biol 1220 (BLS). Biology II. Animal structure, function, and development. Principles of evolution, ecology, and behavior. Three lectures and one lab. Prerequisite: Biol 1210. (4 cr) (Sp)

Biol 1750. Topics in Biology (Topic). (1-3 cr) (F,Sp) ®

Biol 2000. Human Physiology. Functioning of the human body, with emphasis upon major organ systems. Medical and athletic examples used to illustrate important concepts. (4 cr) (F,Sp,Su) ©

Biol 2010. Human Anatomy. Study of the human body, with emphasis on the structure of each of the body's essential organ systems. Three lectures, one lab. (4 cr) (Sp,Su)

Biol 2220. General Ecology. Study of the interrelationships among organisms and their environments, addressing where and how organisms live. Adaptation, population growth, species interactions, biodiversity, and ecosystem function are explored for a wide variety of organisms and ecosystems. Prerequisites: Biol 1210 and 1220. Also taught as NR 2220. (3 cr) (F,Sp)

Biol 2300. Mushroom Identification. Lecture course covering taxonomy, ecology, and importance of macro and micro fungi. Also taught as FRWS 2300. (1 cr) (F)

Biol 2310. Mushroom Identification Lab. Lab course acquainting students with basic fungal taxonomic groups. Students collect, preserve, and identify fungi they collect. Edible fungi prepared and eaten. Also taught as FRWS 2310. (1-2 cr) (F) ®

Biol 2700. Predental Orientation and Observation. Introduces predental students to the dental curriculum and characteristics of the dental profession. Each student assigned to a practicing dentist for part of the course. Prerequisite: Permission of advisor. (3 cr) (F)

Biol 3010 (DSC, CI). Evolution. Origins and evidence for the theory of biological evolution, and its significance for society and science. Prerequisite: University Studies Breadth Life Sciences course. (3 cr) (Sp)

Biol 3020 (DSC). Brain and Behavior. Introduction to human brain structure and function. Perspectives on development, normal function, aging, illness, diagnosis, and treatment will range from molecular to cellular to behavioral. Prerequisite: University Studies Breadth Life Sciences course. (3 cr) (Sp)

Biol 3030 (DSC). Genetics and Society. Course for nonscience majors. Addresses ethical, political, and social implications of advances in genetics. Basic genetic principles, as well as contemporary issues in human genetics. Prerequisite: University Studies Breadth Life Sciences course. Not open to biology majors or to those with credit in Biol 3200. (3 cr) (F)

Biol 3040 (DSC). Plants and Civilization. Examines the importance of plants as food, shelter, clothing, medicine, and drugs. Social and historical role of plants in aesthetics, religion, energy, biotechnology, human exploration, and migration. Prerequisite: University Studies Breadth Life Sciences course. (3 cr) (F)

Biol 3050 (DSC). Insect Biology. Examines life systems and anatomy of insects. Relationship of insects to other arthropods, society, and science. Two lectures, one lab. Prerequisite: University Studies Breadth Life Sciences course. (3 cr) (F)

Biol 3060 (DSC). Exploring Animal Behavior. In-depth investigation into four or five current topics in animal behavior. Students will generate hypotheses, and design and complete experiments to test them in field and laboratory settings. Two lectures, one lab. Prerequisite: University Studies Breadth Life Sciences course. (3 cr) (Sp)

Biol 3100 (CI). Bioethics. Discussion of current controversial ethical issues in medicine, animal rights, and environmental conservation. (3 cr) (Sp)

Biol 3200 (QI). Principles of Genetics. Introduction to transmission, population, and molecular aspects of modern genetics. Prerequisites: Biol 1210; Math 1050; Chem 1110 or 1220. (4 cr) (F,Sp,Su)

Biol 3220 (QI). Field Ecology. Field trips and exercises to study ecological patterns and processes in terrestrial and aquatic habitats. Emphasis on hypothesis testing and collection and analysis of data from the field. Prerequisite: Biol 2220 (may be taken concurrently); Math 1100 or 1210. Recommended: Course in statistics. (2 cr) (F)

Biol 3300 (BLS). General Microbiology. Biology, ecology, and diversity of microorganisms. Emphasis placed on bacteria, viruses, fungi, and protists, and their role in the environment. Two lectures, two labs. Prerequisites: Biol 1210 (with a grade of C- or better); Chem 1120 or 2300 or 2310 (may be taken concurrently). To receive Breadth Life Sciences credit, students must complete *both* Biol 1210 *and* 3300. (4 cr) (F,Sp)

Biol 4000. Human Dissection. Exposure and dissection of the human body, with an emphasis on bones, joints, muscles, and internal organs. One evening lab per week. Prerequisite: Biol 2010. (1 cr) (F)

Biol 4100. Genetics Laboratory. Experimental approach to genetics using bacteria, fungi, plants, insects, and humans. Students will be introduced to several computer and laboratory techniques, and will design many of the experiments. Prerequisite: Biol 3200. (2 cr) (F)

Biol 4200. Cell and Developmental Biology. Advanced course emphasizing cellular structure and function relationships and examining regulation of tissue and organism development. Prerequisites: Biol 1220, 3200; Chem 2300 or 2320; Chem 3700 highly recommended. (4 cr) (Sp)

Biol 4230 (QI). Applied Mathematics in Biology. Formulation, analysis, and experimental tests of mathematical models in biology. Combines mathematics, computing, experimental design, and statistical analysis while applying the scientific method to biological systems. Lectures, recitations, and a laboratory. Prerequisites: Biol 1220 and Math 2250; or permission of instructor. Programming recommended. Also taught as Math 4230. (3 cr) (Sp)

Biol 4250. Prehealth Internship/Co-op. Internship/cooperative work experience in prehealth biology to allow student to gain a professional level of experience. (1-2 cr) (F,Sp,Su)

Biol 4700. Natural History Excursion. Eight-day trip, which may include museums, aquaria, zoos, nature parks and preserves, biological field stations and research stations, and unique habitats in the western United States. Preparatory study and a written report are required. Maximum of 2 credits may be counted toward major electives. Prerequisite: Biol 2220. (2 cr) (Sp) ®

Biol 4710. Teaching Internship. Advanced undergraduates function as teaching interns under supervision of faculty member. Only 1 credit may be counted toward Biology degree electives. Prerequisite: Consent of instructor. (1 cr) (F,Sp,Su) ®

Biol 4750. Topics in Biology (Topic). (1-3 cr) (F,Sp,Su) ®

Biol 4760. Independent Study. Directed individual or group study. Prerequisite: Biol 1220. Not counted as Biology degree elective. (1-3 cr) (F,Sp,Su) ®

Biol 5050. Biophysics of Radiological Health. Brings together sciences relating to nuclear biophysics. Prepares students to be aware of radiological hazards, to safely use radioactive materials, and to comply with relevant laws. Prerequisites: Biol 1210, 1220, Chem 1210, 1220, a physics course, and senior standing. Also taught as Phys 5050. (3 cr) (F,Sp)

Biol 5060. Principles of Electron Microscopy. Integrative course covering theoretical and applied principles of instruments and techniques necessary to perform biological electron microscopy. Prerequisite: Chem 1220. (3 cr) (Sp)

Biol 5100 (d6100).¹ Neurobiology. Physiology, organization, and development of nervous systems. Examples taken from vertebrate and invertebrate systems. Special emphasis placed on cellular and molecular substrates of electrical excitability. Prerequisites: Biol 5600 or 5620; Chem 1220; and Phys 2120 or 2220. (3 cr) (F)

Biol 5150. Immunology. Immune response in health and disease. Experimental approach to investigating immune function and abnormalities. Prerequisites: Chem 1220; Biol 3200; and Biol 3300 or 4200. (3 cr) (Sp)

Biol 5160. Methods in Biotechnology: Cell Culture. Techniques and fundamental knowledge for culturing mammalian and insect cells. Students will learn maintenance, growing, genetic engineering of cells, cytotoxicity, hybridoma creation, cloning, etc. Extensive laboratory experience is provided. Also taught as ADVS 5160, Chem 5160, NFS 5160, and PSB 5160. (3 cr) (Sp)

Biol 5170 (d6170). Introduction to Population Genetics. Examines theoretical and applied aspects of how genes behave in natural and artificial populations of plants and animals. Genetic diversity, population structure, mating systems, selection, mu-

tation, gene flow, genetic drift, molecular evolution, and quantitative genetics. Prerequisite: Biol 3200. (3 cr) (Sp)

Biol 5190. Molecular Genetics. Molecular aspects of genetics, including DNA replication, structure, rearrangement, transposition, recombination, repair, genetic engineering, and gene expression. Prerequisites: Biol 3200; and Chem 3700 or 5700. (3 cr) (Sp)

Biol 5200 (QI). Modeling Biological Systems. Basic techniques of mathematical and computer simulation applied to a wide variety of biological systems: ecology, physiology, agroecosystems, and cell biology. Model formulation, validation, sensitivity and stability analysis, stochastic systems. Prerequisites: Math 1220, Stat 3000, programming experience. (3 cr) (F)

Biol 5240. Methods in Biotechnology: Protein Purification Techniques. Reviews basic methods of protein purification, including scaled-up use of 100L fermenter, large-scale centrifugation, diafiltration, chromatography, and use of BioCAD. Prerequisite: Chem 3700. Also taught as ADVS 5240, Chem 5240, NFS 5240, and PSB 5240. (3 cr) (Sp)

Biol 5250 (CI). Evolutionary Biology. Current topics in organic evolution from molecular to macroevolutionary scales. Prerequisite: Biol 3200 or permission of instructor; Biol/NR 2220 recommended. (3 cr) (F,Sp)

Biol 5260. Methods in Biotechnology: Molecular Cloning. Laboratory-oriented course designed to teach molecular biology techniques such as DNA cloning, genetic probes, polymerase chain reaction, and DNA sequencing. Prerequisite: Chem 3700 or 5710; or Biol 3200; or permission of instructor. Also taught as ADVS 5260, Chem 5260, NFS 5260, and PSB 5260. (3 cr) (F)

*****Biol 5280 (d6280). Quantitative Genetics.** Theory and practice of the genetics of quantitative (continuously-varying) traits. Emphasizes intersection of quantitative genetics with issues in evolution, ecology, and conservation biology. Prerequisites: Biol 3200, Stat 3000. (3 cr) (Sp)

Biol 5800. Undergraduate Research. Faculty-directed research in biology. Prerequisites: Biol 1220 and consent of instructor. Maximum of 3 credits of Biol 5800 or 5810 are acceptable toward Biology degree requirements. (1-3 cr) (F,Sp,Su) ®

Biol 5810. Bachelor's Thesis. Preparation of a written thesis, based upon individual investigation, under the supervision of faculty. Prerequisites: 3 credits of Biol 5800 (or concurrent enrollment) and consent of instructor. Maximum of 3 credits of Biol 5800 or 5810 are acceptable toward Biology degree elective requirements. (3 cr) (F,Sp,Su)

Biol 6100 (d5100). Neurobiology. Physiology, organization, and development of nervous systems. Examples taken from vertebrate and invertebrate systems. Special emphasis placed on cellular and molecular substrates of electrical excitability. For graduate (6000-level) credit, additional reading, recitation, and/or writing will be required. Prerequisites: Biol 5600 or 5620; Chem 1220; and Phys 2120 or 2220. (3 cr) (F)

Biol 6170 (d5170). Introduction to Population Genetics. Examines theoretical and applied aspects of how genes behave in natural and artificial populations of plants and animals. Genetic diversity, population structure, mating systems, selection, mutation, gene flow, genetic drift, molecular evolution, and quantitative genetics. For graduate (6000-level) credit, additional reading, recitation, and/or writing will be required. Prerequisite: Biol 3200. (3 cr) (Sp)

Biol 6180. Molecular Population Genetics Laboratory. Application of molecular techniques to population genetics, ecology, and systematics. Includes experimental and sampling design, and data analysis. Prerequisite: Biol 6170/5170 or permission of instructor. Also taught as FRWS 6180. (5 cr) (F)

****Biol 6200. Biogeochemistry of Terrestrial Ecosystems.** Inputs, outputs, and cycling patterns of major nutrients. Emphasizes mechanisms for transformations, fac-

tors influencing process rates, and the impacts of management and global change on nutrient cycles and air and water quality. Prerequisites: Biol 1220, Soil 3000, Chem 2300 or 2310, or permission of instructor. Also taught as FRWS 6200 and Soil 6200. (3 cr) (F)

***Biol 6210. Advanced Cell Biology.** Presents most recent advances in cell biology research. Prerequisites: Biol 3200 and 4200. (3 cr) (F)

*****Biol 6260. Behavioral Ecology.** Focuses on current topics, emphasizing critical reading and thinking skills. Includes lectures, student presentations, and discussions of primary literature. (3 cr) (Sp)

*****Biol 6270. Evolutionary Ecology.** Contemporary topics in evolutionary ecology with emphasis on life history evolution. Prerequisite: Biol 2220 or permission of instructor. (3 cr) (Sp)

*****Biol 6280 (d5280). Quantitative Genetics.** Theory and practice of the genetics of quantitative (continuously-varying) traits. Emphasizes intersection of quantitative genetics with issues in evolution, ecology, and conservation biology. For graduate (6000-level) credit, additional reading, recitation, and/or writing will be required. Prerequisites: Biol 3200, Stat 3000. (3 cr) (Sp)

Biol 6290. Biophysics Radioisotope Tracer Methodology. Training for users of radioactive material. Instructor provides guidance and study at each student's lab on an individual basis. Prerequisites: Biol/Phys 5050 and senior or graduate standing. (1-3 cr) (F,Sp)

Biol 6750. Topics in Biology (Topic). (1-3 cr) (F,Sp,Su) ⑥

Biol 6800. Biology Seminar. Format for general graduate-level seminar topics. (1 cr) (F,Sp,Su) ⑥

Biol 6810. Microbiology Seminar. (1 cr) (F,Sp,Su) ⑥

Biol 6820. Plant Biology/Pathology Seminar. (1 cr) (F,Sp,Su) ⑥

Biol 6830. Entomology Seminar. (1 cr) (F,Sp,Su) ⑥

Biol 6840. Zoology Seminar. (1 cr) (F,Sp,Su) ⑥

Biol 6870. Ecology Seminar. The Ecology Center schedules regular seminars throughout the school year with ecological scientists from other institutions participating. Ecology majors are required to attend a minimum of 10 such lectures. Students should register for fall semester, but attend through spring semester. Also taught as AWER 6870, EnvS 6870, and FRWS 6870. (1 cr) (F) ⑥

Biol 6890. Molecular Biology Seminar. (1 cr) (F,Sp,Su) ⑥

Biol 6910. Special Problems. Individual or group study under faculty guidance. Prerequisite: Permission of instructor. (1-3 cr) (F,Sp,Su) ⑥

Biol 6960. Graduate General Ecology. General concepts, history, and issues in all major areas of the science of ecology including: environmental biophysics; and physiological, behavioral, evolutionary, community, ecosystem, and applied ecology in both terrestrial and aquatic environments. Also taught as AWER 6960, EnvS 6960, and FRWS 6960. (5 cr) (F)

Biol 6970. Thesis Research. (1-12 cr) (F,Sp,Su) ⑥

Biol 6990. Continuing Graduate Advisement. (1-3 cr) (F,Sp,Su) ⑥

Biol 7750. Topics in Biology. (1-3 cr) (F,Sp,Su)

Biol 7970. Dissertation Research. (1-12 cr) (F,Sp,Su) ⑥

Biol 7990. Continuing Graduate Advisement. (1-9 cr) (F,Sp,Su) ⑥

Botany Courses (Biol)

Biol 2410. Field Botany. Introduction to identification of macrofungi and green plants. Quantitative methods for describing populations and communities. Prerequisite: Biol 1210. (2 cr) (Su)

Biol 3400. Plant Taxonomy. Identification of vascular plant species and recognition of families common in northern Utah. Introduction to principles and practices of plant taxonomy. Prerequisite: Biol 1210. (3 cr) (Sp)

Biol 4400 (QI). Plant Physiology. Introduction to plant metabolism, water relations, and growth. Prerequisites: Biol 1220, Math 1050. (4 cr) (F)

Biol 4410. Plant Structure. Morphology, anatomy, and development of seed plants, with an emphasis on angiosperms. Two lectures, one recitation, and one lab. Prerequisites: Biol 1210, 1220. (3 cr) (Sp)

*****Biol 5400. Advanced Plant Taxonomy.** Survey of vascular plant diversity presented in a phylogenetic and biogeographic context. Introduction to morphologically oriented research in plant taxonomy. Prerequisites: Biol 3400 and Stat 3000. (4 cr) (F)

Biol 5410. Introduction to Plant Pathology. Combined lecture-lab course emphasizing concepts in plant pathology. Symptoms and disease-causing organisms are described. Methods of control, the nature of epidemics, and disease prediction. Prerequisites: Biol 1210, 1220; Biol 3300 recommended. (4 cr) (F)

Biol 5420 (CI). Forest Pathology. Nature, cause, and management of forest diseases. Also taught as FRWS 5420. (2 cr) (Sp)

*****Biol 5440 (d6440). Plant Molecular, Cellular, and Developmental Biology I.** Examines background and recent advances. Students analyze and discuss structure, genome, molecular, development, and photosynthesis topics from a research perspective. Prerequisites: Biol 3200, 4200; Chem 3700 or 5710. Also taught as PISc 5440/6440. (3 cr) (Sp)

*****Biol 5450 (d6450). Plant Molecular, Cellular, and Developmental Biology II.** Examines background and recent advances. Students analyze and discuss cell wall, growth regulator, and environmental response topics from a research perspective. Prerequisites: Biol 3200, 4200; Chem 3700 or 5710. Also taught as PISc 5450/6450. (3 cr) (Sp)

*****Biol 6440 (d5440). Plant Molecular, Cellular, and Developmental Biology I.** Examines background and recent advances. Students analyze and discuss structure, genome, molecular, development, and photosynthesis topics from a research perspective. For graduate (6000-level) credit, additional reading, recitation, and/or writing will be required. Prerequisites: Biol 3200, 4200; Chem 3700 or 5710. Also taught as PISc 6440/5440. (3 cr) (Sp)

*****Biol 6450 (d5450). Plant Molecular, Cellular, and Developmental Biology II.** Examines background and recent advances. Students analyze and discuss cell wall, growth regulator, and environmental response topics from research perspective. For graduate (6000-level) credit, additional reading, recitation, and/or writing will be required. Prerequisites: Biol 3200, 4200, Chem 3700 or 5710. Also taught as PISc 6450/5450. (3 cr) (Sp)

Microbiology Courses (Biol)

Biol 5300 (QI). Microbial Physiology. Lectures, discussions, and laboratory investigations concerning the physiology, structure, and metabolism of prokaryotic and eukaryotic microbes. Prerequisites: Biol 3300, Math 1210. (4 cr) (Sp)

***Biol 5310. Soil Microbiology.** Ecology and diversity of microorganisms in soils. Emphasis on factors controlling microbial activity and the role of microorganisms in organic matter decomposition and nutrient cycling. Prerequisites: Biol 1210, 1220; Chem 2300 or 2310; Soil 3000. Also taught as Soil 5310. (3 cr) (F)

***Biol 5320. Soil Microbiology Laboratory.** Techniques for measuring microbial activity and diversity in soils. Includes use of molecular and isotope methods. Prerequisite: Concurrent or prior enrollment in Biol/Soil 5310. Also taught as Soil 5320. (2 cr) (F)

Biol 5330. Virology. Structure, replication, genetics, and molecular biology of viruses. Virus-host interactions. Viral diseases and antiviral agents. Prerequisites: Biol 3200 and 3300. (3 cr) (Sp)

Biol 5340. Virology Laboratory. Introduction to laboratory techniques using bacterial and animal viruses. Prerequisite: Biol 5330 (may be taken concurrently). (2 cr) (Sp)

***Biol 5350. Mycology.** Classification, ecology, genetics, and physiology of the fungi. Two lectures and one lab. Prerequisite: Biol 1220. (3 cr) (Sp)

Public Health Courses (PubH)

PubH 3120. Family and Community Health. Focuses on health aspects of various population groups within the community. Particular emphasis placed on guidelines for optimal family health. (3 cr) (Sp)

PubH 3310. Occupational Health and Safety. Covers the principles of occupational health and safety, including regulatory standards. Emphasizes on-the-job health and safety problems from the occupational health and safety professional and management view. Prerequisite: Chem 1220. (3 cr) (F)

PubH 3610. Environmental Management. Introduction to environmental health, emphasizing relationships among environmental quality, public health, environmental and occupational health regulations, human health risk assessment, institutions, and engineered systems in environmental health management. Prerequisites: Chem 1210; Biol 1210 or University Studies Breadth Life Sciences course. Also taught as CEE 3610. (3 cr) (F)

PubH 4000. Public Health Field Experience. Field experience in the practice of public health, as appropriate to each student's area of public health emphasis: public health education, environmental health, or industrial hygiene. Prerequisite: Junior standing in public health. (3-6 cr) (F,Sp,Su) ®

PubH 4010. Special Problems in Public Health. Utilization of principles, tools, and techniques of public health in problem solving. Prerequisite: Junior standing in public health. (1-3 cr) (F,Sp,Su) ®

PubH 5000. Public Health Seminar. Participant seminar on current problems in public health. (1 cr) (F,Sp) ®

PubH 5010. Communicable Disease Control. Comprehensive study of communicable diseases, including etiological agents, reservoirs of infection, and mechanisms of transmission, control, and prevention. (3 cr) (F) ©

PubH 5020. Fundamentals of Epidemiology. Introduction to the study of the distribution and causes of communicable and noncommunicable diseases of humans and other animals. Prerequisites: A course in statistics and PubH 5010. (3 cr) (Sp) ©

PubH 5300. Industrial Hygiene Seminar. Participant seminar on current developments in industrial hygiene. (1 cr) (F,Sp) ®

PubH 5310. Industrial Hygiene Chemical and Physical Hazards. Covers anticipation and recognition of chemical health hazards at work, personal protective equipment, and all aspects of physical health hazards, especially occupational noise. Prerequisite: PubH 3310 (may be taken concurrently). (4 cr) (F)

PubH 5320. Industrial Hygiene Chemical Hazard Evaluation. Survey of principles and methods used to evaluate industrial chemical health hazards. Practical application in a field sampling project. Prerequisite: PubH 3310. (3 cr) (Sp)

PubH 5330 (QI). Industrial Hygiene Chemical Hazard Control. Covers methods to control chemical occupational health hazards, with an emphasis on the function, design, and management of local exhaust ventilation. Prerequisites: PubH 3310, Math 1210. (3 cr) (F)

PubH 5350. Industrial Hygiene Field Experience. Field experience in the practice of industrial hygiene. Participation in an active program serving employees in either the private or public sector. Prerequisites: PubH 5310 and 5320. (3-6 cr) (F,Sp,Su) ®

PubH 5500 (CI). Public Health Management. Presentation of basic organizational and financial management tools, which students will utilize in written and oral reports on an educational, environmental, or occupational health problem of their choice. Prerequisite: Senior status in public health or consent of instructor. (2 cr) (Sp)

Zoology Courses (Biol)

Biol 4500. Applied Entomology. Fundamentals of insect biology, emphasizing species of economic importance. Principles and tactics of pest management. Laboratory includes survey of beneficial and harmful insects affecting humans and agriculture. Prerequisites: Biol 1210 and 1220. (3 cr) (Sp)

Biol 5530. Insect Systematics and Evolution. Evolution, biology, and classification of insects, including basic external morphology. Emphasizes role of phylogeny in systematics and importance of systematics in comparative biology. Prerequisite: Biol 1220. (3 cr) (F)

Biol 5540 (QI). Invertebrate Physiology. Physiology of invertebrates relative to structure, function, ecological strategies, and evolutionary trajectories. Laboratory investigations exploiting invertebrate diversity. Prerequisites: Biol 1220; Math 1210. (4 cr) (Sp)

Biol 5550. Freshwater Invertebrates. Taxonomy, ecology, and biology of major freshwater invertebrate taxa, including insects, crustaceans, molluscs, and oligochaetes. Several weekend field trips and a collection required. Prerequisite: One year of general biology or zoology, or permission of instructor. Also taught as AWER 5550. (3 cr) (Sp)

*****Biol 5560. Ornithology.** Surveys evolution, systematics, physiology, anatomy, ecology, behavior, and identification of birds. Includes lectures, laboratory and field exercises, field trips, and an independent project. Attendance required at one Saturday and one Friday-Sunday field trip. Prerequisites: Biol 1210, 1220; Math 1050. (3 cr) (Sp)

Biol 5570. Herpetology. Evolution, adaptations, distribution, natural history, behavior, and identification of amphibians and reptiles of the world, with special emphasis on North American species. Two lectures and one lab. Prerequisite: Biol 1220. (3 cr) (Sp)

Biol 5580. Mammalogy. Evolution, adaptations, distribution, natural history, behavior, and identification of mammals of the world, with special emphasis on North American species. Two lectures and one lab. Prerequisite: Biol 1220. (3 cr) (F)

Biol 5590 (d6590). Animal Community Ecology. Concepts and controversies in modern community ecology emphasizing aquatic and terrestrial animals. Covers the community concept, diversity and stability, null models, relative importance of competition and predation, food webs, disturbance, metapopulations, biogeography, and new directions. Prerequisites: Biol 2220, Stat 3000. (4 cr) (Sp)

Biol 5600. Comparative Animal Physiology. General principles and mechanisms of gas exchange, circulation, locomotion, nutrition, and neurological and endocrine function in vertebrate and invertebrate animals. Prerequisites: Biol 1220, Chem 1220. (3 cr) (F)

Biol 5610 (QI). Comparative Animal Physiology Laboratory. Laboratory exercises designed to explore principles of animal physiology, using computer simulations, tissue models, and animal preparations. Emphasis placed on hypothesis design and data interpretation. Prerequisite: Biol 5600 (may be taken concurrently). (2 cr) (F)

Biol 5620. Medical Physiology. Cardiovascular, respiratory, endocrine, gastrointestinal, excretory, and nervous system function in the mammalian body. Emphasis on molecular mechanisms. Examples from mammalian diseases used to illustrate key concepts. Prerequisites: Biol 1220, 2000, or 5600; Chem 3700 or 5710 (may be taken concurrently). (3 cr) (Sp)

****Biol 6510. Insect-Plant Interactions.** Ecology, evolution, and physiology of the interactions between insects and plants, including herbivory, defenses/compensations of plants to insect attack, pollination, and other mutualisms. (2 cr) (F)

*****Biol 6520. Ecological Vertebrate Physiology.** Physiological responses and adaptations of vertebrates to physical, chemical, and biological environments.

Bioenergetics at the species level. Three lectures. Prerequisites: One course in physiology and one course in ecology. (3 cr) (F)

Biol 6590 (d5590). Animal Community Ecology. Concepts and controversies in modern community ecology emphasizing aquatic and terrestrial animals. Covers the community concept, diversity and stability, null models, relative importance of competition and predation, food webs, disturbance, metapopulations, biogeography, and new directions. For graduate (6000-level) credit, additional reading, recitation, and/or writing will be required. Prerequisites: Biol 2220, Stat 3000. (4 cr) (Sp)

¹Parenthetical numbers preceded by *d* indicate a *dual* listing.

® Repeatable for credit. Check with major department for limitations on number of credits that can be counted for graduation.

© This course is also offered by correspondence through Continuing Education Independent and Distance Education.

*Taught 2002-2003.

**Taught 2003-2004.

***This course is taught alternating years. Check with department for information about when course will be taught.