

**133. 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.

**143A. Hearing Assessment**  
Fall, 3(3-0)  
P: Open only to graduate students in Audiology and Speech Sciences.  
Clinical evaluation of hearing. Pure tone and speech audiometry. Immittance testing.

**143B. 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.

**143C. 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.

**143D. 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.

**143E. 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.

**143F. 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.

**143G. 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.

**143H. 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.

**143I. 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.

**143J. 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-numbered 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-numbered 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.

**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. R: 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 with majors in Biochemistry. 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; MTH 120 or MTH 124 or MTH 132; BS 110, BS 111. R: 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 credits.  
P: BCH 401 or BCH 461; BS 110, BS 111; CEM 262; CEM 352; MTH 120 or MTH 124 or MTH 132 or LBS 118. R: Biochemistry majors or approval of department. Completion of Tier I writing requirement.  
Modern biochemical techniques used in the study of enzymes (proteins), carbohydrates, lipids, and cell organelles.

**472. Biochemistry Laboratory**  
Fall, 3 credits.  
P: BCH 462, CEM 262. R: Biochemistry majors or approval of department.  
Methods of molecular biology and the underlying principles on which these methods are based.

**490. Research**  
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.  
Participation in laboratory or library research projects.

**495. Undergraduate Seminar**  
Spring, 2(2-0)  
P: BCH 462 or concurrently. R: Open only to majors in Biochemistry.  
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 seniors. Total credits in BCH 490 and BCH 499 may not exceed 8. Approval of department.  
Laboratory research culminating in a thesis.

**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.

## Descriptions — Biochemistry of Courses

**521. Medical Biochemistry**  
Fall. 5(5-0)  
R: Graduate-professional students in colleges of Human 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 and Osteopathic Medicine.  
Basic principles of genetics for medical students.

**801. Molecular Biology**  
Fall. 3(3-0)  
P: BCH 462, CEM 383.  
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.

**821. Biochemical Mechanisms and Structure**  
Spring. 3(3-0)  
P: BCH 462, 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 Physiology and Microbiology.  
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.  
Techniques of isolation and characterization of macromolecules. Computer use in structure-function analysis of macromolecules.

**831. Physiological Biochemistry**  
Spring. 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 his course.  
? 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)  
R: Not open to students with credit in LBS 144.  
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. R: 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 credits. Interdepartmental with Lyman Briggs School. Administered by Lyman Briggs School.  
R: Honors College student or approval of department. 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 credits. Interdepartmental with Lyman Briggs School. Administered by Lyman Briggs School.  
P: CEM 141 or CEM 151 or CEM 181H or LBS 165 R: Honors College student or approval of department. Not open to students with credit in BS 111 or LBS 145.  
The physicochemical and molecular organization of cells as the unifying framework for genetics, evolution, and the social relevance of biology.

**158H. Honors Organismal Biology Laboratory**  
Fall. 2 credits. Interdepartmental with Lyman Briggs School. Administered by Lyman Briggs School.  
C: LBS 148H concurrently. R: Honors College student or approval of department. Not open to students with credit in BS 110 or LBS 144.  
Basic procedures used by organismal biologists, including experimental design and statistical methods. Development and implementation of research projects to test hypotheses in genetics, ecology, and evolution.

**159H. Honors Cell and Molecular Biology Laboratory**  
Spring. 2 credits. Interdepartmental with Lyman Briggs School. Administered by Lyman Briggs School.  
P: CEM 141 or CEM 151 or CEM 181H or LBS 165 C: LBS 149H concurrently. R: Honors College student or approval of department. Not open to students with credit in BS 111 or LBS 145.  
Basic techniques of cellular and molecular biology, including experimental design and hypothesis formulation. Development and implementation of research projects to test hypotheses in biochemistry, molecular biology, or genetics.

## BIOMEDICAL ENGINEERING BME College of Engineering

**424. Biomaterials and Biocompatibility**  
Spring of even-numbered years. 3(3-0) Interdepartmental with Materials Science and Mechanics.  
P: MSM 250, PSL 250.  
Materials science of human implants. Design requirements imposed by the body's milieu and the need to protect the body.