961. *Selected Topics in Biochemistry*

Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits. 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. *Doctoral Dissertation Research*

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

BIOLOGICAL SCIENCE B S

College of Natural Science

The content of courses 400, 405, 420, 440, 450 and 451, as well as the research and problems courses 499, 800 and 999, may vary from term to term. Brochures giving detailed information about individual courses are available in the Science and Mathematics Teaching Center and the Office of the Assistant Dean for Lifelong Education. 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.

For prerequisite purposes, the introductory biology sequence in Lyman Briggs School, LBS 140, LBS 141, LBS 242, may be used instead of this sequence.

210. *General Biology*

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

Concepts relating to basic attributes and diversity of living things.

211. *General Biology*

Fall, Winter. 4(4-2) CEM 130 or high school chemistry. Not open to students with credit in LBS 242.

The structure and behavior of cells and their subunits, interactions of tissues, genetics, and the development, history and relations of organisms.

212. *General Biology*

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

Continuation of B S 211.

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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.

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.

422. *Terrestrial Field Biology for Teachers*

Summer. 3 credits. A course in biology or approval of department. Given at W. K. Kellogg Biological Station.

Ecology of forest, field and prairie ecosystems. Emphasis on natural history and field identification of Michigan's common land plants and animals. Biological collection techniques and reference materials.

425. *Aquatic Field Biology for Teachers*

Summer of even-numbered years. 3 credits. A course in biology or approval of department. Given at W. K. Kellogg Biological Station.

Investigation of Michigan's aquatic and wetland ecosystems with special emphasis on field identification of key plant and animal species. Ecological concepts, reference materials, and biological collection techniques.

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 studies in and outside the classroom. Designed for intermediate and secondary inservice teachers.

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. Variable credit. 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 422 or B S 425 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.

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.

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.

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.

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.

BIOPHYSICS BPY

College of Human Medicine
College of Natural Science
College of Osteopathic Medicine

400H. Honors Work in Biophysics

Fall, Winter, Spring, Summer. 3 to 6 credits. May reenroll 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; 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.

IDC. Biological 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. 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. 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.

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, 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

(825.) 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.