

**BIOCHEMISTRY  
AND MOLECULAR  
BIOLOGY**

**BMB**

**Department of Biochemistry  
and Molecular Biology  
College of Natural Science**

**101 Frontiers in Biochemistry**  
Fall. 1(1-0) R: Open to freshmen or sophomores. SA: BCH 101, BMB 100  
Topics in biochemistry research.

**161 Cell and Molecular Biology**  
Fall, Spring, Summer. 3(3-0) Interdepartmental with Biological Science and Microbiology and Molecular Genetics. Administered by Biological Science. P: (CEM 141 or concurrently) or (CEM 151 or concurrently) or (LB 171 or concurrently) or (CEM 181H or concurrently) SA: BS 111, BS 149H Not open to students with credit in BS 181H or LB 145.

Macromolecular synthesis. Energy metabolism. Molecular aspects of development. Molecular genetics.

**171 Cell and Molecular Biology Laboratory**  
Fall, Spring, Summer. 2(1-3) Interdepartmental with Biological Science and Microbiology and Molecular Genetics. Administered by Biological Science. P: (BS 161 or concurrently) or (BS 181H or concurrently) SA: BS 111L, BS 159H Not open to students with credit in BS 191H or LB 145.

Principles and applications of common techniques used in cell and molecular biology.

**181H Honors Cell and Molecular Biology**  
Spring. 3(3-0) Interdepartmental with Biological Science and Lyman Briggs and Microbiology and Molecular Genetics. Administered by Biological Science. P: (CEM 141 or concurrently) or (CEM 151 or concurrently) or (CEM 181H or concurrently) or (LB 171 or concurrently) SA: BS 149H, BS 111 Not open to students with credit in BS 161 or LB 145.

Physicochemical and molecular organization of cells as the unifying framework for genetics, evolution, and the social relevance of biology.

**191H Honors Cell and Molecular Biology Laboratory**  
Spring. 2(1-3) Interdepartmental with Biological Science and Lyman Briggs and Microbiology and Molecular Genetics. Administered by Biological Science. P: BS 181H or concurrently SA: BS 159H, BS 111L Not open to students with credit in BS 171 or LB 145.

Basic techniques of cellular and molecular biology including experimental design and hypothesis formulation; biochemistry, molecular biology and genetics.

**200 Introduction to Biochemistry**  
Fall. 4(4-0) P: CEM 143 or CEM 251 or CEM 351 RB: CEM 252 or CEM 352 SA: BCH 200

Introductions to the major classes of biomolecules and the metabolism of these molecules.

**400 Introduction to Bioinformatics**  
Spring of odd years. 3(2-2) Interdepartmental with Microbiology and Molecular Genetics and Plant Biology. Administered by Plant Biology. P: (STT 200 or STT 201 or STT 231 or STT 421) and (PLB 203 or MMG 201 or BMB 200) RB: An introductory biology course covering basic genetics, macromolecules, evolution, energy metabolism, genetic materials, and signal transduction is recommended for non-biology majors. A statistic course covering random variable, distributions, and basic probability theory is recommended for biology majors.

Bioinformatic theory and practice. How to manage and analyze sequences, structures, gene expression, and other types of biological data.

**401 Comprehensive Biochemistry**  
Fall, Spring, Summer. 4(4-0) P: CEM 252 or CEM 352 RB: BS 161 or BS 181H or LB 145 R: Not open to students in the Biochemistry and Molecular Biology/Biotechnology major or in the Biochemistry and Molecular Biology major. SA: BCH 401 Not open to students with credit in BMB 461.

Structure and function of major biomolecules, organization and regulation of metabolic pathways. Special emphasis on eukaryotic systems and the biochemical basis of human disease.

**461 Advanced Biochemistry I**  
Fall. 3(3-0) P: (CEM 251 or CEM 351) and (CEM 252 or CEM 352) and (MTH 124 or MTH 132 or MTH 152H or LB 118) and (BS 161 or BS 181H or LB 145) and ((BS 162 or concurrently) or (BS 182H or concurrently) or (LB 144 or concurrently)) SA: BCH 461 Not open to students with credit in BMB 401.

Structure, function, and biophysical properties of biomolecules in a wide variety of organisms. Emphasis on proteins and carbohydrates including enzyme catalysis and kinetics, the central metabolic pathways, and photosynthesis.

**462 Advanced Biochemistry II**  
Spring. 3(3-0) P: BMB 461 or BMB 401 SA: BCH 462

Continuation of BMB 461. Structure, function, and biophysical properties of lipids and nucleic acids including membranes, lipid metabolism, signaling and metabolic regulation, DNA replication and repair, transcription, translation, and regulation of gene expression.

**471 Biochemistry Laboratory (W)**  
Spring. 3(0-6) P: BMB 461 and (CSE 101 or CSE 131 or CSE 231 or LB 126) and CEM 262 and Completion of Tier I Writing Requirement R: Open to students in the Biochemistry and Molecular Biology/Biotechnology major or in the Biochemistry and Molecular Biology major or in the Lyman Briggs Biochemistry and Molecular Biology Coordinate Major or in the Lyman Briggs-Biochemistry/Biotechnology Coordinate Major or approval of department. SA: BCH 471 Not open to students with credit in BMB 473.

Biochemical methods and principles used in the study of enzymes (proteins), carbohydrates, lipids, and cell organelles.

**472 Biochemistry Laboratory**  
Fall. 3(0-6) P: CEM 262 and BMB 461 RB: BMB 462 R: Open to students in the Biochemistry and Molecular Biology/Biotechnology major or in the Biochemistry and Molecular Biology major or in the Lyman Briggs Biochemistry and Molecular Biology Coordinate Major or in the Lyman Briggs-Biochemistry/Biotechnology Coordinate Major or approval of department. SA: BCH 472 Not open to students with credit in BMB 473.

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. A student may earn a maximum of 12 credits for BMB 490 and BMB 499. R: Approval of department. SA: BCH 490

Participation in laboratory research projects.

**495 Undergraduate Seminar**  
Spring. 2(2-0) P: BMB 462 or concurrently R: Open only to students in the Biochemistry or Biochemistry/Biotechnology majors. SA: BCH 495

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. A student may earn a maximum of 12 credits for BMB 490 and BMB 499. R: Open to juniors or seniors. Approval of department. SA: BCH 499

Laboratory research culminating in a thesis.

**514 Medical Biochemistry**  
Fall. 3 credits. R: Open only to students in the College of Human Medicine and the College of Osteopathic Medicine. SA: BCH 514 Not open to students with credit in BMB 521.

Basic biochemical principles and terminology; metabolism and function of biomolecules of importance in medical biology and human pathophysiology.

**515 Medical Biochemistry and Molecular Biology**  
Fall. 2(2-0) R: Open to graduate-professional students in the College of Osteopathic Medicine.

Basic biochemical principles and terminology. Overview of metabolism of biomolecules of importance to medical biology and human pathophysiology.

**523 Genetics for Medical Practice**  
Summer. 1(1-0) Interdepartmental with Pediatrics and Human Development. Administered by Pediatrics and Human Development. R: Open only to graduate-professional students in the colleges of Human and Osteopathic Medicine. SA: BCH 523

Basic principles of genetics for medical students.

**526 Molecular Biology and Medical Genetics**  
Fall. 2 credits. Interdepartmental with Pediatrics and Human Development. Administered by Biochemistry and Molecular Biology. R: Open only to students in the College of Human Medicine or the College of Osteopathic Medicine. SA: BCH 526 Not open to students with credit in PHD 523.

Basic principles of human medical genetics; storage and expression of genetic information; transmission of genetic information to progeny.

## Biochemistry and Molecular Biology—BMB

- 527 Medical Genetics**  
Fall. 1(1-0) R: Open to graduate-professional students in the College of Osteopathic Medicine.  
Basic principles of human medical genetics. Storage and expression of genetic information. Transmission of genetic information to progeny.
- 534 Cell Biology and Physiology I**  
Fall. 3 credits. Interdepartmental with Human Anatomy and Physiology. Administered by Physiology. R: Open only to graduate-professional students in the College of Human Medicine or College of Osteopathic Medicine.  
Modern concepts of cell biology as a basis for understanding the physiology of human tissues and organ systems in health and disease.
- 535 Cell Biology and Physiology II**  
Spring. 4 credits. Interdepartmental with Human Anatomy and Physiology. Administered by Physiology. R: Open only to graduate-professional students in the College of Human Medicine or the College of Osteopathic Medicine.  
Modern concepts of cell biology as a basis for understanding the physiology of human tissues and organ systems in health and disease. Continuation of PSL 534.
- 536 Basic Principles of Cell Biology and Physiology**  
Fall. 3(2-2) Interdepartmental with Human Anatomy and Physiology. Administered by Physiology. R: Open to graduate-professional students in the College of Osteopathic Medicine.  
Modern concepts of cell biology as a basis for understanding the structure (histology) and function (physiology) of human tissues in health and disease.
- 801 Molecular Biology**  
Fall. 3(3-0) RB: BMB 462, CEM 383. SA: BCH 801 Not open to students with credit in BMB 897A or BMB 897A.  
Organization of genes. Regulation of gene expression, replication, and recombination.
- 802 Metabolic Regulation and Signal Transduction**  
Spring. 3(3-0) RB: BMB 801. SA: BCH 802  
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) RB: BMB 462, CEM 383 SA: BCH 803  
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) RB: (BMB 462 or concurrently) and (CEM 383 or concurrently) SA: BCH 804  
Structures, methods of structural analysis, synthesis, and reaction mechanisms of biological substances including proteins, carbohydrates, lipids, porphyrins, phosphate esters, enzymes, and coenzymes.
- 805 Protein Structure, Design, and Mechanism**  
Spring. 3(3-0) A student may earn a maximum of 0 credits n/a RB: BMB 462 and CEM 383  
Protein architecture, dynamics, folding, stability, and evolution. Conformational changes, ligand binding, and kinetics. Elucidation of enzyme mechanisms.
- 810 Theories and Practices in Bioinformatics**  
Spring of odd years. 3(2-2) Interdepartmental with Microbiology and Molecular Genetics and Plant Biology. Administered by Plant Biology. RB: Basic genetics, macromolecules, evolution, energy metabolism, genetic materials, and signal transduction is recommended for non-biology majors. A statistic course covering random variable, distributions, and basic probability theory is recommended for biology majors.  
Theories and algorithms behind bioinformatics tools. Basic tool development by writing scripts in the Python programming language for data analysis.
- 816 Integrative Toxicology: Mechanisms, Pathology and Regulation**  
Fall of odd years. 3(3-0) Interdepartmental with Animal Science and Pathobiology and Diagnostic Investigation and Pharmacology and Toxicology. Administered by Pharmacology and Toxicology. P: PHM 819  
Biochemical, molecular, and physiological mechanisms of toxicology. Functional and pathological responses of major organ systems to chemical insult. Mechanisms of mutagenesis, carcinogenesis, and reproductive toxicology. Concepts in risk and safety assessment.
- 825 Cell Structure and Function**  
Spring. 3(3-0) Interdepartmental with Microbiology and Molecular Genetics and Physiology. Administered by Biochemistry and Molecular Biology. RB: BMB 401 or BMB 461. SA: BCH 825  
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) RB: BMB 462 or concurrently SA: BCH 829  
Techniques of isolation and characterization of macromolecules. Computer use in structure-function analysis of macromolecules.
- 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. SA: BCH 855  
Laboratory or library research on special problems in biochemistry.
- 856 Plant Molecular and Omic Biology**  
Spring. 3(3-0) Interdepartmental with Crop and Soil Sciences and Plant Biology. Administered by Plant Biology. RB: ZOL 341 SA: BOT 856  
Recent advances in genetics and molecular biology of higher plants.
- 864 Plant Biochemistry**  
Fall. 3(3-0) Interdepartmental with Plant Biology. Administered by Biochemistry and Molecular Biology. RB: (BMB 401 or BMB 462) and prior undergraduate course in plant physiology. SA: BCH 864  
Biochemistry unique to photosynthetic organisms. Photosynthetic and respiratory electron transport, nitrogen fixation, carbon dioxide fixation, lipid metabolism, carbon partitioning, cell walls, sulfur and nitrogen metabolism and specialized metabolism including isoprenoids, phenylpropanoids and alkaloids.
- 899 Master's Thesis Research**  
Fall, Spring, Summer. 1 to 12 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open only to masters students in the Department of Biochemistry and Molecular Biology. SA: BCH 899  
Master's thesis research.
- 960 Selected Topics in Biochemistry I**  
Fall, Spring. 1 to 3 credits. A student may earn a maximum of 7 credits in all enrollments for this course. R: Open to graduate students in the Department of Biochemistry and Molecular Biology or approval of department. SA: BCH 960  
Selected topics in biochemistry with substantial student presentations.
- 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 to graduate students in the Department of Biochemistry and Molecular Biology or approval of department. SA: BCH 961  
Selected topics in biochemistry with faculty lectures, laboratory, or other instruction.
- 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 the Department of Biochemistry and Molecular Biology. SA: BCH 978  
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 120 credits in all enrollments for this course. R: Open only to doctoral students in the Department of Biochemistry and Molecular Biology. SA: BCH 999  
Doctoral dissertation research.