### 200. Introduction to Biochemistry

*Winter, Summer. 5(5-0) Credit may not be earned in both 200 and 401. General chemistry; one term organic chemistry. Not acceptable for a B.S. degree in biochemistry.*

Survey of biochemistry emphasizing the major metabolic activities of living organisms.

### 363. Clinical Biochemistry

*Spring. 3(2-3) 401; CEM 162. Primarily for Medical Technology majors; not acceptable for a B.S. degree in biochemistry.*

Quantitative clinical laboratory methods.

### 400H. Honors Work

*Fall, Winter, Spring. Variable credit. Approval of department.*

Assigned reading and experimentation.

### 401. Basic Biochemistry

*Fall, Spring. 5(5-0) Credit may not be earned in both 200 and 401. One year organic chemistry or CEM 242; not open to biochemistry majors.*

A one-term presentation of biochemistry emphasizing structure and function of major biomolecules, metabolism and regulation. Examples used for illustrative purposes will emphasize the mammalian organism.

### 404. General Biochemistry Laboratory

*Fall, Winter, Spring. 3(1-6) Analytical chemistry; 401 or 451.*

Experimental aspects of biochemistry.

### 451. Biochemistry

*Fall, Winter. 4(4-0) Credit may not be earned in both 401 and 451. One year organic chemistry or CEM 242.*

A comprehensive presentation of biochemistry designed for undergraduate biochemistry majors, students of medicine, and other students desiring an intensive treatment of the subject. In the winter term, students in the College of Human Medicine are given enrollment priority and the course emphasizes examples from the mammalian organism in contrast to the more cellular approach used in the fall term.

### 452. Biochemistry

*Winter, Spring. 4(4-0) 451.*

Continuation of 451. In the spring term, students in the College of Human Medicine are given enrollment priority and the course emphasizes examples from the mammalian organism in contrast to the more cellular approach used in the winter term.

### 478. Senior Seminar

*Fall, Winter, Spring. 0 or 1(1-0). May re-enroll for a maximum of 2 credits. Undergraduate biochemistry major or approval of department.*

Discussion, by undergraduate students and staff, of recent advances in biochemistry.

### 499. Research

*Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 12 credits. Approval of department.*

A course designed to give qualified undergraduate students an opportunity to gain experience in biochemical research.

### 801. Biochemical Research Methods

*Fall. 1(0-3) One year of organic chemistry or CEM 242; BCH 451 or 811, or concurrently.*

Discussions and demonstrations of selected experimental techniques of wide application in biochemistry.

### 804. Advanced Biochemistry Laboratory

*Fall. 3(1-6) Analytical chemistry; 801 and 811, or concurrently; biochemistry majors or approval of department.*

Experiments to be selected from a representative group illustrating modern biochemical research.

### 805. Advanced Biachemistry Laboratory

Winter. 3(1-6) 804; 812 concurrently.

Experiments to be selected from a representative group illustrating modern biochemical research.

### 806. Advanced Biochemistry Laboratory

*Spring. 3(1-6) 805; 813 concurrently.*

Special experiments in advanced laboratory techniques.

### 811. Advanced Biochemistry

*Fall. 4(4-0) One year of organic chemistry, one year of physical chemistry, one term of introductory biochemistry, 801 taken previously or concurrently, or approval of department. Limited to graduate students in biochemistry or other students needing a similar professional preparation.*

The structure and function of biomolecules, energy transformations and chemical reactions in living cells, regulation of cell reactions, and the replication of living organisms.

### 812. Advanced Biochemistry

*Winter. 4(4-0) 811*

Continuation of 811.

### 813. Advanced Biochemistry

*Spring. 4(4-0) 812.*

Continuation of 812.

### 855. Special Problems

*Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 12 credits. Approval of department.*

Consideration of current problems.

### 899. Research

*Fall, Winter, Spring, Summer. Variable credit. Approval of department.*

### 952. Plant Physiology and Biochemistry I

*Winter of odd-numbered years. 3(3-0) Approval of department. Interdepartmental with the Botany and Plant Pathology Department.*

Selected topics concerning photosynthesis and related processes.

### 955. Plant Physiology and Biochemistry II

*Winter of even-numbered years. 3(3-0) Approval of department. Interdepartmental with the Botany and Plant Pathology Department.*

Metabolic pathways of unique significance to plants.

### 960. Selected Topics in Biochemistry

*Fall, Winter, Spring, Summer. 1(1-0) or 2(2-0) May re-enroll for a maximum of 6 credits if a different topic is taken. Approval of department.*

Topics will be selected from the areas of biochemical genetics, biochemistry of development, biochemical evolution, complex proteins, lipid metabolism, immunochemistry, hormones, control mechanisms and structure of biological macromolecules.

### 961. Selected Topics in Biochemistry

*Fall, Winter, Spring, Summer. 1(1-0) or 2(2-0) May re-enroll for a maximum of 6 credits if a different topic is taken. Approval of department.*

Topics will be selected from the areas of bioenergetics, bioinstrumentation, complex carbohydrates, mechanisms of enzyme action, natural products, carbohydrate metabolism, mass spectrometry and biochemistry of isoprenoid compounds.

### 978. Seminar in Biochemistry

*Fall, Winter, Spring. 0 or 1(1-0)*

Presentation and discussion of reports by graduate students on biochemical topics of current interest.

### 999. Research

*Fall, Winter, Spring, Summer. Variable credit. Approval of department.*

## BIOLOGICAL SCIENCE B S

## College of Natural Science

### 202. Biological Science for Elementary Teachers

*Fall, Winter, Spring. 4(3-3)*

Fundamental principles of biology which provide background appropriate for preparation for elementary education teaching.

### *210. General Biology

*Fall, Winter. 4(4-2)*

Concepts relating to basic attributes and diversity of living things.

### *211. General Biology

*Winter, Spring. 4(4-2) CEM 130 or high school chemistry. Not open to students with credit in LBC 140.*

The structure and behavior of cells and their subunits, interactions of tissues, genetics, and the development, history and relations of organisms.

### *212. General Biology

*Fall, Spring. 4(4-2) Not open to students with credit in LBC 141.*

Continuation of 211.

### 401. Biological Science for Teachers

*Fall. 4(3-3) Bachelor's degree.*

Designed to show the nature of biological science in both its empirical and conceptual aspects. Emphasis is placed on life processes. The theories of the gene and of evolution are stressed. Macromorphology and micromorphology are covered as well as the topics of reproduction, metabolism, physiology, nutrition, enzymes, taxonomy and ecology. Quantitative developments are included whenever possible.

### 402. Biological Science for Teachers

*Fall, Winter. 4(3-3) 401.*

Continuation of 401.

### 403. Biological Science for Teachers

*Spring. 4(3-3) 402.*

Continuation of 402.

### 410. Biotic and Environmental Relationships

*Summer. 6 credits. Approval of department. Given at W. K. Kellogg Biological Station.*

Interrelationship of the biota with its environment. Factors determining distribution and abundance. Interaction of organisms.

### 420. Seminar in Recent Advances in Biological Science

*Fall, Winter, Spring, Summer. 3(3-0) May re-enroll for a maximum of 6 credits if different topic is taken. Approval of department.*

A series of lectures by senior faculty of topics on the history, development, the most recent advances and the possible future and limits of the Biological Sciences.

*For prerequisite purposes, the introductory biology sequence in Lyman Briggs College, L8C, 140, 141, 242, may be used instead of this sequence.

### 421. Seminar on Man, "The Human Organism"

*Fall, Winter, Spring, Summer. 3(3-0) Approval of department.*

The importance of new discoveries in biology for our understanding of the human organism with emphasis from the fields of genetics, molecular biology, behavior, developmental biology, physiology, and ecology.

### 499. Research

*Fall, Winter, Spring. 2 to 4 credits. May re-enroll for a maximum of 12 credits. Approval of director of biological science program and student's adviser.*

Undergraduates are invited on an individual basis into research laboratories of faculty in biological departments of the college. After three terms of research, a presentation in thesis form is produced and defended.

### 800. Problems in Biological Science

*Fall, Winter, Spring. Variable credit. B.S. degree in biological science.*

### 999. Research

*Fall, Winter, Spring. Variable credit. M.S. degree in biological science or equivalent.*

Research in some phase of biological science, data to form the basis for the thesis required for the doctoral degree in biological science.

## BIOPHYSICS BPY

### College of Human Medicine
### College of Natural Science
### College of Osteopathic Medicine

### 402. Introduction to Biophysics

*Spring. 5(5-0) PHY 259, MTH 113, 1 year organic chemistry and 1 year biology.*

Salient features of biophysics, methods and principles. Structure and organization of biological materials, bioenergetics, radiation biophysics, bioelectric phenomena, biomechanics and psychophysics.

### 499. Independent Study

*Fall, Winter, Spring, Summer. 1 to 5 credits. May re-enroll for a maximum of 15 credits. Approval of department.*

Undergraduate research under one of our faculty.

### 804. Experimental Biophysics

*Fall of odd-numbered years. 3 credits. Approval of department.*

Neuro-electric properties of cells, organs and animals, and methods of processing information in humans.

### 805. Experimental Biophysics

*Winter of even-numbered years. 3 credits. Approval of department.*

Electrical and physical properties of significant biological molecules and structures.

### 806. Experimental Biophysics

*Spring of even-numbered years. 3 credits. Approval of department.*

Interaction of protons and high energy particles with biological molecules and structures.

### 821. Molecular Biophysics

*Fall of odd-numbered years. 5(3-4) Approval of department.*

Theoretical/experimental methods for determination of electronic structure, excited states and spectroscopy of biological systems. Biological energy transfer. Quantum processes in photosynthesis. Exciton effects in photoreceptors and pigments. Conformational changes.

### 822. Charge Transport and Solid State Processes

*Winter of even-numbered years. 4(3-2) Approval of department.*

Fundamental electrical properties, dielectric properties and photoconductivity effects and their relevance to the biological functioning of these molecules.

### 823. Radiation Biophysics

*Spring of even-numbered years. 3(2-2) Approval of department.*

Effects of various types of ionizing radiation and ultraviolet and visible light on proteins, nucleic acids, viruses and plant and animal cells. Damage and repair mechanisms at the molecular level.

### 824. Membrane Biophysics

*Fall of even-numbered years. 4(3-2) Approval of department.*

Membrane Biophysics will cover interfacial phenomena in biology and chemistry; structure and function, theoretical and experimental models for biological membranes; membrane biochemistry. Labs will emphasize bimolecular lipid membrane (BLM) techniques.

### 825. Basic Neurobiology

*Winter of odd-numbered years. 4(3-2) Approval of department.*

A comparative survey of fundamental principles of nervous organization will be undertaken in lectures. Laboratory will emphasize examination of prepared neuroanatomical material and a demonstration of important neurophysiological phenomena.

### 826. Biophysics of Perception and Learning

*Spring. 4(3-2) Approval of department.*

Lectures will consider sensory systems, including transduction, coding and information processing. Muscle contraction, muscle control, learned and unlearned behavior will be considered. Laboratory will include neural recording and behavioral observations.

### 880. Special Topics in Biophysics

*Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 credits.*

Special topics within the five subdivisions of biophysics: structure, organization and function of biological phenomena, sensory perception, and psychophysics and biomechanics.

### 890. Readings in Biophysics

*Fall, Winter, Spring. 3 to 6 credits. Approval of department.*

Reading course in special topics adapted to the individual preparation and needs of the student.

### 899. Research

*Fall, Winter, Spring, Summer. Variable credit. Approval of department.*

### 990. Biophysics Seminar

*Fall, Winter, Spring, Summer. 1 credit. May re-enroll for a maximum of 3 credits. Approval of department.*

### 999. Research

*Fall, Winter, Spring, Summer. Variable credit. Approval of department.*

## BOTANY AND PLANT PATHOLOGY BOT

### College of Natural Science

### 200. Resource Ecology and Man

*For course description, see* **Interdisciplinary Courses.**

### 201. Plants and Man

*(304.) Winter, Spring. 3(3-0)*

The relevance of plants to modern society with emphasis on those plants which supply drugs, food, fuel and oxygen, and those which have historical or esthetic importance.

### 205. Plant Biology

*Winter. 3(3-0) High school chemistry and high school algebra.*

An introduction to plant science for students seeking a general knowledge of the principles of plant biology as well as for prospective plant science majors.

### 301. Introductory Plant Physiology

*Fall, Spring. 4(2-4) CEM 131 or 141; 161; B S 211 and introductory organic chemistry recommended.*

General principles of plant physiology relating plant function to structure.

### 302. Introductory Morphology

*Fall, Winter. 4(2-4) B S 212 or approval of department.*

Structures and life cycles of representative plant groups showing progressive evolutionary developments.

### 305. Poisonous Plants

*Spring. 2(0-4) Three terms of Natural Science. Primarily for Veterinary Medicine students.*

Plants poisonous to livestock and human beings, particularly those occurring in Michigan.

### 318. Introductory Plant Systematics

*Spring. 4(2-3) 302 or B S 212 or approval of department.*

Plant diversity with emphasis on identification, classification, nomenclature, and evolutionary relationships of vascular plants.

### 336. Economic Plants

*Fall. 3(3-0)*

Histories, characteristics, and origins of plants used in industrial processes, drug manufacture, and agriculture. Nontechnical to broaden student's cultural interest in plants.

### 400. Aquatic Plants

*Spring. 3(1-4) One year of botany and zoology or approval of department.*

Aquatic plants, their classification, ecology and economic importance. Relationships to problems in fisheries, in wildlife management, and to role in limnology. Experience for student in plant ecology, aquatic biology, and water sanitation.

### 400H. Honors Work

*Fall, Winter, Spring. 3(0-6) Approval of department; Seniors.*

### 401. Special Problems

*Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 16 credits. 302, Seniors, approval of department.*

Students with special ability may carry on laboratory research or study of published literature on a selected topic.

### 402. Introductory Mycology

*Fall, Winter. 4(2-6) B S 212 or approval of department.*

Survey of the fungi, a background course for students taking plant pathology or other courses in mycology.

### 405. Introductory Plant Pathology

*Fall. 4(2-4) 302 or B S 212 or approval of department. Students may not receive credit in both 405 and 407.*

General principles of plant pathology including detailed study of selected diseases as examples of important groups.