

- 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. Foundations of Biological Science**
Fall, Winter, Spring. 4(3-3) N S 183 or 193.
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.
- 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.
- 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.

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.

304. Plant World
Fall, Winter, Spring, Summer. 4(2-6) N S 191 or approval of department.

Basic plant science and its use in teaching. Lectures cover basic subject matter necessary to understanding plant kingdom, evidence and trends of evolution, economic uses and importances, basic principles of ecology. Laboratories give students opportunity to expand subject matter in one of several types of special projects: greenhouse, trees and shrubs, spring or summer flora, what plants do for man.

305. Poisonous Plants
Spring. 2(0-4) N S 193. 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)

Historics, 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.

406. Medical Mycology
Winter, Spring. 4(2-6) 402 or approval of department.

Characteristics, habits, and laboratory identification of fungus diseases infecting humans. Emphasis on laboratory techniques and morphological characteristics of the various mycoses.

407. Diseases of Forest and Shade Trees
Spring. 4(3-3) 301; 302; 318 or FOR 204. Students may not receive credit in both 405 and 407.

Diseases which affect trees in forests, parks, suburbs and nurseries, and methods of control.

411. Systematic Botany
Summer. 4(2-6) B S 212 or approval of department.

Taxonomy, identification, and evolutionary relationships of vascular plants, illustrated by the local flora; extensive field studies.

414. Plant Physiology: Metabolism
Winter, Summer of odd-numbered years. 4(3-4) 302; 1 year chemistry including organic.

Comprehensive study of metabolic activities of plants. Emphasis on mineral nutrition of plants and processes of photosynthesis, protein synthesis, and respiration.

415. Plant Physiology: Growth
Spring. Summer of even-numbered years. 4(3-4) 414.

Comprehensive study of growth processes of plants, with emphasis on germination, dormancy, hormones, and physiological phenomena associated with phases of development.

431. Histological Techniques
Winter. 4(2-6) 302.

Preparation of plant materials for microscopic study. Special emphasis on the many variations in microtechnique, including paraffin and celloidon embedding, freezing microtomy and ultra-thin sectioning for electron microscopy.

434. Plant Anatomy
Fall. Summer of even-numbered years. 4(2-4) 302.

Principles underlying the differentiation and growth of vegetative plant structures with special emphasis upon their functional and developmental genetic relationships.

441. Phytogeography
Winter. 3(3-0) 302.

Distribution of plants over the earth, with special reference to North America. Geological history and environmental factors which influence distribution.

447. Fresh Water Algae
Spring. 4(2-4) One year botany or zoology. Primarily for students in Fisheries Biology, Wildlife Management and Sanitary Engineering.

Identification of fresh water algae, especially those forms concerned with fish food problems, water contamination and limnology. Methods for making analyses of samples for biological survey work on lakes and streams. Economic aspects and life histories of the algae.

450. Ecology
Spring. 4(2-4) 318; 301 or 414

Interrelationship of plants and environment. Factors which govern their distribution.

455. Experimental Ecology
Spring. 5(2-9) Approval of department. Interdepartmental with and administered by the Zoology Department.

Dynamics, regulation and production of biological populations, structure composition and stability of biotic communities; biogeochemical and energetic characteristics of ecosystems.

470. Introductory Nematology
Winter of odd-numbered years. 3(2-3) Interdepartmental with and administered by the Department of Entomology.

Biology, taxonomy and control of plant parasitic and saprophytic nematodes.

480. Insects in Relation to Plant Diseases
Winter of even-numbered years. 4(2-4) 302. Interdepartmental with and administered by the Department of Entomology.

Relationships of insects, mites and nematodes to important plant diseases incited by bacteria, fungi, viruses and toxins. Mode of transmission and means of control. Transmission techniques and important plant-pathogen-insect relationships.

499. Senior Seminar
Winter. 1(1-0) May re-enroll for a maximum of 3 credits. B S 212 and 1 course in botany or approval of department.

Reports by students, faculty, and guest lecturers, with emphasis on current developments in research.

800. Special Problems in Taxonomy
Fall, Winter, Spring. 1 to 15 credits. Approval of department.

801. Special Problems in Anatomy and Morphology
Fall, Winter, Spring. 1 to 15 credits. Approval of department.

802. Special Problems in Pathology
Fall, Winter, Spring, Summer. 1 to 15 credits. Approval of department.

803. Special Problems in Physiology
Fall, Winter, Spring, Summer. 1 to 15 credits. Approval of department.