191H Honors Cell and Molecular Biology
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. Taught by Biological Science. P: (CEM 141 or concurrently) or (CEM 151 or concurrently) or (CEM 181H or concurrently) SA: BS 111, BS 149H Not open to students with credit in BS 181H or LB 145.

171 Cell and Molecular Biology Laboratory
Fall, Spring, Summer. 2(1-3) Interdepartmental with Biological Science and Microbiology and Molecular Genetics. Taught 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. Taught 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. Taught 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. Taught 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.
Bioinformatics 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 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 401 Not open to students with credit in BMB 401.
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, 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 (CEM 161 or BS 181H or LB 145) and (CEM 182 or concurrently) or (CEM 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 SA: BCH 462
Continuation of BMB 461. Structure, function, and biophysical properties of proteins 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. A student may earn a maximum of 12 credits for BMB 490 and BMB 499. R: Approval of department. SA: BCH 469
Participation in laboratory research projects.

471 Advanced Biochemistry Laboratory
Fall. 3(0-6) P: BCH 461 and CEM 262 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.

472 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/Biotechnology Coordinate Major or approval of department. SA: BCH 472
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 (W)
Fall, Spring. 2(2-0) P: (CEM 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. SA: BCH 515
Basic biochemical principles and terminology. Overview of metabolism of biomolecules of importance to medical biology and human pathophysiology.
Biochemistry and Molecular Biology—BMB

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 PSL 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. SA: BCH 527


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 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.

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(2-0) 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) R: BMB 462, CEM 383. SA: BCH 801 Not open to students with credit in BMB 807A or BMB 897A. Organization of genes. Regulation of gene expression, replication, and recombination.

802 Metabolic Regulation and Signal Transduction
Spring. 3(3-0) R: 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) R: 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.

804 Biochemical Mechanisms and Structure
Spring. 3(3-0) R: (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) R: 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
Spring of odd years. 3(2-2) Interdepartmental with Microbiology and Molecular Genetics and Plant Biology. Administered by Plant Biology. R: 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(3-3) Interdepartmental with Animal Science and Pathobiology and Diagnostic Investigation and Pharmacology and Toxicology. Administered by Pharmacology and Toxicology. R: PrM 819 Biochemical, molecular, and physiological mechanisms of toxicity. 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. R: 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) R: 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. 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. R: 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. R: (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 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. 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. 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. 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.