

**Descriptions—Biochemistry  
of  
Courses**

**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. Contemporary biochemistry: its impact on environmental, 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 important molecules and metabolic activities of major importance in living organisms.  
QP: CEM 143 QA: BCH 200

**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.  
QP: CEM 242, CEM 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. Not open to students with credit in BCH 200 or BCH 401. Protein structure and function, enzymology, bioenergetics, and intermediary metabolism.  
QP: CEM 242, CEM 353 QA: BCH 452, BCH 451

**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, BCH 452 QA: BCH 453, BCH 452

**471. Biochemistry Laboratory**  
Spring, 2(0-6)

P: BCH 401 or BCH 461; BS 110, BS 111; CEM 262; MTH 120 or MTH 124 or MTH 132 or LBS 118. R: Biochemistry majors or approval of department. Modern biochemical techniques used in the study of enzymes (proteins), lipids, and cell organelles.  
QP: BCH 451, BCH 401, MTH 113 QA: BCH 404

**472. Biochemistry Laboratory**  
Fall, 3(0-19)

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.  
QP: BCH 453 QA: BCH 405

**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.  
QP: BCH 453

**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.  
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: metabolism 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 383. organization of genes. Regulation of gene expression, replication, and recombination. Protein structure and relationship of function to structure.  
QP: BCH 453, CEM 353, CEM 384 QA: BCH 811, BCH 812

**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 812 QA: BCH 813

**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.  
QP: CEM 353, BCH 453, CEM 384 QA: BCH 821

**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.  
QP: BCH 451, BCH 401 QA: BCH 825

**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.  
QP: BCH 453 QA: BCH 829

**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.  
QP: BCH 401 QA: BCH 831, BCH 832

**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.

**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.  
QP: BCH 401, BOT 301 QA: BCH 864

**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. Research laboratory in biochemical techniques and research approaches.  
QA: BCH 888

**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.  
QA: BCH 960

**961. Selected Topics in Biochemistry II**

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 bioenergetics, bioinstrumentation, complex carbohydrates, mass spectrometry, or biochemistry of isoprenoid compounds.  
QA: BCH 961

**978. Seminar in Biochemistry**

Fall, Spring, 1(1-0) A student may earn a maximum of 5 credits in all enrollments for this course.  
R: Open only to graduate students in Biochemistry. Seminars on biochemistry research mainly with visiting scientists.  
QA: BCH 978

**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)

Biological diversity and organismal biology. Principles of evolution, population biology, and community structure.  
QA: BS 211, BS 212

**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.  
QP: CEM 141 QA: BS 210, BS 211

**BIOMECHANICS BIM**

**Department of Biomechanics  
College of Osteopathic Medicine**

**590. Special Problems in Biomechanics**

Fall, Spring, Summer, 1 to 24 credits. A student may earn a maximum of 48 credits in all enrollments for this course.  
R: Approval of department. Each student works under faculty direction on an experimental, theoretical, or applied problem.  
QA: BIM 590

**601. Osteopathic Manipulative Medicine Clerkship**

Fall, Spring, Summer. 1 to 20 credits. A student may earn a maximum of 30 credits in all enrollments for this course.  
R: Open only to graduate-professional students in the College of Osteopathic Medicine upon completion of Units I and II.  
Advanced training in the diagnosis of musculoskeletal dysfunction and application of osteopathic manipulative techniques.  
QA: BIM 601

**620. Directed Studies**

Fall, Spring, Summer. 1 to 30 credits. A student may earn a maximum of 30 credits in all enrollments for this course.  
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 to 3 credits. A student may earn a maximum of 3 credits in all enrollments for this course.  
Directed study in topics of biomechanics.  
QA: BIM 800

**810. Tissue Biomechanics**

Fall. 3(2-2)  
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(2-0)  
Methods for analysis of biokinematic and biokinetic data.  
QA: BIM 805

**812. Experimental and Analytical Biodynamics**

Spring. 3(2-2)  
P: BIM 811.  
Experimental and analytical methods to measure and interpret biodynamics of musculoskeletal system.  
QP: BIM 805 QA: BIM 811, BIM 873

**813. Kinanthropometry and Biomechanics**

Spring. 3(2-2)  
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. Theory of Connective Tissue Mechanics**

Spring of odd-numbered years. 2(2-0)  
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 of even-numbered years. 2(2-0)  
Neurological control of joint mechanics.  
QA: BIM 810, BIM 805

**842. Theory of Joint Mechanics**

Spring. 2(2-0)  
P: BIM 811.  
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(3-0)  
Applications of biomechanics in ergonomics with emphasis on the whole body.  
QP: BIM 810 QA: BIM 810

**861. Clinical Biomechanics**

Spring of even-numbered years. 3(3-0)  
Application of biomechanics to medicine.

**890. Independent Study**

Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 22 credits in all enrollments for this course.  
R: Approval of department.  
Individual or group work related to biomechanics and/or neuromuscular system.  
QA: BIM 890

**895. Experimental Research Methods**

Fall, Spring, Summer. 1(0-2)  
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. A student may earn a maximum of 25 credits in all enrollments for this course.  
QA: BIM 899

**BIOMEDICAL  
ENGINEERING**

**BME**

**College of Engineering**

**311. Introduction to Biomedical Engineering**

Fall. 3(3-0) Interdepartmental with Materials Science and Mechanics, Mechanical Engineering, and Electrical Engineering.  
P: BS 111, MTH 235, PHY 184.  
Physical and mechanical properties of soft and hard tissues. Biomaterials. Biocompatibility. Biochemical processes, biological transport, and thermodynamics. Bioelectronics and instrumentation.  
QP: MTH 310, PHY 289, BS 210

**405. Biomedical Electronics**

Fall of even-numbered years. 3(3-0) Interdepartmental with 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 odd-numbered years. 3(3-0) Interdepartmental with Materials Science and Mechanics.  
P: BME 311, PSL 250.  
Materials science of human implants. Design requirements imposed by the body's milieu and the need to protect the body.  
QP: PSL 240, PSL 430 QA: BME 424

**435. Biological Transport Mechanisms**

Fall of odd-numbered years. 3(3-0) Interdepartmental with Chemical Engineering and Mechanical Engineering.  
P: BME 311, MTH 235.  
Mechanisms of transport of momentum, heat and mass. Mathematical description of transport processes in biological systems. Solution of biomedical problems.  
QP: BS 210, MTH 310, PHY 289 QA: BME 431

**441. Tissue Mechanics**

Spring of even-numbered years. 3(3-0) Interdepartmental with Materials Science and Mechanics.  
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. A student may earn a maximum of 12 credits in all enrollments for this course.  
P: BME 311.  
Special topics in biomedical engineering or bioengineering such as biochemical design, occupational biomechanics, biological surface science, or low temperature biotechnology.  
QA: BME 499

**BOTANY AND PLANT  
PATHOLOGY**

**BOT**

**Department of Botany and  
Plant Pathology  
College of Natural Science**

**105. Plant Biology**

Fall, Spring. 3(3-0)  
Plant structure, function, development, genetics, diversity and ecology.  
QA: BOT 205

**106. Plant Biology Laboratory**

Fall, Spring. 1(0-3)  
P: BOT 105 or concurrently.  
Cell structure, anatomy, physiology, growth and development, and diversity of plants.  
QA: BOT 206

**202. The Form and Evolution of Plants**

Spring. 4(2-4)  
P: BS 110 or BOT 105.  
Divergent and convergent evolution throughout the plant kingdom. Basic principles underlying the structure, function, and reproduction of plants.  
QP: BS 212, BOT 205 QA: BOT 302

**218. Plants of Michigan**

Fall. 3(2-3)  
P: BS 110 or BOT 105.  
Plant taxa of Michigan and the Great Lakes region and the major habitats in which they occur. Principles and rationale of classification. Relationships between life histories, morphology and environment.  
QP: BOT 205, BS 212

**301. Introductory Plant Physiology**

Fall, Spring. 3(2-3)  
P: CEM 141 or CEM 151; CEM 161; BOT 105 or BS 111 or LBS 145.  
General principles of plant physiology relating plant structure to function. Cell physiology, water relations, effects of light and temperature, respiration, photosynthesis, mineral nutrition, and hormone action.  
QP: CEM 141, CEM 151, CEM 161, BOT 205, BS 210, LBS 141 QA: BOT 301

**335. Plants Through Time**

Spring of even-numbered years. 3(3-0) Interdepartmental with Geological Sciences.  
P: BS 110 or BOT 105 or GLG 201. R: Juniors and above.  
Evolutionary history of plants, the development of ecosystems, and the use of plant fossils in the reconstruction of ancient environments and climate.  
QP: BOT 205, BS 212, LBS 140 QA: GLG 335

**336. Useful Plants**

Spring. 3(3-0)  
P: CEM 142 or CEM 143 or CEM 152; BOT 105 or BS 110, BS 111 or LBS 144, LBS 145.  
Ways in which plants are used for myriad purposes from food and construction materials to medicines and perfumes. The potential for expanding the uses of plants through biotechnology will be explored.  
QP: BOT 205, BS 212 QA: BOT 336

**402. Biology of Fungi**

Fall. 3(2-3)  
P: BS 110, BS 111 or BOT 105 or LBS 140 or MPH 302.  
Major groups of fungi: characteristics, habitats and diversity. Significance of fungi in nature and their economic importance.  
QP: BOT 205, LBS 140, BS 212 QA: BOT 402, BOT 320

**405. Introductory Plant Pathology**

Spring. 4(2-4)  
P: BS 110, BS 111 or BOT 105 or LBS 140. R: Not open to students with credit in BOT 407.  
Important plant diseases and the organisms that cause them. Principles of disease management including application of chemicals, plant breeding, biological control, and genetic engineering.  
QP: BOT 302, BS 212, LBS 140 QA: BOT 405