

**AUDIOLOGY AND SPEECH SCIENCES**

**999\*.** **Doctoral Dissertation Research**  
 Fall, Spring, Summer. 2 to 12 credits  
 in increments of 2 credits. May  
 reenroll for a maximum of 98 credits.  
 R: graduate level ASC  
 Faculty supervised dissertation research.  
 QA: ASC 999

**BIOCHEMISTRY BCH**

**100.** **Current Issues in Biochemistry**  
 Spring. 1(1 -0)  
 R: Freshmen only.  
 Contemporary biochemistry: its impact on environ-  
 mental, medical, and social sciences.  
 QA: BCH 100

**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 impor-  
 tant molecules and metabolic activities of major im-  
 portance in living organisms.  
 QP: CEM 143 QA: BCH 200

**401.** **Basic Biochemistry**  
 Fall, Spring. 4(4 -0)  
 P: CEM 252 or concurrently. 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, metabo-  
 lism, and regulation. Examples emphasize the mam-  
 malian organism.  
 QP: CEM 242 ORCEM 353 QA: BCH 401

**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, bioener-  
 getics, and intermediary metabolism.  
 QP: CEM 242 ORCEM 353 QA: BCH 452

**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.  
 QP: BCH 451 ANDBCH 452 QA: BCH 453

**471.** **Biochemistry Laboratory**  
 Spring. 2(0 -6)  
 P: CEM 262, BCH 461. R: Biochemistry  
 majors or approval of department.  
 Modern biochemical techniques used in the study of  
 enzymes (proteins), lipids, and cell organelles.  
 QP: BCH 451 ORBCH 401MTH 113 QA: BCH  
 404

**472.** **Biochemistry Laboratory**  
 Fall. 2(0 -6)  
 P: CEM 262, BCH 462. R: Biochemistry  
 majors or approval of department.  
 Methods of molecular biology and the underlying  
 principles on which these methods are based.  
 QP: BCH 453 QA: BCH 405

**490.** **Research**  
 Fall, Spring, Summer. 1 to 4 credits.  
 May reenroll for a maximum of 3  
 credits.  
 R: Approval of department.  
 Participation in laboratory or library research pro-  
 jects.

**499\*.** **Senior Thesis**  
 Fall, Spring, Summer. 1 to 8 credits.  
 May reenroll for a maximum of 8  
 credits.  
 P: Approval of department R: Senior  
 Cumulative total credits in BCH 490 & 499 may not  
 exceed 8  
 Laboratory research culminating in submission of a  
 thesis.  
 QA: BCH 499

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

**801\*.** **Molecular Biology and Protein  
 Structure**  
 Fall. 4(4 -0)  
 P: BCH 462, CEM 352, CEM 333  
 Organization of genes including recombination, regu-  
 lation of gene expression, replication, and recombina-  
 tion. Protein structure and relationship of function to  
 structure.  
 QP: BCH 453 CEM 353CEM 384 QA:  
 BCH811 BCH812

**802\*.** **Metabolic Regulation and  
 Molecular Endocrinology**  
 Spring. 4(4 -0)  
 P: BCH 801  
 Molecular basis for metabolic regulation, molecular  
 signalling mechanisms, and mechanisms for allosteric  
 and covalent protein modifications.  
 QP: BCH 453 CEM 353CEM 384BCH 811BCH 812  
 QA: BCH 813

**821\*.** **Biochemical Mechanisms and  
 Structure**  
 Spring. 3(3 -0)  
 P: BCH 462, CEM 353, 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.  
 QP: CEM 353 BCH 453CEM 384 QA: BCH  
 821

**825\*.** **Cell Structure and Function**  
 Spring. 3(3 -0) Interdepartmental  
 with the Department(s) of Physiology,  
 Microbiology and Public Health.  
 P: BCH 461 or BCH 401  
 Molecular basis of structure and function in cells.  
 Fundamental properties of cells: reproduction, dynam-  
 ic organization, integration, programmed and integra-  
 tive information transfer considered through original  
 investigations in all five kingdoms.  
 QP: BCH 451 ORBCH 401 QA: BCH 825

**829\*.** **Methods of Macromolecular  
 Analysis and Synthesis**  
 Fall. 2(2 -0)  
 P: BCH 462  
 Techniques of isolation and characterization of macro-  
 molecule. Uses of the computer in structure-function  
 analysis of macromolecule.  
 QP: BCH 453 QA: BCH 829

**831\*.** **Physiological Biochemistry**  
 Spring. 4(4 -0)  
 P: BCH 401 or BCH 462  
 Mammalian physiological biochemistry; with metabo-  
 lic interpretation of normal and altered physiological  
 states of humans and other mammals.  
 QP: BCH 401 QA: BCH 831 BCH 832

**855\*.** **Special Problems**  
 Fall, Spring, Summer. 1 to 4 credits.  
 May reenroll for a maximum of 8  
 credits.  
 R: graduate level  
 Laboratory or library research on special problems  
 in biochemistry.

**864\*.** **Plant Biochemistry**  
 Spring. 3(3 -0) Interdepartmental  
 with the Department(s) of 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 metabo-  
 lism, carbon partitioning, cell walls, biosynthesis of  
 plant hormones.  
 QP: BCH 401 BOT 301 QA: BCH 864

**888\*.** **Laboratory Rotation**  
 Fall, Spring, Summer. 1 to 4 credits.  
 May reenroll for a maximum of 12  
 credits.  
 R: graduate biochemistry  
 Participation in research laboratories to learn bio-  
 chemical techniques and research approaches, broaden  
 research experience, and assess research interests  
 prior to selecting a thesis adviser.

**899\*.** **Master's Thesis Research**  
 Fall, Spring, Summer. 1 to 4 credits.  
 May reenroll for a maximum of 60  
 credits.  
 R: Master's level biochemistry

**960\*.** **Selected Topics in Biochemistry**  
 Fall, Spring. 1 to 2 credits. May  
 reenroll for a maximum of 7 credits.

Topics from areas of biochemical genetics, biochemis-  
 try of development, biochemical evolution, complex  
 proteins, lipid metabolism, or other areas of contempo-  
 rary biochemical research interest.

**961\*.** **Selected Topics in Biochemistry**  
 Fall, Spring. 1 to 2 credits. May  
 reenroll for a maximum of 7 credits.

Topics from areas of bioenergetics, bioinstrumenta-  
 tion, complex carbohydrates, mass spectrometry,  
 biochemistry of isoprenoid compounds, or other areas  
 of contemporary biochemical research interest.

**978\*.** **Seminar in Biochemistry**  
 Fall, Spring. 1(1 -0) May reenroll  
 for a maximum of 5 credits.  
 R: graduate biochemistry  
 Seminars on research topics in biochemistry, mainly  
 by visiting scientists.

**999\*.** **Doctoral Dissertation Research**  
 Fall, Spring, Summer. 1 to 4 credits.  
 May reenroll for a maximum of 99  
 credits.  
 R: Ph.D. level biochemistry

**BIOLOGICAL SCIENCE BS**

**110.** **Organisms and Populations**  
 Fall, Spring. 4(3 -3)  
 Biological diversity and organismal biology. Princi-  
 ples of evolution, population biology, and community  
 structure.

**BIOLOGICAL SCIENCE**

**111. Cells and Molecules**  
 Fall, Spring. 4(3-3)  
 P: CEM 141 or CEM 151.  
 Cell structure and function; macromolecular synthesis; energy metabolism; molecular aspects of development; principles of genetics.

**BIOMECHANICS BIM**

**590\*. Special Problems in Biomechanics**  
 Fall, Spring, Summer. 1(01-00) May reenroll for a maximum of 22 credits.  
 R: Not open to freshmen and sophomores.  
 Approval of department.  
 Each student works under faculty direction on an experimental, theoretical, or applied problem.  
 QP: DEPT.APP QA: BIM 590

**601\*. Osteopathic Manipulative Medicine Clerkship**  
 Fall, Spring, Summer. 4 to 12 credits in increments of 2 credits.  
 P: Units I and II. R: Open only to graduate-professional students in the College of Osteopathic Medicine.  
 Advanced training in the diagnosis of musculoskeletal dysfunction and application of osteopathic manipulative techniques.  
 QA: BIM 601

**620\*. Directed Studies**  
 Fall, Spring, Summer. 2 to 10 credits in increments of 2 credits. May reenroll for a maximum of 10 credits.  
 R: Open only to students in the College of Osteopathic Medicine. Approval of department.  
 Individual or group work on special problems related primarily to the biomechanics of the musculoskeletal system.  
 QA: BIM 620

**800\*. Special Topics**  
 Fall, Spring, Summer. 1(01-00) May reenroll for a maximum of 3 credits.  
 R: Open only to graduate students. Approval of department.  
 Directed study in topics of biomechanics.  
 QP: DEPT.APP QA: BIM 800

**810\*. Tissue Biomechanics**  
 Fall. 3(02-02)  
 R: Open only to Biomechanics graduate students.  
 Integrate concepts of tissue mechanics and microstructure, develop experimental methods to study connective tissue mechanics using engineering principles.  
 QA: BIM 812 BIM 871

**811\*. Biomechanical Analysis**  
 Fall. 2(02-00)  
 R: Open only to Biomechanics graduate students.  
 Methods for analysis of biokinematic and biokinetic data.  
 QA: BIM 805

**812\*. Experimental and Analytical Biodynamics**  
 Spring. 3(02-02)  
 P: BIM 811.  
 Experimental and analytical methods to measure and interpret biodynamics of musculoskeletal system.  
 QP: BIM 805 QA: BIM 811 BIM 873

**813\*. Biokinematics**  
 Spring. 3(02-02)  
 P: BIM 811.  
 Size, position, and mobility of the human body as a mechanical linkage system. Detailed study of body joints and kinematic models.  
 QP: BIM 805 QA: BIM 810 BIM 872

**840\*. Therapy of Connective Tissue Mechanics**  
 Fall. 3(03-00)  
 P: BIM 810.  
 Mechanical properties, chemical content, and anatomical structure in connective tissues.  
 QP: BIM 812 QA: BIM 812

**841\*. Theory of Neuromuscular Mechanics**  
 Fall. 3(03-00)  
 R: Open only to Biomechanics graduate students.  
 Neurological control of joint mechanics.  
 QA: BIM 810 BIM 805

**842\*. Theory of Joint Mechanics**  
 Fall. 3(03-00)  
 P: BIM 813.  
 Motion and force transmission, and their relationship to anatomical structure and tissue function in joints.  
 QP: BIM 810 QA: BIM 810 BIM 805

**860\*. Occupational Biomechanics**  
 Fall. 3(03-00)  
 P: BIM 813.  
 Applications of biomechanics in ergonomics with emphasis on the whole body.  
 QP: BIM 810 QA: BIM 810

**861\*. Clinical Biomechanics**  
 Fall. 3(03-00)  
 R: Open only to Biomechanics graduate students.  
 Application of biomechanics to medicine.

**890\*. Independent Study**  
 Fall, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 22 credits.  
 R: Open only to graduate students in Biomechanics. Approval of department.  
 Individual or group work related to biomechanics and/or neuromuscular system.  
 QP: P

**895\*. Experimental Research Methods**  
 Fall. 1(00-02)  
 R: Open only to Biomechanics graduate students.  
 Methods of experimental research in biomechanics.  
 QA: BIM 871 BIM 872 BIM 873

**899\*. Master's Thesis Research**  
 Fall, Spring, Summer. 1 to 25 credits. May reenroll for a maximum of 25 credits.  
 R: Open only to Biomechanics graduate students. Approval of department.  
 QP: DEPT.APP QA: BIM 899

**BIOMEDICAL ENGINEERING BME**

**311\*. Introduction to Biomedical Engineering**  
 Fall. 3(3-0) Interdepartmental with the Department(s) of Metallurgy, Mechanics, and Materials Science, Chemical Engineering, Mechanical Engineering, Electrical Engineering, Metallurgy, Mechanics, and Materials Science.  
 P: MTH 235, PHY 184, BS 210  
 Physical and mechanical properties of soft and hard tissues. Biomaterials. Biocompatibility. Biochemical processes, biological transport and thermodynamics. Bioelectronics and instrumentation.  
 QP: MTH 310 PHY 289BS 210

**405\*. Biomedical Electronics**  
 Fall of even-numbered years. 3(3-0)  
 Interdepartmental with the Department(s) of Electrical Engineering.  
 P: MTH 132, PHY 184.  
 Electronic components and circuits. Physiological measurements, transduction of physiological events to electrical signals. Ultrasonic techniques, biomedical applications of lasers, x-ray and magnetic resonance imaging.  
 QP: MTH 112 PHY 238 QA: BME 410

**424\*. Biomaterials and Biocompatibility**  
 Spring of even-numbered years. 3(3-0)  
 Interdepartmental with the Department(s) of Metallurgy, Mechanics, and Materials Science, Metallurgy, Mechanics, and Materials Science.  
 P: BME 311, PSL 245  
 Materials science of human implantable materials. Design requirements imposed by the body's milieu and the need to protect it.  
 QP: PSL 240 ORPSL 430 QA: BME 424

**431\*. Biological Transport Mechanisms**  
 Fall of odd-numbered years. 3(3-0)  
 Interdepartmental with the Department(s) of Chemical Engineering, Mechanical Engineering.  
 P: BME 311 and MTH 235  
 Mechanisms which govern transport of momentum, heat and mass. Application to the mathematical description of transport processes in biological systems and to solution of biomedical problems.  
 QP: MTH 215 QA: BME 431

**441\*. Tissue Mechanics**  
 Spring of odd-numbered years. 3(3-0)  
 Interdepartmental with the Department(s) of Metallurgy, Mechanics, and Materials Science, Metallurgy, Mechanics, and Materials Science.  
 P: BME 311.  
 Application of solid mechanics to understanding mechanical responses of biological tissues. Microstructure and biological function for soft and hard connective tissues and muscle.  
 QP: ANT 316 QA: BME 481

**491\*. Special Topics (MTC)**  
 Fall, Spring. 3 to 12 credits. May reenroll for a maximum of 12 credits.  
 P: BME 311.  
 Special topics in biomedical engineering or bioengineering such as biochemical design, occupational biomechanics, biological surface science, or low temperature biotechnology.  
 QP: APPROVAL QA: BME 499

**491A\*. Biomechanical Design**  
 . 3(3-0)  
 P: BME 311, MMM 211, MMM 306.  
 Special topics in biomedical engineering or bioengineering of current interest and importance.  
 QP: APPROVAL QA: BME 499

**491B\*. Occupational Biomechanics**  
 . 3(3-0)  
 P: BME 311.  
 Special topics in biomedical engineering or bioengineering of current interest and importance.  
 QP: APPROVAL QA: BME 499

**491C\*. Biological Surface Science**  
 . 3(3-0)  
 P: BME 311.  
 Special topics in biomedical engineering or bioengineering of current interest and importance.  
 QP: APPROVAL QA: BME 499