

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 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 101, BMB 100
Introduction to topics in biochemistry, career paths, professional development, and campus resources.

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 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 Not open to students with credit in 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
Fall of even 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 or BS 161) RB: An introductory biology course covering basic genetics, macromolecules, evolution, energy metabolism, genetic materials, and signal transduction is recommended for non-biology majors. A statistics course covering random variable, distributions, and basic probability theory is recommended for biology majors.
Managing and analyzing biological data with bioinformatic tools, basic programming, and statistics.

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.

410 Bioinformatics and Computational Biology
Spring. 3(2-2) Interdepartmental with Computational Mathematics, Science, & Engineering and Microbiology and Molecular Genetics and Plant Biology. Administered by Computational Mathematics, Science, & Engineering. P: {(CMSE 201 and LB 144 and LB 145) or (CMSE 201 and BS 161 and BS 162) or (CMSE 201 and BS 181H and BS 182H)} and (STT 200 or STT 201 or STT 231 or STT 421 or STT 351 or ECE 280)
Computational approaches in modern biology with a focus on applications in genomics, systems biology, evolution, and structural biology.

411 Computational Medicine
Fall of odd years. 3(3-0) Interdepartmental with Computational Mathematics, Science, & Engineering and Microbiology and Molecular Genetics. Administered by Computational Mathematics, Science, & Engineering. P: (CMSE 201 and LB 144 and LB 145) or (CMSE 201 and BS 161 and BS 162) or (CMSE 201 and BS 181H and BS 182H)
Computational approaches in biology with a focus on medicine.

461 Advanced Biochemistry I
Fall, Spring. 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
Fall, Spring. 3(3-0) P: (BMB 461 or BMB 401) and (BS 161 or BS 181H or LB 145) and ((BS 162 or concurrently) or (BS 182H or concurrently) or (LB 144 or concurrently)) and (CEM 252 or CEM 352) RB: LB 118 or MTH 132 or MTH 152H 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.

469 Special Topics in Biochemistry
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 4 credits in all enrollments for this course. P: BMB 461 and BMB 462 R: Open to juniors or seniors 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.
Special topics in biochemistry and molecular biology including biological computing, bioinformatics, biotechnology, genomics or other current topics.

470 Advanced Molecular Biology 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 and Molecular Biology Coordinate Major or approval of department. SA: BCH 472, BMB 472
Methods of molecular biology and the underlying principles on which these methods are based.

471 Advanced Biochemistry Laboratory
Spring. 3(0-6) P: BMB 461 and CEM 262 and CMSE 201 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
Biochemical methods and principles used in the study of enzymes (proteins), carbohydrates, lipids, and cell organelles.

Biochemistry and Molecular Biology— BMB

- 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 (W)**
Spring. 2(2-0) P: (BMB 462 or concurrently) 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. SA: BCH 495
Extension and synthesis of concepts of biochemistry. Relationships to societal issues.
- 499 Senior Thesis (W)**
Fall, Spring, Summer. 2 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. P: Completion of Tier I Writing Requirement 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.
- 516 Metabolic Biochemistry: Nutrients and Products**
Summer. 1 credit. R: Open to students in the College of Osteopathic Medicine. Not open to students with credit in BMB 515 or BMB 527.
Basic biochemical principles and terminology. Overview of metabolism of biomolecules of importance to medical biology and human pathophysiology.
- 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.
- 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.
- 528 Molecular Biology and Medical Genetics**
Fall. 2 credits. R: Open to students in the College of Osteopathic Medicine. Not open to students with credit in BMB 515 or BMB 527. C: PSL 539 concurrently and MMG 531 concurrently and MMG 532 concurrently and PHM 564 concurrently.
Basic principles of molecular biology and 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.
- 539 Principles of Cell Biology and Pathophysiology**
Fall. 4(3-2) Interdepartmental with Human Anatomy and Microbiology and Molecular Genetics and Physiology. Administered by Physiology. R: Open to graduate-professional students in the College of Osteopathic Medicine.
Modern concepts of human cell biology as a basis for understanding integration of structure (histology) and function (physiology) in health and disease (pathology). Introduction to adaptive growth response, cell injury, inflammation, hemodynamic disorders, and tissue repair.
- 801 Molecular Biology**
Fall. 3(3-0) RB: BMB 462 and CEM 383 SA: BCH 801
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**
Spring. 2(2-0) RB: BMB 462 and CEM 383 R: Not open to students in the Department of Biochemistry and Molecular Biology. SA: BCH 803 Not open to students with credit in BMB 805.
Protein structure and relationship of function to structure. Applications of kinetic methods to elucidation of enzyme mechanisms and regulation. Offered first ten weeks of semester.
- 805 Protein Structure, Design, and Mechanism**
Spring. 3(3-0) RB: BMB 462 and CEM 383 Not open to students with credit in BMB 803.
Protein architecture, dynamics, folding, stability, and evolution. Conformational changes, ligand binding, and kinetics. Elucidation of enzyme mechanisms.
- 810 Theories and Practices in Bioinformatics**
Fall of even 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 statistics 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.
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.

843 Forum in Computational and Plant Sciences
 Fall, Spring. 1(1-0) A student may earn a maximum of 4 credits in all enrollments for this course. Interdepartmental with Computational Mathematics, Science, & Engineering and Crop and Soil Sciences and Horticulture and Plant Biology. Administered by Plant Biology.

Professional development focused on diverse modes of communication in support of interdisciplinary science with an emphasis on plant and computational sciences.

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
 Fall. 3(3-0) Interdepartmental with Plant Biology. Administered by Plant Biology. RB: IBIO 341 SA: BOT 856

Advanced genetics and molecular biology of higher plants.

864 Plant Specialized Metabolism
 Spring. 3(3-0) Interdepartmental with Plant Biology. Administered by Biochemistry and Molecular Biology. P: BMB 461 or BMB 462 or (PLB 866 or concurrently) RB: Enrolled in a graduate program related to plant molecular sciences. SA: BCH 864

Specialized metabolism unique to photosynthetic organisms including aspects of nitrogen and sulfate assimilation and essential amino acid synthesis relevant to specialized metabolism, vitamin synthesis, mono-, di-, tri- and tetra-terpenoid synthesis, synthesis of phenylpropanoids and other aromatic compounds and synthesis of various alkaloids.

866 Molecular Plant Physiology
 Spring. 3(3-0) Interdepartmental with Plant Biology. Administered by Plant Biology. RB: Enrolled in a graduate program in plant molecular science. An advanced undergraduate course in biochemistry or plant physiology.

Molecular basis of the physiology of plants including photosynthesis, respiration, primary metabolism, water relations, and nutrition. Quantitative and systems approaches are emphasized.

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 master's 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 36 credits in all enrollments for this course. R: Open to doctoral students in the Department of Biochemistry and Molecular Biology. SA: BCH 999

Doctoral dissertation research.