590. Special Problems in Biomechanics
Fall, Winter, Spring, Summer. 1 to 8 credits. May reenroll for a maximum of 32 credits. Approval of department.
Each student will work under direction of a faculty member on an experimental, theoretical, or applied problem.

601. Osteopathic Manipulative Medicine Clerkship
Fall, Winter, Spring, Summer. 6 credits. May reenroll for a maximum of 12 credits. Grade is in all courses offered in terms 1 through 8.
Advanced training in the diagnosis of musculoskeletal dysfunctions and application of osteopathic manipulative techniques in patient care.

620. Directed Studies
Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 24 credits. Approval of department.
Individual or group work on special problems related to biomechanics, neuromusculoskeletal system primarily.

890. Independent Study
Fall, Winter, Spring, Summer. 1 to 8 credits. May reenroll for a maximum of 32 credits. Approval of department.
Individual or group work related to biomechanics and/or neuromusculoskeletal system.

### BIOLOGICAL ENGINEERING BME

**College of Engineering**

410. Electronic Instrumentation in Biology and Medicine
Fall. 4(4-0) MTH 112, PHY 238 or approval of instructor.
Electronic components and circuits, physiological measurements. Transduction of physiological 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 288.

414. Clinical Instrumentation
Winter of even-numbered years. 3(3-0) BME 410.
990. **Biophysics Seminar**  
Fall, Winter, Spring, Summer. 1 credit. May be repeated for a maximum of 3 credits. Approval of department.

400H. **Honors Work**  
Fall, Winter, Spring. 3(0-8) Approval of department; Seniors.

401. **Special Problems**  
Fall, Winter, Spring. Summer. 1 to 4 credits. May be repeated for a maximum of 15 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.

402. **Introductory Mycology**  
Winter. 3(2-6) B S 212 or LBC 140 or approval of department.  
Survey of the fungi including characteristics, habits and diversity. Background course for biology students or those expecting to specialize in microbiology, mycology, plant pathology, or other fields involving fungi.

405. **Introductory Plant Pathology**  
Fall, 3(2-4) B OT 302 or B S 212 or approval of department. Students may not receive credit in both BOT 405 and BOT 407.  
General principles of plant pathology including detailed study of selected diseases as examples of important groups.

406. **Medical Mycology**  
Fall, Spring, 3(2-6) BOT 402 or approval of department, Interdepartmental with the Department of Microbiology and Public Health.  
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(2-1) B S 318, BOT 302, BOT 318 or BOT 204. Students may not receive credit in both BOT 405 and BOT 407.  
Diseases which affect trees in forests, parks, suburbs and nurseries, and methods of control.

408. **Freshwater Ecology**  
Summer. 6 credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station, Interdepartmental with Biological Science and the Department of Zoology. Administered by Biological Science.  
The ecology of freshwater ecosystems, their biotic structure, and the functional interrelationships of environmental variables regulating population dynamics, productivity and community structure. Extensive field investigations.

409. **Plant Disease Control**  
(S83.) Winter of odd-numbered years. 3(3-0) BOT 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.

410. **Terrestrial Ecology**  
Summer. 6 credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station, Interdepartmental with Biological Science and the Department of Zoology and administered by Biological Science. Extensive field investigations of several types of terrestrial communities. Interrelationships of plants, animals, and environment. Factors determining distribution and abundance.

**Botany and Plant Pathology - Descriptions of Courses**

**334. Membranes: Natural and Artificial**  
Spring of odd-numbered years. 2 to 3 credits. May be repeated 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.

**850. Simpler Systems Approaches to Learning and Memory**  
Winter of odd-numbered years. 4(4-0) BPY 450 or BPY 827.

Simpler vertebrate and vertebrate, nervous systems which have been or could be useful for electrophysiological and molecular approaches to learning and memory.

**865. Advanced Neurobiology**  
(BIM 685.) Spring. 4(4-0) BPY 827.  
Interdepartmental with the departments of Anatomy, Physiology, Psychology, and Zoology, Administered by the Department of Anatomy.

Basic organization structure and function of neural networks comprising sensory, motor, and autonomic systems including examples from invertebrates and vertebrates. Attendance at neuroscience seminar is required.

**880. Special Topics in Biophysics**  
Fall, Winter, Spring, Summer. Variable credit. May be repeated 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.

**885. Vertebrate Neural Systems I**  
Fall of odd-numbered years. 5(3-4)  
Approval of department: ANT 415 and BPY 827 recommended. Interdepartmental with the departments of Zoology, Physiology, and Psychology, 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.

**886. Vertebrate Neural Systems II**  
Winter of even-numbered years. 5(3-4)  
PSY 885. Interdepartmental with the departments of Psychology, Physiology, and Zoology, Administered by the Department of Zoology.

Continuation of BPY 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.

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

**BOTANY AND PLANT PATHOLOGY**

**B5T**

**College of Agriculture and Natural Resources**

**College of Natural Science**

**201. Plants, Man and the Environment (N)**  
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.

**205. Plant Biology**  
Winter. 3(2-0)  
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(2-1) CEM 131 or CEM 141; CEM 161; BOT 205 or B S 212 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) B S 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 B S 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 Paleoeoclogy**  
Spring. 3(3-0) 
One course in geology or botany or biology or approval of department. 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 geologic patterns, paleoenvironments, paleoecologies and community structure. Field trip.

**336. Economic Plants**  
Spring. 3(4-0)

Historical, 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(2-3) BOT 318 and/or BOT 302.  
Aquatic plants, their classification, ecology and economic importance. Relationships to problems in fisheries, wildlife management, and to role in limnology. Experience for student in plant ecology, aquatic biology, and water sanitation.