BIOLOGICAL SCIENCE  B S

College of Natural Science

202. Foundations of Biological Science
Fall, Winter, Spring. 4(3-3) N S 193.
Primarily for elementary education majors. Fundamental principles of biology.

211. General Biology
Fall, Winter, Spring. 5(4-3) Organic chemistry or concurrently. Integrated course emphasizing cell structure and function, genetics, comparative morphology and physiology of living organisms and their developmental and community relationships.

212. General Biology
Fall, Winter, Spring. 5(4-3) 211. 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. Macromolecules and microorganisms 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. 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

420. Seminar in Recent Advances in Biological Science
Fall, Winter, Spring, Summer. 3(2-0) 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(2-0) 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

402. Introduction to Biophysics
Spring. 5(3-0) PHY 223, MTH 113, 1 year organic chemistry and 1 year biology. Salient features of biophysics, methods and principles. Structure and organization of biological materials, biocenergetics, radiations, biophysical phenomena, biomechanics and psychophysics.

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.

811. Principles of Biophysics
Fall of odd-numbered years. 5(5-0) Approval of department. Principles of physics. Characteristics of biological materials, quantum biology, information theory, properties of biological systems.

812. Principles of Biophysics
Winter of odd-numbered years. 5(5-0) Approval of department. Biophysical investigations of exciton theory, charge migration, radiation biophysics, primary photophysical processes in photosynthesis, surface chemistry and interfacial phenomena.

813. Principles of Biophysics
Spring of odd-numbered years. 5(5-0) Approval of department. Consideration of membrane characteristics, the initiation and propagation of biophysical signals, sensory mechanisms, information processing in humans, invertebrate and vertebrate central nervous system functions, psychophysics, and cybernetics.

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.

999. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

999. 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. Elementary Plant Physiology
Fall, Winter, Spring. 4(2-4) B S 212 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 importance, 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(2-4) N S 192. Primarily for Veterinary Medicine students. Plants poisonous to livestock and human beings, particularly those occurring in Michigan.

318. Introductory Plant Taxonomy
Spring. 3(2-3) 302 or B S 212 or approval of department. Principles of identification, classification, nomenclature, and evolutionary relationships of vascular plants.

336. Economic Plants
Fall. 3(3-0) Histochemistry, characteristics, and origins of plants used in industrial processes, drug manufacture, and agriculture. Necessity 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.

A-17
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 10 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 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.
Detailed study of selected diseases as examples of the fungi, a background course for students taking plant pathology or other courses in mycology.

409. Distribution of plants over the earth, with special emphasis upon their functional and developmental relationships. 15 credits. Approval of department; Seniors.

410. Special Problems  
Fall, Winter, Spring. 3(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 an analysis of samples for biological survey work on lakes and streams. Economic aspects and life histories of the algae.

415. Tropical Biology: An Ecological Approach  
Winter. 12 credits. Approval of department. Morphology and taxonomy of liehes. The laboratory will be devoted to the collection and identification of liehes.

416. Industrial Mycology  
Fall of even-numbered years. 3(2-4) 402 or approval of department.
Industrially important fungi, their uses and characteristics. Methods of commercial production, including acids, enzymes, cheeses, mushrooms, and antibiotics. Several field trips will be taken.

417. Plant Morphology I  
Fall. 4(4-6) 302.
First course in a series dealing with evolutionary morphology within the various groups of plants. The morphology and life histories of the several phyla of both fresh water and marine algae as a basis for an evolutionary study of land plants.

418. Plant Morphology II  
Winter. 4(2-6) 817.
Structure and life histories of mosses and fens in relation to origin of land flora and evolution of higher plants. Contributes to understanding of relationships between existing groups of plants.

419. Plant Morphology III  
Spring. 4(2-6) 818.
Morphology and evolution of seed plants. Development and evolution of plant structures and habits which play critical roles in human economy and social evolution.

420. Ecology of Hydrophytes  
Summer of every third year; given in 1967. 3 credits. 400 and 447 or approval of department. Given at W. K. Kellogg Biological Station.
Physiological and ecological relationships of periphyton, macroalgae, and vascular aquatic plants; field and laboratory methods of analysis of growth factors.

421. Physiography  
Summer of even-numbered years. 3 credits. 318, 420, or approval of department. Given at W. K. Kellogg Biological Station.
Taxonomic, evolutionary, and ecological relationships of fens; emphasis on local forms.

422. Plant Taxonomy I  
Fall of odd-numbered years. 4(3-3) 318; ZOL 441 recommended.
First course of a series on classification and relationships of vascular plants. Family characteristics, patterns, geographic distribution, and evolutionary trends are stressed. Contributions from classical taxonomy, cytotaxonomy and experimental taxonomy are discussed.

424. Plant Taxonomy II  
Winter of even-numbered years. 4(3-3) 823.
Second course of a series on classification and relationships of vascular plants.

425. Tropical Biology: An Ecological Approach  
Winter. 12 credits. Approval of department and acceptance by Organization for Tropical Studies. Interdepartmental with the Zoology Department.
An introduction in the field to the principles of ecology as they operate in the tropics, especially concerning the tropical environment and biota, ecological relations, communities and evolution in the tropics. Given in Costa Rica by Organization for Tropical Studies.
826. Advanced Tropical Botany
Summer. 18 credits. Approval of department and acceptance by Organization for Tropical Studies. A field course on the adaptation, evolution, and physiological characteristics of tropical plants. The subject will vary from term to term, but will include such topics as the reproductive biology of tropical plants, tropical forest ecology, biology of tropical epiphytes, and physiology of tropical grasses, biology of tropical ferns, etc.

827. General Cytology
Spring and Summer of odd-numbered years. 3 (2-0). One year general chemistry and 1 year general botany or general zoology. Designed primarily for biological science students. Plant and animal materials. Cell morphology and variation, organization and distribution of standard inclusions, structure of the nucleus and the mechanism of mitosis.

830. Paleobotany
Fall. 4 (3-4). Approval of department. Interdepartmental with the Geology Department. Survey of fossil plants: their preservation, occurrence, geology, palaeoecography, palaeoecology, evolutionary history, classification, and representative types. One weekend field trip to fossil plant locality.

831. Palynology
Spring. 4 (3-4). Approval of department. Interdepartmental with and administered by the Geology Department. An introduction to the principles and techniques of spore and pollen analysis, both fossil and recent, and utilization of plant microfossils for stratigraphic determinations and palaeoecological interpretation of most sedimentary accumulations and rocks. Includes certain algae, protozoans, similar organisms of uncertain affinity, and dissected fragments of larger organisms.

835. Morphogenesis of Reproductive Structures
Spring of even-numbered years. 4 (3-4). Principles underlying the differentiation and growth of reproductive plant structures with special emphasis upon their functional and developmental genetic relationships.

836. Advanced Mycology: Current Biological Advances
Winter. 4 (4-0). Approval of department. Recent and current advances in the biology of fungi, with emphasis upon experimental studies of structural and functional differentiation during ontogeny.

837. Advanced Mycology: Morphology and Taxonomy
Spring. 4 (3-2). 402. Recent morphological studies, taxonomic methods, and phylogeny. The laboratory will be devoted to special problems related to the student's interests.

838. Advanced Paleobotany
Winter. 3 (2-4). Approval of department. Interdepartmental with the Geology Department. Morphology, anatomy, phylogenetic relationships and classification of fossil plants. Microscopic analysis of tissues and organs prepared by thin section, transfers, peels, polished and etched surfaces, and macerations.

839. Population Ecology
Summer of odd-numbered years. 6 credits. Approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with and administered by the Zoology Department. A synopsis of growth and regulation of plant and animal populations; interrelationships of biotic and environmental factors that control population responses and interactions. Laboratory and field experiments.

841. Physiology of the Algae
Spring. 4 (3-2). Approval of department. Physiology, chemistry, biochemistry, and aspects of the ultra-structure of the various algal divisions. Discussion of use of algae for the study of classical physiological and developmental problems.

845. Current Problems in Plant Metabolism
Fall, Winter, Spring. 1 (1-0). 414.

846. Seminar in Plant Pathology
Fall, Winter, Spring. 1 (1-0). Approval of department.

855. Effects of Ionizing Radiations on Plants
Spring of odd-numbered years. 3 (2-0). Approval of department. Nature of ionizing radiations related to their effects upon plant growth and development including aspects of radiation sensitivity, dosimetry, direct and indirect effects, genetic, evolutionary and environmental implications related to modes of action at the cell, organism, and population levels.

880. Plant Virology
Fall, 5 (2-0) 405 or approval of department. External and internal symptomatology, transmission, infections, purifications, assay and serology of plant viruses.

881. Parasitism and Pathogenesis
Winter of even-numbered years. 4 (2-4). 415, 405, or approval of department. Physiology of parasitism and disease development in plants. Parasitism by plant pathogens is compared with parasitism in other groups.

883. Plant Disease Control
Fall. 3 (2-3) 405. Principles and methods in controlling plant diseases. Considerable emphasis is placed on the chemistry of fungicides, and their role in controlling plant diseases. Other factors affecting disease epidemiology are covered.

885. Plant Diseases in the Field
Spring. 4 credits. 405 and approval of department. Diagnosis, distribution and sequential development of plant diseases in the field.

890. Selected Topics in Plant Pathology
Fall, Winter, Spring. 2 to 5 credits. Approval of department. Topics will be selected from the following areas: parasitism, plant viruses, ecology, genetics, nematology, fungal action, and soil microbiology.

899. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department. Research for theses at the master's degree level in one of the following fields: anatomy, cytology, ecology, genetics, lichenology, morphology, mycology, pathology, physiology, and taxonomy.

915. Advanced Genetics
Winter of odd-numbered years. 3 (3-0). Approval of department. Roles of the gene in differentiation and development, with special emphasis upon the genetic mechanisms responsible for the control of phenogenetics.

919. Cytogenetics
Fall. 3 (3-0). 913.

920. Advanced Plant Taxonomy
Spring of even-numbered years. 4 (4-0). 824. ZOL 441. Consideration of the recent scientific developments affecting plant classification.

930. Advanced Plant Ecology
Spring of odd-numbered years. 3 (2-4). 415. 450. 824. Fundamental theories and modern research horizons.

943. Advanced Plant Physiology I
Fall of even-numbered years. 3 (3-0). 414. Selected topics concerning absorption and inorganic nutrition.

944. Advanced Plant Physiology II
Winter of odd-numbered years. 3 (3-0). 414. Selected topics concerning photosynthesis and related processes.

945. Advanced Plant Physiology III
Spring of odd-numbered years. 3 (3-0). 415. Selected topics concerning the chemistry, physiology and mechanism of action of plant growth hormones.

946. Advanced Plant Physiology IV
Fall of odd-numbered years. 3 (3-0). 414. Selected topics from environmental physiology.

947. Advanced Plant Physiology V
Winter of even-numbered years. 3 (3-0). 414. Metabolic pathways of unique significance to plants.

948. Advanced Plant Physiology VI
Spring of even-numbered years. 3 (3-0). 415. Factors influencing vegetative and reproductive physiology.

999. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department. Research for thesis at the doctor's degree level in one of the following fields: anatomy, cytology, ecology, genetics, lichenology, morphology, mycology, pathology, physiology, and taxonomy.

BUILDING CONSTRUCTION
See Packaging

BUSINESS LAW AND OFFICE ADMINISTRATION

College of Business

201. Shorthand I
Fall, Winter, Spring, Summer. 201. 4 (4-0). 234 or 1 term typing writing. Basic principles, elementary vocabulary, beginning dictation, and transcription for students with no previous training.