

**G. Language Intervention: Early Stages**  
Spring. 4(4-0) Approval of department.

Language intervention for those children functioning at or below a four-year-old level in their language behavior; mental retardation, autism, and other developmental delays associated with severe language impairments.

**H. Language Intervention: Later Stages**  
Summer. 4(4-0) Approval of department.

Treatment of developmental language delays and disorders with emphasis upon children functioning at or above the four-year-old level in language behavior; preadolescent and adolescent language disorders are included.

**842. Augmentative and Alternative Communication Systems**  
Summer. 4(4-0) Approval of department.

Historical perspective and philosophy of augmentative/alternative communication systems. Aided and unaided nonspeech communication systems. Assessment, selection, and intervention procedures.

**843. Transfer and Maintenance of Speech Behaviors**  
Winter. 4(4-0)

Various clinical procedures; assisting others in transferring and maintaining these behaviors outside the clinical environment.

**853. Speech Perception: Theory and Measurement**  
Spring. 4(4-0) Approval of department.

Evaluation and analysis of various theories of speech perception and their implications for speech and language pathologists, audiologists, and speech and hearing scientists.

**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.

**874. Speech and Hearing Problems in Public Schools**  
Summer. 4(3-0) May reenroll for a maximum of 16 credits.

Graduate seminar in speech and hearing involving problems that arise in relation to speech and hearing therapy in the public schools.

**875A. Clinical Practicum in Speech and Language Pathology**  
Fall, Winter, Spring, Summer. 1 credit. ASC 474. May reenroll for a maximum of 8 credits.

Directed diagnostic, therapeutic, and prognostic experience in speech and language pathology.

**875B. Clinical Practicum in Audiology**  
Fall, Winter, Spring, Summer. 1 credit. ASC 454. May reenroll for a maximum of 8 credits.

Directed diagnostic, therapeutic and prognostic experience in audiology in various clinical settings.

**876. Communication Disorders: Neuroanatomy-Neurophysiology**  
Fall. 4(3-1) Approval of department.

Neuroanatomical and neurophysiological correlates of speech, language, and hearing.

**880A. Algorithms for Speech and Hearing Sciences**  
Fall. 4(4-0)

A discussion of useful algorithms applicable to quantification of phenomena related to audiology and speech sciences.

**880B. Acoustic Phonetics**  
Winter. 4(2-2) ASC 880A or approval of department.

An analytic study of the acoustics of speech.

**880C. Instruments and Electronics for Audiology and Speech Sciences**  
Spring. 4(3-3) ASC 880B or approval of department.

A discussion of the electronic principles and instruments necessary to measure parameters related to hearing and speech processes.

**880D. Experimental Phonetics**  
Summer. 4(4-0) ASC 880C or approval of department.

Critical review of the literature in experimental phonetics. Selected papers on acoustic and physiological phonetics and related fields are presented in seminar fashion.

**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**

**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.

**400H. Honors Work**  
Fall, Winter, Spring. Variable credit. 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**  
(363.) Winter, Summer. 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**  
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 the properties and functions of biomolecules, energy-yielding and energy-requiring processes, and the transfer of genetic information.

**452. Biochemistry**  
Winter. 3(3-0) BCH 451.  
Continuation of BCH 451.

**453. Biochemistry**  
Spring. 3(3-0) BCH 452.  
Continuation of BCH 452.

**499. Research**  
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll 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. 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**  
Fall. 3(3-0) BCH 501 or approval of department.  
A continuation of BCH 501.

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

## Descriptions - Biochemistry

### of Courses

#### 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.

#### 801. Biochemical Research Methods

Fall. 1(1-1) or 2(2-1) May reenroll for a maximum of 2 credits. One year of organic chemistry or CEM 242; BCH 451 or BCH 811, or concurrently.

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

#### 811. Advanced Biochemistry

Fall. 4(4-0) One year of organic chemistry, one year of physical chemistry, one term of introductory biochemistry, BCH 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) BCH 811.

Continuation of BCH 811.

#### 813. Advanced Biochemistry

Spring. 4(4-0) BCH 812.

Continuation of BCH 812.

#### 821. Biochemical Mechanism and Structure I

Fall. 3(3-0) BCH 401, one year of organic chemistry and physical chemistry or concurrently; or approval of department.

Structures, methods of structural analysis, synthesis, and reaction mechanisms of biological substances including proteins, carbohydrates, lipids, porphyrins, phosphate esters, enzymes and coenzymes.

#### 822. Biochemical Mechanism and Structure II

Winter. 2(2-0) BCH 821 or approval of department.

Continuation of BCH 821.

#### 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. Variable credit. May reenroll for a maximum of 12 credits. Approval of department.

Consideration of current problems.

#### 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, 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. 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.

#### 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.

#### 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.

## BIOLOGICAL SCIENCE B S

### College of Natural Science

The content of courses 400, 405, 420, and 440, 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 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.