823X. 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 evaluative procedures for infant, pediatric, mentally-impaired, multiply-handicapped, and geriatric populations.

843F. Hearing Conservation
Fall. 3(3-0) P: ASC 833, ASC 843A, or approval of department. R: Open only to graduate students in Audiology and Speech Sciences.
Hearing conservation programs in occupational, educational, and community settings. The role of the audiologist.

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 M.A. 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 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 hearing disorders.

899. Master's Thesis Research
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.

914A. Speech Production and Perception I
Fall of even years. 4(3-2) P: ASC 803 or concurrently. R: Open only to graduate students in Audiology and Speech Sciences.
Classroom and laboratory study of issues regarding speech production and perception.

914B. Speech Production and Perception II
Spring of odd years. 4(3-2) P: ASC 914A. R: Open only to graduate students in Audiology and Speech Sciences.
Further classroom and laboratory study of issues regarding speech production and perception.

990. Independent Study
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 16 credits in all enrollments for this course. R: Open only to Ph.D. students. Approval of department.
Individualized study under faculty direction.

991. Special Topics in Communication Sciences and Disorders
Fall, Spring, Summer. 3(3-0) A student may earn a maximum of 12 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences.
Topics vary.

992. Seminar in Communication Sciences and Disorders
Fall, Spring, Summer. 3(3-0) A student may earn a maximum of 12 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences.
Topics vary.

994. Research Practicum in Communication Sciences and Disorders
Fall, Spring, Summer. 1 credit. A student may earn a maximum of 12 credits in all enrollments for this course. P: ASC 803 or concurrently. R: Approval of department.
Individual research under faculty supervision.

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 Ph.D. students in Audiology and Speech Sciences. Approval of department.

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, Spring. 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 158H 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 158H 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.
Participation in laboratory or library research projects.

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. 5(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.

801. 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.

802. Metabolic Regulation and Signal Transduction
Spring. 3(3-0) P: BCH 801.
Molecular basis for metabolic regulation. Molecular signalling mechanisms and mechanisms for allosteric and covalent protein modifications.

803. Protein Structure and Function
Fall. 2(2-0) P: BCH 462, CEM 383
Protein structure and relationship of function to structure. Applications of kinetic methods to elucidation of enzyme mechanisms and regulation.

804. Biochemical Mechanisms and Structure
Spring. 3(3-0) P: (BCH 462 or concurrently and CEM 383 or concurrently)
Structures, methods of structural analysis, synthesis, and reaction mechanisms of biological substances including proteins, carbohydrates, lipids, porphyrins, phosphate esters, enzymes, and coenzymes.

825. Cell Structure and Function
Spring. 3(3-0) Interdepartmental with Microbiology; and Physiology. P: BCH 401 or BCH 461.
Molecular basis of structure and function. Cell properties: reproduction, dynamic organization, integration, programmed and integrative information transfer. Original investigations in all five kingdoms.

829. Methods of Macromolecular Analysis and Synthesis
Fall. 2(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 341.
Recent advances in genetics and molecular biology of higher plants.

864. Plant Biochemistry
Spring. 3(3-0) Interdepartmental with Botany and Plant Pathology. P: BCH 401 or BCH 462.
Biochemistry unique to photosynthetic organisms. Photosynthetic and respiratory electron transport, nitrogen fixation, carbon dioxide fixation, lipid metabolism, carbon partitioning, cell walls, biosynthesis of plant hormones.

888. Laboratory Rotation
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Open only to graduate students in Biochemistry.
Participation in research laboratories to learn experimental techniques and approaches, broaden research experience, and assess research interests prior to selecting a thesis or dissertation adviser.

899. Master's Thesis Research
Fall, Spring, Summer. 1 to 12 credits. A student may earn a maximum of 24 credits in all enrollments for this course. R: Open only to master's students in Biochemistry.

960. Selected Topics in Biochemistry I
Fall, Spring. 1 to 2 credits. A student may earn a maximum of 7 credits in all enrollments for this course. R: Open only to graduate students in Biochemistry or approval of department.
Contemporary biochemical research topics in such areas as biochemical genetics, biochemistry of development, biochemical evolution, complex proteins, or lipid metabolism.

961. Selected Topics in Biochemistry II
Fall, Spring. 1 to 3 credits. A student may earn a maximum of 7 credits in all enrollments for this course. R: Open only to graduate students in the Department of Biochemistry.
Contemporary biochemical research topics in such areas as bioenergetics, bioinstrumentation, complex carbohydrates, mass spectrometry, biomolecular spectroscopy or computer-based modeling and analysis of DNA and protein sequences and structures.

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.

BIOLOGICAL 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 148H.
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. 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. P: (CEM 141 or concurrently or CEM 151 or concurrently or CEM 181H or concurrently or LBS 165 or concurrently) 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.