

**Descriptions — Biochemistry
of
Courses**

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.

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 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.

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.

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 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 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.

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)
Biological diversity and organismal biology. Principles of evolution, population biology, and community structure.

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

**Department of Biomechanics
College of Osteopathic Medicine**

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.

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.

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.

830. Biomechanical Analysis of Physical Activity
Fall. 3(2-2) Interdepartmental with Physical Education and Exercise Science. Administered by Physical Education and Exercise Science.
Kinematic analysis of mechanical and anatomical characteristics in physical activity and sport skills.

831. Advanced Biomechanics of Physical Activity
Spring of even-numbered years. 3(2-2) Interdepartmental with Physical Education and Exercise Science. Administered by Physical Education and Exercise Science.
P: PES 830.
Kinetic analyses of the performance of physical activity and sport.

841. Theory of Neuromuscular Mechanics
Fall of even-numbered years. 2(2-0)
Neurological control of joint mechanics.

861. Clinical Biomechanics
Spring of odd-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.

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.

930. Current Issues in Biomechanical Aspects of Physical Activity
Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. Interdepartmental with Physical Education and Exercise Science. Administered by Physical Education and Exercise Science.
P: PES 830.
Selected issues of biomechanical analyses of sport and physical activity.

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.

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.

424. Biomaterials and Biocompatibility
Spring of even-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.

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.

441. Tissue Mechanics
Spring of odd-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.

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.

BIOSYSTEMS ENGINEERING

BE

**Department of Agricultural Engineering
College of Agriculture and Natural Resources
College of Engineering**

180. Current Issues in Biosystems
Fall, Spring. 2(2-0)
P: MTH 110 or MTH 116. R: Open only to freshmen or sophomores.
The relationship of biosystems engineering to current problems in food production and processing. Environment, natural resources, harvesting, handling, safety, and water quality.

230. Principles of Biosystems Engineering
Fall. 3(3-0)
P: MTH 132. R: Open only to sophomores or juniors in College of Agriculture and Natural Resources, College of Engineering, or College of Natural Science.
Concepts of biosystems. Hard and soft systems. Conceptual and computer modeling of components of biosystems.

232. Food Production and Processing Systems
Fall. 1(0-2)
R: Open only to students in College of Agriculture and Natural Resources or College of Engineering.
Crop and animal production systems. Food processing systems. Field trips required.

336. Machinery Systems for Food Production
Fall. 3(3-0)
P: MTH 235.
Processes performed by agricultural production machines. Power systems, tillage mechanics, traction, metering, distribution, conveying, fluidization, mixing, separation, and atomization. Machinery management.
SA: AE 336

350. Heat Transfer in Biosystems
Spring. 2(2-0)
P: MTH 235; CPS 130 or CPS 131. R: Not open to students with credit in CHE 311 or ME 410.
Steady state and transient heat conduction. Radiation and convection heat transfer. Heat exchangers. Application problems in biosystems engineering.

351. Environmental Thermodynamics
Spring. 3(3-0)
P: MTH 235. R: Not open to students with credit in CHE 321 or ME 201.
First and Second Laws of Thermodynamics with applications in food, biosystems, and environmental engineering. Refrigeration cycles. Entropy. Thermodynamic aspects of fluid flow. Psychrometrics.

430. Power and Control Hydraulics
Spring. 3(2-2)
P: CE 321 or CHE 311 or ME 332. R: Open only to majors in College of Engineering.
Hydraulic fluid properties. Pump and motor performance parameters. Control valves and hydraulic circuitry components. Analysis and design of hydraulic systems.
SA: AE 430

438. Design of Machinery Structures
Fall. 3(3-0)
P: MSM 211. R: Open only to majors in College of Engineering. Not open to students with credit in ME 471.
Design of structural components and systems in machines. Tension, compression, torsion, bending and combined loadings. Joint connections.
SA: AE 438

453. Engineering Principles of the Plant Environment
Fall. 3(3-0)
P: BOT 105 or BS 110 or BS 111; CEM 141, BE 350, BE 351. R: Open only to majors in College of Engineering.
Analysis of the soil-plant-atmosphere continuum. Thermodynamics effects on plant environment: water, soil heat flow, radiation, and soil water movement.
SA: AE 353

456. Electric Power and Control
Spring. 3(2-2)
P: EE 200 or EE 345. R: Open only to majors in College of Engineering.
Alternating current circuits, power distribution, electrical machines, protection, and programmable motor controllers. Design project related to food and agricultural industries.
SA: AE 356

481. Agricultural and Small Watershed Hydrology
Spring. 3(2-2)
P: CPS 130 or CPS 131; CE 321 or CHE 311 or BE 350; BE 453 or CE 312. R: Open only to seniors in College of Engineering or graduate students.
Runoff, infiltration, surface and subsurface drainage and soil erosion.
SA: AE 481

486. Biosystems Design Fundamentals
Fall. 3(3-0)
P: BE 350 or BE 336 or BE 453. R: Open only to seniors in College of Engineering or graduate students.
Concepts, methods, and procedures of the total design process from problem identification to final specifications.
SA: AE 486

487. Biosystems Design Project (W)
Spring. 3(0-6)
P: BE 486. R: Open only to seniors in College of Engineering. Completion of Tier I writing requirement.
Individual or team design project selected in BE 486. Information expansion, development of alternatives, and evaluation, selection, and completion of a design project.
SA: AE 488

490. Independent Study
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 5 credits in all enrollments for this course.
P: BE 230 or BE 336 or BE 350 or BE 453. R: Open only to majors in College of Engineering. Approval of department; application required.
Supervised individual student research and study in biosystems engineering.
SA: AE 490

491. Special Topics in Biosystems Engineering
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course.
P: BE 230, BE 336 or BE 350 or BE 453. R: Open only to majors in College of Engineering. Approval of department.
Special topics in biosystems engineering.
SA: AE 491