410. Terrestrial Ecology
Summer, 6 credits. B S 929 or approval of department. Given at W. K. Kellogg Biological Station, Interdepartmental with the departments of Botany and Plant Pathology and Zoology.

Factors determining distribution and abundance. Interrelationship of plants, animals, and environment. Extensive field investigations of several types of terrestrial communities in light of current theory.

420. Seminar in Recent Advances in Biological Science
Fall, Winter, Spring, Summer. 1 to 3 credits. May be repeated for a maximum of 6 credits if different topics are taken. Approval of department.

A series of lectures by senior faculty of topics on the history, development of ideas and activities of the field.

440. Man and Environment Workshop for Teachers
Summer. 3 credits. Approval of department. Given at W. K. Kellogg Biological Station.

Discussions and practical work sessions concerning the development of ideas and activities for environmental study in and outside the classroom. Designed for intermediate and secondary inservice teachers.

450. Outdoor Environmental Studies
Summer, 3 credits. May be repeated for a maximum of 9 credits when new topics are given. Teaching experience or approval of department. B S 450 must be taken some summer. Given at W. K. Kellogg Biological Station.

Emphasis on environmental understanding. Planning and developing interdisciplinary program for elementary and intermediate children.

451. Outdoor Environmental Studies: Laboratory
Summer, 2 to 5 credits. May be repeated for a maximum of 15 credits when new topics are given. Teaching experience, B S 450. Given at W. K. Kellogg Biological Station.

Testing instrumental materials and strategies developed in B S 450 with elementary and middle school children in an outdoor environmental education program.

499. Research
Fall, Winter, Spring. 2 to 4 credits. May be repeated for a maximum of 12 credits. Approval of director of biological science program and student's advisor.

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. Doctoral Dissertation 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.

BIOMECHANICS

College of Osteopathic Medicine

590. Special Problems in Biomechanics
Fall, Winter, Spring, Summer. 1 to 5 credits. May be repeated for a maximum of 32 credits. Approval of department.

Each student will work under direction of a faculty member on an experimental, theoretical, or clinical problem.

620. Directed Studies
Fall, Winter, Spring, Summer. 1 to 6 credits. May be repeated for a maximum of 24 credits. Approval of department.

Individual or group work on special problems related to biomechanics, neuromusculoskeletal system primarily.

880. Athletic Medical Systems
(FS1) Fall, Spring, 3 to 4 credits. Bachelor's degree in athletic training.

Health care systems for athletes in growth years. Physiological and psychological concepts applied to human development, training, and care. Injury prevention, emergency medicine, and rehabilitation stressed.

890. Independent Study
Fall, Winter, Spring, Summer. 1 to 8 credits. May be repeated for a maximum of 32 credits. Approval of department.

Individual or group work related to biomechanics and/or neuromusculoskeletal system.

BIOMEDICAL ENGINEERING

College of Engineering

410. Electronic Instrumentation in Biology and Medicine
Fall. 4(4-0) MTH 112, PHY 239 or approval of instructor.

Electronic components and circuits. Physiological electrical events to electrical signals. Detection of physiological events by electrical impedance measurements. Ultrasonic techniques in biomedical systems. Biomedical applications of lasers.

411. Electric Theory of Nerves
Winter of odd-numbered years. 4(4-0) MTH 310, PHY 258.


414. Clinical Instrumentation
Winter of even-numbered years. 3(3-0) BME 410.


424. Materials in Biomedical Engineering
Winter. 3(3-0) PSL 240 or PSL 431 or approval of department.


431. Biological Transport
Spring. 3(3-0) MTH 315.

Mechanisms which govern transport or movement, heat and mass. Application to mathematical description of transport processes in biological systems and to solution of biomedical problems.

481. Tissue Biomechanics
Fall. 3(3-0) ANT 316 or approval of department.

Fundamentals of continuum mechanics in relation to morphological classification of tissue. Mechanical properties of connective and muscle tissue.

499. Independent Study
Fall, Winter, Spring, Summer. 1 to 4 credits. May be repeated for a maximum of 9 credits. Approval of instructor.

Individual reading and research under the supervision of a member of the Biomedical Engineering Committee.

BIOPHYSICS

College of Human Medicine

400H. Honors Work in Biophysics
Fall, Winter, Spring, Summer. 3 to 6 credits. May be repeated for a maximum of 6 credits. Approval of department.

Independent study and investigation under the direction of a faculty member.

402. Introductory Biophysics: Molecular and Thermal
Spring. 3(3-0) One year organic chemistry or biochemistry; 1 year biology. PHY 239, PHY 259, MTH 113, or approval of department.

Salient features of biophysics, principles and methods. Structure, function, and organization of biologic molecules; molecular biophysics; thermal biophysics; bioenergetics and photobiology.

403. Introductory Biophysics: Membranes and Electrical
Fall. 3(3-0) One year organic chemistry or biochemistry. PHY 239, PHY 259, MTH 113 or approval of department.

Salient features of biophysics, principles and methods; radiation biophysics; membrane biophysics; biologic electric phenomena; bioenergetics; and psychophysiology.

500. Medical Membranes
For course description, see Interdisciplinary Courses.

480. Special Topics in Biophysics
Fall, Winter, Spring. Summer. 2 to 4 credits. Approval of department; BPY 402 recommended.

Special topics within five areas of biophysics; structure-function correlation, neurobiophysics, membrane biophysics, molecular biophysics, or theoretical biophysics.
499. Independent Study
Fall, Winter, Spring, Summer. 1 to 5 credits. May reenroll for a maximum of 15 credits. Approval of department.
Undergraduate research under one of our faculty.

804A. Neuroscience Laboratory I
Winter. 4(2-4) Approval of instructor. Interdepartmental with the departments of Physiology, Psychology, and Zoology and administered by the Department of Psychology.
Development of skills in the methods, techniques and instrumentation necessary for research in a variety of areas concerned with neuroscience.

804B. Neuroscience Laboratory II
Spring. 4(2-4) PSY 804A. Interdepartmental with the departments of Physiology, Psychology, and Zoology and administered by the Department of Psychology.
Continuation of PSY 804A.

821. Molecular Biophysics
Winter of even-numbered years. 4(4-0)
Approval of department.

822. Charge Transport and Solid State Processes
Spring of even-numbered years. 4(4-0)
Approval of department.
Fundamental electrical properties, dielectric properties and photoconductivity effects and their relevance to the biological functioning of these molecules.

824. Membrane Biophysics
Winter of odd-numbered years. 4(3-2)
Approval of department.
Membrane Biophysics will cover interfacial phenomena in biology and chemistry; structure and function, and theoretical and experimental models for biological membranes; membrane biochemistry. Labs will emphasize biomolecular lipid membrane (BLM) techniques.

826. Cellular Biophysics
Spring of odd-numbered years. 4(4-0)
Approval of department.
Basic cell structure and function at the molecular level. Emphasis will be on genetic and molecular controls of cellular systems.

827. Basic Neurobiology
Fall. 4(4-0) Approval of department. Interdepartmental with the Department of Zoology.
Neural structure and function at cellular and intercellular levels. Membrane and synaptic potentials, receptor transduction, and intracellular transport with an introduction to comparative and evolutionary aspects.

834. Membranes: Natural and Artificial
Spring of odd-numbered years. 2 to 3 credits. May reenroll for a maximum of 3 credits. Approval of department.
Emphasis is placed on the biophysical and biochemical characterization of biological membranes and their theoretical and experimental models. Presentation and discussion by students and staff of recent advances in membrane research.

855. Vertebrate Neural Systems I
Fall of odd-numbered years. 3(3-4)
Approval of department: ANT 815 and PSY 827 recommended. Interdepartmental with the departments of Zoology, Psychology, and Zoology and administered by the Department of Psychology.
Structure and function of major component systems of vertebrate brains, their evolution, ontogeny and comparative analysis in mammals, birds, reptiles, amphibians and fish. Interrelation of behavioral, anatomical and physiological studies.

856. Vertebrate Neural Systems II
Winter of even-numbered years. 3(3-4)
PSY 885. Interdepartmental with the departments of Psychology, Physiology, and Zoology and administered by the Department of Zoology.
Continuation of PSY 885. Major component systems of vertebrate brains, their evolution, ontogeny, and comparative analysis in mammals, birds, reptiles, amphibians and fish. Interrelation of behavioral, anatomical, and physiological studies.

890. Readings in Biophysics
Fall, Winter, Spring, Summer. 3 to 6 credits. Approval of department.
Reading course in special topics adapted to the individual preparation and needs of the student.

899. Master’s Thesis Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

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

BOTANY AND PLANT PATHOLOGY

College of Agriculture and Natural Resources
College of Natural Science
IDC. Resource Ecology and Man
For course description, see Interdisciplinary Courses.

201. Plants, Man, and the Environment (N)
Winter, Spring. 3(3-0)
Relevance of plants to modern society on issues such as food production, environmental quality, drug use and abuse, and the exploitation of plants in natural areas for commercial purposes.

265. 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 CEM 141. CEM 161; BOT 205 or BS 210 or LBC 141.
Introductory organic chemistry recommended. General principles of plant physiology relating plant structure to function. Topics include cell physiology, water relations, effects of light and temperature, respiration, photosynthesis, mineral nutrition, and hormone action.

302. Introductory Morphology
Fall, Winter. 4(2-4) BS 212 or approval of department.
Structures and life cycles of representative plant groups showing progressive evolutionary developments.

318. Introductory Plant Systematics
Spring. 4(2-3) BOT 302 or BS 212 or approval of department.
Plant diversity with emphasis on identification, classification, nomenclature, and evolutionary relationships of vascular plants.

335. Fossil Plants, Their History and Paleocology
Spring. 3(0-3) One course in geology or botany recommended. Interdepartmental with and administered by the Department of Geology.
History of plants through geologic time; their form and evolution; how and where found, identified and reconstructed; their use in determining ancient geographic patterns, paleoenvironments, paleoclimates and community structure. Field trip.

336. Economic Plants
Spring. 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
Fall. 3(3-0) BOT 315 and/or BOT 362.
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. 1 to 4 credits. May reenroll for a maximum of 16 credits. BOT 302. Seniors, approval of department. Students with special ability may carry on laboratory research or study of published literature on a selected topic.