Division of Biological Sciences

Note: The middle digits of biological sciences course numbers are used to denote courses in specific areas: 0, general; 1 and 5, animal physiology and anatomy; 2 and 9, neurobiology and behavior; 3, biochemistry and cell biology; 4 and 5, botany; 5, 6, and 7, ecology, systematics, and evolution; 8, genetics and development.

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General Courses

101–102 Biological Sciences, Lectures 101, fall; 102, spring. 2 credits each term. Prerequisite: concurrent enrollment in Biological Sciences 103 (fall), or 104 or 208 (spring). 101 is prerequisite to 102, unless written permission is obtained from instructor. May not be taken for credit after Biological Sciences 105–106 or 109–110.

Lecs, M W F 9:05 or 10:10. 2 lecs each week; to accommodate these, students must reserve all 3 days. Prelims: fall, 6:30 p.m. Sept. 30 and Nov. 6; spring, 6:30 p.m. Mar. 5 and Apr. 9. K. K. Adler.

Designed both for students who intend to specialize in biological sciences and for those specializing in other subjects, such as the social sciences or humanities, who want to obtain a thorough knowledge of biology as part of their general education. Plant and animal materials are considered together rather than in separate units. The fall semester covers the chemical and cellular basis of life, energy transformations, anatomy, and physiology. The spring semester covers genetics and development, evolution, ecology, behavior, the origin of life, and the diversity of living organisms. Each topic is considered in the light of modern evolutionary theory.

103–104 Biological Sciences, Laboratory 103, fall; 104, spring. 2 credits each term. Prerequisite: concurrent enrollment in Biological Sciences 101 (fall) or 102 (spring), or written permission of instructor. 103 is prerequisite to 104, unless written permission is obtained from instructor. No admittance after second week of classes.

Lab, M T W or R 1:25–4:25, M or W 7:30–10:30 p.m., T R or S 8–11, or F 10:10–1:10. One 3–hour lab each week and a weekly lec section for discs, special lecs, etc. To accommodate weekly lec section, students must reserve M W and F 9:05 or 10:10 since the day of the lec section varies throughout the semester. J. C. Glase, P. R. Ecklund, M. A. Houck, and staff.

A laboratory course emphasizing the methods used by biologists to discover new knowledge. Students design and perform investigations in biology. In preparation for this, exposure is given to basic biological concepts, research methodologies, relevant data analysis techniques and statistics, instrumentation, and laboratory techniques in all of the major areas of biology. Research projects include investigative design, data analysis, and communication of investigative results and conclusions.

105–106 Introductory Biology 105, fall; 106, spring. 4 credits each term (or 2 credits for transfer or advanced placement students, with permission of instructor). Prerequisite: 105 is prerequisite to 106, unless written permission is obtained from instructor. S-U grades optional, with written permission of instructor. May not be taken for credit after Biological Sciences 101–104 or 109–110.

Lec, M 12:20; 1–hour disc and 2 office hours each week to be arranged at first lec meeting; additional study and lab hours arranged at student's convenience each week. E. R. Loew.

Designed primarily for students who intend to specialize in the biological or other sciences; also open to nonmajors who want a more comprehensive biology course than the one for nonmajors (Biological Sciences 109–110). Recommended for students whose first language is not English. The course is taught in an autotutorial format and students are expected to put in some time *each* week (students can seldom work ahead and there are severe penalties for falling behind). Laboratory work is an integral part of the course.

Course material is divided into required units that must be completed by all students, and elective units that offer a choice of related topics for students who wish to improve their grades. Students are expected to achieve greater than 80 percent mastery of required material. The final exam covers the entire semester's work.

108 Interactive Computing for Students of Biological Sciences Spring. 1 credit. Not open to students with prior courses in computing.

Lec, T 1:25; lec every other week. H. C. Howland.

An introduction to computing using the interactive language BASIC with a discussion of other algebraic computing languages such as FOCAL and elementary FORTRAN. Students are issued tickets for 10 hours of computing time at the Division of Biological Sciences interactive computing facility. Applications to problems in the biological sciences are emphasized.

109–110 Biology for Nonmajors 109, fall; 110, spring. 3 credits each term. Limited to 600 students. Prerequisite: 109 is prerequisite to 110, unless written permission is obtained from instructor and the student has at least 3 credits of college biology. S-U grades optional. May not be taken after Biological Sciences 101–104 or 105–106. This course may be used to fulfill the distribution requirement in the Colleges of Agriculture and Life Sciences, Arts and Sciences, and Human Ecology but may *not* be used as an introductory course for the major in biological sciences. *Note that this course may not always satisfy the prerequisite for second- and third-level courses in biology.*

Lecs, M W F 9:05 or 11:15; lab, M T W R or F 2–4:25 or T 10:10–12:35. Students do not choose lab sections during course enrollment; lab assignments are made during first week of classes. Each student must attend lab on alternate weeks. Prelims: fall, 6:30 p.m. Sept. 30 and Nov. 6; spring, 6:30 p.m. Mar. 5 and Apr. 16. C. H. McFadden, C. Eberhard.

Students who do not plan to major in biology may take this broad introductory course in modern biology. It is not a course in social biology, but addresses itself to biological principles with academic rigor. The content is designed to appeal to anyone who seeks a comprehensive knowledge of biology as part of a general education. Laboratory

sections enable small groups of students to meet with the course staff and are used for problem-solving experiments, demonstrations, and discussions.

200 Special Studies in Biology Fall or spring. 1–3 credits. Prerequisites: written permission of instructor and of the associate director of the Division of Biological Sciences (a special form for this purpose is available in Stimson 118). S-U grades optional, with permission of instructor.

Hours to be arranged. Staff.

For students who wish to take only a portion of a regular biological sciences course — for example, only the lectures or only the laboratory in a course that includes both. Course 200 will ordinarily be taken only by transfer students who have already had training equivalent to the portion of the regular course that is to be omitted. May not be substituted for 100-level courses.

[201–202 History of Biology (also History 287–288) 201, fall; 202, spring. 3 credits each term. Prerequisite: one year of introductory biology. 201 is not prerequisite to 202. S-U grades optional. Not offered 1980–81.

Lecs, T R 10:10–11:30. W. B. Provine.

An examination of the history of biology, emphasizing the interaction of biology and culture. Original writings of biologists constitute the bulk of reading assignments. The fall semester covers the period from classical antiquity to 1900. The spring semester is devoted entirely to twentieth-century biology.]

205 Biomedical Ethics (also Philosophy 245) Fall. 3 credits. Primarily for sophomores, juniors, and seniors; permission of instructor required for graduate students.

Lecs, M W F 1:25. S. M. Brown.

Critical analysis of the conceptual framework in which ethical problems in biology and medicine are to be understood, debated, and solved. Problems include experimentation on humans, abortion and euthanasia, genetic diseases and recombinant DNA research, behavior modification, and the right to health care and health care systems. Each of the topics is covered in lectures and assigned readings.

206 Environmental Ethics (also Philosophy 246) Spring. 3 credits. Open to sophomores, juniors, and seniors; permission of instructor required for graduate students. Prerequisite: one year of introductory biology.

Lecs, M W F 1:25. S. M. Brown.

Critical analysis of the conceptual framework in which environmental policies are formulated and judged. Problems include private interest versus the public good; the relation of individual rights to the collective welfare with respect to property, compensation, regulation, and the exercise of eminent domain; moral obligations to the poor and to future generations; the concept of pollution; and the ideas of diversity, balance, and stability in the natural environment.

208 Biological Discovery Laboratory Spring. 2 credits. Limited to 30 students who apply for admission and are recommended by their instructors in Biological Sciences 103. Prerequisite: Biological Sciences 103.

Labs, T R 1:25–4:25. J. M. Fessenden-Raden.

A research-oriented alternative to Biological Sciences 104. Designed to instruct students in the ways that scientists ask questions about living things and design and carry out observations or experiments to answer these questions. Students work individually on extended research problems that they design. Instruction is highly individualized and aimed at improving each student's ability to ask meaningful questions, organize and quantify observations, analyze research data, and relate results to previously reported biological findings. Written research reports are prepared and oral reports presented. Specific research techniques are introduced when needed.

300 Laboratory Methods in Biology Summer, 6-week session. 3 credits. Prerequisite: one year of introductory college biology. Fee, $5.

Lecs and Labs, M T W R F 1:30–4 for 6 weeks. L. D. Uhler.

For students who intend to teach or follow some phase of biology as a profession. Subjects covered: collection, preservation, and storage of materials; preparation of bird and mammal study skins; injection of circulatory systems with latex; clearing and staining of small vertebrates; and preparation and staining of squashes, smears, whole mounts and sections. No formal exams. Grade is based on required work submitted at the end of the course.

301 Biology and Society I: The Biocultural Perspective (also Anthropology 301 and Biology and Society 301) Fall. 3 or 4 credits (4 credits by arrangement with instructor). Prerequisite: one year of introductory biology. S-U grades optional. This is part of the two-semester core course for the biology and society major and is also available to other students who have fulfilled the necessary prerequisite.

Lecs, M W F 9:05. D. J. Greenwood.

Human biology, behavior, and institutions are viewed as the ongoing products of the interactions between human biological evolution and cultural change. These interactions are documented with reference to the evolution of the capacity for culture; human groups and institutions; language, meaning, and cultural "realities"; and major models of human nature and human institutions.

302 Biology and Society II: Biology, Society, and Ethics (also Anthropology 302 and Biology and Society 302) Spring. 3 or 4 credits (4 credits by arrangement with instructor). Prerequisite: Biological Sciences 301. S-U grades optional. This is the second semester of the two-semester core course for the biology and society major and is also available to other students who have taken 301.

Lecs, M W F 9:05. D. J. Greenwood, S. J. Risch, S. M. Brown.

This course considers the complex intellectual, practical, and ethical issues centering on the relationships between biological and social phenomena. Specific current issues such as pollution, genetic counseling, and recombinant DNA research are considered, and an effort is made to develop viable biocultural ethics for dealing with such problems.

305 Basic Immunology, Lectures (also Veterinary Medicine 315) Fall. 2 credits. Prerequisite: a course in basic microbiology or permission of instructor.

Lecs, T R 9:05. A. J. Winter.

Course material covers current concepts in immunology at an elementary level, with special emphasis on the biological functions of the immune response.

307 Basic Immunology, Laboratory (also Veterinary Medicine 316) Fall. 2 credits. Prerequisite: a course in basic microbiology or permission of instructor. Recommended: concurrent enrollment in Biological Sciences 305.

Labs, T R 10:10–1:10. N. L. Norcross.

Designed to illustrate immunological concepts presented in Biological Sciences 305. Laboratory exercises are selected to familiarize students with basic humoral and cellular immune phenomena and to offer firsthand experience in immunological laboratory techniques.

309 Techniques in Animal Handling and Surgery Intersession. 2 credits. Limited to 12 students, with preference given to students who are registered in an independent research course. Prerequisite: written permission of instructor. S-U grades only. Fee, $5.

Lecs and labs, M T W R F 9–4:30 for 3 weeks. A. van Tienhoven.

Audiovisual materials and actual experience are used in this minicourse to teach students techniques needed for independent research and honors projects.

498 (403, 404) Teaching Experience Fall or spring. 1–4 credits. Enrollment limited. Prerequisites: previous enrollment in the course to be taught or equivalent, and written permission of instructor. S-U grades optional, with permission of instructor. *Students in the College of Arts and Sciences may not count credits from this course towards the 100 Arts College credits required for graduation.*

Hours to be arranged. Staff.

Designed to give qualified undergraduate students teaching experience through actual involvement in planning and assisting in biology courses. This experience may include supervised participation in a discussion group, assisting in a biology laboratory, assisting in field biology, or tutoring. Biological Sciences courses currently offering such experience include 103–104, 105–106, 109–110, 274, 311, 313, 319, 324, 330, 430, 464, 468, and 475.

499 (409, 419, 429, 439, 449, 469, 489) Undergraduate Research in Biology Fall or spring. Variable credit. Prerequisite: written permission from the staff member who will supervise the work and assign the grade. S-U grades optional. Any faculty member in the Division of Biological Sciences may act as a supervisor. Faculty supervisors outside the division are acceptable only if a faculty member of the division agrees to take full responsibility for the quality of the work. *This course is divided into multiple sections as printed in the* Course and Time Roster *and the supplement to the* Course and Room Roster. Students must register under supervisor's assigned section number, or Section 01 if supervisor was not assigned a section number.

Hours to be arranged. Staff.

Practice in planning, conducting, and reporting independent laboratory and library research programs.

Research credits may *not* be used in completion of the following concentration areas: animal physiology and anatomy; biochemistry; botany; cell biology; and ecology, systematics, and evolution.

No more than 4 credits of research may be used in completion of the following concentration areas: genetics and development, and neurobiology and behavior.

600 Introduction to Scanning Electron Microscopy Fall or spring, weeks 1–4. 1 credit. Primarily for graduate students, but open to seniors who can demonstrate a need for the course. Limited to 10 students. Prerequisite: permission of instructor. S-U grades only.

Lec and lab to be arranged. M. V. Parthasarathy, M. K. Hausmann.

The course is a general introduction to the principles and the proper use of the scanning electron microscope. Emphasis is on using the instrument to observe biological specimens and on methods of preparing biological material for scanning electron microscopy.

602 Advanced Electron Microscopy for Biologists I Spring, weeks 1–3. 1 credit. Primarily for graduate students. Limited to 8 students. Prerequisites: Biological Sciences 603 or equivalent, and permission of instructor. S-U grades only.

Lec, T 11:15; disc to be arranged; labs, T R 1:25–4:25. M. V. Parthasarathy.

High-resolution electron microscopy; problems of obtaining high-resolution electron micrographs of biological specimens; visualization of macromolecules.

603 Electron Microscopy for Biologists Fall. 3 credits. Primarily for graduate students, but open to upperclass students. Limited to 12 students, with preference given to students with research projects

requiring electron microscopy. Prerequisites: either Biological Sciences 300, 313, 345, or 347, or equivalent, and written permission of instructor. Registration during course enrollment recommended. S-U grades optional.

Lec, T 11:15; labs, M W 1:25–4:25, T R 1:25–4:25, or W F 8–11. M. V. Parthasarathy.

Principles of electron microscopy; histological techniques for electron microscopy, such as ultrathin sectioning, negative staining, and metal shadowing; and interpretation of results. A brief introduction to scanning electron microscopy is also included.

604 Advanced Electron Microscopy for Biologists II Spring, weeks 4–6. 1 credit. Primarily for graduate students. Limited to 8 students. Prerequisites: Biological Sciences 603 or equivalent, and permission of instructor. S-U grades only.

Lec, T 11:15; disc to be arranged; labs, T R 1:25–4:25. M. V. Parthasarathy.

Principles of autoradiography at both light microscopy and electron microscopy levels; incorporation of radioactive material into biological specimens for autoradiography; problems of resolution and quantitative aspects of autoradiography.

606 Advanced Electron Microscopy for Biologists III Spring, weeks 7–9. 1 credit. Primarily for graduate students. Limited to 8 students. Prerequisites: Biological Sciences 603 or equivalent, and permission of instructor. S-U grades only.

Lec, T 11:15; disc to be arranged; labs, T R 1:25–4:25. M. V. Parthasarathy.

Principles of freeze fracturing and freeze substitution techniques; freezing artifacts and interpretation of images.

608 Advanced Electron Microscopy for Biologists IV Spring, weeks 10–14. 1 credit. Primarily for graduate students. Limited to 6 students. Prerequisites: Biological Sciences 603 or equivalent, and either Biological Sciences 602, 604, or 606. S-U grades only.

Hours to be arranged. M. V. Parthasarathy.

Project in biological ultrastructure.

[702 X-Ray Elemental Analysis in Biology Spring. 1 credit. Limited to 8 students. Prerequisites: Biological Sciences 600 or 603, and permission of instructor. S-U grades only. Offered alternate years. Not offered 1980–81.

Lec and lab to be arranged. M. V. Parthasarathy, M. K. Hausmann.

Principles of x-ray elemental analysis are discussed, with special reference to the energy-dispersive system. Emphasis is on qualitative elemental analysis of biological specimens and preparation of material for such analysis. A brief introduction to quantitative elemental analysis is also given.]

Related Courses in Other Departments

Biology and Society Senior Seminars (Biology and Society 400–403)

Students interested in training in **biophysics** may find the following courses useful:

Bioinstrumentation (Electrical Engineering 621)

Biomechanical Systems — Analysis and Design (Engineering M&AE 565)

General Animal Physiology (Biological Sciences 416, 418)

Mammalian Neurophysiology (Biological Sciences 610)

Membrane Biophysics (Engineering A&EP 615)

Neuroelectric Systems (Biological Sciences 696)

Photosynthesis (Biological Sciences 445)

Physics of Macromolecules (Physics 464)

Physiological Optics (Biological Sciences 695)

Special Topics in Biophysics (Engineering A&EP 614)

The Physics of Life (Engineering A&EP 206)

Vision (Biological Sciences 395)

Animal Physiology and Anatomy

212 (310) Invertebrate Zoology Spring. 3 credits. Limited to 20 students. Prerequisite: one year of introductory biology for majors.

Lecs, T R 11:15; lab, T 2–4:25. A. W. Blackler.

An introduction to the structure, function, and development of invertebrate animals of the major phyla, with emphasis on the phylogenetic relationships.

214 Biological Basis of Sex Differences (also Women's Studies 214) Spring. 3 credits. Prerequisite: one year of introductory biology. S-U grades optional.

Lecs, M W F 10:10. J. E. Fortune.

A basis for objective evaluation of sex differences in relation to contemporary life is provided by examination of the structural and functional differences between the sexes. The course provides an overview of both sex differences and reproductive patterns for the vertebrates and deals more specifically with topics that relate only to mammals or humans.

274 The Vertebrates Spring. 5 credits. Primarily for sophomores; this course is a prerequisite for many advanced courses in vertebrate biology, anatomy, and physiology. Each lab limited to 21 students. Prerequisite: one year of introductory biology for majors. Fee, $10.

Lecs, T R 10:10; labs, M W 1:25–5, M W 7–10 p.m., or T R 1:25–5. Staff.

An introduction to the evolution, classification, comparative anatomy, life history, and behavior of vertebrate animals. Laboratory dissection and demonstration are concerned with structure, classification, systematics, biology of species, and studies of selected aspects of vertebrate life.

311 Introductory Animal Physiology, Lectures (also Veterinary Medicine 346) Fall. 4 credits. Prerequisites: one year of college biology, chemistry, and mathematics.

Lecs, M W F 11:15; disc to be arranged. D. N. Tapper.

A general course in vertebrate physiology emphasizing the basic characteristics of the circulatory, nervous, pulmonary, renal, and gastrointestinal systems; energy metabolism; endocrinology; and reproductive physiology. Neural and hormonal control of function is emphasized.

312 Anatomy and Behavior of the Gull Summer. 2 credits. Prerequisite: one year of introductory college biology. S-U grades optional. A special 2-week course offered at Cornell's Shoals Marine Laboratory (SML) on an island off Portsmouth, N.H. For more details and application, consult the SML office, Stimson G14. Estimated cost, $475.

Daily lecs, lec-demonstrations, and labs for 2 weeks. SML faculty.

The gull has been a major subject in the study of animal behavior. In this course the functional anatomy of all gull organ systems is considered and demonstrated, with emphasis on sensory, nervous, digestive, and respiratory systems. The large nesting colonies of two species of gulls on Appledore Island are used to demonstrate territoriality, aggression, mating, and other basic patterns of gull behavior.

313 Histology: The Biology of the Tissues Fall. 4 credits. Prerequisites: one year of introductory biology. Recommended: background in vertebrate anatomy and organic chemistry or biochemistry.

Lecs, T R 11:15; labs, T R 2–4:25. W. A. Wimsatt.

Provides the student with a basis for understanding the microscopic, fine-structural, and functional organization of vertebrates, as well as the methods of analytic morphology at the cell and tissue levels. The dynamic interrelations of structure, composition, and function in cells and tissues are stressed.

[315 Ecological Animal Physiology, Lectures Fall. 3 credits. Prerequisite: one year of introductory biology for majors. Offered alternate years. Not offered 1980–81.

Lecs, M W F 10:10. W. N. McFarland, F. H. Pough.

An introductory course for students interested in ecology and physiology. The characteristics of the physical environment that are important to organisms are discussed; and representative physiological, behavioral, and morphological adaptations of vertebrate and invertebrate animals to their environments are analyzed.]

[317 Ecological Animal Physiology, Laboratory Fall. 1 credit. Limited to 12 students. Prerequisite: concurrent enrollment in Biological Sciences 315. Offered alternate years. Not offered 1980–81.

Lab, W or R 1:25–4:25. W. N. McFarland, F. H. Pough.

Exercises involve measurement of important environmental factors in local habitats; laboratory experiments to familiarize students with the use of physiological methods; and an individual student research project dealing with specific adaptations of organisms to their environment.]

318 Cellular Physiology Summer, 3-week session. 3 credits. Prerequisites: one year of introductory college biology and chemistry; or permission of instructor.

Lecs, M T W R F 9:30–12 for 3 weeks. M. V. Hinkle.

A basic course on physiological processes at the cellular level. Particular emphasis is placed on eucaryotic cells and on membrane-related phenomena. Topics include active, passive, and bulk transport across membranes; structure and function of cell organelles; cell growth and proliferation; intercellular communication; excitability; contractility; and specialized cells of the immune, endocrine, and neuromuscular systems. Course may be used as an introduction to organ or medical physiology.

319 Introductory Animal Physiology, Laboratory (also Veterinary Medicine 348) Fall. 1 credit. Limited to 100 students, with preference given to students concentrating in animal physiology and anatomy. Prerequisite: concurrent or previous enrollment in Biological Sciences 311.

Lab, M T W or R 1:25–4:25. Each student must attend lab on alternate weeks. Each lab section limited to 25 students. D. N. Tapper.

Laboratory sessions consist of demonstrations, instructor-assisted experiments, and student-run experiments covering the nervous, pulmonary, renal, circulatory, and gastrointestinal systems.

351 Biological Rhythms with a Period of 1 Day to 1 Year Fall. 1 credit. Prerequisites: one year of introductory biology and either Mathematics 106, 111, or 113.

Lec, R 12:20. A. van Tienhoven.

Theoretical and practical aspects of circadian and circennial rhythms are considered. Selective topics such as the biological clock of plants, insects, and vertebrates are presented. Light is considered as a stimulus and as an entraining agent. The role of rhythms on migration and reproduction is emphasized.

410 Seminar in Anatomy and Physiology Fall or spring. 1 credit. May be repeated for credit only once. Limited to upperclass students. S-U grades only.
Sem to be arranged. Organizational meeting first T of each semester at 7:30 p.m. in Biology Center (Stimson G20). Staff (coordinator: W. Hansel).

411 Motor Physiology Fall. 4 credits. Prerequisites: Biological Sciences 321 and written permission of instructor. S-U grades optional.
Lecs, M W F 8; disc to be arranged. A. H. Cohen.
An examination of the control of movement, primarily in vertebrates, with an emphasis on centrally generated movements. It begins with the sensory and motor components, followed by the known central connections. Finally, spinally generated movements are discussed. Other topics are included such as cerebellar function and respiration.

412 Special Histology: The Biology of the Organs Spring. 4 credits. Limited to 12 students. Prerequisite: Biological Sciences 313 or written permission of instructor. Offered alternate years.
Lecs, W F 9:05; labs, W F 2–4:25. W. A. Wimsatt.
A continuation of Biological Sciences 313. The microscopic and ultrastructural organization of the principal vertebrate organ systems are studied in relation to their development, functional interaction, and special physiological roles. Courses 313 and 412 together present the fundamental aspects of the microscopic and submicroscopic organization of the vertebrate. The organization of the course involves student participation in lecture-seminars and independent project work supplementary to the regular work of the laboratory. The latter enables students to gain practical experience with histological and histochemical preparative techniques.

414 Vertebrate Morphology (also Veterinary Medicine 700) Spring. 3 credits. Prerequisite: graduate standing, or Biological Sciences 274 or equivalent. (Prerequisite waived for students concentrating in animal physiology and anatomy.) S-U grades optional.
Labs, T R 2–4:25. H. E. Evans.
Student dissections of the dog serve as the basis for a functional consideration of the major component parts of the body and its organ systems. This is followed by a dissection of the cow. Other species (fish to mammal) of interest to members of the class may also be dissected.

416 General Animal Physiology: A Quantitative Approach, Lectures Spring. 3 credits. Prerequisites: one year of college biology and physics. S-U grades optional.
Lecs, M W F 10:10. H. C. Howland.
The principles of animal physiology are developed through consideration of the functioning of cells, tissues, and organs. Specific topics discussed include respiration, metabolism, circulation, excretion, body mechanics, muscle contraction, nerve action, sensory reception, and central nervous system function. A quantitative, systems-theoretical approach is emphasized.

418 General Animal Physiology, Laboratory Spring. 2 credits. Prerequisite: concurrent enrollment in Biological Sciences 416 or equivalent.
Lec, 1 hour, to be arranged; lab, M or T 1:25–4:25. H. C. Howland.
Students are introduced to basic techniques utilized in the study of the physiology of animal tissues. Experiments cover topics dealing with respiration, properties of muscle, circulation, activity of nerves, and osmotic phenomena.

452 Comparative Physiology of Reproduction of Vertebrates, Lectures (also Animal Science 452) Spring. 3 credits. Prerequisite: Animal Science 427 or permission of instructor.
Lecs, M W F 1:25. A. van Tienhoven.
Sex and its manifestations. Neuroendocrinology, endocrinology of reproduction, sexual behavior, gametogenesis, fertilization, embryonic development, care of the zygote, environment and reproduction, and immunological aspects of reproduction.

454 Comparative Physiology of Reproduction of Vertebrates, Laboratory (also Animal Science 454) Spring. 2 credits. Prerequisite: concurrent or previous enrollment in Biological Sciences 452 or permission of instructor.
Lab to be arranged. Organizational meeting first F of semester at 2:30. A. van Tienhoven.
The laboratory provides students with an opportunity to independently design and execute experiments with limited objectives.

458 (654–656) Mammalian Physiology Spring. 6 credits. Enrollment limited. Prerequisite: Biological Sciences 311 or 416, or equivalent with written permission of instructor.
Lecs, M W F 8; lab, M or W 1:25–4:25; 4 additional hours to be arranged. K. W. Beyenbach and staff.
Selected topics in mammalian physiology are discussed in the lecture and concurrently studied in the laboratory. Topics are selected from the following: physiology of membranes and epithelia; nerve and muscle; heart and circulation; autonomic, somatic, and sensory nervous systems, respiration, digestion; salt and water balance; acid-base balance; and endocrine regulation.

[610 Mammalian Neurophysiology (also Veterinary Medicine 753) Spring. 3 credits. Limited to 16 students. Prerequisites: two years of college biology. Recommended: courses in biochemistry and physics. Offered alternate years. Not offered 1980–81.
Lec and disc, R 10:10; lab, R 1:25–4:25; additional hours to be arranged. E. L. Gasteiger.
Studies include electrical activity of cells; reflexes; decerebrate rigidity; acoustic microphonic response; subcortical stimulation; and evoked and spontaneous cortical activity.]

615 Nutrition and Physiology of Mineral Elements (also Veterinary Medicine 759 and Nutritional Sciences 659) Fall. 2 credits. Prerequisites: courses in basic physiology, intermediate biochemistry, and general nutrition. Offered alternate years.
Lecs, T R 10:10. R. H. Wasserman, R. Schwartz, D. R. VanCampen.
Lectures on nutritional aspects and physiological, biochemical, and hormonal relationships of the prominent macroelements and microelements, with emphasis on recent developments. Information is included on methodologies of mineral research and the essentiality, requirements, transport, function, homeostasis, interrelationships, and toxicity of various mineral elements.

616 Radioisotopes in Biological Research (also Veterinary Medicine 750) Spring. 4 credits. Prerequisites: courses in animal or plant physiology, or permission of instructor.
Lecs, T R 11:15; lab, T 1:25–5. F. W. Lengemann.
Lectures and laboratories deal with the radioisotope as a tool in biological research. Among the topics considered are the utilization and detection of beta-emitting isotopes, gamma spectrometry, Cerenkov counting, neutron activation, autoradiography, and whole-body counting. Emphasis is placed on liquid scintillation counting, double-label experiments, and C^{14} and H^3 as metabolic tracers. Experiments are designed to present basic principles, using plants and animals as subject material.

617 Applied Electrophysiology (also Veterinary Medicine 652) Fall. 2 credits. Open to seniors, graduate students, and second-, third-, and fourth-year veterinary students. Prerequisites: physics and two years of college biology; or permission of instructor.
Lec, W 8; lab, W 2–4:25. E. L. Gasteiger, E. R. Loew.
Theory and practice of electrophysiological techniques currently used for study of the nervous and muscular systems in normal and diseased states. Topics include electroencephalography, electromyography, electroretinography, and evoked potentials.

618 Biological Membranes and Nutrient Transfer (also Veterinary Medicine 752) Spring. 2 credits. Prerequisites: courses in animal or plant physiology, quantitative and organic chemistry, and physics, and permission of instructor. Recommended: courses in cellular physiology and elementary physical chemistry. Offered alternate years.
Lecs, T R 11:15. R. H. Wasserman.
An introduction to elementary biophysical properties of biological membranes; theoretical aspects of permeability and transport; and mechanism of transfer of inorganic and organic substances, primarily across epithelial membranes.

619 Lipids (also Nutritional Sciences 602) Fall. 2 credits. Prerequisite: Biological Sciences 330 or 331.
Lecs, T R 11:15. A. Bensadoun.
Advanced course on biochemical, metabolic, and nutritional aspects of lipids. Emphasis on critical analysis of current topics in lipid methodology; lipid absorption; lipoprotein secretion, structure, and catabolism; mechanism of hormonal regulation of lipolysis and fatty acid synthesis; and cholesterol metabolism and atherosclerosis.

[658 Molecular Mechanisms of Hormone Action (also Veterinary Medicine 758) Spring. 2 credits. Prerequisite: permission of instructor. Offered alternate years. Not offered 1980–81.
Lecs, T R 10:10. R. A. Corradino.
An advanced course developed from the current literature on endocrine mechanisms.]

719 Graduate Research in Animal Physiology and Anatomy (also Veterinary Medicine 600) Fall or spring. Variable credit. Prerequisite: written permission of section chairperson and staff member who will supervise the work and assign the grade. S-U grades optional.
Hours to be arranged. Staff.
Similar to Biological Sciences 499 but intended for graduate students who are working with faculty members on an individual basis.

Related Courses in Other Departments

Advanced Work in Animal Parasitology (Veterinary Medicine 737)

Animal Reproduction and Development (Animal Science 220)

Cellular Neurobiology (Biological Sciences 496)

Developmental Biology (Biological Sciences 385)

Fundamentals of Endocrinology (Animal Science 427)

Insect Morphology (Entomology 322)

Neuroanatomy (Veterinary Medicine 504)

Parasitic Helminthology (Veterinary Medicine 440)

Population Biology of Health and Disease (Veterinary Medicine 330)

Teaching Experience (Biological Sciences 498)

Undergraduate Research in Biology (Biological Sciences 499)

Vertebrate Developmental Anatomy (Biological Sciences 389)

Vision (Biological Sciences 395)

Neurobiology and Behavior

321 Neurobiology and Behavior Fall. 3 credits. Prerequisite: one year of introductory biology. S-U grades optional, with permission of instructor.
Lecs, M W F 12:20. M. M. Salpeter, T. Eisner, and staff.
A general introduction to the field of neurobiology and behavior. Topics include evolution of behavior, cueing of behavior, animal orientation, social and nonsocial behavior, neuroanatomy, neurophysiology, neurochemistry, neural networks, and memory.

322 Hormones and Behavior (also Psychology 322) Spring. 3 credits. Primarily for upperclass students; permission of instructor required for sophomores. Prerequisites: one year of introductory biology, and Biological Sciences 321 or a course in psychology.
Lecs, T R 10:10–11:30. E. K. Adkins, R. E. Johnston.
The relationship between endocrine and neuroendocrine systems and the behavior of animals, including humans. Major emphasis is on sexual, parental, and aggressive behavior.

324 Biopsychology Laboratory (also Psychology 324) Spring. 3 credits. Limited to 25 upperclass students. Prerequisites: laboratory experience in biology or psychology, Biological Sciences 321 or Psychology 123, and permission of instructor. S-U grades optional.
Labs, T R 1:25–4:25. Staff.
Experiments designed to provide research experience in animal behavior (including learning) and its neural and hormonal mechanisms. A variety of techniques, species, and behavior patterns are included.

[395 Vision (also Engineering A&EP 611) Fall. 3 credits. Prerequisites: Chemistry 104 or 208; Mathematics 106, 111, or 113; and either Physics 102 or 208; or permission of instructor. Offered alternate years. Not offered 1980–81.
Lecs, M 1:25 and T R 10:10. R. K. Clayton.
A study of the mechanism of seeing that includes biological, physical, and chemical approaches to the subject.]

396 (495) Introduction to Sensory Systems (also Psychology 396) Spring. 3 credits. No auditors. Prerequisites: an introductory course in biology or biopsychology, and a second course in neurobiology and behavior or perception or cognition or biopsychology; students are expected to have elementary knowledge of perception, neurophysiology, and chemistry. S-U grades optional for graduate students only. Offered spring 1981; next offered spring 1983 and each spring term thereafter.
Lecs, T R 9:05; disc to be arranged. B. P. Halpern.
Both those characteristics of sensory systems that are common across living organisms and those sensory properties that represent adaptations of animals to particular habitats or environments are studied. The principles and limitations of major methods used to examine sensory systems are considered. Behavioral (including psychophysical, biophysical, and neurophysiological) and anatomical methods are usually included.

420 Seminar in Neurobiology and Behavior Fall or spring. Variable credit. May be repeated for credit. Primarily for undergraduates. S-U grades optional.
Sem to be arranged. Organizational meetings first M of each semester at 8 p.m. in Caldwell 100. Staff.
In most semesters, at least two seminars on different topics are offered. Topics and instructors are listed in the division's catalog supplement issued at the beginning of the semester.

421 Comparative Vertebrate Ethology Fall. 3 credits. Prerequisites: one year of introductory biology for majors. Biological Sciences 321, and permission of instructor. S-U grades optional.
Lecs, T R 9:05; lab to be arranged. Independent research project required. W. C. Dilger.
A survey of the methods and principles of vertebrate ethology, including such topics as aggression, fear, sex, feeding, and other normal activities. Emphasis is placed on the causation, function, biological significance, and evolution of species-typical behavior. The laboratories are designed to give firsthand knowledge of the material covered in lectures.

Also offered during the 3-week Summer Session. During the summer, field trips and field projects are substituted for many of the laboratories.

423 Animal Communication Fall. 4 credits. Limited to 32 students. Prerequisites: Biological Sciences 321 and either Physics 102 or 208. Offered alternate years.
Lecs, T R 10:10; lab, T or R 1:25–4:25; other meetings to be arranged. R. R. Capranica, R. R. Hoy.
The functional aspects of biological signals, their physical properties, and the physiological mechanisms underlying their generation and reception. Lectures examine in detail selected biological communication problems from each of the known sensory modalities. Discussion covers signal analysis, transmission properties, and the limitations of each type of communication. Laboratories include behavioral observations under both field and captive conditions, and individual experience with the techniques of signal recording and analysis.

[424 Animal Social Behavior Spring. 3 credits. May be repeated for credit with permission of instructor. Prerequisite: Biological Sciences 321. S-U grades optional. Not offered 1980–81.
Lecs, T R 10:10–11:30. G. Hausfater.
This course examines animal social behavior and social organization in a phylogenetic perspective. A different taxonomic group serves as the focus of the course each year.]

[427 Vertebrate Social Behavior Fall. 3 credits. Prerequisites: Biological Sciences 321 and 360, or their equivalents, and written permission of instructor. S-U grades optional, with permission of instructor. Offered alternate years. Not offered 1980–81.
Lecs, M W F 10:10; disc to be arranged. S. T. Emlen.
A discussion of vertebrate social behavior, with emphasis on behavioral adaptations to the environment; ecological significance of diverse social systems; advantages of territoriality, coloniality, and nomadism; evolution of cooperative and communal social organizations; feeding and flocking strategies; ecological constraints on monogamous, polygamous, and promiscuous mating systems; and the role of social behavior in population regulation.]

491 Principles of Neurobiology, Laboratory (also Psychology 491) Fall. 4 credits. Limited to 36 students. Prerequisite: Biological Sciences 396 (495) or 496, or written permission of instructor.
Labs, M W or T R 12:20–4:25. B. R. Land and staff.
Laboratory practice with neurobiological preparations and experiments, designed to teach the techniques, experimental designs, and research strategies used to study biophysical and biochemical properties of excitable membranes, sensory receptors, and the central nervous system transformation of afferent activity, as well as the characteristic composition and metabolism of neural tissue. Theoretical content at the level of Junge's *Nerve and Muscle Excitation.*

[494 Neuropharmacology Spring. 3 credits. Prerequisites: Biological Sciences 321 and either 330 or 331; or written permission of instructor. Not offered 1980–81.
Lecs, M W F 8. Staff.
Deals with drugs that affect the nervous system, both central and peripheral. Emphasis is on mechanisms of drug action whereby basic biochemical processes and neurophysiological and behavioral phenomena are bridged. Stimulants, anesthetics, hallucinogens, and neurotoxins are discussed, as well as drug addiction, psychopharmacology, endocrine pharmacology, and the biochemical basis of the therapeutic uses of drugs in diseases of the nervous system.]

496 Cellular Neurobiology Spring. 4 credits. Prerequisite: Biological Sciences 321.
Lecs, M W F 10:10; disc to be arranged. R. B. Campenot, M. M. Salpeter.
A one-semester, intensive undergraduate course in neurobiology. The course provides in-depth, current treatment of the basic principles of cellular, chemical, pharmacological, molecular, anatomical, and integrative aspects of neurobiology.

[497 Neurochemistry Fall. 3 credits. Prerequisites: Biological Sciences 321 and either 330 or 331. Not offered 1980–81.
Lecs and discs, M W F 9:05. Staff.
Special features of the composition and metabolism of neural tissue are discussed. The identification of synaptic transmitters in the nervous system, including their specific localization, biosynthesis and metabolism, release, inactivation, and action on postsynaptic receptors, is considered in detail.]

[623 Chemical Communication (also Chemistry 622) Fall. 3 credits. Primarily for research-oriented students. Limited to 30 senior and graduate students. Prerequisites: one year of introductory biology for majors or equivalent, course work in biochemistry, and Chemistry 358 or equivalent. Offered alternate years. Not offered 1980-81.
Lecs, M W F 1:25. T. Eisner, J. Meinwald, W. L. Roelofs, and guest speakers.
The production, transmission, and reception of chemical signals in communicative interactions of animals, plants, and microorganisms. Studies of insects are emphasized. Specific topics are treated, with varying emphasis on chemical, biochemical, neurobiological, ecological, and evolutionary principles.]

[624 Behavioral Neurogenetics Spring. 3 credits. Primarily for research-oriented students. Prerequisites: Biological Sciences 321 and 281. Recommended: course work in developmental biology. S-U grades optional. Offered alternate years. Not offered 1980–81.
Lecs, T R 9:05; disc and demonstration to be arranged. R. R. Hoy.
The study of the neurogenetic basis of behavior in animals, using "simple" behaviors that can be analyzed genetically and neurobiologically. Both vertebrate and invertebrate animals are discussed, although emphasis is on the invertebrates. Lectures and assigned readings draw heavily from journal articles.]

[627 Quantitative Approaches to Animal Behavior Fall. 3 credits. Primarily for graduate students; written permission of instructor required for undergraduates. Enrollment limited. Prerequisite: Biological Sciences 321 or equivalent. S-U grades optional, with permission of instructor. Offered alternate years. Not offered 1980–81
Lecs and discs, T R 10:10–11:30. G. Hausfater.
This course emphasizes a quantitative approach to research on animal behavior. Lectures, discussions, and readings focus on the formulation of precise, testable hypotheses for behavior research, especially mathematical models, and on the use of systematic sampling techniques in observational research. Basic probability distributions are introduced and used in the analysis of behavior sequences and interaction patterns. Stochastic models of behavior are also discussed.]

[628 Field Methods in Animal Behavior Spring. 4 credits. Limited to 20 students. Prerequisites: Biological Sciences 321 and either 421 or 427, or their equivalents, and written permission of instructor. Not offered 1980–81.

Lecs and discs, T R 10:10; lab, T 1:25–4:25. Independent project required. Enrolled students must participate in all aspects of course; no partial credit given. Staff.

A practically oriented course for seniors and first-year graduate students who will be pursuing field studies. Lecture-discussion areas include the scope and design of field behavior projects, sources of variability, and evaluation of relevant publications. Laboratory periods are devoted to introduction, demonstration, and practice of techniques and to individual fieldwork.]

[691 Developmental Neurobiology Fall. 2 credits. Prerequisite: Biological Sciences 496 or permission of instructor. S-U grades optional, with permission of instructor. Offered alternate years. Not offered 1980–81.

Lecs and discs, 2 hours each week, to be arranged. R. B. Campenot.

The embryologic development of the nervous system is considered in the light of both historical and current research. Emphasis is on cellular issues, i.e., How do nerve cells differentiate both morphologically and biochemically, and how do they interact to produce a properly wired nervous system?]

[692 Behavioral Neurophysiology, Lectures Fall. 3 credits. Prerequisite: Biological Sciences 496 or permission of instructor. Offered alternate years. Not offered 1980–81.

Lec, M 9:05; discs, 2 hours each week, to be arranged. J. M. Camhi.

The course treats those aspects of the organization of the nervous system that are important in determining the forms of behavior observed. Some special emphasis is given to the nervous system of invertebrates, which serve as models for the more complex organization of vertebrates. Some material is treated from a neuroethological perspective. Readings are original papers in the field.]

[694 Behavioral Neurophysiology, Laboratory Fall. 2 credits. Limited to 10 students. Prerequisite: concurrent enrollment in Biological Sciences 692. Offered alternate years. Not offered 1980–81.

Lab to be arranged. J. M. Camhi.

After learning basic techniques, students work on extended research projects under the direction of J. M. Camhi and the staff of Biological Sciences 491.]

[695 Physiological Optics Fall. 3 credits. Limited to 24 students. Recommended: courses in elementary biology or psychology, and physics, and courses appropriate to particular track (see below). Offered alternate years. Not offered 1980–81.

Lecs, T R 9:05; lab, 3 hours each week, to be arranged. H. C. Howland.

The course is primarily for upperclass students who intend to pursue research or conduct clinical work in vision. Topics include geometrical optics, clinical refraction, measurement of MTF and contrast sensitivity, and the vegetative physiology of the eye relevant to optical quality of the optical image.

Laboratory work is divided into three tracks: (1) *Clinical Track* for students intending to work in optometry or medicine; (2) *Psychophysical Track* for students intending to conduct research in human or animal vision; and (3) *Engineering Track* for students intending to use or design optical devices for which the human eye is a component in the system.

Grades are based on the student's accomplishments within the chosen track, in view of the background brought to it.]

696 Neuroelectric Systems (also Electrical Engineering 622) Spring. 3 or 4 credits (4 credits with lab). Prerequisite: either Biological Sciences 423 or 496 or Electrical Engineering 301 or 621; written permission of instructor required for lab. Offered alternate years.

Lecs, M W 9:05; disc and demonstration to be arranged; lab to be arranged. R. R. Capranica, M. Kim.

Application of microprocessors for neuroelectric data acquisition and systems analysis. Lectures cover electrical activity of single nerve cells, electrodes and instrumentation techniques, analysis of electrophysiological data, and coding principles in the nervous system, as well as appropriate background material for the use of microprocessors in neurobiology. Laboratory exercises provide experience in the actual use of microprocessors.

720 Seminar in Advanced Topics in Neurobiology and Behavior Fall or spring. Variable credit. May be repeated for credit. Primarily for graduate students; written permission of instructor required for undergraduates. S-U grades optional.

Sem to be arranged. Staff and students.

Designed to provide several study groups each semester on specialized topics. A group may meet for whatever period is judged adequate to enable coverage of the selected topics. Ordinarily, topics will be selected and circulated during the preceding semester. Suggestions for topics should be submitted by faculty or students to the chairperson of the Section of Neurobiology and Behavior.

[723 Graduate Seminar in Vertebrate Social Behavior Fall. 2 credits. May be repeated for credit. Enrollment limited. Prerequisites: Biological Sciences 321, 360, and 477, or their equivalents, and written permission of instructor. S-U grades only. Not offered 1980–81.

Sem to be arranged. S. T. Emlen, G. Hausfater.

Intended as a graduate-level follow-up to Biological Sciences 424 and 427. An advanced, participation-format seminar dealing with various aspects of the evolution of social organization in vertebrates.]

Related Courses in Other Departments

Biochemistry and Human Behavior (Psychology 361 and Nutritional Sciences 361)

Mammalian Neurophysiology (Biological Sciences 610)

Motor Physiology (Biological Sciences 411)

Teaching Experience (Biological Sciences 498)

Undergraduate Research in Biology (Biological Sciences 499)

Biochemistry and Cell Biology

132 Orientation Lectures in Biochemistry Spring, weeks 1–3. Noncredit. Primarily for freshman, sophomores, and transfer students. S-U grades only (registered students receive an unsatisfactory grade for nonattendance).

Lec, S 10:10–11:30, first 3 Saturdays of semester. Section chairperson and staff.

Lectures illustrate modern research and training in biochemistry and molecular and cell biology.

231 Some Applications of Biochemistry to Medicine and Agriculture Fall. 3 credits. Intended for students who have not previously studied biochemistry and who do not expect to pursue it further. Not recommended for students who have taken organic chemistry. Prerequisite: Chemistry 104 or 208 or equivalent. S-U grades optional.

Lecs, M W F 12:20. J. M. Griffiths.

A brief introductory section relating organic chemistry to biochemistry is given, followed by the biochemical material in the usual one-semester introductory courses. Topics of general interest are also included, such as nutrition, cancer, diseases, and viruses.

330–331 Principles of Biochemistry Introductory biochemistry is offered in two formats: individualized instruction (330) and lectures (331). *Individualized instruction is offered to a maximum of 150 students each semester. Lectures given fall semester only.*

330 Principles of Biochemistry, Individualized Instruction Fall or spring. 4 credits. Prerequisite: Chemistry 253 or equivalent.

Discs, M W F 8 or 10:10; additional hours to be arranged. No formal lecs. Fall: M. Ferger, G. P. Hess, and staff; spring: M. Ferger, R. Wu, and staff.

The focal point for this course is a study center — open mornings, afternoons, and some evenings — where students find materials, get help, participate in discussions, and take exams. Students are required to master a minimum body of core material. The pace at which this material is assimilated is largely self-determined. Students who want to go beyond core material have available a wide range of electives, including discussions of research papers and independent study of a variety of problems and *Scientific American* articles. Grades are determined primarily by the amount of elective work satisfactorily completed and by a final exam.

331 Principles of Biochemistry, Lectures Fall; also offered during Summer Session. 4 credits. Prerequisite: Chemistry 253 or equivalent.

Lecs, M W F S 10:10. B. K. Tye, J. K. Moffat, R. Barker.

Chemistry of biological substances, presented in a lecture format. Course content is similar to that of Biological Sciences 330.

430 Basic Biochemical Methods Fall or spring. 4 credits. Enrollment limited. Prerequisites: Biological Sciences 330 or 331, a lab course in organic chemistry, and permission of instructor.

Lec and disc, F 1:25; labs, M W or T R 12:20–4:25. R. R. Alexander, M. L. Wilkinson, N. B. Wurster.

A modular course designed to introduce the student to the biochemical techniques most commonly used in various biological fields. Students select two of the following modules: clinical and nutritional biochemistry, lipids, isolation and characterization of cell components, or nucleic acids. An enzymology module is taken by all students.

432 Survey of Cell Biology Spring. 3 credits. Prerequisite: Biological Sciences 330 or 331 or equivalent.

Lecs, M W F 11:15. J. T. Lis.

A survey of material covered in depth in Biological Sciences 433, 438, and 483. The course covers a wide array of topics, including microscopic techniques, membrane activities, cell junctions, organelles, cell movement, cell division, chromosome structure and the control of gene expression, and cellular differentiation.

433 Cell Structure and Physiology Fall. 2 credits. Prerequisite: Biological Sciences 330 or 331 or permission of instructor.

Lecs, T R 12:20. R. E. MacDonald.

The functional aspects of cells and their organelles: bioenergetics, transport, movement, growth, nutrition, and structure are examined in detail in free-living cells, differentiated cells, and highly specialized cells. The course attempts to integrate current knowledge about cell biochemistry, structure, and function with the role of the cell in its environment and in its interrelationship with other cells.

434 Laboratory in Cell Biology Spring. 4 credits. Enrollment limited. Prerequisite: written permission of instructor.

Labs, M W 1:25–4:25 or R 9:05–4:25; disc to be arranged. C. M. Resch.

The course provides experience in experimental design and stresses techniques for handling and experimenting with cells of different kinds.

435–436 Undergraduate Biochemistry Seminar 435, fall; 436, spring. 1 credit each term. May be repeated for credit. Enrollment limited, upperclass students only. Prerequisite: Biological Sciences 330 or 331, or written permission of instructor. S-U grades optional, with permission of instructor.

Sem to be arranged. Organizational meeting first T of each semester at 4 p.m. Fall: P. C. Hinkle; spring: J. K. Moffat.
A group of selected papers from the literature are critically evaluated during six or seven two-hour meetings. Fall: ion transport and bioenergetics; spring: three-dimensional structure of macromolecules.

438 Cell Proliferation and Oncogenic Viruses Spring. 2 credits. Prerequisite: Biological Sciences 330 or 331. Recommended: Biological Sciences 281.
Lecs, T R 12:20. V. M. Vogt.
A description of the growth properties of animal cells in culture, followed by discussions of the changes in cells that are induced by tumor viruses and carcinogens. Topics include macromolecular growth factors, contact inhibition, cell surface properties, cell cytoskeleton, transcription and translation of viral and host genes, and integration of viral DNA into host chromosomes.

[456 Molecular Biology of Yeast Spring. 3 credits. Prerequisites: Biological Sciences 281 and a course in organic chemistry. Not offered 1980–81; first offered spring 1983.
Lecs, M W F 9:05. G. R. Fink.
Saccharomyces cerevisiae, a single-celled lower eucaryote, possesses physiological, biochemical, and genetic characteristics that make it an ideal organism for investigating many fundamental aspects of gene expression in eucaryotes. These characteristics will be discussed, together with current research methodologies (tetrad analysis, fine structure mapping, mutant isolation, transformation, and recombinant DNA techniques) and their application in understanding phenomena such as cell division and determination of mating type.]

631 Protein Structure and Function Fall. 2 or 3 credits (3 credits with discussion). Prerequisites: Biological Sciences 330 or 331, Chemistry 288, and either Chemistry 358 or 360; or written permission of instructor. S-U grades optional, with permission of instructor.
Lecs, M W 9:05; disc, F 9:05. G. W. Feigenson and staff.
Lectures on protein structure and the nature of enzymatic catalysis. Discussions cover some of these areas in more depth, through recent research papers and advanced lectures.

632 Bioenergetics and Membranes Spring. 2 credits. Prerequisites: Biological Sciences 330 or 331, and either Chemistry 358 or 360; or written permission of instructor. Recommended: physical chemistry.
Lecs, T R 11:15. P. C. Hinkle and staff.
Oxidative phosphorylation, photophosphorylation, active transport, muscle contraction, and the structure of biological membranes.

633 Biosynthesis of Macromolecules Fall. 2 credits. Prerequisites: Biological Sciences 330 or 331, and either Chemistry 358 or 360; or written permission of instructor.
Lecs, T R 9:05. J. W. Roberts, D. B. Wilson.
DNA, RNA, and protein synthesis; regulation of gene expression; and other topics.

[634 Biochemistry of the Vitamins and Coenzymes (also Nutritional Sciences 634) Spring. 2 credits. Prerequisites: Biological Sciences 330 or 331 or equivalent, and either Chemistry 358 or 360. Offered alternate years. Not offered 1980–81.
Lecs, T R 10:10. M. N. Kazarinoff.
The chemical, biochemical, and nutritional aspects of the vitamins and coenzymes.]

635 Metabolic Regulation (also Nutritional Sciences 635) Spring. 2 credits. Prerequisites: Biological Sciences 330 or 331, and either Chemistry 358 or 360; or written permission of instructor. Recommended: physical chemistry.
Lecs, T R 9:05. W. L. Dills and staff.
The study of enzymes and the molecular mechanisms of metabolic regulaion.

637 Vertebrate Biochemistry (also Veterinary Medicine 525) Fall. 5 credits. Prerequisite: Biological Sciences 330 or 331 or equivalent. S-U grades optional.
Lecs, M T W R F 9:05. W. J. Arion, J. F. Wootton.
An intermediate-level biochemistry course correlating metabolic, structural, and functional characteristics of animal tissues. Metabolic integration and regulation are emphasized.

638 Intermediate Biochemical Methods Spring. 4 credits. Primarily for undergraduates majoring in biochemistry and for graduate students with a minor in biochemistry. Prerequisites: Biological Sciences 330 or 331, and permission of instructor. Students must obtain permission of instructor by the last day of the course enrollment period.
Lab, T or R 9:05–4:25. E. B. Keller, L. A. Heppel, and staff.
Selected experiments on proteins, enzymes, DNA, and bioenergetics to illustrate basic biochemical principles. The course emphasizes quantitative aspects and techniques currently used in biochemical research.

731–739 (732–739) Current Topics in Biochemistry Fall or spring. ½ or 1 credit for each topic. May be repeated for credit. (Students registering for ½ credit should *not* fill in the credit-hour column on the optical mark registration form; the computer is programmed to automatically register students for ½ credit.) Prerequisite: Biological Sciences 330 or 331 or equivalent. S-U grades only.
Lectures and seminars on specialized topics.
Fall 1980: five topics are offered.

731 Intracellular Protein Degradation ½ credit.
T R 12:20 (6 lecs); Sept. 2–18. M. N. Kazarinoff.

733 Regulation of Membrane Transport in Microorganisms ½ credit.
T R 12:20 (6 lecs); Sept. 23–Oct. 9. D. B. Wilson.

735 Unusual Genetic Events ½ credit.
W F 12:20 (6 lecs); Oct. 1–17. G. R. Fink.

737 Lipids in Biomembranes 1 credit.
W F 10:10 (12 lecs); Oct. 22–Dec. 5.
D. B. Zilversmit.

739 Biochemistry of Inborn Errors of Carbohydrate Metabolism ½ credit.
T R 12:20 (6 lecs); Nov. 4–20. W. L. Dills.

Spring 1981: four topics are offered.

732 Monosaccharides and Oligosaccharides: Structure-Reactivity Relationships ½ credit.
T R 12:20 (6 lecs); Feb. 3–19. R. Barker.

734 Genetic Engineering Applied to Plant Cells ½ credit.
T R 12:20 (6 lecs); Feb. 24–Mar. 12. A. A. Szalay.

736 Chloroplast Biogenesis ½ credit.
T R 12:20 (6 lecs); Mar. 17–Apr. 9. A. T. Jagendorf.

738 Chemical Carcinogenesis ½ credit.
T R 12:20 (6 lecs); Apr. 21–May 7. T. C. Campbell.

830 Biochemistry Seminar Fall or spring. Noncredit.
Sem, F 4:15. Staff.
Lectures on current research in biochemistry, presented by distinguished visitors and staff.

831 Advanced Biochemical Methods I Fall. 6 credits. Limited to graduate students majoring in biochemistry.
Labs and discs, 12 hours each week to be arranged. Organizational meeting first T of semester at 10:10. D. B. Wilson and staff.
To learn the basic techniques of biochemical research, each student completes a set of experiments.

832 Advanced Biochemical Methods II Spring. 6 credits. Limited to graduate students majoring in biochemistry. S-U grades only.
Lab to be arranged. Staff (coordinator: J. K. Moffat).
Research in the laboratories of three different professors chosen by the student. Arrangements are made jointly between the field representative and the research adviser.

833 Research Seminar in Biochemistry Fall and spring. 1 credit each term. (Students must register for 2 credits each term, since an "R" grace is given at the end of the fall term.) May be repeated for credit. Required of all graduate students (first-year students excepted) majoring in biochemistry. S-U grades only.
Sem, M 7:30–9 p.m. E. Racker.

Related Courses in Other Departments

Lipids (Biological Sciences 619)

Molecular Aspects of Development (Biological Sciences 483)

Molecular Mechanisms of Hormone Action (Biological Sciences 658)

Plant Biochemistry (Biological Sciences 648)

Teaching Experience (Biological Sciences 498)

Undergraduate Research in Biology (Biological Sciences 499)

Botany

241 Plant Biology Fall. 3 credits. Enrollment may be limited, with preference given to sophomores and juniors majoring in agronomy, botany, environmental education, floriculture, horticulture, natural resources, plant sciences, vegetable crops, and wildlife. Prerequisite: one year of introductory biology for majors or equivalent.
Lecs, T R 9:05; lab, M T W R or F 1:25–4:25, or M or W 7:30–10:30 p.m. Prelims: 8:40 p.m. Oct. 30, Dec. 4. K. J. Niklas.
Introductory botany for those who plan to specialize in or use some aspect of the plant sciences. Emphasizes structure reproduction, and classification of angiosperms and the history of life on earth. Laboratory emphasizes development of skills in handling plant materials, including identification. First, second, and fourth weeks of laboratory are field trips, starting with the first day of classes. *Those who register for an evening laboratory are still required to attend the afternoon field trips.*

242 Plant Physiology, Lectures Spring. 3 credits. Primarily for undergraduates in agricultural sciences. Prerequisites: one year of introductory biology and introductory chemistry; concurrent enrollment in Biological Sciences 244 or written permission of instructor required for undergraduates.
Lecs, M W F 10:10. P. J. Davies.
Plant physiology as applied to plants growing in communities. Examples deal with crop plants or higher plants where possible, though not exclusively. Topics include cell structure and function; plant metabolism, including photosynthesis; soil-plant-water relations; water uptake, transport, and transpiration; irrigation of crops; sugar transport; mineral nutrition of crops; respiration and photosynthesis; light relations in crops; growth and development–hormones, flowering, fruiting, dormancy, and abscission; and chemical control of plant growth.

244 Plant Physiology, Laboratory Spring. 2 credits. Prerequisite: concurrent enrollment in Biological Sciences 242.
Lab, M T W or R 1:25–4:25; disc, M T W or R 12:20. Lab and disc must be on same day. C. Reiss.

246 Plants and Human Affairs Spring. 3 credits. Intended for students in all colleges. S-U grades optional.
Lecs, M W F 8; disc, F 9:05, 10:10, 11:15, or 12:20. Discs are held only 5 times during semester. Students do not choose disc sections during course enrollment; disc assignments are made at the first lec period. D. M. Bates.
A consideration of the role of plants in the cultural evolution of man and the development of civilizations. Emphasis is ethnobotanical. Themes developed include: the ecological constraints placed on evolving man; agricultural origins and the evolution of domesticated plants; the rich array of plants populating the earth and the innovative ways in which man uses them; physiologically active plant substances, including medicinals and hallucinogens; and a biological view of the future prospects for plants and humanity.

247 Poisonous Plants Fall. 2 credits. *Offered fall 1980 only.*
Lecs, T R to be arranged. J. M. Kingsbury.
A discussion of incidence and conditions of poisoning in man and animals, poisonous principles from plants, and effects of toxic plants on vertebrates.

341 Plant Physiology, Lectures Fall. 3 credits. Prerequisites: one year of introductory biology, organic chemistry, and either concurrent enrollment in Biological Sciences 349 or written permission of instructor.
Lecs, T R 10:10 and M 7:30 p.m. A. T. Jagendorf.
The behavior, growth, transport processes, and environmental response of plants. Topics include membrane properties, solute and water transport, and function of osmotic forces; mineral and organic nutrition; stress resistance; growth and hormonal action; metabolism, including photosynthesis and respiration; and responses to gravity, light, photoperiod, and temperature.

342 (248) Taxonomy of Cultivated Plants (also Floriculture and Ornamental Horticulture 342) Spring. 4 credits. Limited to 28 students. Prerequisite: one year of introductory biology or written permission of instructor. May not be taken for credit after Biological Sciences 343 (346).
Lecs, M W 10:10; labs, M W 2–4:25. J. W. Ingram.
A study of ferns and seed plants, their relationships, and their classification into families and genera, emphasizing cultivated plants. Particular emphasis is placed on gaining proficiency in identifying and distinguishing families and in preparing and using analytical keys. Attention is also given to the economic importance of taxa, to the basic taxonomic literature, and to the elements of nomenclature.

343 (346) Taxonomy of Vascular Plants Fall. 4 credits. Prerequisites: introductory biology and written permission of instructor. May not be taken for credit after Biological Sciences 342 (248).
Lecs and discs, T R 9:05; labs, T R 2–4:25. M. D. Whalen.
An introduction to the classification of ferns and flowering plants, with attention to principles, methods of identification, and literature. Field trips are held during laboratory periods in the first half of the term.

345 Plant Anatomy Fall. 4 credits. Limited to 48 students. Prerequisite: one year of introductory biology or a semester of botany. Not intended for general education. Students in doubt about their level of preparedness or the role of this course in their curricula are encouraged to consult the instructor before registering.
Lecs, T R 8; labs, M W 2–4:25 or T R 10:10–12:35. D. J. Paolillo.
A descriptive course with equal emphasis on development and mature structure. Lecture, laboratory, and reading are integrated in a study guide. The laboratory offers the opportunity to develop the practical skills required to make anatomical diagnoses and to write anatomical descriptions.

346 (343) Field Phycology Summer. 4 credits. Prerequisite: Biological Sciences 364 or general familiarity with marine algae. S-U grades optional. A special 3-week course offered at Cornell's Shoals Marine Laboratory (SML) on an island off Portsmouth, N.H. For more details and application, consult the SML office, Stimson G14. Estimated cost, $695.
Daily lecs, labs, and fieldwork for 3 weeks. SML faculty.
An overview of the major marine algal groups, including aspects of anatomy, morphology, development, life histories, physiology, and utilization. Laboratories and fieldwork emphasize relationships between distribution and major environmental parameters and involve student projects.

347 Cytology Fall. 4 credits. Prerequisite: one year of introductory biology for majors. Recommended: Biological Sciences 281.
Lecs, M W 9:05; labs, M W or T R 10:10–12:35. C. H. Uhl.
A study primarily of the structure of cells and their components, and the relation of these to function and heredity. Special attention is given to chromosomes. Both plant and animal materials are used.

348 Phycology Spring. 4 credits.
Lecs, M W F 10:10; lab, M W or F 2–4:25. J. M. Kingsbury.
An introduction to freshwater and marine algae, including consideration of their ecology as members of the plankton and benthos and their importance to man. The laboratory uses field material and cultures from an extensive living collection to illustrate lecture topics, provide familiarity with algae in the field, and introduce the student to techniques used in isolating, culturing, and studying algae in the laboratory.

349 Plant Physiology, Laboratory Fall. 2 credits. Prerequisite: concurrent enrollment in Biological Sciences 341.
Lab, T W or R 1:25–4:25; disc, T W or R 12:20. Lab and disc must be on same day. C. Reiss.

442 Taxonomy and Evolution of Vascular Plants Spring. 4 credits. Prerequisites: Biological Sciences 342 (248) or 343 (346), and written permission of instructor.
Lecs and discs, T R 9:05; labs, T R 2–4:25. M. D. Whalen.
An interdisciplinary view of broad-scale and species-level evolution in vascular plants, with consideration of morphological, ecological, biogeographic, cytogenetic, and biochemical aspects.

444 Comparative and Developmental Morphology of the Embryophyta Spring. 4 credits. Prerequisite: Biological Sciences 345. Offered alternate years.
Lecs, T R 8; labs, T R 2–4:25. D. J. Paolillo.
The life histories of bryophytes, vascular cryptogams, and seed plants are examined for their developmental attributes and for their bearing on concepts of evolution and group relationships. The course content is designed to develop an awareness of the integration between morphology and other disciplines in biology.

[445 Photosynthesis (also Engineering A&EP 601) Fall. 3 credits. Prerequisites: Chemistry 104 or 208; Mathematics 106, 111, or 113; and either Physics 102 or 208; or permission of instructor. Offered alternate years. Not offered 1980–81.
Lecs, M 1:25 and T R 10:10. R. K. Clayton.
A detailed study of the process by which plants use light in order to grow; physical and physicochemical aspects of the problem are emphasized.]

[446 Cytogenetics Spring. 3 credits. Prerequisites: Biological Sciences 281 and 347, or their equivalents. Offered alternate years. Not offered 1980–81.
Lecs, M W 9:05; lab, M or W 10:10–12:35. C. H. Uhl.
Deals mainly with the cellular mechanisms of heredity, including recent research in cytology, cytogenetics, and cytotaxonomy.]

[448 Plant Evolution and the Fossil Record Spring. 3 credits. Prerequisite: Biological Sciences 241 or equivalent, or written permission of instructor. Offered alternate years. Not offered 1980–81.
Lecs, T R 9:05; lab, R 12:20–2:15. K. J. Niklas.
An introduction to evolution, surveying major changes in plants from the origin of life to the present. Emphasis is placed on plant form and function, adaptations to particular ecologic settings, and evolutionary theory as it relates to plants.]

642 Topics in Ultrastructure of Plant Cells Spring. 3 credits. Primarily for graduate students, although upperclass students with adequate background are allowed to enroll. No auditors. Prerequisites: Biological Sciences 345 or 347, and written permission of course coordinator. Offered alternate years.
Lecs, M W F 10:10; optional disc, F 1:25 or to be arranged. Staff (coordinator: M. V. Parthasarathy).
An advanced course dealing with organelles in depth, and in breadth where necessary. Topics include salient ultrastructural features of some plant groups and certain specialized cells and processes. Content of the course and staff direction vary to some extent from year to year.

643 Plant Physiology, Advanced Laboratory Techniques Fall. 4 credits. Primarily for graduate students doing work in plant physiology, but open to others if space permits. Prerequisites: organic chemistry, biochemistry, and a course in plant physiology. S-U grades only.
Lab, T or W 8–5; disc, M 4:30–5:30. A. T. Jagendorf and staff.
An introduction to some modern methods in experimental plant biology.

[644 Plant Growth and Development Spring. 3 credits. Prerequisites: Biological Sciences 345 and either 242 or 341, or their equivalents; or written permission of instructor. Offered alternate years. Not offered 1980–81.
Lecs, M W F 9:05. P. J. Davies, D. J. Paolillo.
Explores the changes that occur during plant growth and development and their control: morphological and anatomical changes in apices, tissue differentiation, organ formation, embryo development, gene regulation, hormone action and interaction, the influence of light in development, flowering, fruiting, dormancy, abscission, and senescence.]

[645 (640) Families of Tropical Flowering Plants Fall. 1 credit. Prerequisite: written permission of instructor. S-U grades only. Offered alternate years. Not offered 1980–81
Lec and disc, F 11:15. H. E. Moore.
The families of flowering plants encountered solely or chiefly in tropical regions are considered in lectures, discussions, and demonstrations, with the aim of providing basic points of recognition for, and an understanding of, diversity and relationships in these families for the student venturing into the tropics.]

[646 Families of Tropical Flowering Plants: Field Laboratory Intersession. 3 credits. Limited to 20 students, with preference given to seniors and graduate students from member institutions of the Organization for Tropical Studies. Prerequisite: Biological Sciences 342 (248) or 343 (346) or equivalent. Recommended: Biological Sciences 645 (640). S-U grades only. For more details and application, consult H. E. Moore, Jr., L. H. Bailey Hortorium, 467 Mann Library. Estimated

cost of tuition plus room and board (exclusive of transportation), $800. Offered alternate years. Not offered 1980–81.
H. E. Moore.
An intensive orientation to families of tropical flowering plants represented in forests of the American tropics. Emphasis on field identification combined with laboratory analysis of available materials in a "whole-biology" context.]

647 Seminar in Systematic Botany Spring. 1 credit. May be repeated for credit. Prerequisite: written permission of course coordinator required for undergraduates. S-U grades optional.
Sem to be arranged. Organizational meeting first F of semester at 1:25. Staff (coordinator: D. M. Bates).
Lectures and discussions led by staff, visitors, and students on topics of current importance to systematic botany. In spring 1981 the topic is phytogeography.

648 Plant Biochemistry Spring. 3 credits. Prerequisites: organic chemistry, biochemistry, and a course in plant physiology. Offered alternate years.
Lecs, M W F 9:05. A. T. Jagendorf, R. E. McCarty, J. F. Thompson.
Selected areas of plant biochemistry are reviewed in the context of the plant life cycle and responses to the environment. Topics include metabolism of lipids, carbohydrates, organic acids, and proteins; nitrogen and sulfur assimilation; respiration; photosynthesis; development and replication of chloroplasts; and cell wall composition and properties. Attention is paid to operation of control mechanisms.

649 Transport of Solutes and Water in Plants Fall. 3 credits. Prerequisite: Biological Sciences 341 or equivalent. Offered alternate years.
Lecs, M W F 10:10. R. M. Spanswick.
Transport of ions, water, and organic materials in plants; mechanisms of ion transport; relationships between ion transport and metabolism; ion uptake and transport in higher plants; phloem transport; and water relations of single cells and whole plants.

[651 Quantitative Whole-Plant Physiology Fall. 3 credits. Prerequisites: introductory physics, calculus, and plant physiology. S-U grades only. Offered alternate years. Not offered 1980–81.
Lecs, T R 10:10–11:30, R. M. Spanswick.
An exploration of the extent to which physiological processes and their interactions can be formulated in a quantitative manner and integrated to describe various aspects of plant behavior, including growth and yield. Consideration is given to characterization of the plant environment, energy balance, gas exchange, water relations, photosynthesis, respiration, translocation, nutrient supply, and the timing of developmental events.]

[652 Botanical Latin Spring. 1 credit. Prerequisite: written permission of instructor. S-U grades optional. Offered alternate years. Not offered 1980–81.
Lec and disc to be arranged. W. J. Dress.
Basic grammar and vocabulary and exercises in writing and reading the Latin of plant taxonomy, as well as applications to botanical nomenclature.]

[654 (640) Plant Nomenclature Spring. 1 credit. Prerequisite: written permission of instructor. Recommended: concurrent enrollment in Biological Sciences 652. S-U grades optional. Offered alternate years. Not offered 1980–81.
Lec and disc to be arranged. W. J. Dress.
An analysis of the International Code of Botanical Nomenclature and its application to various plant groups.]

656 Topics in Paleobotany Spring. 1 credit. Prerequisite: Biological Sciences 448 or equivalent background in evolution, or written permission of instructor.
Lab and disc to be arranged. K. J. Niklas.
A series of selected topics designated to provide a background in plant evolution, paleobotanical literature, and evolutionary theory. Among the topics discussed are the origin of a terrestrial flora, the evolution of the seed plants, and the origin and adaptive radiation of the angiosperms.

[657 (640) Literature of Taxonomic Botany Fall. 1 credit. Prerequisite: written permission of instructor. S-U grades optional. Offered alternate years. Not offered 1980–81.
Lec and disc, R 10:10. J. W. Ingram.
A survey of the basic reference works in taxonomy from the pre-Linnaean literature drawn on by Linnaeus to contemporary publications, with comments on the peculiarities of the books (when appropriate), on publication dates, typographic devices, and intricacies of bibliographic citation.]

740 Plant Biology Seminar Fall and spring. Noncredit (no official registration). Required of graduate students doing work in plant physiology.
Sem, F 11:15. Staff.
Lectures on current research in plant biology, presented by visitors and staff.

749 Graduate Research in Botany Fall or spring. Variable credit. May be repeated for credit. S-U grades optional.
Hours to be arranged. Staff.
Similar to Biological Sciences 499 but intended for graduate students who are working with faculty members on an individual basis.

840 Current Topics in Plant Physiology Fall or spring. 2 credits. May be repeated for credit. S-U grades only.
Sem to be arranged. Staff.
Seminar reports by graduate students on current literature in experimental plant physiology or related areas.

Related Courses in Other Departments

Advanced Mycology (Plant Pathology 579)

Current Topics in Mycology (Plant Pathology 649)

Introductory Mycology (Plant Pathology 309)

Plant Ecology (Biological Sciences 463, 465)

Plant Ecology Seminar (Biological Sciences 669)

Taxonomy of Fungi (Plant Pathology 599)

Teaching Experience (Biological Sciences 498)

Undergraduate Research in Biology (Biological Sciences 499)

Ecology, Systematics, and Evolution

260 Introductory Ecology Fall or spring. 3 credits. Prerequisite: one year of introductory biology or written permission of instructor.
Lecs, T R 11:15; disc, T or R 1:25, 2:30, or 3:35.
Fall: S. J. Risch; spring: P. F. Brussard.
An introduction to biological phenomena that occur at the population, community, and ecosystem levels of organization. The relevance of ecological principles to current environmental problems is examined.

274 The Vertebrates Spring. 5 credits. Primarily for sophomores; this course is a prerequisite for many advanced courses in vertebrate biology, anatomy, and physiology. Each lab limited to 21 students. Prerequisite: one year of introductory biology for majors. Fee. $10.
Lecs, T R 10:10, labs, M W 1:25–5, M W 7–10 p.m., or T R 1:25–5. Staff.
An introduction to the evolution, classification, comparative anatomy, life history, and behavior of vertebrate animals. Laboratory dissection and demonstration are concerned with structure, classification, systematics, biology of species, and studies of selected aspects of vertebrate life.

360 General Ecology Fall or spring. 3 credits. For students concentrating in ecology or a related subject. Not open to freshmen in fall semester. Prerequisite: one year of introductory biology for majors.
Lecs, T R 9:05; disc, W or R 1:25, 2:30, or 3:35.
Fall: P. P. Feeny, P. L. Marks; spring: R. B. Root, B. F. Chabot.
Principles concerning the interactions between organisms and their environment; influence of competition, predation, and other factors on population size and dispersion; analysis of population structure and growth; processes of speciation; interspecific competition and the niche concept; succession and community concepts; influence of climate and past events on the diversity and stability of communities in different regions of the world; and role of energy flow and biogeochemical cycling in determining the structure and productivity of ecosystems. Modern evolutionary theory is stressed throughout and attention is given to conflicting ecological hypotheses.

362 Chemical Oceanography in the Field Summer. 4 credits. Prerequisites: one year of introductory college chemistry and an introductory marine science course at the college level. S-U grades optional. A special 3-week course offered at Cornell's Shoals Marine Laboratory (SML) on an island off Portsmouth, N.H. For more details and application, consult the SML office, Stimson G14. Estimated cost, $695.
Daily lecs, labs, and fieldwork for 3 weeks. SML faculty.
A field-oriented course in the chemical oceanography of coastal waters. Lectures, frequent field trips, and laboratory sampling and analysis; includes tests of salinity, temperature, pH, chlorophyll, alkalinity, total CO_2, nutrients, organic material, and suspended materials in coastal waters, with some work on the analysis of coastal sediments.

363 Field Marine Science for Teachers Summer. 1 credit. Primarily for teachers, grades 6 through 12, but open to others. Prerequisite: one year of introductory college biology. S-U grades; letter grades optional, with permission of instructor. A special 1-week course offered at Cornell's Shoals Marine Laboratory (SML) on an island off Portsmouth, N.H. For more details and application, consult the SML office, Stimson G14. Estimated cost, $240.
Daily lecs, labs, and fieldwork for 1 week. SML faculty.
Designed to give an overview of living marine organisms (algae, invertebrates, fishes, marine mammals, and shorebirds) and of the environment they inhabit. Fieldwork is emphasized. Occasional lectures and films deal with additional topics, such as coastal zone problems, marine fisheries, economics of marine organisms, and educational resources of the marine environment. The core faculty of marine biologists will be augmented by specialists in science and environmental education.

364 Field Marine Science Summer. 6 credits. Prerequisite: one year of college biology or other supporting subject. S-U grades; letter grades optional, with permission of instructor. A special 4-week course offered twice each summer at Cornell's Shoals Marine Laboratory (SML) on an island off Portsmouth, N.H. For more details and application, consult the SML office, Stimson G14. Estimated cost, $895.
Daily lecs, labs, and fieldwork for 4 weeks. 3 core faculty assisted by 15 to 25 visiting lecturers, including representatives of governmental agencies and commercial fishermen. SML faculty.

Designed for the student who desires an initial overview of the marine sciences, this course emphasizes living material in natural habitats. Most of the course work is concerned with the biology of intertidal plants and animals, biological oceanography, ichthyology, and fisheries. Attention also is given to introductory physical and chemical oceanography and marine geology. Marine ecology and the effects of human activity on the marine environment are included.

365 Underwater Research Summer. 2 credits. Prerequisites: recognized scuba certification and a medical examination. S-U grades optional. A special 2-week course offered at Cornell's Shoals Marine Laboratory (SML) on an island off Portsmouth, N.H. For more details and application, consult the SML office, Stimson G14. Estimated cost, $495.

Daily lecs and fieldwork for 2 weeks. Team-taught by a diving safety officer, a faculty member, and guest lecturers.

For competent divers only. Covers special problems of research underwater, including random sampling, use of dive tables, underwater instrumentation, special diving equipment, photographic techniques, integration with boat and shore facilities, and emergency procedures. Students are required to conduct a transect study on both soft and hard substrates.

366–370 SEA Semester In cooperation with the Sea Education Association (SEA), the Shoals Marine Laboratory offers a semester-length sequence of courses designed to provide college undergraduates with a thorough academic, scientific, and practical understanding of the sea. This sequence is repeated approximately every 2 months throughout the year. The first half of SEA Semester (the 6-week basic shore component) is spent in Woods Hole, Mass., receiving instruction in the marine and nautical sciences and studying our relationship with the sea. The second half of SEA Semester (the 6-week sea component) is spent at sea aboard R/V *Westward*. Applicants are interviewed in Ithaca before admission. Enrollment is open to men and women judged capable of benefiting from SEA Semester; no specific prior training or study is required. *Cornell students enrolled in the SEA Semester must take the entire sequence.*

For more details and applications, consult the Shoals Marine Laboratory office, Stimson G14. Program costs to be paid in place of regular Cornell tuition and fees: tuition for basic shore component, about $1,100; tuition plus room and board for sea component, about $2,400.

Instructors for the SEA Semester include faculty of the SEA, Cornell, Woods Hole Oceanographic Institution, Boston University, and others.

Basic Shore Component (6 weeks)

366 SEA Introduction to Marine Science 3 credits. Prerequisite: a laboratory course in physical or biological science, or equivalent. A survey of the characteristics and processes of the global ocean. Oceanographic concepts are introduced and developed from their bases in biology, physics, chemistry, and geology. Provides a broad background in oceanography with special attention to areas pertinent to the subsequent *Westward* cruise. Guest lecturers from the Woods Hole research community interpret current trends and activities in this rapidly-evolving field. Students are encouraged to develop individual projects to be carried out at sea.

367 SEA Man and the Sea 2 credits. An interdisciplinary consideration of our relationship with the marine environment. Included are the political, economic, social, and cultural results of our use of the sea for recreation, scientific research, food, fuel, minerals, and energy-efficient transportation. Covers the elements of maritime history, law, literature, and art necessary to appreciate our marine heritage and to understand contemporary maritime affairs. Examples of mariners' journals are studied in preparation for the diary required of each student at sea.

368 SEA Introduction to Nautical Science 3 credits. Prerequisite: college algebra or equivalent. An introduction to the technologies of operation at sea. The concepts of navigation (piloting, celestial, and electronic), naval architecture, ship construction, marine engineering systems, and ship management are taught from their bases in physics and astronomy. Provides the theoretical foundation for the navigation, seamanship, and engineering that the student will employ at sea.

Sea Component (6 weeks)

Courses 369 and 370 take place aboard the R/V *Westward*, a 250-ton steel auxiliary-powered staysail schooner built in 1961. *Westward* normally puts to sea with a ship's company of 34. The professional staff of 9 includes the captain, 3 science watch officers, 3 deck watch officers, an engineer, and a steward. In addition, 1 or more visiting investigators are frequently aboard. Up to 25 students round out the complement.

369 SEA Marine Science Laboratory 4 credits. Prerequisite: Biological Sciences 366. The practice of oceanography at sea. The student is introduced to the oceanic environment, including its biological, physical, chemical, and geological aspects; is instructed in the operation of oceanographic equipment through the taking of samples and measurements; and practices reducing and analyzing data and solving simple problems related to the surrounding oceanic environment. Topics vary with the cruise track but include attention to all of the major subdisciplines of oceanography.

370 SEA Nautical Science Laboratory 4 credits. Prerequisite: Biological Sciences 368. The practice of nautical science at sea. The student is introduced to the technical and psychological problems of operation and existence in the physical environment of the ocean. Instruction and practice are provided in navigation, seamanship, marine engineering, and shipboard operations. Daily lectures build on the theoretical foundation established by the shore course and deal with the practical problems and applications presented by ship operation. During the final two weeks at sea, each student is expected to demonstrate, in succession, competence as navigator, deck watch officer, and engineering watch officer.

[455 (460) Insect Ecology, Lectures (also Entomology 455) Fall. 2 credits. Prerequisites: Biological Sciences 360 and Entomology 212, or their equivalents. Recommended: concurrent enrollment in Biological Sciences 457. Offered alternate years. Not offered 1980–81.

Lecs, W F 11:15. R. B. Root.

Ecological and evolutionary principles are integrated by thorough examination of outstanding investigations. Topics discussed include the factors responsible for the great diversity of insects, adaptive syndromes associated with climate, natural history of arthropod guilds, impact of insects on terrestrial vegetation, population regulation, and the contrast between natural and managed ecosystems.]

[457 (460) Insect Ecology, Laboratory (also Entomology 457) Fall. 2 credits. Limited to 16 students. Prerequisite: concurrent enrollment in Biological Sciences 455. Offered alternate years. Not offered 1980–81.

Lab, W 1:25–4:25; plus F or S field trips to be arranged during the field season. R. B. Root.

Field exercises focus on insect natural history and methods of sampling populations. Laboratories devoted to rearing insects, estimating life-table parameters, and analyzing communities.]

461 Oceanography Fall. 3 credits. Prerequisites: college physics and either Biological Sciences 260 or 360; or written permission of instructor. S-U grades optional.

Lecs, T R 10:10; additional lec, R 12:20, alternating with disc, T or R 1:25. J. P. Barlow.

A general introduction to the oceans, with emphasis on physical and chemical processes that interact with marine communities. Discussions use case studies from current literature to illustrate application to problems in biological oceanography. Field techniques and analytical methods are demonstrated.

462 Limnology, Lectures Spring. 3 credits. Prerequisite: Biological Sciences 260 or 360, or written permission of instructor.

Lecs, M W F 11:15. G. E. Likens.

A study of the interaction of biological communities and their aquatic environment. The physical, chemical, and biological dynamics of freshwater ecosystems.

463 Plant Ecology, Lectures Fall. 3 credits. Prerequisites: two advanced-level courses in biology, including Biological Sciences 360, or written permission of instructor. Recommended: some taxonomic familiarity with vascular plants and concurrent enrollment in Biological Sciences 465.

Lecs, M W F 11:15. P. L. Marks.

Principles of plant-environment interactions in relation to the evolution, distribution, structure, and functioning of plants and plant communities.

464 Limnology, Laboratory Spring. 2 credits. Prerequisite: concurrent or previous enrollment in Biological Sciences 462.

Lab, T W R or F 1:25–4:25; 1 all-day field trip. G. E. Likens.

Field trips and laboratories devoted to studies of aquatic ecosystems.

465 Plant Ecology, Laboratory Fall. 1 credit. Prerequisite: concurrent enrollment in Biological Sciences 463 or equivalent background in plant ecology.

Lab, F 12:05–5. P. L. Marks.

Laboratory and field exercises in plant ecology. Field studies of plant communities and techniques for the analysis of community data are emphasized.

466 Chemical Ecology Fall. 2 credits. Prerequisites: one year of introductory biology for majors and either Chemistry 253, 358, or 360; or written permission of instructor. S-U grades optional. Offered alternate years.

Lecs, M W 8; occasional lec F 8. R. H. Whittaker, T. Eisner, P. P. Feeny, J. Meinwald, W. L. Roelofs.

Ecological and evolutionary significance of chemical interactions of organisms; survey of major classes of natural products with emphasis on appropriate analytical techniques; chemical adaptations for reproduction, defense, habitat selection, dispersal, feeding efficiency, and competition in animals, plants, and microorganisms; choice of adaptive strategy in relation to energy flow; and practical applications of chemical ecology.

468 Systems Ecology Spring. 4 credits. Prerequisites: Biological Sciences 360 and calculus. Recommended: Computer Science 102. S-U grades optional.

Lecs, M W F 10:10; disc, T or R 2:30–4:05. C. A. S. Hall.

An introduction to the quantitative study of populations, communities, and ecosystems. Emphasis on the development and validation of computer models based on component interactions and entire systems. Topics covered include relevant ecological principles, system diagramming, rudimentary mathematical techniques, simulation modeling, and the use of analog and digital computers. Format includes student presentations and guest lectures describing individual case

histories in which a variety of methods were used for ecological analysis, simulation, or prediction. Each student is required to develop an original computer model.

[470 Undergraduate Ecology Seminar Fall or spring. 1 or 2 credits. May be repeated for credit. From time to time different seminars are offered. Not offered 1980–81.]

471 Mammalogy Fall. 4 credits. Recommended: Biological Sciences 274 or equivalent. S-U grades optional, with permission of instructor. Fee, $15.
Lecs, M W F 9:05; lab, M or T 1:25–4:25; 1 weekend field trip required. P. J. Parker.
Lectures on the evolution, classification, distribution, and adaptations of mammals. Laboratory and fieldwork on systematics, ecology, and natural history of mammals of the world, with primary emphasis on the North American fauna. Systematics laboratories held in the museum at Research Park.

472 (472, 474) Herpetology Spring. 4 credits. Recommended: Biological Sciences 274. S-U grades optional, with permission of instructor. Offered alternate years.
Lecs and labs, T R 12:20–4:25; occasional field trips and special projects. F. H. Pough.
Lectures cover various aspects of the biology of amphibians and reptiles, including evolution, zoogeography, ecology, behavior, and physiology. Laboratory parallels lectures and includes taxonomy, functional morphology, and behavior. Field trips include observations of amphibian breeding congregations and analysis of the physical and biological characteristics of microhabitats of local species.

475 Ornithology Fall. 4 credits. Prerequisites: Biological Sciences 274 or equivalent, and written permission of instructor. S-U grades optional, with permission of instructor.
Lecs and labs, T R 12:20–4:25; occasional field trips and special projects. D. R. Gray.
Lectures cover various aspects of the biology of birds, including anatomy, physiology, classification, evolution, migration and orientation, behavior, ecology, and distribution, and are fully integrated with laboratory studies. Laboratory includes studies of external and internal morphology, pterylosis, molts and plumages, specimen identification of birds of New York, and families of birds of the world. Several demonstration periods emphasize hybridization, evolution, adaptive radiation, mimicry, and geographic variation.

476 Biology of Fishes Fall. 4 credits. Prerequisite: Biological Sciences 274, or equivalent experience in vertebrate zoology with written permission of instructor. S-U grades optional, with permission of instructor. Offered alternate years.
Lecs, M W F 9:05; lab to be arranged. E. B. Brothers.
An introduction to the study of fishes: their structure, classification, evolution, distribution, ecology, physiology, and behavior.

477 Organic Evolution Fall. 4 credits. Prerequisites: Biological Sciences 281 and either 260 or 360; or permission of instructor.
Lecs, T R 11:15; lec or disc, R 12:20; optional sessions to be arranged. P. F. Brussard.
Lectures and class discussions on organic evolution, including the origin of life, genetic mechanisms, the properties of populations, the ways in which adaptation and speciation occur, and the resultant major patterns of organic diversity.

478 Biology of Fishes, Laboratory Fall. 1 credit. Limited to 15 students. Prerequisite: concurrent enrollment in Biological Sciences 476. Offered alternate years.
Lab, M 1:25–4:25; plus irregular hours as required for experiments and some required field trips. E. B. Brothers, J. B. Heiser.
Laboratory and fieldwork on structure, identification, ecology, physiology, and behavior of fishes, with emphasis on local species.

662 Mathematical Ecology (also Statistics and Biometry 662) Spring. 3 credits. Prerequisites: one year of calculus and a course in statistics. Recommended: a general ecology course. Offered alternate years.
Lecs, M W F 12:20. S. A. Levin, D. L. Solomon.
Mathematical and statistical analysis of populations and communities: theory and methods. Spatial and temporal pattern analysis. Deterministic and stochastic models of population dynamics. Model formulation, parameter estimation, simulation, and analytical techniques.

664 Seminar in Coevolution between Insects and Plants (also Entomology 664) Spring. 2 credits. Intended for seniors and graduate students. Limited to 15 students. Prerequisites: courses in entomology, ecology, evolution, and organic chemistry, and written permission of instructor. S-U grades optional. Offered alternate years.
Sem, 1 evening each week, to be arranged. P. P. Feeney.
Presentations and discussions by students on the evolution of patterns of interaction between plants and insects, emphasizing critical evaluation of concepts and evidence.

[665 Limnology Seminar Fall. 1 credit. May be repeated for credit. Primarily for graduate students; written permission of instructor required for undergraduates. S-U grades optional. Not offered 1980–81.
Sem to be arranged. G. E. Likens.
A seminar course on advanced limnological topics.]

666 Marine Ecology Spring. 3 credits. Prerequisites: Biological Sciences 260 or 360, and 461; or written permission of instructor. S-U grades optional.
Lecs, M W F 9:05. J. P. Barlow.
An introduction to biological oceanography, including adaptation of organisms to marine environments, organization of pelagic and benthic communities, and dynamics of marine ecosystems, with some special consideration of current research in coastal and estuarine regions.

[667 Topics in Theoretical Ecology Fall. 3 credits. Primarily for graduate students; permission of instructor required for undergraduates. Prerequisite: one year of calculus. Recommended: Biological Sciences 662. S-U grades optional. Offered alternate years. Not offered 1980–81; first offered fall 1981.
Lecs, 3 hours each week, to be arranged. S. A. Levin.
Current and classical theoretical issues in ecology and evolutionary biology. Biological issues are emphasized, although mathematical models are utilized throughout as tools to address those issues. Lectures cover both standard material and current journal articles.]

[669 Plant Ecology Seminar Fall. 1 credit. May be repeated for credit. Suggested for students majoring or minoring in plant ecology. S-U grades optional. Not offered 1980–81.
Sem to be arranged. B. F. Chabot.
Includes review of current literature, student research, and selected topics of interest to participants.]

670 Graduate Seminar in Vertebrate Biology Fall or spring. 1 credit. May be repeated for credit. Primarily for graduate students; written permission of instructor required for undergraduates.
Sem to be arranged. Vertebrate biology staff.
Seminar presentations and discussions by students on areas of current research in vertebrate biology. Topics vary from semester to semester.

[679 Ichthyology Fall. 5 credits. Enrollment limited. Prerequisites: Biological Sciences 476 and 478; or written permission of instructor. Offered alternate years. Not offered 1980–81.
Lecs, M W 10:10; labs, W F 1:25–5; plus irregular hours as required for experiments and some required field trips. Independent research project or term paper required. E. B. Brothers.
Lectures on advanced topics in fish biology, including systematics, ecology, behavior, life history, and literature. Laboratory studies of the orders, major families, and principal genera and of systematic procedures. Field studies of the ecology and life history of local species.]

760 Special Topics in Evolution and Ecology Fall or spring. 1–3 credits. May be repeated for credit. Enrollment limited. S-U grades optional, with permission of instructor.
Hours to be arranged. Staff.
Independent or group intensive study of special topics of current interest. Content varies and is arranged between student and staff member.

761 Seminar in Population and Community Ecology Fall. 1 credit. May be repeated for credit. Prerequisite: permission of instructor.
Sem, T 4:25. S. A. Levin.

[765 Autecology Fall. 3 or 4 credits (4 credits with term paper). Offered alternate years. Not offered 1980–81.
Lecs, T R 10:10–11:30. B. F. Chabot and staff.
Comparison of the responses and adaptations of organisms to environment in selected ecosystems. Emphasis on similarities and differences in molecular and organismal mechanisms by which plants and animals cope with their environments.]

[766 Population Ecology Spring. 3 or 4 credits (4 credits with term paper). Prerequisite: graduate standing with some background in calculus, statistics, ecology, and evolutionary theory; or written permission of instructor. Offered alternate years. Not offered 1980–81.
Lecs and discs, M W F 9:05. P. F. Brussard, S. A. Levin.
Critical examination of the properties and dynamics of populations. Emphasis on theories of population structure, dynamics, and regulation. Discussion of experimental approaches to analyses of natural populations.]

767 Community Ecology Fall. 3 or 4 credits (4 credits with term paper). Prerequisite: Biological Sciences 360 or equivalent, or written permission of instructor. Offered alternate years.
Lecs, T R 10:10–12:05. R. H. Whittaker and staff.
The structure and dynamics of natural communities; patterning and sampling problems; species diversity; niches and gradient relations; and ordination, classification, succession, climax, and disturbance. Comparative aspects of terrestrial, marine, and freshwater communities are stressed.

768 Ecosystems Spring. 3 or 4 credits (4 credits with term paper). Prerequisite: Biological Sciences 360 or equivalent, or written permission of instructor. Offered alternate years.
Lecs, T R 10:10–12:05. G. E. Likens and staff.
Analysis of ecosystems in terms of energy flow, biogeochemistry, and model systems. Emphasis on the functional properties of ecosystems, from simple systems to the biosphere as a whole

Population Biology of Health and Disease (Veterinary Medicine 330) Spring. 3 or 4 credits (4 credits with either lab exercises or library research).
Lecs, T R 11:15; disc and demonstration, T 2–3:30. J. H. Whitlock and staff.
An integrative study of the problems of health and disease in populations of humans, plants, and animals. Examples are drawn from the whole symbiotic spectrum. Parasitoses that result in disease are demonstrated to have comparable structures and

functions. These structures and functions are examined as adaptive phenomena from ecological, genetic, sociological, and economic points of view. In the demonstrations, specific diseases or symbioses are presented for discussion either through the medium of motion pictures or by specialists (such as epidemiologists, virologists, plant nematologists, and insect pathologists) from the Cornell staff.

Related Courses in Other Departments

Advanced Insect Taxonomy (Entomology 631, 632, 633, 634)

Advanced Soil Microbiology (Agronomy 606)

Advanced Work in Animal Parasitology (Veterinary Medicine 737)

Bionomics of Freshwater Invertebrates (Entomology 471)

Ecological Animal Physiology (Biological Sciences 315, 317)

Human Paleontology (Anthropology 374)

Insect Biology (Entomology 212)

Insect Pathology (Entomology 453)

Introductory Insect Taxonomy (Entomology 331)

Invertebrate Zoology (Biological Sciences 212)

Microbial Ecology (Agronomy 410 and Microbiology 492)

Parasitic Helminthology (Veterinary Medicine 440)

Phycology (Biological Sciences 348)

Soil Microbiology (Agronomy 406)

Taxonomy and Evolution of Vascular Plants (Biological Sciences 343, 442)

Teaching Experience (Biological Sciences 498)

Undergraduate Research in Biology (Biological Sciences 499)

Vertebrate Social Behavior (Biological Sciences 427)

Genetics and Development

281 Genetics Fall or spring. 5 credits. Not open to freshmen in fall semester. Prerequisite: one year of introductory biology or equivalent. Students who have taken Biological Sciences 282 may register only with written permission of instructor. No admittance after first week of classes.

Lecs, T R 10:10–11:30; lab, M T W or R 2:30–4:25; additional hours to be arranged. Lab sections may also be scheduled T or R 8–9:55, W or F 10:10–12:05, F 2:30–4:25, or S 10:10–12:05, if enrollment requires it. Students do not choose lab sections during course enrollment; lab assignments are made at the end of first lec period. Staff.

A general study of the fundamental principles of genetics in eucaryotes and procaryotes. Discussions of gene transmission, gene action and interaction, gene linkage and recombination, gene structure, gene and chromosome mutations, genetic aspects of differentiation, genes in populations, breeding systems, and extrachromosomal inheritance. In the laboratory students perform experiments with microorganisms and conduct an independent study of inheritance in *Drosophila*.

282 Human Genetics Spring. 3 credits. Each disc section limited to 25 students. Prerequisite: one year of introductory biology or equivalent. Students who have taken Biological Sciences 281 may register only with written permission of instructor.

Lecs, M W 10:10; disc, R or F 10:10 or 11:15 (1 disc section R 10:10, 2 sections R 11:15, 4 sections F 10:10, and 1 section F 11:15). A. M. Srb.

An introduction to biological heredity through consideration of human genetics. Advances in the science of genetics are having a profound effect on our understanding of ourselves and on our potential for influencing our present and future well-being. The course is intended primarily to contribute to the student's general education in these matters. Although certain aspects of genetics are considered with some rigor, the course is not designed to serve as a prerequisite to advanced courses in genetics.

384 Invertebrate Embryology Summer. 4 credits. Prerequisite: Biological Sciences 364 or a course in invertebrate zoology. S-U grades optional. A special 3-week course offered at Cornell's Shoals Marine Laboratory (SML) on an island off Portsmouth, N.H. For more details and application, consult the SML office, Stimson G14. Estimated cost, $495.

Daily lecs, labs, and fieldwork for 3 weeks. SML faculty.

A comparative study of aspects of reproduction and early development in selected invertebrates, providing a classical approach to the morphology of the gonads, fertilization, various kinds of cleavage and gastrulation, and the formation of larvae. For each group, students first consider gametes during formation in the gonads, then development of a new individual through fertilization and the formation of the early larval structure.

385 Developmental Biology Fall. 3 credits. Prerequisite: Biological Sciences 281.

Lecs, M W F 11:15. A. W. Blackler.

Morphogenetic, cellular, and genetic aspects of the developmental biology of animals.

389 Vertebrate Developmental Anatomy Fall. 2 credits. Limited to 30 students, with preference given to seniors. Prerequisite: concurrent or previous enrollment in Biological Sciences 385.

Lab, W or F 1:25–4:25; additional hours to be arranged. A. W. Blackler.

A course in the morphogenesis of vertebrates, with emphasis on avian and mammalian development.

481 Population Genetics Fall. 3 credits. Prerequisite: Biological Sciences 281 or equivalent. S-U grades optional.

Lecs, M W 10:10. B. Wallace.

A study of factors that influence the genetic structure of Mendelian populations and that are involved in race formation and speciation. Four quizzes and an optional term paper determine the final grade.

[483 Molecular Aspects of Development Fall 3 credits. Prerequisite: Biological Sciences 330 or 331. Not offered 1980–81.

Lecs, M W F 11:15. Staff.

An examination of the molecular biology of developing systems. Emphasis on understanding the mechanisms involved in gene expression in developing systems, both at the transcription and translation levels. Specific topics include regulation of RNA synthesis and utilization, nucleo-cytoplasmic interactions, and induction of cell-specific protein synthesis. Examples are discussed from both higher and lower eucaryotic systems.]

[484 Molecular Evolution Spring. 3 credits. Prerequisites: Biological Sciences 281 and organic chemistry. Offered alternate years. Not offered 1980–81.

Lecs, T R 11:15. R. J. MacIntyre.

An analysis of evolutionary changes in proteins and nucleic acids, and gene-enzyme variability in natural populations. The role of natural selection in effecting these changes and maintaining genetic variation at the molecular level is critically examined. Theories on the evolution of the genetic code and the construction of phylogenetic trees from biochemical data are discussed.]

485 Microbial Genetics, Lectures Fall. 2 credits. Limited to upperclass and graduate students. Prerequisites: Biological Sciences 281 and Microbiology 290; or written permission of instructor. S-U grades optional.

Lec, W 7:30–9:25 p.m. S. A. Zahler.

Genetics of bacteria and their viruses, with emphasis on the mechanisms of genetic phenomena.

486 Immunogenetics (also Animal Science 486) Spring. 3 credits. Enrollment limited. Prerequisites: Biological Sciences 281 or Animal Science 221, and a course in immunology or permission of instructor.

Lecs, M W F 9:05; disc, W or R 12:20. R. R. Dietert.

The genetic control of a variety of cellular antigens and their use in understanding biological and immunological functions. The genetics of antibody diversity, antigen recognition, immune response, transplantation, and disease resistance are discussed.

487 Microbial Genetics, Laboratory Fall. 3 credits. Primarily for upperclass students. Limited to 20 students. Prerequisites: concurrent or previous enrollment in Biological Sciences 485, Microbiology 291 or equivalent, and written permission of instructor.

Lab, T 1:25–4:25; additional hours to be arranged. S. A. Zahler.

Problem solving in bacterial genetics.

[488 Genetics of Lower Eucaryotes Spring. 3 credits. Prerequisites: Biological Sciences 281 and a course in organic chemistry. S-U grades optional. Not offered 1980–81.

Lecs, M W F 9:05. P. J. Bruns, G. R. Fink, A. M. Srb.

Genetic aspects of the biology of a few eucaryotic microorganisms — primarily yeast, *Neurospora*, and ciliated protozoa — with emphasis on the use of these organisms as experimental tools. Major topics covered include gene action, control mechanisms, cytoplasmic genetic systems, recombination and conversion, morphogenetic systems, and evolutionary aspects of physiological systems. Extensive appropriate reading in the original literature of genetics is a primary component of the course.]

780 Current Topics in Genetics Fall or spring. 2 credits. May be repeated for credit. Primarily for graduate students, with preference given to majors in the Field of Genetics; written permission of instructor required for undergraduates. Limited to 20 students. No auditors. S-U grades optional, with permission of instructor.

Sem to be arranged. Staff.

A seminar course with critical presentation and discussion by students of original research papers in a particular area of current interest. Content of the course and staff direction varies from term to term and will be announced a semester in advance.

Related Courses in Other Departments

Animal Cytogenetics (Animal Science 419)

Behavioral Neurogenetics (Biological Sciences 624)

Current Topics in Biochemistry (Biological Sciences 731–739)

Cytogenetics (Biological Sciences 446)

Cytology (Biological Sciences 347)

Organic Evolution (Biological Sciences 477)

Physiological Genetics of Crop Plants (Plant Breeding 605)

Plant Growth and Development (Biological Sciences 644)

Teaching Experience (Biological Sciences 498)

Undergraduate Research in Biology (Biological Sciences 499)