DEPARTMENT OF BIOLOGICAL SCIENCES

Faculty

Distinguished Teaching Professors

Stephen C. Brown, Ph.D.
University of Michigan

Helmut V. B. Hirsch, Ph.D.
Stanford University

John S. Mackiewicz, Ph.D.
Cornell University

Professors

Richard P. Cunningham, Ph.D.
Johns Hopkins University

Helen T. Ghiradella, Ph.D.
University of California, Santa Barbara

Colin S. Izzard, Ph.D.
Cambridge University (England)

Jon W. Jacklet, Ph.D.
University of Oregon

Paulette McCormick, Ph.D.
University at Albany

Albert J. T. Millis, Ph.D.
University of Pennsylvania

John T. Schmidt, Ph.D.
University of Michigan

David A. Shub, Ph.D.
Massachusetts Institute of Technology

Daniel L. Wulff, Ph.D. (Collins Fellow)
California Institute of Technology

Richard S. Zitomer, Ph.D.
University of Pennsylvania

Associate Professors

Dmitry A. Belostotsky, Ph.D.
Ukraine Academy of Sciences

Thomas B. Caraco, Ph.D.
Syracuse University

Gary S. Kleppel, Ph.D.
Fordham University

Gregory Lnenicka, Ph.D.
University of Virginia, Charlottesville

Robert Osuna, Ph.D.
University of Michigan

George Robinson, Ph.D.
University of California, Davis

Caro-Beth Stewart, Ph.D.
University of California, Berkeley

Ben G. Szaro, Ph.D.
John Hopkins University

Sho-Ya Wang, Ph.D.
State University of New York
at Stony Brook

Assistant Professors
Ravindra Gupta
University of Bombay, Ph.D.
Ing-Nang Wang, Ph.D.
SUNY at Stony Brook
Affiliated Faculty
Jeffrey L. Travis, Ph.D.
Dartmouth College
Suzannah Bliss Tieman, Ph.D.
Stanford University
Adjuncts (estimated): 41
Teaching Assistants (estimated): 26

The objective of the department is to provide the undergraduate student with a broad background in the biological sciences and adequate supporting strength in the physical sciences. Accordingly, most of the B.S. programs listed here are structured around a combined major/minor sequence.

The department also offers programs leading to the M.S. and the Ph.D. in which the graduate student is able to obtain an in-depth professional education in one of several more restricted areas of biological sciences.

Careers

The B.A., which specifies the major only and requires a separate minor sequence outside science and mathematics, is designed with the aims of the liberal or fine arts students in mind and as such is not intended for the professional biologist or teacher. The B.S. programs provide a strong background for further study either in graduate school or medicine and prepare the student for secondary school teaching and a variety of careers in biology at the technical level. Graduates with a B.S. degree often find technical-level positions with pharmaceutical companies or as research assistants in grant-related positions. Those who go on to graduate or professional school have a wide array of career opportunities in research, health fields, and business.

Degree Requirements for the Major in Biology

General Program B.A.: Major sequence consisting of a minimum of 36 credits.
Required courses are: A Bio 110F or 110N, 111N, 212; A Chm 120N, 121N, 122A, 122B; and 16 additional credits of biology major electives including two courses which are partially or exclusively laboratory courses. A Bio 399, 399Z, 499, and 499Z may contribute up to a total of 4 credits of non-laboratory major elective credit. Courses that do not yield credit toward the major are indicated in the individual bulletin descriptions. Major electives must be selected so that a total of 12 credits at the 300 level or above is included in the major. The minor sequence will consist of a minimum of 18 credits. The student may not have a minor in: atmospheric science, biology, chemistry, computer science, electronics, geology, mathematics, physics, or statistics.

Bachelor of Arts in Biology Requirements

A Bio 110F& 111N	8
A Bio 212	4
Chemistry	8
Subtotal	20
Additional credits in biology	16
Total	36
Plus nonscience/math minor	18–24

General Program B.S.: Combined major and minor sequence consisting of a minimum of 66 credits.

Required courses: A Bio 110F or 110N, 111N, 212, 365, 402; A Phy 105N, 106, 108N, 109; 6 credits in mathematics exclusive of A Mat 100, 101, 102N, 103, 105, 110; and A Chm 120N, 121N, 122A, 122B, 216A, 216B, 217A, 217B.

18 additional credits in biology are also required, and must include at least 3 laboratory courses. *At least one course* must be selected from *each* of the following areas:

- Molecular-Cell Biology: A Bio 214, 217, 312, 314, 366, 412
- Development-Function: A Bio 303, 317, 335, 341, 406, 410, 420, 422, 441, 460
- Ecology-Behavior-Diversity: A Bio 306, 308, 316, 319, 319Z, 320, 321, 325, 326, 409, 432, 436, 442, 443, 444, 445, 450, 455, and 468.

Credits in A Bio 399, 399Z, 499, and 499Z may be used to fulfill the requirement for 1 laboratory course if the

student completes at least 4 credits over at least 2 semesters. A Bio 399, 399Z, 499, and 499Z may contribute a total of 4 credits towards the major. Courses that do not yield credit toward the major are so indicated in the individual bulletin descriptions.

Courses in the combined major/minor sequence must include at least six credits at the 300-level and at least 6 credits at the 400-level or above. Graduate courses are open to qualified seniors with appropriate departmental and instructor consent.

Bachelor of Science Requirements

A Bio 110F& 111N	8
A Bio 212	4
A Bio 365	3
A Bio 402	3
Biology major electives	18
A Bio ___ (Molecular-Cell)	
A Bio ___ (Function-Development)	
A Bio ___ (Ecology-Behavior-Diversity)	
Chemistry	16
Mathematics	6
Physics	8
Total	66

Degree Requirements for the Faculty-Initiated Interdisciplinary Major with a Concentration in Human Biology are listed in the Human Biology Program section of this bulletin.

Degree Requirements for the Faculty-Initiated Interdisciplinary Major with a Concentration in Biochemistry and Molecular Biology

The Biochemistry and Molecular Biology program is a Faculty-Initiated Interdisciplinary major (Biology and Chemistry) designed for students interested in these rapidly developing fields of science. Students with training in these fields can pursue careers as researchers in academic or industrial settings or they can pursue further study in graduate or professional schools. Students must complete 40 graduation credits before application to the program, generally in the spring of the sophomore year.

Admission: Students must obtain the approval of the Program Director before officially declaring this Faculty-Initiated Interdisciplinary Program as a major.
General Program B.S. Combined major and minor sequence consisting of a minimum of 65 credits.

Required Courses: A Bio 110F or 110N, 111N, 212, 312, 313, 365, 366, 367; A Chm 120N, 121N, 122A, 122B, 216A, 216B, 217A, 217B, 340A 441A, 340B or 441B; A Phy 140, 150; A Mat 111 or 112 or 118, 113 or 119; and an additional laboratory course in Biology or Chemistry at or above the 300 level. Credits in A Bio 399, 399Z, 499, 499Z or A Chm 425, 426 maybe used to fulfill this laboratory requirement if the student completes at least 4 credits over 2 semesters.

Bachelor of Science Requirements:

A Bio 110F (or 110N) & 111N	8
A Bio 212	4
A Bio 312 & 313	5
A Bio 365, 366 & 367	8
A Chm 120N, 121N 122A, & 122B	8
A Chm 216A, 216B, 217A, & 217B	8
A Chm 441A (or 340A) & 441B (or 340B)	6
A Phy 140 & 150	7
A Mat 111, 112, or 118 & 113 or 119	8
Additional laboratory and elective credits	3
Total	65

Honors Program

The honors program in biology is designed for outstanding students in the programs leading to the B.S. degree. Students may apply for admission to the honors program by submitting a letter of request to the departmental honors

committee no later than April 15 of the freshman or sophomore year (for admission for the fall) or November 15 of the sophomore year (for admission in the spring). Junior transfers may apply at the time of their admission to the University. Students found acceptable by the committee must find a research adviser to supervise the independent study leading to an HONORS THESIS.

The requirements for admission include: (1) the candidate must declare the major and have completed (or have in progress at time of application) 12 credits of course work required for the biology major, including A Bio 110F or 110N, and 111N; (2) an overall grade point average of 3.50; (3) a grade point average of 3.50 in courses required for the major; and (4) a written recommendation from an adviser, professor or teaching assistant if possible. Primary emphasis will be placed on indications of academic ability and maturity sufficient for applicants to complete with distinction a program involving independent research.

Students in the program are required to complete a minimum of 65 or 66 credits as specified for the respective program for the B.S. in biology and must include: (1) at least 6 credits of independent study (A Bio 399, 499); the independent study, or honors research project, which will result in an HONORS THESIS; (2) at least 3 credits of course work at the 500 level or higher (not including A Bio 515) in the student's area of interest; and (3) oral presentation of research at a public seminar.

Students in the program must maintain both a minimum grade point average of 3.50 overall and in biology courses taken to satisfy major requirements during the junior and senior years. The progress of participants in the honors program will be reviewed at the end of the sophomore and junior years by the student's adviser and the departmental honors committee. Students not meeting academic and independent research standards may be precluded from continuing in the program during their senior year. These students may, of course, continue as majors.

After completion of the requirements above, the departmental honors committee will make its recommendation to the faculty to grant the degree "with honors in biology" based upon (1) overall academic record, (2) performance and accomplishments of the independent study project(s), (3) the quality of the Oral Presentation (4) the evaluations of departmental faculty members who have supervised these activities.

Combined B.S./M.S. Program

The combined B.S./M.S. program in biology provides an opportunity for students of recognized academic ability and educational maturity to fulfill integrated requirements of undergraduate and master's degree programs from the beginning of the junior year. A carefully designed program can permit a student to earn the B.S. and M.S. degrees within nine semesters.

The combined program requires a minimum of 138 credits, of which at least 30 must be graduate credits. In qualifying for the B.S., students must meet all University and college requirements, including the requirements of the undergraduate major described previously, the minimum 60-credit liberal arts and sciences requirement, general education requirements, and residency requirements. In qualifying for the M.S., students must meet all University and college requirements as outlined in the Graduate Bulletin, including completion of a minimum of 30 graduate credits and any other conditions such as a research seminar, thesis, comprehensive examination, professional experience, and residency requirements. Up to 12 graduate credits may be applied simultaneously to both the B.S. and M.S. programs.

While satisfying B.S. and M.S. requirements, students must complete a coherent sequence of courses in one of the two core areas: ecology, evolution, and behavior (EEB); or, molecular, cellular, developmental, and neural biology (MCDN). This sequence of courses begins with a 400-level course and includes a minimum of three graduate courses up to a total of at least 9 credits. In addition, the sequence should include two semesters involving a discussion of the current literature in the field of biology selected by the student (one of the following: A Bio 650 or A Bio 633).

Students are considered as undergraduates until completion of all B.S. requirements. Upon meeting B.S. requirements, students are automatically considered as graduate students. Although the Graduate Record Examinations are not required for this program, students are encouraged to take the examinations in their senior year with the expectation that they will continue graduate studies.

Students may be admitted to the program at the beginning of the junior year or after the completion of 56 credits. Normally an application should be made at the completion of the sophomore year. Those students who are accepted into the program in their Junior year must complete at least three (3) semesters of research in the Bio 399-499 sequence. Seniors are not normally admitted into this program. However, students may be accepted if they have completed at least one semester of Bio 399 (for admittance at the beginning of first semester senior year) or one semester each of Bio 399 and 499 (for admittance at the beginning of second semester senior year). A minimum grade point average of 3.20 is required and the application should be supported by a minimum of three letters of recommendation from faculty. The application should be submitted to the department chair.

Joint Seven-Year Biology/ Optometry Program

This combined program sponsored by the State College of Optometry, State University of New York, and the University at Albany, provides students an opportunity to earn a Bachelor of Science (B.S.) degree in biology and a Doctor of Optometry (D.O.) in seven years. Participating students will matriculate at the University at Albany for three years and begin their Optometry studies in year four of the program. Students will be awarded the B.S. degree after completion of their requirements at the end of the fourth year.

At the end of the seventh year and completion of all program requirements, students will be awarded the D.O. degree.

Students interested in making application to this program shall submit the necessary materials to the Pre-Health adviser in the University's Advisement Services Center by the stated deadline in the middle of the spring semester of the freshman or sophomore year (transfer students are ineligible). Selection will be based on written application materials, academic progress, and a personal interview.

A minimum of a 3.2 grade point average on a scale of 4.0 in undergraduate courses completed at the time of application is required.

Students will complete three years (90 credits) of study at the University at Albany with a major in biology for a B.S. degree. Students attend SUNY-Optometry (New York, NY) for the fourth year of study (and pay SUNY-Optometry tuition), beginning the first year of the professional program. With the completion of the fourth year of study, the University at Albany will accept as transfer credits twenty-four credits of biology and six credits of physics electives, for a total of 30 credits. Students in this program should take the Optometry Admission Test (OAT) in October or February of the third year at the University at Albany.

A minimum of 90 credits must be taken at the University at Albany. Summer course work completed the first and second year or between the second and third year at the University at Albany is acceptable for this program.

The following courses are required: A Bio 110F, 111N, 212, 16 credits of biology electives* (of which twelve credits must be the 300 or 400 level); A Chm 120N, 122a, 121N, 122b, 216a, 217a, 216b, 217b; A Mat 112, 108; A Phy 105N, 106, 108N, 109; and A Psy 101M. In addition to the General Education Program requirements, students are required to enroll in ten credits of electives.

*The biology electives MUST be 300-400 level courses in biology that are designated as courses that count towards the biology major. The following courses will not be used as biology electives: A Bio 303, 325, 341, 342, 365, 406, 410, and 411.

Courses

A Bio 100 Contemporary Biology (3)
Topics in selected areas of the Biological Sciences. May be repeated for credit when topic varies. **Does not yield credit toward the major in biology**.

A Bio 102N General Biological Sciences (3)
Introduction to the major concepts in biology and a survey of the common structures of organisms, including humans, and their functions at the molecular, cellular, organismal and population levels. Emphasis placed on principles of ecology, inheritance, evolution and physiology relevant to human society. May not be taken for credit by students who have credit in A Bio 110N or A Bio 110F or A Bio 111N or other equivalent introductory courses. **Does not yield credit toward the major in biology**. [NS]

A Bio 110F General Biology I (4)
A Bio 110F is the writing intensive version of A Bio 110N; only one may be taken for credit. Offered fall semester only. [NS WI]

A Bio 110N General Biology I (4)
First course in a two semester sequence which offers a comprehensive survey of the structures and functions common to all living systems at the molecular, cellular, organismal, and population levels. This course emphasizes evolutionary principles, ecology, and behavior. Three class periods and one laboratory per week. A Bio 110F is the writing intensive version of A Bio 110N; only one may be taken for credit. Offered fall semester only. .May not be offered in 2003-2004. [NS]

A Bio 111N General Biology II (4)
Second course in a two-semester sequence which offers a comprehensive survey of the structures and functions common to all living systems at the molecular. cellular, organismal, and population levels. This course emphasizes structure and function at the cellular level as a basis for understanding function at the organismal level. Offered spring semester only. Three class periods and one laboratory per week. Prerequisite(s): A Bio 110F or 110N. [NS WI]

A Bio 117N Nutrition (3)
The biological roles of energy, protein, vitamins, and minerals; digestion, absorption, and storage of nutrients, the chemical nature of foods and food processing; assessment of nutritional status; interactions of nutrients and disease; food supplementation and community nutrition. **Does not yield credit toward the major in biology**. [NS]

A Bio 199 Contemporary Issues in Biological Sciences (1–3)
Issues from the current literature in selected areas of biological sciences. Particular areas of study to be announced each semester. Intended for students interested in exploring in depth themes covered in large lecture classes. *S/U* or *A-E* graded. May be repeated for credit when topic varies. May not be offered in 2003-2004.

A Bio 205 Human Genetics (3)
Survey of human genetics emphasizing the principles and mechanisms of inheritance and including the analysis of the genetic material of humans; the behavior of genes in individuals families, and populations; and the implications for human behavior and evolution, medicine, and society. Prerequisite(s): A Bio 110F and 111N or permission of instructor. **Does not yield credit toward**

the major in biology.

A Bio 209N The Human Organism (3)
An introduction to the biology of the human organism from the perspective of its anatomy and physiology, emphasizing applications to modern life and human society. **Does not yield credit toward the major in biology**. [NS]

A Bio 212 Introductory Genetics (4)
Genetics from the classical Mendelian Laws of inheritance to molecular genetics. Topics will include: DNA structure and replication; Mendelian genetics and recombination; population, fungal, somatic cell, and bacterial genetics; gene organization; the genetic code; mechanisms of gene expression and regulation; and applications of genetic technology. Three class periods and one discussion section. Prerequisite(s): A Bio 111N. [OD]

A Bio 214 Genetics II (3)
A continuation of A Bio 212. Topics to be covered will include viruses; genetics of organelles (mitochondria and chloroplasts); genetic diseases; mutagenesis and repair of DNA; RNA splicing; gene regulation; transposition and other gene arrangements; developmental genetics; and genetic engineering. Prerequisite(s): A Bio 212. May not be offered in 2003-2004.

A Bio 217 Cell Biology (3)
An introduction to modern cell biology. This course will present the basic organization of eukaryotic cells while stressing their elaborate structural-functional integration. The cell's fundamental properties conserved through evolution will be stressed. May not be taken for credit by students who have credit in A Bio 301 or A Bio 304. Prerequisite(s): A Bio 212.

A Bio 230N People and Resources in Ecological Perspective (3)
Introduction to environmental science from the perspective of ecosystem dynamics: succession, matter cycling, productivity, resource allocation and biodiversity. Concepts and connections to major problems of pollution, global warming, resource exploitation and human overpopulation in a historical and contemporary context. **Does not yield credit toward the major in biology**. May not be offered in 2003-2004. [NS]

A Bio 241N The Biology of Sex (3)
This course, designed for nonmajors, examines sex from a biological perspective in species from bacteria to humans. Topics covered include sexual and asexual reproduction, sexual selection, mate choice, sex determination, sexual dimorphisms, mating strategies, courtship, genetic and environmental determinants of sexual behavior, and genetic and neural bases of sexual orientation. This course focuses on biological rather than social or cultural constructions of sex and reproduction. Prerequisite(s): high school biology. **Does not yield credit toward the major in biology**. [NS]

A Bio 299 Introduction to Methods for Research ((2)
This course helps to prepare students for supervised undergraduate research in A Bio 399 and A Bio 499. It will provide basic, current laboratory training applicable to various areas of modern biology. Laboratory exercises are drawn from the general areas of molecular, neural, cellular and developmental, and behavioral biology. Emphasis is placed on learning fundamental laboratory techniques, interpreting and presenting data, and designing simple experiments. One laboratory per week and additional flexible time as required. Prerequisite(s): A Bio 212 and permission of instructor.

A Bio 302Z Cell Biology Laboratory (2)
Introduction to modern techniques in cell biology, including advanced optical microscopy, DNA extraction and analysis, protein electrophoresis and western blotting, cell homogenization and fractionation, and cell culture. These techniques are used to investigate cell motility, membrane structure and permeability, mitochondrial respiration, DNA replication, the cell cycle, and cell adhesion. One laboratory period per week; additional time as required. Prerequisite or corequisite: A Bio 217 or 301; A Bio 365. [WI]

A Bio 303 (formerly A Bio 403) Developmental Biology (3)
The development of form and function in animals with emphasis on molecular analyses of organismal and cellular events underlying fertilization, early development, morphogenesis and growth. Prerequisite(s): A Bio 212.

A Bio 305 Developmental Biology Laboratory (2)
This laboratory course examines the mechanisms of animal and plant development at the molecular and cellular level by modern and classical techniques. Topics include gametogenesis, fertilization, early and later development, cell division and morphogenesis. One laboratory period per week; additional time as required. Prerequisite or corequisite(s): A Bio 303.

A Bio 306 Marine Biology (3)
Exploration of life in the sea; biological processes in marine environments; structure and function of marine biological communities; productivity and food webs; diversity, evolution and adaptations of marine organisms; and role of the oceans in global cycles. Covers planktonic, soft-bottom, coral reef, intertidal, deep-sea communities and environments; and the effects of human activity on life in the sea. Prerequisite(s): A Bio 110F and A Bio 111N; A Chm 120N and A Chm 122A.

A Bio 308 Parasitic Diseases and Human Welfare (3)
Ecological, medical, and social interrelationships of selected parasitic diseases of people and domestic animals in temperate, semi-tropical, and tropical climates; role of wild animals as reservoirs or vectors of parasitic diseases in humans. Prerequisite(s): 10 credits of biology or permission of instructor.

A Bio 311N (= A Gog 310N and U Uni 310N) World Food Crisis (3)
Interdisciplinary approach to understanding world food problems through analyses of social, political, economic, nutritional, agricultural, and environmental aspects of world hunger. Faculty from several departments in the sciences, humanities, and social and behavioral sciences present views from various disciplines. **Does not yield credit toward the major in biology.** Only one of A Bio 311N & U Uni 310N may be taken for credit. Prerequisite(s): junior or senior class standing, or permission of instructor. May not be offered in 2003-2004.

A Bio 312 Molecular Biology (3)
Mechanisms of gene expression and regulation will be studied, using examples from bacteria and eukaryotes. Discussion will include experimental approaches to gene cloning and sequencing, analysis of DNA-protein interactions, and structure and function of RNA. Prerequisite(s): A Bio 212; prerequisite or corequisite: A Bio 365 or A Chm 342.

A Bio 313 Laboratory in Molecular Biology (2)
Experiments in the modern techniques of recombinant molecular biology will be performed. These may include restriction mapping of plasmids, gene cloning, DNA blotting, DNA sequence analysis, plasmid constructions, and gene expression studies. One laboratory per week, plus additional flexible time as required. Prerequisite: A Bio 212. Prerequisite or corequisite(s): A Bio 312.

A Bio 314 Microbiology (3)
Introduction to the morphology, physiology, structure, genetics, and metabolism of microorganisms, including the roles played by microorganisms in medical, environmental, agricultural, and biotechnological sciences. Prerequisite(s): A Bio 212, or both A Bio 111N and A Bio 205; and A Chm 342 or A Bio 365.

A Bio 315 Microbiology Laboratory (2)
Laboratory studies that deal with the culture and study of microorganisms, the dynamics of microbial growth, and the physiological basis of bacterial identification. One laboratory per week; additional flexible time as required. Prerequisite(s) or corequisite:

A Bio 314A Bio 316 Biogeography (3)
Origin and differentiation of floras and faunas; biotic regions of the world, principles of distribution; migration, adaptation, evolution, and extinction. Three class periods each week. Prerequisite(s): A Bio 111N, or A Bio 102N

A Bio 317 Comparative Animal Physiology (3)
The physiological mechanisms employed by animals in meeting the stresses imposed by different environments. Considers strategies of adaptive radiation including toleration, avoidance, and regulation from an evolutionary perspective. Prerequisite(s): A Bio 111N and junior status

A Bio 318 (= A Ant 312; former A Bio 419/A Ant 412) Human Population Genetics (3)
Population genetics theory is the foundation of evolutionary biology and contributes heavily to modern ideas in ecology, systematics, and agriculture. This course is an introduction to that theory with special emphasis on evolution. Only one of A Ant 312 and A Bio 318 may be taken for credit. Prerequisite(s): A Ant 211 or A Bio 205 or 212. .May not be offered in 2003-2004.

A Bio 319Z Field Biology (3)
Introduction to those aspects of biology which are based on field study; local flora and fauna from an ecological viewpoint; selected field and laboratory techniques and related literature. Students are required to complete an independent field investigation. Two class periods, one laboratory period each week. Prerequisite(s): A Bio 111N, or A Bio 102N. Not open to freshmen. [WI]

A Bio 320 Ecology (3)
Introduction to the study of organisms, populations, and communities in relation to their environments. Stresses an integrated approach at all levels of biological organization. Topics include: the niche concept, species diversity, nutrient cycling, energy flow, population dynamics and control, biological rhythms, and other physiological mechanisms influenced by the environment. Three class periods each week. Prerequisite(s): A Bio 111N.

A Bio 321 The Insects (3)
A multilevel examination of the biology of insects, with particular emphasis on those aspects of design, physiology and behavior that make them so distinctive and successful. Prerequisite(s): A Bio 111N or equivalent. May not be offered in 2003-2004.

A Bio 325 Comparative Anatomy of Chordates (4)
Comparative study of embryonic development, functional morphology, adaptive radiation, and evolution of chordates. Three class periods, one laboratory period each week. Prerequisite(s): 12 credits of biology or permission of instructor. Not open to freshmen.

A Bio 326 Environmental Microbiology Lab (2)
Microorganisms are an essential part of many environments. This course explores the role of microbes in natural and human-impacted systems; topics include nutrient cycling, waste degradation, bioremediation, waterborne disease, and pollution control. Some informal lectures and current events discussions are incorporated into laboratory exercises. Prerequisite(s): A Bio 314 or equivalent. May not be offered in 2003-2004.

A Bio 335 Immunology (3)
The structure and function of the antibody molecule and of reactions between antigen and antibody. Also covers cellular interactions in the immune response as well as both the beneficial and harmful consequences of the response. Prerequisite(s): A Bio 212; prerequisite(s) or corequisite(s): A Chm 342 or A Bio 365.

A Bio 336Z (formerly A Bio 336) Laboratory in Immunology (2)
Modern laboratory techniques will be performed to study the cellular and humoral components of the immune system; immune cells and cell markers, immunoglobulin purification and characterization, antibody and antigen identification assays including immunodiffusion and immunoelectrophoresis, and enzyme-based immunoassays (ELISA). One laboratory per week, plus additional flexible time as required. The former A Bio 336 does not meet the writing intensive requirement. Only one of A Bio 336 and 336Z may be taken for credit. Prerequisite(s) or corequisite(s): A Bio 335. [WI]

A Bio 341 Neurobiology (3)
The structure and function of the nervous system examined at the cellular level. Topics include: organization of nervous systems; morphology and physiology of nerve cells; synaptic transmission; sensory processing; cellular circuitry underlying "simple" behaviors; cellular basis of learning; and the development of neuronal connections. Prerequisite(s): A Bio 111N; prerequisite(s) or corequisite(s): A Phy 108N.

A Bio 342 Neurobiology Laboratory (2)
Experimental analyses of the morphology and electrophysiology of nerve cells. Experiments include the visualization of individual nerve cells through selective staining, stimulation and recording of electrical potentials in nerve cells; and an examination of synaptic transmission. Experiments will be performed on invertebrate nervous systems. One laboratory period each week. Prerequisite(s) or corequisite(s): A Bio 341.

A Bio 365 Biological Chemistry (3)
The chemistry and biochemical interrelationship of carbohydrates, lipids, proteins, and nucleic acids; enzyme catalysis and introduction to metabolism. Prerequisite(s): A Chm 216A and 217A.

A Bio 366 Biological Chemistry II (3)
Control and regulation of metabolic pathways, expression and transmission of genetic information, and a variety of selected current topics. Prerequisite(s): A Bio 365.

A Bio 367 Biochemistry Laboratory (2)
This laboratory course is designed to provide basic training in various procedures used in present day biochemical research. These

will include methods for protein purification, enzyme kinetics, peptide sequencing, and fractionation of intracellular components. In addition, biochemical processes such as glucose metabolism and photosynthesis will be studied. One laboratory period each week. Prerequisite(s) or corequisite(s): A Bio 365 or equivalent and permission of instructor.

A Bio 389Z Writing in Biology (1)

Students who are concurrently registered in, or have previously taken, any 300- or 400-level biology course which yields credit toward the major, may with permission of the instructor of that course, enroll in A Bio 389Z and fulfill a writing intensive version of that other course. One additional meeting per week in which writing techniques and experiences are stressed is required. Written work that will be used for credit in A Bio 389Z must be in addition to any writings required for the companion course. Prerequisite(s) or corequisite(s): a companion biology course at the 300 or 400 level. *S/U* graded. [WI]

A Bio 399 Supervised Research for Juniors (1–3)

Individual, independent research on selected topics in biology. Critical analysis of selected research papers. Junior majors in the department of biological sciences apply for this course through the prospective research advisor. Students taking two or more semesters of A Bio 399, 399Z, 499, or 499Z will prepare a poster or make an oral presentation at the Departmental Research Symposium. A copy of the final written report of each semester's work, preferably typewritten in journal format, is kept on permanent file in the department. May be taken either semester. A maximum of 6 credits may be earned in A Bio 399 and 399Z.

A Bio 399Z Supervised Research for Juniors (2–3)

Writing intensive version of A Bio 399 open to junior majors in biology who have completed a minimum of one previous semester in A Bio 399 for at least two credits. Students taking two or more semesters of A Bio 399, 399Z, 499, or 499Z will prepare a poster or make an oral presentation at the Departmental Research Symposium. Requires permission of research advisor. A maximum of 6 credits may be earned in A Bio 399 and 399Z. Prerequisite(s): A Bio 399. [WI]

A Bio 402 Evolution (3)

The patterns and processes of biological change with time from the origins of life, through major evolutionary innovations, to the development of human culture. Fundamental concepts in biology will be stressed, including information, mutation, selection, random drift, and adaptation. Prerequisite(s): A Bio 212.

A Bio 406 Vertebrate Histology (4)

Microanatomy and function of animal cells, tissues and major vertebrate organs, excluding the brain. Practical work with bright-field microscopy and preparation of formalin-fixed, paraffin-embedded, sectioned and stained tissues. Three class periods, one laboratory period each week. Extra time may be needed to complete individual projects. Prerequisite(s): A Bio 212; A Bio 325 and/or A Bio 410 recommended but not required.

A Bio 409 Introduction to Biological Materials (3)

Investigation of the structure, function, and materials properties of non-living biological products (e.g., insect and plant cuticles, mineralized shell, bone, etc.). Particular attention to developmental control on the cellular and other levels. Prerequisite(s): One of the following courses: A Bio 321, 324, 325, or 422, or equivalent. May not be offered in 2003-2004

A Bio 410 Human Physiology (3)

The functions of organ systems and their contributions to the functions of the human body as a whole. Topics to include: nervous, cardiovascular, respiratory, gastrointestinal systems and energy metabolism and temperature regulation. Two 1 1/2-hour lecture periods each week. Prerequisite(s): A Bio 111N and A Chm 121N.

A Bio 411Z Human Physiology Laboratory (2)

Experimental investigations in systemic physiology with emphasis on membrane transport, nerve excitability, muscle contraction, sensory mechanisms, cardiac activity, and special problems. Three hour laboratory and one hour discussion per week. Emphasis will be placed on writing of scientific laboratory reports. The former A Bio 411 does not yield writing intensive credit. Corequisite(s): A Bio 410. [WI]

A Bio 412 Biological Movement (3)

Biological movements at the level of molecules, organelles, cells, and tissues examined in terms of their contractile and/or other basis. Emphasizes the role of molecular assembly, reorganization and interaction in producing movement, and intrinsic and extrinsic control of movement. Three class periods each week. Prerequisite(s): a course in biochemistry. May not be offered in 2003-2004.

A Bio 416 (=A Ant 416; former A Ant 315) Topics in Human Biology (3)

Selected topics in biological anthropology. May be repeated for credit when topic differs. Consult class schedule for specific topic. Only one of A Bio 416 and A Ant 416 may be taken for credit. Prerequisite(s): A Ant 110N and 211. May not be offered in 2003-2004

A Bio 420 Plant and Animal Morphogenesis (3)

Cellular basis and control of morphogenesis during development of the embryo in animals and plants, and in vegetative and reproductive growth from plant meristems. Topics examined in terms of cell division, motility and adhesion, cellular rearrangements, matrices produced by cells, hormonal factors, and gene expression. Prerequisite(s): A Bio 212. May not be offered in 2003-2004

A Bio 422 (formerly A Bio 304) Biological Architecture (3)

An analysis of the basic physical and architectural principles underlying the design of biological organisms. Topics to be covered include architecture and materials of skeletons, biological design for swimming and flight, structural colors, patterns of branching and fractal growth. Three lectures per week. Prerequisite(s): A Bio 110F or 110N, 6 credits of upper level biology or permission of instructor.

A Bio 432 Animal Behavior (3)

The organization, causation, development, and evolution of behavior in vertebrates and invertebrates. Emphasizes a synthesis of information from both field and laboratory. Topics include stimuli and responsiveness, motivation, conflict behavior, social behavior with emphasis on ecological aspects, orientation and navigation, rhythmicity, learning, and the neural organization responsible for behavior. Three class periods each week. Prerequisite(s): 15 credits in biology. May not be offered in 2003-2004.

A Bio 436 Sensory Worlds (3)

A physical, physiological and evolutionary perspective on how vertebrates and invertebrates acquire and interpret information about the surrounding world and its inhabitants. Prerequisite(s): A Bio 111N and at least one of the following: A Bio 422, A Bio

460, A Phy 105, A Psy 214, A Psy 382 or consent of instructor. May not be offered in 2003-2004.

A Bio 441 Molecular Neurobiology (3)
The molecular biology of learning, memory, neural development and neurological disease. The course will relate the structure and function of receptors, second messangers, cytoskeletal proteins, transcription factors and gene structure to their roles in the nervous system. Prerequisite(s): A Bio 312 or 341 or 301. May not be offered in 2003-2004

A Bio 442 Restoration Ecology (3)
Restoration ecology seeks to enhance natural recovery of damaged ecosystems. Through lectures and readings, we review the science and practice of ecological restoration, with emphasis on application of ecological principles. Prerequisite(s): 15 credits in Biology, including a course in organismal biology or ecology. May not be offered in 2003-2004.

A Bio 443 Restoration Ecology Laboratory (1)
Demonstrations and laboratory exercises will explore tools for the design, implementation, and assessment of restoration projects in a variety of habitats. As the principal assignment, student teams will prepare a design plan for a restoration project. Prerequisite(s): concurrent enrollment A Bio 442. May not be offered in 2003-2004.

A Bio 444 The Biology of Birds (3)
A broad survey of the biology of birds. Topics will include the origin and evolution of birds, the taxonomy and diversity of living birds, biogeography, anatomy and physiology with an emphasis on comparisons with other vertebrates and adaptations for flight, communication, behavior, ecology, and the importance of birds as conservation indicators. Prerequisite(s): 15 credits in biology. May not be offered in 2003-2004.

A Bio 445 Experimental Ecology (3)
Ecological concepts are demonstrated with experimental manipulations and comparative assessment techniques. Local wetlands are studied; the focus is on the effects of invasive species. Ecological assessment skills are developed in the field and laboratory. Lectures couple fundamental and applied topics, balancing understanding of ecological principles with realistic environmental problem solving. Students contribute to a report that becomes part of the record for a municipal wetland. Two lectures and one laboratory period each week. Prerequisite(s): A Bio 320 or equivalent, junior or senior standing or permission of instructor.

A Bio 450 Biodiversity (3)
Lectures, readings, discussions, and students' presentations examine theoretical and empirical studies of the extent and distribution of faunal and floral diversity; of patterns of relative abundance of species in major ecosystems; and of the significance of diversity loss. Approaches to preserve, restore, and manage ecosystem structure and function will be examined. Prerequisite(s): Ecology or Field Biology. May not be offered in 2003-2004

A Bio 455 Plant Ecology (3)
Current research and theoretical background in the field of plant ecology will be explored. Topics will include population and community dynamics, evolution of life history traits, physiological responses to environmental stresses, plant-animal interactions, and the role of vegetation in ecosystem processes. Prerequisite(s): A Bio 319, 391Z, or A Bio 320 or permission of instructor. May not be offered in 2003-2004

A Bio 456 Plant Ecology Laboratory (1)
Field and laboratory studies will explore experimental and analytical technique used in plant ecology. Topics include population dynamics, community patterns, plant-animal interactions, and vegetation mapping. Pre-requisite or co-requisite(s): A Bio 455.

A Bio 460 Neural Basis of Behavior (3)
The neural basis of innate and learned behaviors in vertebrates and invertebrates will be examined. Emphasis will be placed on sensory processing, reflexive behavior, fixed action patterns, rhythmic behavior and simple learned behavior amenable to analysis at the neuronal level including analysis of membrane electrical activity, chemical synaptic activity and neuromodulation. Prerequisite(s): A Bio 341 or equivalent or permission of instructor.

A Bio 468 Behavioral Ecology (3)
Recent theoretical models of the evolution of behavior by natural selection applied to animals, especially to social insects, birds, and mammals. Includes sociobiology and optimal foraging. Three class periods each week. Prerequisite(s): A Bio 320 (A Bio 402 and 432 recommended). May not be offered in 2003-2004.

A Bio 497 Topics in Biology (1–3)
Issues from the current literature in selected areas of biology. Particular areas of study to be announced each semester. Yields credit toward the major in biological sciences. May be repeated for credit. Prerequisite(s): junior or senior class standing, and permission of instructor. May not be offered in 2003-2004.

A Bio 498 Topics in Biology, with Laboratory (1–3)
Issues in selected areas of biology. Particular areas of study to be announced each semester. Yields laboratory credit toward the major in biological sciences. May be repeated for credit. Prerequisite(s): junior or senior class standing, and permission of instructor. May not be offered in 2003-2004.

A Bio 499 Supervised Research for Seniors (1–4)
Individual, independent research on selected topics in biology. Critical analysis of selected research papers. Senior majors in the department of biological sciences apply for this course through the prospective research advisor. A copy of the final written report of each semester's work, preferably typewritten in journal format, is kept on permanent file in the department. May be taken either semester. Students taking two or more semesters of A Bio 399, 399Z, 499, or 499Z will prepare a poster or make an oral presentation at the Departmental Research Symposium. A maximum of 8 credits may be earned in A Bio 499 and 499Z.

A Bio 499Z Supervised Research for Seniors (2–4)
Writing intensive version of A Bio 499 open to senior majors in biology who have completed a minimum of one previous semester in A Bio 399 or 499 for at least two credits. Requires permission of research advisor. Students taking two or more semesters of A Bio 399, 399Z, 499, or 499Z will prepare a poster or make an oral presentation at the Departmental Research Symposium. A maximum of 8 credits may be earned in A Bio 499 and 499Z. Prerequisite(s): A Bio 399 or 499. [WI]