

**888. Laboratory Rotation**

Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 15 credits. Graduate student majors; approval of department.

Participation in research laboratories to learn experimental techniques and research approaches, broaden research experience, and assess research interests prior to selecting a thesis adviser.

**899. Master's Thesis Research**

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

**960. Selected Topics in Biochemistry**

Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 10 credits if different topics are 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 to 3 credits. May reenroll for a maximum of 10 credits if different topics are 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. 1(1-0). May reenroll for a maximum of 8 credits. Approval of department.

**999. Doctoral Dissertation Research**

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

**211. General Biology**

Fall, Winter. 4(4-2) CEM 140 or high school chemistry. Not open to students with credit in LBS 242.

Principles of biological regulation and integration: genetics, development, and selected physiological topics.

**212. General Biology**

Winter, Spring. 4(4-2) Not open to students with credit in LBS 140.

Principles of biological diversity: taxonomy and systematics, comparative physiology, and ecology.

**400. Biological Science for Teachers**

Fall, Winter, Spring, Summer. 3 to 4 credits. May reenroll for a maximum of 12 credits. Teacher certification with science major or minor.

A course for in-service teachers, topics will be selected from actual classroom problems of the participants. Stress will be placed on field, laboratory and inquiry teaching.

**405. Topics in Biological Science**

Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits if different topic is taken. Approval of department.

Presentation of single topics from the biological sciences by senior faculty and guest lecturers. Topics are selected to facilitate development of strong biological science programs in schools.

**408. Freshwater Ecology**

Summer. 6 credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with the departments of Zoology, and Botany and Plant Pathology.

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.

**410. Terrestrial Ecology**

Summer. 6 credits. B S 212 or approval of department. Given at W. K. Kellogg Biological Station. Interdepartmental with the departments of Botany and Plant Pathology, and Zoology.

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

**418. Field Biology for Teachers**

Summer. 4(2-5) Biology course or approval of department. Given at the W. K. Kellogg Biological Station.

Field investigation and interpretation of prairie, dune, forest and wetland communities. An ecosystem approach to ecological concepts. Natural history and identification of key species. Field trips required.

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

Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll 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.

**460. Ornithology for Teachers**

Summer. 3 credits. A course in biology or approval of department. Not open to Zoology majors. Given at W. K. Kellogg Biological Station. Interdepartmental with and administered by the Department of Zoology.

Distribution, breeding cycles, migration, food and feeding habits, voice and other important areas of avian biology. Emphasis on field identification and natural history.

**499. Research**

Fall, Winter, Spring. 2 to 4 credits. May reenroll 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. 1 to 6 credits. May reenroll for a maximum of 18 credits. B.S. degree in biological science.

**805. Outdoor Environmental Studies**

(451.) Summer. 1 to 4 credits. May reenroll for a maximum of 9 credits if different topics are taken. B S 418 or ZOL 460 or approval of department. Given at W. K. Kellogg Biological Station.

Emphasis on environmental understanding. Development of educational materials through team research and testing. Interaction with elementary and middle school children in two-week outdoor oriented workshop.

**899. Master's Thesis Research**

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

**BIOLOGICAL SCIENCE      B S**

**College of Natural Science**

The content of courses 400, 405, and 420, as well as the research and problems courses 499, 800 and 899, may vary from term to term. Brochures giving detailed information about individual courses are available in the Office of the Assistant Dean for Lifelong Education in the College of Natural Science. These courses are primarily designed for in-service teachers and interested adults and are offered in off-campus locations.

**202. Introductory Biology for Non-Science Majors**

Fall, Winter, Spring. 4(3-3) 12 credits in general education natural science courses.

Concepts, procedures, and perspectives appropriate to developing a basic literacy in biology with emphasis on fundamental biological principles and their relation to world society. Appropriate preparation for pre-service elementary teachers.

**210. General Biology**

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

Principles of biological organization: scientific method, biochemistry, cell biology, and evolution.

**BIOMECHANICS                      BIM**

**College of Osteopathic Medicine**

**560. Acupuncture and Other Peripheral Stimulation Therapy**

Winter. 1 to 3 credits. Approval of department.

Clinical application of traditional Chinese acupuncture and related peripheral stimulation therapies.

**561. Clinical Craniosacral Manipulative Therapy**

Spring. 1 to 3 credits. Approval of department.

Basic concepts of the craniosacral system, clinical applications.

**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.

**Descriptions - Biomechanics  
of  
Courses**

**601. Osteopathic Manipulative Medicine Clerkship**  
Fall, Winter, Spring, Summer. 6 credits. May reenroll for a maximum of 12 credits. Grade P 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.

**431. Biological Transport Mechanisms**  
Spring. 3(3-0) MTH 215.

Mechanisms which govern transport or momentum, 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 reenroll for a maximum of 9 credits. Approval of instructor.

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

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

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

**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, 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.

**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.

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

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

**865. Advanced Neurobiology**  
(BIM 865.) 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 reenroll 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, Summer. 3 to 6 credits. Approval of department.

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

**BIOPHYSICS BPY**

**College of Human Medicine  
College of Natural Science**

**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; bioelectric phenomena; neurobiology; and psychophysics.

**450. Introduction to the Nervous System**  
Spring of even-numbered years. 3(3-0) B S 211, B S 212.

Nervous structure and function from protozoa (aneural) to mammals normal and abnormal innate and learned behavior in animals and humans from the cellular level to the intact organism; emergence of mind and consciousness.

**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. 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.

**BIOMEDICAL 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.

Neurophysiology: basic organization, structure, function and electrical activity of neurons. Subthreshold membrane phenomena: Nernst-Planck equations, constant field membrane model, electrotonus. Membrane action potentials; voltage clamp experiments, Hodgkin-Huxley equations, computer simulation.

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

Ultrasound theory and applications in medicine. Photoelectric, piezoelectric and temperature transducers. Detection of physiological events by impedance measurements. Radiology and x-ray techniques. Isotopes and nuclear medicine. Lasers in medicine. Field trips required.

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

Basics of materials science. Biocompatibility of metals, polymers and ceramics. Internal and external prosthetic materials.