

854. Psychophysics and Theories of Audition
Fall. 4(4-0) Approval of instructor.
Nature of auditory stimuli and the results of psychophysical experimentation in audition.

875A. Clinical Practicum in Speech and Language Pathology
Fall, Winter, Spring, Summer. 1 credit. May reenroll for a maximum of 8 credits. ASC 474 and satisfactory completion of a speech, language, and hearing screening/evaluation at the MSU Speech and Hearing Clinic.
Directed diagnostic, therapeutic, and prognostic experience in speech and language pathology.

875B. Clinical Practicum in Audiology
Fall, Winter, Spring, Summer. 1 credit. May reenroll for a maximum of 8 credits. ASC 454 and satisfactory completion of a speech, language, and hearing screening/evaluation at the MSU Speech and Hearing Clinic.
Directed diagnostic, therapeutic and prognostic experience in audiology in various clinical settings.

876. Communication Disorders: Neuroanatomy-Neurophysiology
Fall. 4(3-2) Approval of department.
Neuroanatomical and neurophysiological correlates of speech, language, and hearing.

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

940. Seminar in Audiology and Speech Sciences
Fall, Winter, Spring, Summer. 4(4-0) May reenroll for a 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. Doctoral Dissertation 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**

100. Lectures in Biochemistry
Spring. 1(1-0) Biochemistry majors; others by approval of department.
An introduction to modern biochemistry using an historical approach.

200. Introduction to Biochemistry
Winter, Summer. 5(5-0) Credit may not be earned in both BCH 200 and BCH 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.

400II. Honors Work
Fall, Winter, Spring. 1 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department.
Assigned reading and experimentation.

401. Basic Biochemistry
Fall, Spring. 5(5-0) Credit may not be earned in both BCH 200 and BCH 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
Winter. 3(1-6) Analytical chemistry; BCH 401 or BCH 451.
Experimental aspects of biochemistry.

405. Biochemistry Laboratory
Fall, Spring. 3(0-9) BCH 453 or concurrently; BCH 404; undergraduate biochemistry majors or approval of department.
Advanced undergraduate laboratory to illustrate modern biochemical methods and techniques.

412. Clinical Biochemistry
Winter. 3(2-3) BCH 401; CEM 162. Medical Technology majors. Not acceptable for a B.S. degree in biochemistry. Others: approval of department.
Quantitative clinical laboratory methods.

451. Biochemistry I
Fall. 3(3-0) Credit may not be earned in both BCH 401 and BCH 451. One year organic chemistry or CEM 242.
A comprehensive survey of biochemistry, with emphasis on protein structure and function, enzymology, and bioenergetics.

452. Biochemistry II
Winter. 3(3-0) BCH 451.
Continuation of BCH 451, with emphasis on intermediary metabolism.

453. Biochemistry III
Spring. 3(3-0) BCH 452.
Continuation of BCH 452, with emphasis on the replication and expression of genetic information.

460. Principles of Biochemical Methods
Spring. 3(3-0) One year physical chemistry or CEM 384 concurrently; BCH 453 or concurrently, or BCH 401.
Principles of biochemical methods with emphasis on electrophoresis, chromatography, immunological techniques, sedimentation, diffusion, viscosity, radiochemistry, and absorption and emission spectroscopy.

470. Biological Membranes
(IDC 470.) Spring. 3(3-0) BCH 401. Interdepartmental with the departments of Microbiology and Public Health, and Physiology. Administered by the Department of Physiology.
The chemistry, physics and mathematics of the permeability, energy transductions and surface functions of differentiated cell membranes and membranous organelles are compared. A brief discussion of theoretical and experimental models is included.

499. Research
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 12 credits. Undergraduates; approval of department.
Participation in research projects.

501. Medical Biochemistry
Fall. 3(3-0) Open only to students in the professional programs in the College of Human Medicine and the College of Osteopathic Medicine.
Basic biochemical principles and terminology of importance in medical biology.

502. Medical Biochemistry
Winter. 3(3-0) BCH 501 or approval of department.
A continuation of BCH 501.

503. Introduction to Medical Biology
Fall. 5(5-0) Admission to the College of Human Medicine. Interdepartmental with the departments of Microbiology and Public Health, Pharmacology and Toxicology, and Physiology. Administered by the Department of Microbiology and Public Health.
Principles of medical biology for medical students.

511. Medical Biochemistry I
Winter. 3(3-0) One year of organic chemistry. Open only to students in the professional programs in the College of Human Medicine and the College of Osteopathic Medicine.
Basic biochemical principles and terminology with emphasis on metabolism and function of biomolecules of importance in medical biology.

512. Medical Biochemistry II
Spring. 4(4-0) BCH 511.
Basic biochemical principles and processes pertinent to specific areas of human pathophysiology.

811. Nucleic Acid Structure and Function
Fall. 4(4-0) One year of organic chemistry, one year of physical chemistry, one term of introductory biochemistry, or approval of department. Limited to graduate students in biochemistry or other students needing a similar professional preparation.
Organization and expression of eucaryotic genes including gene structure, regulation of gene expression, replication, and recombination. Molecular cloning, DNA sequencing and gene transfer techniques.

812. Protein Structure and Function
Winter. 4(4-0) BCH 811.
Protein structure and function relationships, macromolecule-ligand interactions, enzyme kinetics and principles of methods used in enzymology.

813. Metabolism and Its Regulation
Spring. 4(4-0) BCH 812.
Molecular basis of metabolic regulation, compartmentation and interrelationships of metabolic cycles involving carbohydrates, proteins and lipids.

821. Biochemical Mechanisms and Structure
Fall. 4(4-0) One year of organic chemistry; introductory biochemistry; and physical chemistry or concurrently.
Structures, methods of structural analysis, synthesis, and reaction mechanisms of biological substances including proteins, carbohydrates, lipids, porphyrins, phosphate esters, enzymes and coenzymes.

Descriptions — Biochemistry

of

Courses

831. *Physiological Biochemistry I*

Winter. 3(3-0) BCH 401.

Physiological biochemistry, with emphasis on metabolic interpretation of normal and altered physiological states of the human organism and appropriate animal models.

832. *Physiological Biochemistry II*

Spring. 3(3-0) BCH 831.

Continuation of BCH 831.

855. *Special Problems*

Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 12 credits. Approval of department.

Consideration of current problems.

856. *Plant Genetics and Molecular Biology*

Spring of even-numbered years. 3(3-0)

Approval of department and a course in introductory genetics. Interdepartmental with Genetics and the Department of Botany and Plant Pathology. Administered by the Department of Botany and Plant Pathology.

Recent advances in genetics and molecular biology of higher plants.

864. *Plant Biochemistry*

Spring. 4(4-0) BCH 401, BOT 301 or approval of department. Interdepartmental with the Department of Botany and Plant Pathology.

Metabolism of nitrogen-compounds, carbohydrates, and lipids unique to plants' cell organelles; photosynthesis; photorespiration; dark respiration; cell walls; lectins; nitrogen cycle including nitrogen fixation; sulfur cycle.

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. 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. 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.

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, Summer. 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.

211. *General Biology*

Fall, Winter, Summer. 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, Summer. 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. 1 to 6 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 4 credits. May reenroll for a maximum of 8 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.

418. *Field Biology for Teachers*

Fall, Winter, Spring, Summer. 4 credits. Biology course or approval of department.

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*

Fall, Winter, Spring, 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.

Emphasis on environmental understanding. Development of educational materials through team research and testing. Trials of materials with elementary, middle, secondary school or college students.

899. *Master's Thesis Research*

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

BIOMECHANICS BIM

College of Osteopathic Medicine

500. *Basic Concepts in Biomechanics*

Winter. 2(2-0) Admission to a college of medicine or approval of department. Interdepartmental with the College of Osteopathic Medicine.

Basic concepts of biomechanics and their relationship to functional anatomy and osteopathic manipulative therapy.