

Biology

College of Science, Engineering & Technology

Department of Biological Sciences

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Web site: www.mnsu.edu/dept/biology

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The Department of Biological Sciences offers programs for students preparing for careers in education, laboratory and field research, biotechnology, environmental sciences, clinical laboratory sciences, cytotechnology, food science technology and pre-professional programs including pre-agriculture, pre-forestry, pre-medicine, and pre-veterinary medicine.

The biology major offers a core program intended to develop a common background in biology and additional upper level courses designed to provide specialized options. Students typically take a broad based general biology major or an emphasis in one of the following: general biology, bio-business, cytotechnology, ecology, human biology, microbiology, physiology, plant science, toxicology, or zoology. Programs in biotechnology, environmental sciences, food science technology and science teaching are also offered.

Admission to Major is granted by the department. Admission requirements are 32 earned semester credit hours including BIOL 105 and 106, with a grade of a "C" or better in both BIOL 105 and 106; and a minimum cumulative GPA of 2.00.

BIOLOGY BA (40 credits)

Required for Major (Core, 21-25 credits):

BIOL 105	General Biology I (4)
BIOL 106	General Biology II (4)
BIOL 211	Genetics (3)

Choose two courses from the following:

BIOL 215	General Ecology (4)
BIOL 270	Microbiology (4)
one physiology course [Biol 230(4), Biol 431 (3), Biol 441 (4), or Biol 476 (5)]	

Choose one course from the following:

BIOL 230	Human Physiology (4)
BIOL 320	Cell Biology (4)

BIOL 431	Comparative Animal Physiology (3)
BIOL 441	Plant Physiology (4)
BIOL 476	Microbial Physiology and Genetics (5)

Required Electives for Major (Biology, 19-22 credits):

Choose 19-22 credits of electives in consultation with an advisor.

Required for Bachelor of Arts (BA) degree ONLY:

Language (8)

Required Minor: Yes. Chemistry

BIOLOGY BS

Students may elect to complete the general non-specialized biology major or select one of the alternative specialized options or emphases.

GENERAL, NON-SPECIALIZED OPTION (40 credits)

Required for Option (Core, 20-21 credits):

BIOL 105	General Biology I (4)
BIOL 106	General Biology II (4)
BIOL 211	Genetics (4)

Choose two courses from the following:

BIOL 215	General Ecology (4)
BIOL 320	Cell Biology (4)

One physiology course [Biol 230 (4), Biol 431 (4), Biol 441 (4), or Biol 476 (5)]

Required Electives (5-8 credits):

Choose two courses from the following:

BIOL 301	BIOL 316	BIOL 403
BIOL 408	BIOL 418	BIOL 430
BIOL 435	BIOL 436	BIOL 442
BIOL 443	BIOL 451	BIOL 452

Additional upper division electives:

Choose additional Biology 300-400 level courses to total 40 credits in this option.

Required Minor: Yes. Chemistry.

BIOBUSINESS OPTION (40 credits)

Required for Option (credits vary):

A student may choose the Biology BA or any BS option or program to satisfy the BioBusiness option.

Required (Chemistry, 10 credits):

A minimum of one year of chemistry is required.

Required Minor: Yes. Any Business Minor.

CYTOTECHNOLOGY OPTION (85 credits)

Required for Option (Core, 48 credits):

Choose 30 credits from the following:

BIOL 105	General Biology I (4)
BIOL 106	General Biology II (4)
BIOL 211	Genetics (3)
BIOL 220	Human Anatomy (4)
BIOL 230	Human Physiology (4)
BIOL 270	General Microbiology (4)
BIOL 320	Cell Biology (4)
BIOL 420	Diagnostic Parasitology (3)
BIOL 434	Development & Human Embryology (3)
BIOL 435	Histology (4)

Choose 18 credits from the following:

CHEM 201	General Chemistry I (5)
CHEM 202	General Chemistry II (5)
CHEM 305	Analytical Chemistry (4)
CHEM 320	Organic Chemistry I (5)
CHEM 360	Principles of Biochemistry (4)

Required Elective (4 credits):

MATH 112 or any higher numbered math course listed in General Education Category 4.

Professional Education (32 credits):

Clinical Internship at Mayo

ECOLOGY OPTION

Required General Education (13 credits):

BIOL 105	General Biology I (4)
PHYS 211	Principles of Physics I (4)
CHEM 201	General Chemistry I (5)

Recommended Support Courses (12 credits):

COMS 100	Introduction to Computer Science (4)
MATH 121	Calculus I (4)
ENG 271	Technical Communication (4)

Required Support Courses (8 credits):

Choose one:

CHEM 111	Chemistry of Life Processes (5)
CHEM 202	General Chemistry II (5)

Choose one:

STAT 154	Elementary Statistics (3)
HLTH 475	Biostatistics (3)

Core Courses (28-30 credits required):

BIOL 106	General Biology II (4)
BIOL 211	Genetics (3)
BIOL 215	General Ecology (4)
BIOL 301	Evolution (2)
BIOL 408	Vertebrate Ecology (4)
BIOL 412	Soil Ecology (4)
BIOL 443	Plant Ecology (4)

Choose one letter:

- a) BIOL 320 Cell Biology (4)
- b) BIOL 431 Comparative Animal Physiology (3)
- c) BIOL 217 Plant Science (3) and
BIOL 441 Plant Physiology (4)
- d) BIOL 270 Microbiology (4) and
BIOL 476 Microbial Physiology and Genetics (5)

Elective Courses (2-8 credits required)

BIOL 403	BIOL 436	BIOL 492#
BIOL 404	BIOL 442	BIOL 497#
BIOL 409	BIOL 460	BIOL 499#
BIOL 410	BIOL 472	and others by
BIOL 432	BIOL 479	consent of advisor.

#Limit of 4 credits total from these courses.

Required Minor: Related area approved by advisor.

HUMAN BIOLOGY OPTION (39-41 credits)

Required Support Courses (15-18 credits):

Calculus - one semester

Physics - one year

Computer Science - one course

Required for Option (Core, 26-27 credits):

BIOL 105	General Biology I (4)
BIOL 106	General Biology II (4)
BIOL 220	Human Anatomy (4)
BIOL 230	Human Physiology (4)
BIOL 211	Genetics (3)
BIOL 320	Cell Biology (4)

Choose one course from the following:

BIOL 270	Microbiology (4)
BIOL 217	Plant Science (3)

Required Electives (13-14 credits):

Choose electives from the following to total 40 credits in Biology:

BIOL 316*	BIOL 324	BIOL 410
BIOL 417	BIOL 418	BIOL 420*
BIOL 430*	BIOL 433*	BIOL 434
BIOL 435*	BIOL 438	BIOL 452*
BIOL 460	BIOL 466	BIOL 474*
BIOL 475*	BIOL 479*	BIOL 497*#
BIOL 498*#	BIOL 499#	

* Choose at least one course from these courses

Choose a maximum of 4 credits from these courses

Required Minor: Yes. Chemistry.

MICROBIOLOGY OPTION (42-43 credits)

Required General Education for Option (4 credits):

MATH 112	College Algebra (4)
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Required for Option (Core, 18-19 credits):

BIOL 105	General Biology I (4)
BIOL 106	General Biology II (4)
BIOL 211	Genetics (3)
BIOL 270	General Microbiology (4)

Choose one course from the following:

BIOL 215	General Ecology (4)
BIOL 217	Plant Science (3)
BIOL 230	Human Physiology (4)
BIOL 320	Cell Biology (4)

Required Electives (20 credits):

Choose electives from the following to total 40 credits in Biology:

BIOL 420	BIOL 452	BIOL 472
BIOL 474	BIOL 475	BIOL 476
BIOL 478	BIOL 479	BIOL 497
BIOL 499		

Required Minor: Yes. Chemistry.

PHYSIOLOGY OPTION (48-50 credits)

Required General Education (11-12 credits):

BIOL 105	General Biology I (4)
MATH 121	Calculus I (4) or
STAT 154	Elementary Statistics (3)
PHYS 211	Principles of Physics I (4)

Required Support Courses (7 credits):

BIOL 106	General Biology II (4)
CHEM 460	Biochemistry I (3)

Required for Option (Core, 21 credits):

BIOL	211	Genetics (3)
BIOL	230	Human Physiology (4)
BIOL	320	Cell Biology (4)
BIOL	431	Comparative Animal Physiology (3)
BIOL	441	Plant Physiology (4)
BIOL	460	Introduction to Toxicology (3)

Required Electives (9-10 credits):

Choose at least 9 credits from the following courses:

BIOL	324	BIOL	433	BIOL	438
BIOL	466	BIOL	479	BIOL	499

Required Minor: Yes. Chemistry.**PLANT SCIENCE OPTION (69 credits)****Required General Education (13 credits):**

BIOL	105	General Biology I (4)
PHYS	211	Principles of Physics I (4)
CHEM	201	General Chemistry I (5)

Recommended Support Courses (12 credits):

ENG	271	Technical Communication (4)
COMS	100	Introduction to Computer Science (4)
MATH	121	Calculus I (4)

Required Support Courses (8 credits):

Choose one:

CHEM	111	Chemistry of Life Processes (5)
CHEM	202	General Chemistry II (5)

Choose one:

STAT	154	Elementary Statistics (3)
HLTH	475	Biostatistics (3)

Required Core (23 credits):

BIOL	106	General Biology II (4)
BIOL	211	Genetics (3)
BIOL	215	General Ecology (4)
BIOL	217	Plant Science (3)
BIOL	441	Plant Physiology (4)
BIOL	442	Plant Taxonomy (4)

Required Electives (13 credits required)*:

BIOL	403	BIOL	404	BIOL	410
BIOL	412	BIOL	414	BIOL	432
BIOL	440	BIOL	443	BIOL	445
BIOL	446	BIOL	451	BIOL	460
BIOL	479	BIOL	492*	BIOL	497*
BIOL	499				

*Electives must include a minimum of two laboratory courses with a laboratory component

#Limit of 4 credits total from these courses

Required Minor: Related area approved by advisor**TOXICOLOGY OPTION (67 credits)****Required General Education (17 credits):**

BIOL	105	General Biology I (4)
CHEM	201	General Chemistry I (5)
PHYS	211	Principles of Physics I (4)
MATH	121	Calculus I (4)

Required for Major (Support Courses, 32 credits):

BIOL	106	General Biology II (4)
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CHEM	202	General Chemistry II (5)
CHEM	305	Analytical Chemistry (4)
CHEM	320	Organic Chemistry I (5)
CHEM	321	Organic Chemistry II (2)
CHEM	460	Biochemistry I (3)
CHEM	461	Biochemistry II (3)
CHEM	465	Biochemical Techniques I (1)
CHEM	466	Biochemical Techniques II (2)
HLTH	475	Biostatistics (3)

Required for Option (Core, 35 credits):

BIOL	211	Genetics (3)
BIOL	215	General Ecology (4)
BIOL	230	Human Physiology (4)
BIOL	270	Microbiology (4)
BIOL	460	Introduction to Toxicology (3)
BIOL	461	Environmental Toxicology (4)
BIOL	462	Toxicology Seminar (1)
BIOL	464	Methods of Applied Toxicology (3)
BIOL	465	Applied Toxicology Project (3)
BIOL	466	Principles of Pharmacology (3)
BIOL	467	Industrial Hygiene (3)

Required Minor: None.**ZOOLOGY OPTION (57 credits)****Required General Education (13 credits):**

BIOL	105	General Biology I (4)
CHEM	201	General Chemistry I (5)
PHYS	211	Principles of Physics I (4)

Recommended Support Courses (8 credits):

COMS	100	Introduction to Computer Science (4)
MATH	121	Calculus I (4)

Required Support Courses (8 credits):

Choose one:

CHEM	111	Chemistry of Life Processes (5)
CHEM	202	General Chemistry II (5)

Choose one:

STAT	154	Elementary Statistics (3)
HLTH	475	Biostatistics (3)

Required Core (26 credits):

BIOL	106	General Biology II (4)
BIOL	211	Genetics (3)
BIOL	215	General Ecology (4)
BIOL	301	Evolution (2)
BIOL	316	Animal Diversity (3)
BIOL	421	Entomology (3)
BIOL	431	Comparative Animal Physiology (3)
BIOL	436	Animal Behavior (4)

Electives (10 credits required):

BIOL	320	BIOL	324	BIOL	403
BIOL	408	BIOL	409	BIOL	410
BIOL	412	BIOL	420	BIOL	434
BIOL	435	BIOL	438	BIOL	460
BIOL	472	BIOL	479	BIOL	492#
BIOL	497#	BIOL	499#		

and others by consent of advisor.

#Limit of 4 credits total from these courses.

Required Minor: Yes, related area approved by

advisor.

LIFE SCIENCE TEACHING BS

See the SCIENCE TEACHING section of this bulletin.

BIOLOGY MINOR

Required for Minor (Core, 17 credits):

BIOL 105 General Biology I (4)

BIOL 106 General Biology II (4)

BIOL 211 Genetics (3)

Choose one course from the following:

BIOL 215 BIOL 217 BIOL 220

BIOL 270

Additional Elective :

Any 200 level or above course to total 17 credits in the minor.

POLICIES/INFORMATION

P/N Grading Policy: All courses leading to a major or a minor in biology must be taken for letter grades. Any exception to this policy must be approved by the chairperson of the department.

Refer to the College regarding required advising for students on academic probation.

GPA Policy: In programs where not specifically noted, a minimum GPA of 2.0 must be maintained in biological sciences. A minimum GPA of 2.6 in the sciences must be maintained to meet student teaching requirements.

Several biology scholarships are available for entering freshmen and currently enrolled MSU students who meet the requirements. Application deadline is March 31 of each year.

The Department of Biological Sciences offers a well-balanced summer school program. For details concerning the courses being offered consult the summer bulletin.

COURSE DESCRIPTIONS

BIOL 100 (4) Our Natural World

World Introductory course designed for students not majoring in science. Focuses on basic biological principles with special emphasis on the human species. Includes scientific problem solving, biodiversity, human and social aspects of biology, ecology, cellular processes and organ function, human reproduction, pre-natal development, and heredity. Lecture, laboratory, and small group discussions. F, S *GE-3*

BIOL 101 (2-4) Biological Perspectives

Students focus on specific biological perspectives, including environmental science, biology of women, biotechnology, human heredity, etc. May be repeated for credit under different sub-titles.

F, S

BIOL 102 (3) Biology of Women

An introduction to biological topics of special interest to women with emphasis on anatomic and physiologic changes over the course of a woman's lifetime. Designed for students not majoring in science. Presents fundamental biologic concepts within this specialized context and provides opportunity to collect, evaluate, and analyze data.

F, S *GE-3 CD-Core*

BIOL 103 (3) Introduction to Biotechnology

An introductory course designed for students not majoring in science. Focuses on basic biological principles as applied to biotechnology. Includes basic natural science principles, scientific problem solving, and human and social aspects of biotechnology. Lecture, laboratory, and small group discussions.

F *GE-1C, 3*

BIOL 105 (4) General Biology I

Study of biological processes at the suborganismal level including cell chemistry, metabolism, reproduction, genetics, and complex tissue physiology. Laboratory and discussion sessions stress problem solving and experimental design.

F, S *GE-1C, 3*

BIOL 106 (4) General Biology II

Study of biological processes at the organismal level including a survey of life forms (viruses, bacteria, protists, fungi, plants, and animals), their evolution, and ecology. Laboratory and discussion sessions stress problem solving and experimental design.

Pre: BIOL 105 F, S

BIOL 175 (1) Orientation to Clinical Laboratory Science

An introduction to the health care profession with special emphasis on clinical laboratory personnel. Course includes presentations by professionals in some of the major health care fields, especially medical technology. Includes lectures, field observations.

S

BIOL 199 (3) Clep Biology

F, S

BIOL 201 (3) Ecology and Human Society

Ecological principles as related to current environmental problems. Topics of current interest include energy, human demography, food productions, pollution, and social, political, and economic change. Primarily for general education and non-science majors.

GE-8, 10 CD-Related

BIOL 203 (3) Taxidermy Techniques

BIOL 211 (3) Genetics

Introduction to genetic analysis. Topics covered include: crosses, linkage and mapping, Mendelian and Non-Mendelian inheritance, molecular genetics, genetic manipulation of organisms, population genetics and evolution.

Pre: BIOL 105, 106, and MATH 112 F, S

BIOL 215 (4) General Ecology

Principles of the study of relationships between organisms and the environment. Topics include flow of energy and materials, organism-level interactions, growth and evolution of populations, and community ecology. Field trips to prairie, lake, stream, and forest communities, training in data collection and analysis, use of equipment, and report writing. Lab included.

Pre: BIOL 105 and 106 or consent F

BIOL 217 (4) Plant Science

Biology of plants including unique features of plant cells, life histories, metabolism, anatomy, physiology, and ecology. The course empathizes plants' remarkable adaptations to their environments, their diversity, and the vital roles they play in ecological interactions. For biology and environmental science majors and minors. Lab included. Pre: BIOL 105 and 106 or consent S

BIOL 220 (4) Human Anatomy

Systems approach to the structure of the human body. The course is designed for students majoring in biology or health related programs. Lab included. F, S

BIOL 230 (4) Human Physiology

Function of living systems with emphasis on human species. Lab included.

Pre: BIOL 220 and 1 semester of chemistry F, S

BIOL 270 (4) Microbiology

An introduction to the general principles and methods used in the study of microorganisms. Lab included.

Pre: 1 BIOL course and 1 CHEM course F, S
GE-3

BIOL 301 (2) Evolution

Evolution is a unifying theory of biology. Students are provided the history of evolutionary thought and the Darwinian revolution, evidence for evolution, mechanics of evolution, and an array of special topics such as speciation, molecular evolution, conservation, and extinction. Readings will include book chapters and journal articles. Lecture/discussion.

Pre: BIOL 105, 106 S

BIOL 316 (3) Animal Diversity

A comprehensive phylogenetic survey of both invertebrate and vertebrate animals. Emphasis on evolutionary relationships among phyla, the evolution of organ systems, animal organization and function, animal adaptations, and zoogeographical considerations. Research and inquiry of animal unity and diversity will include using the Internet. Lab included.

Pre: BIOL 105 and 106 F

BIOL 320 (4) Cell Biology

An examination of eukaryotic cellular structure, organization and physiology for students preparing careers in biology, medicine, and related fields. Topics include cell surface, intracellular compartments, cell junctions, cytoskeleton, cell motility, signal transduction mechanisms,

energy flow and metabolism, information flow, protein sorting and transport, and common research techniques. Students will research on the Internet. Lab included.

Pre: BIOL 105 and 106 F

BIOL 324 (3) Neurobiology

Basic anatomy and physiology of the nervous system. The course is designed for students majoring in biology, psychology or health related programs.

Pre: BIOL 220 and 230 F

BIOL 380 (3) Blood Banking/Urinalysis

Basic understanding of the principles of immunohematology applied to the area of blood banking including major blood group systems, principles for antigen/antibody detection and identification, donor blood collection, transfusion evaluation, theory of renal function in health and disease, specimen collection, handling, and processing, and components of routine urinalysis.

Pre: BIOL 230 S

BIOL 402 (4) Stream Limnology**BIOL 403 (3) Conservation Biology**

Applications of principles from ecology, genetics, behavior, demography, economics, philosophy, and other fields to the conservation and sustainable use of natural populations of plants and animals. Lectures and discussions address topics such as habitat fragmentation, parks and reserves, genetic diversity, population viability, and extinction.

Pre: BIOL 215 or consent S

BIOL 404 (4) Wetlands

To provide students the values and functions of wetlands and to use wetlands as an example of the relationship of ecology to management, and the impact that classification systems have politically. Lab (field-work) included.

Pre: BIOL 105, 106, 215, or consent S

BIOL 405 (3) Fisheries Biology**BIOL 408 (4) Vertebrate Ecology**

A field course in the ecology of birds, mammals, amphibians, reptiles, and fishes. Students are trained in sampling techniques such as mark-and-recapture, population size estimation and monitoring, and species identification of live and preserved specimens. Lectures encompass evolution and adaptation, origins, energetics, mating systems, morphology, geographical distributions, and population-level phenomena. Lecture and Laboratory.

Pre: BIOL 105, 106, 215 or consent F

BIOL 409 (4) Advanced Field Ecology

A field course focused on the function and dynamics of various North American ecosystems. Emphases will be on natural history, critical thought, and experimental design. Students will be trained in a variety of soil, plant, and animal sampling techniques. Depending on enrollment, there may be additional costs (e.g., camping fees) for the course.

Pre: BIOL 105, 106, 215 or consent S

BIOL 410 (3) Human Ecology

The human species' place in the biological world, effects on various communities and potential methods of correcting the detrimental effects with economic and social implications.

Pre: BIOL 105, 106, 215, or consent S

BIOL 411 (2) Evolution for Teachers**BIOL 412 (4) Soil Ecology**

Soil ecology will focus on the genesis and classification of soils, the physical properties of soil as they relate to habitat formation, niches, interactions that exist among soil organisms, human impact on soil systems relative to population pressures and management practices. Lab included.

Pre: BIOL 105, 106, 215, or consent S

BIOL 417 (3) Biology of Aging and Chronic Diseases

Emphasis is placed on the biomedical aspects of aging and chronic disease. The course is designed for students majoring in biology, gerontology programs, or other health related programs.

Pre: BIOL 100 or 105 F, S

BIOL 418 (4) Macro and Microscopic Imaging

Properties and physical principles underlying biological images. The course provides a survey of macro-imaging techniques (such as x-ray tomography, magnetic resonance imaging, positron emission tomography, and ultrasound) and micro-imaging techniques (such as light microscopy, transmission and scanning electron microscopy, fluorescence microscopy, laser scanning confocal microscopy and atomic force microscopy).

Pre: One Year of Physics F

BIOL 419 (2-3) Special Topics in Instrumentation

Instruction in specialized biological instrumentation.

Pre: BIOL 105 and 106 F

BIOL 420 (3) Diagnostic Parasitology

Clinically important parasites. Protozoans, Flukes, Tapeworms, Roundworms, Ticks, Mites and Insects. Designed for Medical Technology, Pre-Med, Pre-Vet and Biology majors. Identification, clinical disease, epidemiology and ecology are covered. Lab included.

Pre: BIOL 100 or 105, BIOL 106 recommended S

BIOL 421 (3) Entomology

Morphological, physiological, medical, and economic significance of insects.

Pre: BIOL 105 and 106 or consent ALT-F

BIOL 422 (2) General Principles of Cytology

This course consists of a series of lectures, demonstrations, and laboratory sessions designed to teach the principles of cytology. This includes basic (ultra and light microscope) cell structures, cellular biology, including cell division and growth and general mechanisms of pathologic changes. Cytotechnology emphasis only. Permission required. F, S

BIOL 423 (4) Gynecologic Cytology

This course involves a study of the normal and abnormal anatomy, physiology, histology, and cytology of the female genital tract. Lectures, demonstrations, and laboratory sessions are given. Normal and abnormal cytology are emphasized. Non-neoplastic changes, such as hormonal abnormalities and inflammatory conditions are discussed. Cytotechnology emphasis only. Permission required. F, S

BIOL 424 (3) Advanced Gynecologic Cytology

This course is a continuation of Gynecologic Cytology to include malignant conditions of the endocervix, endometrium, ovary and vagina. Lectures will also be given on special topics including cytology of pregnancy and therapeutic changes. Cytotechnology emphasis only. Permission required.

F, S

BIOL 425 (3) Pulmonary Cytology

This course consists of a series of lectures, demonstrations, and laboratory sessions of the gross and microscopic anatomy, physiology, pathology, and cytology of the respiratory tract. Particular areas covered include benign conditions, inflammatory disorders, malignancies, and therapeutic effects. Cytotechnology emphasis only. Permission required.

F, S

BIOL 427 (3) Urinary Cytology

This course consists of a series of lectures, demonstrations, and laboratory sessions of the gross and microscopic anatomy, physiology, pathology, and cytology of the urinary tract. Areas covered include benign conditions, inflammatory disorders, malignancies, and therapeutic effects. Cytotechnology emphasis only.

Permission required. F, S

BIOL 428 (3) Gastrointestinal Cytology

This course consists of a series of lectures, demonstrations, and laboratory sessions of the gross and microscopic anatomy, physiology, pathology, and cytology of the GI tract. Cytotechnology emphasis only. Permission required.

F, S

BIOL 429 (3) Body Cavity and Miscellaneous Secretion Cytology

This course consists of a series of lectures, demonstrations, and laboratory sessions of the gross and microscopic anatomy, physiology, pathology, and cytology of the body cavity fluids (pleural, peritoneal, and pericardial) and other sites including the cerebrospinal fluid and eye. Cytotechnology emphasis only. Permission required.

F, S

BIOL 430 (4) Hematology/Introduction to Immunology

Collection, examination, evaluation, morphology, function and diseases of blood cells. Hemostasis/coagulation of blood. Immunology theory is presented. Lab included.

Pre: BIOL 230 S

BIOL 431 (3) Comparative Animal Physiology

A comparison of adaptation mechanisms, from cell to

organ-system, used by animals in response to “changes in” environmental conditions such as oxygen, carbon dioxide, food availability, temperature, water, solutes, pressure and buoyancy.

Pre: BIOL 105, 106 or consent ALT-F

BIOL 432 (4) Limnology

Biotic, physical and chemical characteristics of freshwater ecosystems. Lab (fieldwork) included.

Pre: BIOL 105, 106, 215, or consent F

BIOL 433 (3) Cardiovascular Physiology

This course is a functional study of the heart and circulatory system. S

BIOL 434 (3) Development and Human Embryology

Understanding the process of cell differentiation and development. These principles are then applied to the descriptive study of human embryology including the basis of congenital malformations.

Pre: BIOL 100 or 105 F

BIOL 435 (4) Histology

Study of types, arrangements and special adaptations of human tissues. Lab included.

Pre: BIOL 220 S

BIOL 436 (4) Animal Behavior

An exploration of behavioral strategy, communication, learning, and social systems of animals, with emphases placed on the causes, evolution, ecological implications, and function of behavior at the individual and population level. Lab included.

Pre: BIOL 105, 106, or consent S

BIOL 438 (3) General Endocrinology

This course provides the basis for understanding hormones and the mechanisms of their actions in both the normal and pathological states. Sample topics to be included are diabetes, osteoporosis, hormones of reproduction and current social and medical issues related to the course.

Pre: BIOL 100 or 105 S

BIOL 440 (4) Horticulture

Fundamental principles of horticulture: classification, structure, growth and reproduction, technology including propagation, mineral nutrition, training and pruning, growth regulation and protection, horticultural crops and esthetic horticulture. Lab included.

Pre: BIOL 105 and 106 F

BIOL 441 (4) Plant Physiology

Plant functions such as water relations, mineral nutrition, translocation, metabolisms, photosynthesis, photorespiration, fat and protein metabolisms, respiration, growth and development, phytohormones, reproduction and environmental physiology. Lab included.

Pre: BIOL 105, 106, 217, one semester organic chemistry recommended. S

BIOL 442 (4) Plant Taxonomy

Field identification of plants with emphasis on local flora. History of systematics, techniques, plant bioge-

ography, methods of plant collection, preservation, preparation of herbarium specimens are covered. Lab and field trips included.

Pre: BIOL 105, 106, or consent. BIOL 217 recommended. S

BIOL 443 (4) Plant Ecology

Expands upon general principles of ecology to focus on the factors that regulate the distribution and abundance of plants, analysis of plant populations, and dynamics of plant communities. Lecture and lab (fieldwork) included.

Pre: BIOL 105, 106, 215 or consent. BIOL 217 strongly recommended. F

BIOL 444 (3) Fine Needle Aspiration Cytology

This course consists of a series of lectures, demonstrations, and laboratory sessions of the gross and microscopic anatomy, pathology, and cytology of various areas sampled using fine needle aspiration. Cytotechnology emphasis only. Permission required.

F, S

BIOL 445 (4) Economic Botany

We interact with plants every day and they've had a profound affect on human history and society. This course surveys the roles of plants in foods, beverages, medicines, drugs, poisons, fibers, fuels, building materials, ceremony, landscape, and more. Lecture, discussion, lab, and field trip. Open to non-science majors.

Pre: BIOL 100 or 105, or consent

BIOL 447 (3) Cytopreparation Cytology

Lectures, demonstrations and laboratory sessions will be given in the various procedures carried out in the cytology laboratory. Collection and preparation techniques are described throughout the course series. Assignments in laboratory techniques continue through the year. Cytotechnology emphasis only. Permission required.

F, S

BIOL 448 (3) Independent Projects

This course includes Check Sample and Journal Club presentations; projects involving literature research, cytopreparation, quality control/assurance, and cytology correlation. These projects will involve knowledge and use of: May search program, photography, computer skills (including Power Point for presentations) and educational methodology for presentation preparation. Cytotechnology emphasis only. Permission required.

F, S

BIOL 449 (2) Computers, Networks, and Science

BIOL 450 (5) Clinical Cytology

This portion of the program includes graded daily screening exercises. Students screen four hours a day at first, then move on to full day screening for approximately 30 days. A management series is presented during the clinical portion of the program, with two projects to be completed during the clinical segment. Cytotechnology emphasis only. Permission required.

BIOL 451 (3) Plant Biotechnology
ALT-S**BIOL 452 (3) Biological Instrumentation**

The principle and operation of instruments and their application to biological research. Types of instrumentation examined include spectroscopic, chromatographic, electroanalytic, radiographic, and imaging. Laboratory Information Management systems (LIMS) will also be examined. Emphasis is placed on GLP, GMP, and ISO 9000 practices.

Pre: BIOL 105, 106, or consent

BIOL 453 (4) Biological Engineering Analysis I

The application of engineering principles and skills as applied to fermentation and to biological product recovery. Pre: BIOL 270 and one semester each of calculus, physics, and organic chemistry
F

BIOL 454 (4) Biological Engineering Analysis II

Continuation of Biological Engineering Analysis I. The application of engineering principles and skills as applied to fermentation and to biological product recovery.

Pre: BIOL 453 S

BIOL 456 (3) Biotechnology Project/Laboratory I

Practical laboratory experience in biotechnology through the selection and development of a research project. Students are expected to spend an average of 12 hours per week on the project.

Pre: Concurrent enrollment in BIOL 453 F

BIOL 457 (3) Biotechnology Project/Laboratory II

Continuation of Biotechnology Project/Laboratory I. Practical laboratory experience in biotechnology through the selection and development of a research project. Students are expected to spend an average of 12 hours per week on the project.

Pre: BIOL 456, taken concurrently with BIOL 454 S

BIOL 460 (3) Introduction to Toxicology

A lecture course covering basic principles of toxicity evaluation in living organisms, mechanisms of responses to chemicals or physical agents within an overview of practical medical, environmental and science policy implications. Presentation of comparisons of specific organ and tissue reactions to toxins in a variety of species follow these introductory concepts.

Pre: BIOL 105, 106, and 1 year of General Chemistry ALT-F

BIOL 461 (4) Environmental Toxicology

A lecture/laboratory course that focuses on anthropogenic and natural toxicants, mathematical modeling of the dispersion of chemical and physical agents in the environment, effects on species and ecosystems with a special section on aquatic risk assessment. The laboratory includes techniques in environmental toxicity and a genuine research project.

Pre: BIOL 460 ALT-S

BIOL 462 (1) Toxicology Seminar

A seminar course that involves critical evaluation of published studies in toxicology, student presentations of a selected published manuscript and requires students to write a paper on one aspect of the course's topic area that semester. Topic areas vary each time the course is offered.

Pre: BIOL 105, 106, and General Chemistry ALT-F

BIOL 464 (3) Methods of Applied Toxicology

A lecture/laboratory course focusing on the steps necessary to start a research project from project definition through methods testing and evaluation, and a final report that includes a project flow chart. Third year students will have senior and/or graduate mentors.

Pre: BIOL 105, 106, and General Chemistry ALT-F

BIOL 465 (3) Applied Toxicology Project

A lecture/laboratory course where students perform all aspects of their own designed research topic in toxicology while critically evaluating the progress of other projects as well. Students will be expected to keep timelines or develop modified timelines as necessary. The inverted triangle approach of project design will be examined and then included in all designs.

Pre: BIOL 464 ALT-S

BIOL 466 (3) Principles of Pharmacology

A lecture course that examines mechanisms of drug action, physiological responses and adverse reactions from sensitivities or allergies through overdose.

Pre: BIOL 105, 106, 230, and 1 year of General Chemistry ALT-F

BIOL 467 (3) Industrial Hygiene

A lecture course that examines Minnesota State University, Mankato, as your own work place to develop reports on a selected group of chemical and physical hazards of the workplace. Evaluation methods and solutions to existing problems are developed with concise reporting skills.

Pre: BIOL 105, 106, and 1 year of General Chemistry ALT-S

BIOL 472 (4) Microbial Ecology and Bioremediation

Role of microorganisms in soil, air, water, sewage processes as well as methods of measurement and detection. Special emphasis on the role of microorganisms in bioremediation. Lab included.

Pre: BIOL 105, 106, and 270 ALT-S

BIOL 474 (4) Immunology

Fundamental principles of humoral and cell mediated immunity and the application of these principles. Current experimental work in the different areas of immunology will be discussed. Lab included.

Pre: BIOL 105, 106, and 270 F

BIOL 475 (4) Medical Microbiology

This course will cover bacterial, fungal, and viral human pathogens: what diseases they cause, how they cause disease, and how humans defend against and prevent those diseases. In the laboratory the student will isolate and identify pathogenic microorganisms using microbiologi-

cal, biochemical, and immunological techniques.

Pre: BIOL 270

BIOL 476 (5) Microbial Physiology and Genetics

This course presents the physiology and genetics of microorganisms emphasizing those aspects unique to bacteria and archaea. Topics include: energy production; biosynthesis of small molecules and DNA, RNA, and proteins; the formation of cell walls and membranes; microbial differentiation and behavior; and the genetic and biochemical regulation of these processes. Lab included.

Pre: BIOL 105, 106, 270 S

BIOL 478 (4) Food Microbiology and Sanitation

The role microbes play in production and spoilage of food products, as prepared for mass market. Topics include foodborne pathogens, epidemiology and control, essential principles in sanitation including Hazard Analysis/Critical Control Point and ISO 9000 requirements. Lab included.

Pre: BIOL 105, 106 and 270 S

BIOL 479 (4) Molecular Biology

This course will cover both eukaryotic and prokaryotic molecular biology including: DNA and RNA structure, transcription, regulation of gene expression, RNA processing, protein synthesis, DNA replication, mutagenesis and repair, recombination, and insertion elements. A number of important techniques used in recombinant DNA technology will be discussed and practiced.

Pre: BIOL 105, 106, or consent S

BIOL 480 (2) Biological Laboratory Experiences for Elementary Teachers

Provides experience with a wide variety of biological laboratory exercises to prepare prospective elementary teachers. Emphasis is on building knowledge, skills, and confidence. The course will cover major biological concepts and environmental education through classroom-ready examples selected to illustrate each concept.

F, S

BIOL 481 (1) Lab Supervision and Maintenance

Experience in maintaining and supervising laboratories. For individuals desiring additional experience with students in laboratory situations.

F, S

BIOL 485 (4) Biology Teaching Methods and Materials

A basic science methods course designed to prepare prospective junior and senior high life science teachers. Course will cover science teaching methods and support materials as they apply to life science teaching situations.

Pre: 16 credits BIOL F

BIOL 486 (3) Field-Based Teaching Methods and Materials

A lecture/laboratory course that provides opportunity for prospective junior and senior high life science teachers to observe, practice, and refine their teaching skills. Students will work in a school setting and experience actual classroom.

Pre: BIOL 485 ALT-S

BIOL 490 (1-4) Workshop

A variable topic course designed for a selected topic in Biology. Workshops provide an intensive learning experience on a new topic in the Biological Sciences and/or hands-on experiences in a current area not covered by other course offerings. The course involves background reading, demonstrations, and laboratory or field experiences.

F, S

BIOL 491 (1-4) In-Service

F, S

BIOL 492 (1-3) Honors Research

F, S

BIOL 497 (1-12) Internship I

Experience in applied biology according to a prearranged training program for a minimum of five 40-hour weeks.

Pre: Consent F, S

BIOL 498 (1-12) Internship II

Experience in applied biology according to a prearranged training program for a minimum of five 40-hour weeks. Only four credits can be applied to the major.

Pre: Consent F, S

BIOL 499 (1-4) Individual Study