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

940. Seminar in Audiology and Speech Sciences
Spring, Summer. 4(2-0) May re-enroll for maximum of 16 credits.

990. Special Problems in Audiology and Speech Sciences
Fall, Winter, Spring, Summer. 1 to 6 credits.

Special projects in audiology and speech sciences.

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

BIOCHEMISTRY BCH

College of Agriculture and Natural Resources
College of Human Medicine
College of Natural Science
College of Osteopathic Medicine

200. Introduction to Biochemistry
Winter, Summer. 5(5-0) Credit may not be earned in both 200 and 401. General chemistry; one term organic chemistry. Not acceptable for a B.S. degree in biochemistry.

Survey of biochemistry emphasizing the major metabolic activities of living organisms.

363. Clinical Biochemistry
Spring. 3(2-3) 401; CEM 162. Primarily for Medical Technology majors; not acceptable for a B.S. degree in biochemistry.

Quantitative clinical laboratory methods.

400H. Honors Work
Fall, Winter, Spring. Variable credit. Approval of department.

Assigned reading and experimentation.

401. Basic Biochemistry
Fall, Summer. 5(5-0) Credit may not be earned in both 200 and 401. One year organic chemistry or CEM 242; not open to biochemistry majors.

A one-term presentation of biochemistry emphasizing structure and function of major biomolecules, metabolism and regulation. Examples used for illustrative purposes will emphasize the mammalian organism.

404. General Biochemistry Laboratory
Fall, Winter, Spring. 3(1-6) Analytical chemistry; 401 or 451.

Experimental aspects of biochemistry.

451. Biochemistry
Fall. 4(4-0) Credit may not be earned in both 401 and 451. One year organic chemistry or CEM 242.

A comprehensive presentation of biochemistry designed for undergraduate biochemistry majors, students of medicine, and other students desiring an intensive treatment of the subject.

452. Biochemistry
Winter. 4(4-0) 451.

Continuation of 451.

499. Research
Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 12 credits. Approval of department.

A course designed to give qualified undergraduate students an opportunity to gain experience in biochemical research.

501. Medical Biochemistry
Fall, Winter. 3(3-0) One year organic chemistry, or CEM 242. Fall: Osteopathic Medicine students; Winter: Human Medicine students; Others approval of department.

Basic biochemical principles and terminology of importance in medical biology.

801. Biochemical Research Methods
Fall. 1(0-3) One year of organic chemistry or CEM 242; BCH 451 or 811, or concurrently.

Discussions and demonstrations of selected experimental techniques of wide application in biochemistry.

804. Advanced Biochemistry Laboratory
Fall. 3(1-6) Analytical chemistry; 801 and 811, or concurrently; biochemistry majors or approval of department.

Experiments to be selected from a representative group illustrating modern biochemical research.

805. Advanced Biochemistry Laboratory
Winter. 3(1-6) 804; 812 concurrently.

Experiments to be selected from a representative group illustrating modern biochemical research.

806. Advanced Biochemistry Laboratory
Spring. 3(1-6) 805; 813 concurrently.

Special experiments in advanced laboratory techniques.

811. Advanced Biochemistry
Fall. 4(4-0) One year of organic chemistry, one year of physical chemistry, one term of introductory biochemistry, 801 taken previously or concurrently, or approval of department. Limited to graduate students in biochemistry or other students needing a similar professional preparation.

The structure and function of biomolecules, energy transformations and chemical reactions in living cells, regulation of cell reactions, and the replication of living organisms.

812. Advanced Biochemistry
Winter. 4(4-0) 811

Continuation of 811.

813. Advanced Biochemistry
Spring. 4(4-0) 812.

Continuation of 812.

855. Special Problems
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 12 credits. Approval of department.

Consideration of current problems.

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

952. Plant Physiology and Biochemistry I
Winter of odd-numbered years. 3(3-0) Approval of department. Interdepartmental with the Botany and Plant Pathology Department.

Selected topics concerning photosynthesis and related processes.

955. Plant Physiology and Biochemistry II
Winter of even-numbered years. 3(3-0) Approval of department. Interdepartmental with the Botany and Plant Pathology Department.

Metabolic pathways of unique significance to plants.

960. Selected Topics in Biochemistry
Fall, Winter, Spring, Summer. 1(1-0) or 2(2-0) May re-enroll for a maximum of 6 credits if a different topic is 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(1-0) or 2(2-0) May re-enroll for a maximum of 6 credits if a different topic is 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. 0 or 1(1-0)

Presentation and discussion of reports by graduate students on biochemical topics of current interest.

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

BIOLOGICAL SCIENCE B S

College of Natural Science

200. Studies in Contemporary Biological Science
Spring. 4(3-3) 12 credits in a Department of Natural Science sequence.

Biological topics impacting contemporary, American and world society are studied in the context of major biological themes and individual laboratory investigation of a self chosen topic.

202. Biological Science for Elementary Teachers
Fall, Winter, Spring. 4(3-3)

Fundamental principles of biology which provide background appropriate for preparation for elementary education teaching.

*210. General Biology
Fall, Spring. 4(4-2)

Concepts relating to basic attributes and diversity of living things.

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

*211. General Biology

Fall, Winter. 4(4-2) CEM 130 or high school chemistry. Not open to students with credit in LBC 140.

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 LBC 141.

Continuation of 211.

400. Biological Science for Teachers

Fall, Winter, Spring, Summer. 3 to 4 credits. May re-enroll 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.

410. Biotic and Environmental Relationships

Summer. 6 credits. 212 or approval of department. Given at W. K. Kellogg Biological Station.

Interrelationship of the terrestrial biota with its environment. Factors determining distribution and abundance. Interaction of organisms.

413. Freshwater Ecology

Summer. 6 credits. 212 or approval of department. Given at W. K. Kellogg Biological Station.

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.

420. Seminar in Recent Advances in Biological Science

Fall, Winter, Spring, Summer. 3(3-0) 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(3-0) 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.

499. Research

Fall, Winter, Spring. 2 to 4 credits. May re-enroll 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.

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.

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

BIOMECHANICS* BME

College of Osteopathic Medicine

411. Electric Theory of Nerves

Winter. 4(4-0) MTH 215, 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.

424. Materials in Biomedical Engineering

Winter. 3(3-0) PSL 331 or approval of department.

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

431 Biological Transport Mechanisms

Spring. 4(4-0) MTH 215, PSL 331.

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.

BIOPHYSICS BPY

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

402. Introduction to Biophysics

Spring. 5(5-0) PHY 259, MTH 113, 1 year organic chemistry and 1 year biology.

Salient features of biophysics, methods and principles. Structure and organization of biological materials, bioenergetics, radiation biophysics, bioelectric phenomena, biomechanics and psychophysics.

499. Independent Study

Fall, Winter, Spring, Summer. 1 to 5 credits. May re-enroll for a maximum of 15 credits. Approval of department.

Undergraduate research under one of our faculty.

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.

821. Molecular Biophysics

Fall of odd-numbered years. 5(3-4) 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.

*Established July 1, 1972.

822. Charge Transport and Solid State Processes

Winter of even-numbered years. 4(3-2) Approval of department.

Fundamental electrical properties, dielectric properties and photoconductivity effects and their relevance to the biological functioning of these molecules.

823. Radiation Biophysics

Spring of even-numbered years. 3(2-2) Approval of department.

Effects of various types of ionizing radiation and ultraviolet and visible light on proteins, nucleic acids, viruses and plant and animal cells. Damage and repair mechanisms at the molecular level.

824. Membrane Biophysics

Fall of even-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 bimolecular lipid membrane (BLM) techniques.

825. Basic Neurobiology

Winter of odd-numbered years. 4(3-2) Approval of department.

A comparative survey of fundamental principles of nervous organization will be undertaken in lectures. Laboratory will emphasize examination of prepared neuroanatomical material and a demonstration of important neurophysiological phenomena.

826. Cellular Biophysics

Spring. 4(3-2) 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 re-enroll 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.

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.

885. Vertebrate Neural Systems I

Fall of odd-numbered years. 5(3-4) Approval of departments; ANT 815 and BPY 825 recommended. Interdepartmental with the Zoology, Physiology and Psychology Departments and administered by the Psychology Department.

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 Psychology, Physiology and Zoology Departments and administered by the Zoology Department.

Continuation of 885. Major component systems of vertebrate brains, their evolution, ontogeny,