

also business management skills to allow students to pursue careers in performance and institution management. Some of these careers may include operating art galleries and museums, managing groups and concert halls, and managing theatrical companies. This program leads to the Bachelor of Arts degree.

All students in the program complete a core of courses that offers a broad overview of the various business functional areas, public relations, two-dimensional design, and an internship in fine arts management. Additionally, students will emphasize one area of the fine arts from art, music, or theatre; or the student may choose to emphasize two of the fine arts areas. Students should know that if they decide to emphasize two of the fine arts areas, careful planning of course schedules is necessary in order to meet graduation requirements in a timely fashion.

Candidates for the Bachelor of Arts degree will complete 30 hours of core courses and an additional 33 hours of art, music, or theatre courses if one fine arts area emphasis is chosen. If the student chooses to emphasize two fine arts areas, in addition to the 30 hours of core courses, the student will take 39-43 hours depending on the combination of fine arts areas chosen.

Requirements for Bachelor of Arts in Arts Management:

#### **Arts Management Core**

- ACCT 203 Principles of Accounting I (3)
- ACCT 305 Business Law (3)
- B AD 230 Marketing (3)
- B AD 241 Management (3)
- B AD 242 Business and Professional Communication (3)
- ART 101 Two-Dimensional Design (3)
- COMM 205 Public Relations I (3)
- COMM 238 Journalism I (3)
- Professional Internship (399) (6)

In addition, students are required to complete a major area of emphasis or two minor areas of emphasis, one of which must be Music or Theatre.

#### **Requirements for major areas of emphasis are:**

##### Art

(1) ART 100, 103, 218, 300. (2) One course in three different media, chosen from painting, printmaking, ceramics, fibers, photography, and sculpture (ART 201, 203, 205, 208, 209, 215, 220). One class must be from a three-dimensional medium (ceramics, fibers, sculpture). (3) A second class plus three hours of Advanced Studio (ART 351) in one of the four media (including electronic) you have taken. (ART 301, 204, 305, 210, 315, 318, 319, 320). (4) Eight hours of Art History (AHIS). (5) Two additional hours of Advanced Studio (ART 351), either in studio or senior exhibition preparation. Participation in senior exhibition is required.

##### Music

101, 102, 103, 104, 341, 6 hours of music history (316, 318, 319), 4 semesters of applied music, 6 hours of electives in music, 8 semesters of ensemble or 6 semesters of ensemble and 2 hours of music activities.

##### Theatre

100 (2 credits), 108, 207, 300 (1 credit) 304, 312 or 313 (3 credits from either course), 315, 316, 419, 421, 9 hours of electives in theatre.

#### **Requirements for minor areas of emphasis are:**

##### Art

ART 100, 103; 9 hours of electives in Art; and AHIS 211, 212.

##### Art History

20 hours of AHIS.

##### Music

101, 102, 103, 104, 107, 341; 4 hours of applied music; 4 semesters of ensemble or 2 semesters of ensemble and 2 hours of music activities.

##### Theatre

100 (2 credits), 108, 207, 300 (1 credit), 304 and 9 hours of electives in Theatre.

## **Biology**

The biology department is noted for its environmental and evolutionary programs, cellular and molecular biology studies, prehealth science preparation and taxonomic research. Facilities include a 48-acre natural science study area with forest and aquatic habitats; two 10-acre wildlife preserves; a biochemical genetics laboratory for DNA, protein and evolutionary research; an animal behavior and communication center utilizing radio telemetry, sonographic and video procedures; a tissue culture facility permitting the in vitro cultivation of animal and plant cells and related research; and reference collections of taxonomically important species. The department has prepared students for careers with the Department of Natural Resources, National Park Service, U.S. Interior Department, the U.S. Department of Agriculture and many academic, industrial and research institutions. Many other biology alumni are dentists, medical technologists, nurses, optometrists, physicians, podiatrists and teachers in elementary and secondary schools, colleges and universities.

Students majoring in biology earn a Bachelor of Arts degree. The department also offers the Associate of Arts degree and a minor in biology. Students are encouraged to acquire strong backgrounds in the supporting sciences, particularly chemistry, mathematics and physics. Those interested in careers requiring further education in professional or graduate schools may obtain specific program information from the Career Planning Office.

### **Major Program Requirements**

#### Bachelor of Arts in Biology

(30 hours of Biology and 12 hours of cognates)

#### **Biology core (20 hours)**

- BIOL 103 Plant Biology (4)
- BIOL 104 Animal Biology (4)

BIOL 217	Principles of Ecology (3)
BIOL 221	Principles of Genetics (3)
BIOL 301	Junior Seminar (1)
BIOL 326	Microbiology (4)
BIOL 401	Senior Seminar (1)

**Biology electives (10 hours)**

**Biology Cognates (12 hours)**

Chemistry 105/107; 106/108	College Chemistry (4, 4)
Mathematics 115	Pre-Calculus Mathematics (4)

Students are strongly urged to include a systematics course (BIOL 130, 212, 262, 364, or 366) within their program. A maximum of three credits of Biology 451 and four credits of Biology 199 or 399 may be counted toward the required 30 credits of biology. Students are required to take a biological knowledge assessment test during the spring semester of their final year. Students are encouraged to take additional course work in chemistry (Chemistry 311-314), physics and statistics.

Bachelor of Arts with Teacher Certification in Biology.

See the Teacher Certification section of the catalog.

**Minor and Associate Program Requirements**

Those who desire to earn the Associate of Arts degree in biology must complete a minimum of 16 semester hours in the department (including BIOL 103 and 104), 8 hours of chemistry and mathematics at or above the 101 level.

Students minoring in biology must complete at least 20 semester hours of biology, including BIOL 103 or 104; 221 or 326; and 301.

Students who wish to be considered for departmental honors should submit a letter indicating this to the biology department chairperson before beginning their senior year. To graduate with departmental honors in biology, a student must earn a 3.00 grade point average in science; complete two credits of Biology 450 or 451 associated with an approved research project; and prepare a paper for presentation to the biology faculty and majors or a professional group (a paper worthy of submission to a refereed journal will be viewed as meeting this requirement). Having met these criteria, the student qualifies for consideration for honors. Final selection is based on departmental evaluation.

The semesters listed after course descriptions indicate when courses are expected to be offered. Schedules are subject to change; students should confirm semester offerings with the department when planning degree programs.

**101. Biology and Society (NATURAL SCIENCE) (4).** A general biology course for nonscience majors. Selected topics ranging from the level of the cell to the biosphere are covered. Does not count towards Biology elective credit for Biology majors or minors. Three hours of lecture and two hours of laboratory per week. Fall.

**103. Plant Biology (NATURAL SCIENCE) (4).** The study of the morphology, anatomy, development, metabolism, physiology, classification, genetics, and evolution of plants,

bacteria and fungi. Three hours of lecture and two hours of laboratory per week. Fall.

**104. Animal Biology (4).** Primary emphasis is on the structure, development and physiology of animals. Their genetics and ecology are also examined. Three hours of lecture, two hours of laboratory per week. (Prerequisite: Biology 101 or Biology 103.) Spring.

**130. Local Flora (3).** A field course dealing with collection, identification and classification of wild flowers and trees of Michigan and other designated areas. Offered as needed.

**209. Human Nutrition (3).** The fundamentals of nutrition and their applications in meeting nutritional needs during the life span. Emphasis is on the functions of essential food elements, health and the adequacy of dietary patterns. Not intended for Biology majors (Prerequisite: Biology 101 or 104.) Spring.

**212. Vertebrate Zoology (4).** A survey of the major classes of vertebrates, including anatomy, behavior, ecology, distribution and taxonomy. Three hours of lecture, three hours of laboratory per week. (Prerequisite: Biology 101 or 104.) Fall.

**217. Principles of Ecology (3).** The structure and function of living systems, including patterns of relationship between organisms and their environment. The study begins with populations and builds to the level of ecosystems and the biosphere. Three hours of lecture per week. See Biology 218 for a related laboratory experience. (Prerequisites: 100 level Biology or Environmental Science/Studies; and Mathematics 101). Fall.

**218. Ecology Laboratory (1).** Laboratory and field exercises designed to illustrate principles discussed in Biology 217. (Co requisite: Biology 217). Fall.

**220. Winter Ecology (4).** An examination of the biological responses of organisms to the environmental conditions associated with winter. Additional emphasis on field studies of over-wintering organisms and the identification of the organisms in their winter condition. Two Saturday or Sunday field trips included. Three lectures, one 3-hour laboratory per week. (Prerequisites: Biology 104 or Biology 217. When offered as a writing intensive course, English 101 is also a prerequisite.) Offered as needed.

**221. Principles of Genetics (3).** Mechanisms and laws of inheritance, the nature of the genetic material, and the structure and function of genes and the regulation of their activity. Three hours of lecture, one hour of recitation per week. See Biology 223 for a related laboratory experience. (Pre-requisites: Biology 104; Chemistry 101; Mathematics 101.) Fall

**223. Genetics Laboratory (1).** Laboratory exercises and experiments designed to illustrate principles discussed in Biology 221. (Co requisite: Biology 221.) Fall.

- 237.** Hematology and Serology (3). Methods used in the study of blood, including blood cell count, hematocrit value, blood cell morphology, hematologic changes in diseases and immunohematology. Designed for medical technology and other paramedical or premedical students. Two hours of lecture, two hours of laboratory per week. (Prerequisites: Biology 104; Chemistry 104) Offered as needed.
- 262.** Invertebrate Zoology (4). The biology of invertebrates (excluding insects but including parasitic invertebrates) with reference to anatomy, ecology, taxonomy and physiology. Three hours of lecture, three hours of laboratory per week. (Prerequisite: Biology 101 or 104.) Fall.
- 301.** Junior Seminar (1). Required for all junior Biology majors. A course exploring critical issues in biology through selected readings, discussion and presentations (oral and written). (Prerequisite: Junior standing, Biology 103 or Biology 104, Biology 221 or 326, and four additional hours of Biology credits.) Fall, spring.
- 309.** Topics in Biology (1-4). Investigations of advanced or specialized topics of current interest. Topics and coverage varies with semester and instructor. May be repeated. (Prerequisites vary with coverage.) Offered as needed.
- 324.** Conservation Biology (3). An examination of the genetic and ecological concepts important in developing plans for preserving species and habitats. Techniques designed to gather the required information will be examined. Case studies of work on selected species will be discussed. Three hours of lecture per week. (Prerequisite: Biology 217 or 221.) Fall.
- 326.** Microbiology (4). An introduction to microorganisms including bacteria, fungi and viruses. Cell structure, metabolism and genetics will be covered with an emphasis on current techniques used in medical and environmental studies. Laboratory work emphasizes microscopical, biochemical and molecular genetic identification of bacteria. Three hours of lecture, three hours of laboratory per week. (Prerequisite: Biology 103 and 104; Co requisite: Chemistry 104.) Spring.
- 333.** Biochemistry (3). See Chemistry 333. Spring.
- 334.** Biochemistry Laboratory (1). See Chemistry 334. Spring.
- 341.** Cell and Tissue Culture (3). The theory and techniques of culturing in vitro cells, tissues and organs of plants and animals. Two hours of lecture, four hours of laboratory per week. (Prerequisite: Biology 326.) As needed.
- 343.** Molecular Cell Biology (3). The structure and functioning of eukaryotic cells, with emphasis on the control of gene expression. Molecular aspects of the control of development are also discussed. (Prerequisites: Biology 221 and Chemistry 311 or permission of instructor.) Fall.
- 345.** Methods in Molecular Biology (3). The basic techniques utilized in molecular biology are discussed. Students learn the techniques through a series of laboratory exercises with progressively more demanding protocols. One hour lecture and five hours of laboratory per week. (Prerequisites: Biology 221 or 343 and permission of instructor.) Spring.
- 364.** Entomology (4). The biology of insects with reference to anatomy, ecology, taxonomy and physiology, focusing on local species and medically important ones. Three hours of lecture, three hours of laboratory per week. (Prerequisite: Biology 101 or 104.) Offered as needed.
- 365.** General Physiology (4). The structural and functional correlates of organismal biology; topics include membrane specializations, intermediary metabolism and homeostatic control mechanisms. Primary emphasis is on animals, usually vertebrates. (Prerequisites: Biology 104; Chemistry 311; Mathematics 115.) Fall.
- 366.** Biology of Parasites (4). The biology of common parasites of humans and animals. Emphasis is on the study of evolutionary strategies of parasites and their vectors, the identification and life histories of common parasites and the methods used to analyze outbreaks and patterns of disease incidence. Three hours of lecture and three hours of laboratory per week. (Prerequisite: Biology 101 or 104.) Spring.
- 368.** Developmental Biology (3). Modern principles of gene regulation and biochemical control of plant and animal developmental processes, from embryo through senescence. Includes environmental signals, teratogens and cancer. (Prerequisites: Biology 221; Chemistry 311.) Offered as needed.
- 370.** Immunology (3). Principles of immunology, including the structure of antigens and the regulation of cell-mediated and humoral immunity. Non-specific immunity and body defenses are also discussed. Recent papers on related topics are discussed. (Prerequisite: Biology 221 or 326; co requisite: Chemistry 312 or 333.) Spring.
- 375.** Animal Behavior and Communication (4). The behavior and communication of a variety of animals, particularly vertebrates, examined at the physiological, ecological and evolutionary levels. Both indoor and field laboratory experiences incorporate behavioral and communication instrumentation and computer-aided statistical analysis of results. (Prerequisite: 200-level Psychology or Biology or higher.) Spring.
- 378.** Ichthyology (4). The principles of classification, distribution, behavior and adaptation of fishes, within an ecological and evolutionary context. Includes laboratory and field identification, with emphasis on Michigan fauna. Three hours of lecture, three hours of laboratory per week. (Prerequisite: Biology 212.) May, spring, or summer.
- 379.** Herpetology (4). The principles of classification, distribution, behavior and adaptation of amphibians and reptiles, within an ecological and evolutionary context. Includes laboratory and field identification, with emphasis on Michigan fauna. Three hours of lecture, three hours of laboratory per week. (Prerequisite: Biology 212.) May or Summer.

**380.** Ornithology (4). The principles of classification, distribution, behavior and adaptation of birds, within an ecological and evolutionary context. Includes laboratory and field identification, with emphasis on Michigan fauna. Three hours of lecture, three hours of laboratory per week. (Prerequisite: Biology 212.) Spring, May or Summer.

**381.** Mammalogy (4). The principles of classification, distribution, behavior and adaptation of mammals, within an ecological and evolutionary context. Includes laboratory and field identification, with emphasis on Michigan fauna. Three hours of lecture, three hours of laboratory per week. (Prerequisite: Biology 212.) Spring, May or Summer.

**401.** Capstone: Senior Seminar (1). Student-led discussions of recent advances in biological research. One hour per week. (Prerequisite: Senior Biology major, BIOL 103, BIOL 104, and two of BIOL 217, 221, or 326.) Fall, spring.

**455.** Human Anatomy (3). Dissection and the anatomical exploration of the human body using cadavers. Two hours of lecture and two hours of laboratory per week. (Prerequisite: Biology majors with junior or senior standing and permission of instructor.) Spring.

### ***Special and Advanced Courses***

**199.** Exploratory Internship (1-3).

**299.** Experimental Course (1-4).

**399.** Professional Internship (1-12). Previously approved internships include hospital observational experience and work at Kalamazoo Nature Center and Hidden Lake Gardens.

**450.** Biological Research (1-2). Original research in biology requiring acceptance of a thesis proposal by the biology faculty prior to registration. Proposal must include literature survey, budget and time scale for completion of each segment. May be repeated. (Prerequisite: Permission of instructor.) Fall, spring.

**451.** Independent Study (1-3). Independent study in biology that is supervised by a biology faculty member. May be repeated. (Prerequisite: permission of instructor.)

**499.** Advanced Experimental Course (1-4).

## **Chemistry**

### ***Mission Statement***

The study of Chemistry firmly embraces all aspects of the Ribbons of Excellence. By researching and understanding the causes and effects of global problems (environmental issues, medicine, energy, and health related concerns) we develop methods for Caring for Humanity and the World. The Chemistry coursework is designed to develop Critical Thinking Skills through rigorous coursework and laboratory exercises (both conceptual and calculational). The integration of Chemistry courses into multiple majors (CHEM, BIOL, GEOL, and PHYS) and the offering of contextually oriented non-majors

courses, we Cross Boundaries and Disciplines. With the understanding that the fundamental basis of the study of science are that it evolves, gets updated and changes, Chemists must embrace Learning for a Lifetime. Through a research-based orientation of coursework and requirements, our students understand that they are moving into a field that requires the constant solution to new problems and therefore requires Developing Creativity.

The chemistry department offers programs leading to either a Bachelor of Arts or a Bachelor of Science degree. In addition the department offers a minor which can be tailored to enhance other majors throughout the curriculum. Chemistry majors traditionally have many career fields open to them including chemical research, industrial chemistry, science writing, science policy making and medical fields. Students intending to enter graduate school are encouraged to earn the Bachelor of Science degree.

### ***Major Program Requirements***

#### **Bachelor of Arts in Chemistry**

(35-36 hours of Chemistry and 23 hours of cognates)

#### **Chemistry B.A. Core (30 hours)**

CHEM 105	General Chemistry I (3)
CHEM 107	General Chemistry Lab I (1)
CHEM 106	General Chemistry II (3)
CHEM 108	General Chemistry Lab II (1)
CHEM 201	Sophomore Seminar (1)
CHEM 301	Junior Seminar (1)
CHEM 303	Quantitative Analysis (3)
CHEM 304	Quantitative Analysis Laboratory (2)
CHEM 311, 312	Organic Chemistry (3, 3)
CHEM 313, 314	Organic Chemistry Laboratory (1,1)
CHEM 321, 322	Physical Chemistry (3, 3)
CHEM 323, 324	Physical Chemistry Laboratory (1,1)
CHEM 401	Senior Seminar (1)

#### **Chemistry B.A. Electives (3-4 hours)**

One of the following:

CHEM 404, 405, 406, 407 and 408

Choose one of the following (2 hours)

CHEM 399, CHEM 450, or CHEM 451

#### **Chemistry B.A. Cognates (23 hours)**

CIS 106	Computer Programming (3)
MATH 115	Pre-Calculus Mathematics (4)
MATH 135, 205	Calculus I, II (4, 4)
PHYS 101, 102*	Introductory Physics I, II (3, 3)
PHYS 103, 104*	Introductory Physics Lab I, II (1, 1)

\*8 hours of higher-level physics may be substituted for the Introductory Physics requirement.

#### **Bachelor of Science in Chemistry**

(41 hours in Chemistry and 26-27 hours of cognates)