

**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**  
Spring, Summer. 4(2-0) 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, Spring. 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.

**IDC. Biological Membranes**  
For course description, see Interdisciplinary Courses.

**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**  
Summer. 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.

**511. Medical Biochemistry I**  
Winter. 4(4-0) 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. 3(3-0) BCH 511.  
Basic biochemical principles and processes pertinent to specific areas of human pathophysiology.

**801. Biochemical Research Methods**  
Fall. 1(0-3) 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.

**804. Advanced Biochemistry Laboratory**  
Fall. 1 to 3 credits. May reenroll for a maximum of 6 credits. Analytical chemistry; BCH 801 and BCH 811, or concurrently; biochemistry majors or approval of department.  
Experiments to be selected from a representative group illustrating modern biochemical research.

**806. Advanced Biochemistry Laboratory**  
Spring. 3(0-8) BCH 805; BCH 813 or concurrently; biochemistry majors or approval of department.  
Special experiments in advanced laboratory techniques.  
Approved through Spring 1981.

**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. 2(2-0) BCH 401, one year of organic chemistry and physical chemistry or concurrently; or approval of department.  
Structures, methods of structural analysis, synthesis, and reactions mechanisms of biological substances including protein, 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.

## Descriptions - BIOCHEMISTRY

of

### Courses

#### 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.

#### 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 6 credits. 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 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 College, LBC 140, LBC 141, LBC 242, may be used instead of this sequence.

#### 210. General Biology

Fall, Spring, 4(4-2) Not open to students with credit in LBC 141.  
Concepts relating to basic attributes and diversity of living things.

#### 211. General Biology

Fall, Winter, Spring, 4(4-2) CEM 130 or high school chemistry. Not open to students with credit in LBC 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 LBC 140.  
Continuation of BS 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.  
Factors determining distribution and abundance. Interrelationship of plants, animals, and environment. Extensive field investigations of several types of terrestrial communities in light of current theory.

#### 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.

#### 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.

#### 450. Outdoor Environmental Studies

Summer. 3 credits. May reenroll for a maximum of 9 credits when new topics are given. Teaching experience or approval of department. B S 451 must be taken same summer. Given at W. K. Kellogg Biological Station.  
Emphasis on environmental understanding. Planning and developing interdisciplinary program for elementary and intermediate children.

#### 451. Outdoor Environmental Studies: Laboratory

Summer. 2 to 5 credits. May reenroll for a maximum of 15 credits when new topics are given. Teaching experience, B S 450. Given at W. K. Kellogg Biological Station.  
Testing instructional materials and strategies developed in B S 450 with elementary and middle school children in an outdoor environmental education program.

#### 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.

#### 999. Doctoral Dissertation 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.