83X.  Augmentative Communication  
Fall. 3(3-0) R: Open only to graduate students in Audiology and Speech Sciences. History and philosophy of augmentative communication. Assessment, system selection, and intervention considerations for aided and unaided systems. Topics include synthesized voice output and micro-processor-based systems.

833. Auditory Psychophysics  
Spring. 3(3-0) P: ASC 803 or concurrently. R: Open only to graduate students in Audiology and Speech Sciences. Psychophysical theory and methods as applied to the study of hearing phenomena.

843A. Hearing Assessment  
Fall. 3(3-0) R: Open only to graduate students in Audiology and Speech Sciences. Clinical evaluation of hearing. Pure tone and speech audiometry. Immittance testing.

843B. Differential Diagnostic Audiology  
Spring. 3(3-0) P: ASC 843A. R: Open only to graduate students in Audiology and Speech Sciences. Tests of peripheral and central auditory function for differential diagnosis of hearing impairment.

843C. Hearing Amplification and Rehabilitation  
Spring. 3(3-0) P: ASC 843A. R: Open only to graduate students in Audiology and Speech Sciences. Clinical management of the hearing impaired. Amplification and other forms of aural rehabilitation.

843D. Electrophysiologic Assessment  
Fall. 3(3-0) P: ASC 813 or concurrently. R: Open only to graduate students in Audiology and Speech Sciences. Theory and methods of electrophysiologic testing of the auditory and vestibular systems.

843E. Special Populations in Audiology  
Summer. 3(3-0) P: ASC 843C. R: Open only to graduate students in Audiology and Speech Sciences. Audiologic considerations and evalutionary procedures for infant, pediatric, mentally-impaired, multiply-handicapped, and geriatric populations.

843F. Hearing Conservation  
Fall. 3(3-0) P: ASC 823, ASC 842A, or approval of department. R: Open only to graduate students in Audiology and Speech Sciences. Hearing conservation programs in occupational, environmental, medical, and social sciences.

890. Independent Study  
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences. Approval of department. Individualized study under faculty direction.

894A. Clinical Practicum in Speech-Language Pathology  
Fall, Spring, Summer. 1 credit. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences. Approval of department. Supervised clinical experience in the management of clients with speech-language disorders.

894B. Clinical Practicum in Audiology  
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences. Approval of department. Supervised clinical experience in the management of clients with hearing disorders.

999. Doctoral Dissertation Research  
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Total credits in BCH 490 and BCH 499 may not exceed 8. Approval of department. Participation in laboratory or library research projects.

BIOCHEMISTRY  
BCH

Department of Biochemistry
College of Human Medicine
College of Natural Science
College of Osteopathic Medicine

100. Current Issues in Biochemistry  
Spring. 1(1-0) R: Open only to freshmen or sophomores. Not open to students with credit in BCH 101. Contemporary biochemistry: its impact on environmental, medical, and social sciences.

101. Frontiers in Biochemistry  
Fall. 1(1-0) R: Open only to freshmen or sophomores. Not open to students with credit in BCH 100. Description of topics in biochemistry research.

200. Introduction to Biochemistry  
Fall. 4(4-0) P: (CEM 143) Not open to students with credit in BCH 401 or BCH 461. Basic structures of major classes of biologically important molecules and metabolic activities of major importance in living organisms.

401. Basic Biochemistry  
Fall. 4(4-0) P: (CEM 252 or CEM 352) R: Not open to students in the Biochemistry or in the Biochemistry/Biotechnology major. Not open to students with credit in BCH 200 or BCH 461. Structure and function of major biomolecules, metabolism, and regulation. Examples emphasize the mammalian organism.

461. Biochemistry I  
Fall. 3(4-0) P: (CEM 252 or CEM 352) and (BS 110) and (MTH 124 or MTH 132 or MTH 152H or LBS 118) and (BS 111L or LBS 145 or LBS 159H or LBS 159H) Not open to students with credit in BCH 200 or BCH 401. Protein structure and function, enzymology, bioenergetics, and intermediary metabolism.

462. Biochemistry II  
Spring. 3(4-0) P: (BCH 461) Continuation of BCH 461 with emphasis on metabolic regulation and nucleic acid structure, replication and protein synthesis.

471. Biochemistry Laboratory (W)  
Spring. 3(0-9) P: (BCH 401 or BCH 461) and (BS 110 and (CEM 262 and CEM 356 and CSE 101) and (MTH 124 or MTH 132 or MTH 152H or LBS 118) and (BS 111L or LBS 145 or LBS 159H or LBS 159H) and completion of Tier I writing requirement.

Biochemical methods and principles used in the study of enzymes (proteins), carbohydrates, lipids, and cell organelles.

472. Biochemistry Laboratory  
Fall. 3(0-9) P: (BCH 462) and (CEM 262) R: Open only to Biochemistry or Biochemistry/Biotechnology majors or approval of department. Methods of molecular biology and the underlying principles on which these methods are based.

490. Biochemistry Research  
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Total credits in BCH 490 and BCH 499 may not exceed 8. Approval of department.
495. Undergraduate Seminar
Spring, 2(2-0) P: (BCH 462 or concurrently) R: Open only to students in the Biochemistry or Biochemistry/Biotechnology majors. Extension and synthesis of concepts of biochemistry. Relationships to societal issues.

499. Senior Thesis
Fall, Spring, Summer. 1 to 8 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Open only to students in the Biochemistry or the Biochemistry/Biotechnology major. Total credits in BCH 490 and BCH 499 may not exceed 8. Approval of department. Laboratory research culminating in a thesis.

521. Medical Biochemistry
Fall. 3(5-0) R: Graduate-professional students in colleges of Human Medicine and Osteopathic Medicine. Basic biochemical principles and terminology; metabolism and function of biomolecules of importance in medical biology and processes pertinent to human pathophysiology.

523. Genetics for Medical Practice
Summer. 1(1-0) Interdepartmental with Pediatrics and Human Development. Administered by Pediatrics and Human Development. R: Graduate-professional students in colleges of Human Medicine and Osteopathic Medicine. Basic principles of genetics for medical students.

580. Protein Structure and Function
Fall. 3(3-0) P: BCH 462, CEM 383. Not open to students with credit in BCH 897A or BCH 897A. Organization of genes. Regulation of gene expression, replication, and recombination.

601. Molecular Biology
Fall. 3(3-0) P: BCH 462, CEM 383. Not open to students with credit in BCH 897A or BCH 897A. Organization of genes. Regulation of gene expression, replication, and recombination.

829. Methods of Macromolecular Analysis and Synthesis
Fall. 3(2-0) P: (BCH 462 or concurrently) Techniques of isolation and characterization of macromolecules. Computer use in structure-function analysis of macromolecules.

831. Physiological Biochemistry
Spring of even years. 4(4-0) P: BCH 401 or BCH 462. Mammalian physiological biochemistry. Metabolic interpretation of normal and altered physiological states of humans and other mammals.

855. Special Problems
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Approval of department. Laboratory or library research on special problems in biochemistry.

856. Plant Molecular Biology
Spring. 3(3-0) Interdepartmental with Botany and Plant Pathology. Administered by Botany and Plant Pathology. P: ZOL 441. Recent advances in genetics and molecular biology of higher plants.

978. Seminar in Biochemistry
Fall, Spring. 1(1-0) A student may earn a maximum of 8 credits in all enrollments for this course. R: Open only to graduate students in Biochemistry. Seminars on biochemistry research mainly with visiting scientists.

999. Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to doctoral students in Biochemistry.

**BIOLGICAL SCIENCE—BS**

**College of Natural Science**

110. Organisms and Populations
Fall, Spring. 4(3-3) Not open to students with credit in LBS 144 or LBS 145H. Biological diversity and organismal biology. Principles of evolution, population biology, and community structure.

111. Cells and Molecules
Fall, Spring, Summer. 3(3-0) P: CEM 141 or CEM 151. Not open to students with credit in LBS 145. Cell structure and function; macromolecular synthesis; energy metabolism; molecular aspects of development; principles of genetics.

111L. Cell and Molecular Biology Laboratory
Fall, Spring, Summer. 2(1-3) Interdepartmental with Microbiology; Botany and Plant Pathology; and Zoology. P: BS 111 or concurrently Principles and applications of common techniques used in cell and molecular biology.

148H. Honors Organismal Biology
Fall, Spring. 3(3-0) Interdepartmental with Lyman Briggs School. Administered by Lyman Briggs School. R: Honors College student or approval of school. Not open to students with credit in BS 110 or LBS 144. Diversity and basic properties of organisms, with emphasis on genetic principles, ecological interactions, and the evolutionary process. Historical approach to knowledge discovery.

149H. Honors Cell and Molecular Biology
Spring. 3(3-0) Interdepartmental with Lyman Briggs School. Administered by Lyman Briggs School. R: Honors College student or approval of school. Not open to students with credit in BS 111 or LBS 145. Exploration of the physicochemical and molecular organization of cells as the unifying framework for genetics, evolution, and the social relevance of biology.