

BIOCHEMISTRY, MOLECULAR AND CELLULAR BIOLOGY (BMCB)

The field of biochemistry, molecular and cellular biology (BMCB) encompasses a broad range of the life sciences, from biophysics and biochemistry to applied biology and medicine. The B.S. in biochemistry, molecular and cellular biology is designed for students to gain a solid foundation in biology, chemistry, physics, and math, along with advanced knowledge in molecular biology, biochemistry, cell biology, and genetics. The program offers cutting-edge research opportunities in the areas of structural biology, cell signaling pathways, cancer biology, gene regulation, neurobiology, cellular structure and function, proteomics and glycomics, and lipid metabolism. BMCB students are highly-motivated and seek exposure to cutting-edge techniques and "hands-on" experience through laboratory- and research-based opportunities. Graduates are "profession-ready" people who are well-prepared for entry-level positions in biomedical research or in the biotechnology and pharmaceutical industries, for graduate education, or for post-baccalaureate professional programs (e.g., medical school, veterinary school, dental school, etc.).

The curriculum provides most of the required and recommended courses for students seeking admission to graduate schools and to professional schools in medicine, dentistry, veterinary medicine, and pharmacy. Students who major in BMCB can also use their training in conjunction with advanced degrees in law and business. Students obtaining the B.S. in BMCB enjoy excellent job prospects immediately upon graduation. There is currently a demand for skilled research technicians in biotechnology companies, pharmaceutical companies, government agencies, forensics, academic research laboratories, and hospitals. Graduates also have knowledge that is valuable in the fields of management, sales, marketing, regulatory affairs, technical writing, and science journalism. With additional courses in education, the B.S. in BMCB also qualifies graduates to teach at the elementary, junior high, and high school levels.

Faculty participating in the BMCB major combine a passion for teaching and student advising with strong research expertise in their chosen discipline. BMCB faculty are committed to providing independent research experiences for undergraduate students, and many faculty have well-funded research programs utilizing state-of-the-art equipment and techniques. On-campus research facilities that students can use to enhance their research experience include the Hubbard Center for Genome Studies (<http://hcgs.unh.edu>) and the Center for Comparative and Molecular Endocrinology (<http://unh.edu/cme>).

Pre-Professional Health Programs

Students interested in postgraduate careers in the health care professions (e.g., medical, dental, physician assistant, pharmacy, etc.) should visit the Pre-Professional Health Programs Advising Office (<http://www.unh.edu/uacc/premed-advising>) online or in person (Hood House, Room 102). Students interested in veterinary medicine should consult the Pre-Veterinary Medicine Program (<http://colsa.unh.edu/mcbs/prevet>) website. While many of the prerequisite courses required by professional schools are also requirements of the BMCB major, students should consult with their faculty adviser to create a plan of study that best prepares them for pursuing a career in one of these health professions.

<http://colsa.unh.edu/mcbs/bmcb>

Programs

- Biochemistry, Molecular and Cellular Biology Major (B.S.) (<http://catalog.unh.edu/archives/2017-2018/undergraduate/life-sciences-agriculture/programs-study/biochemistry-molecular-cellular-biology/biochemistry-molecular-cellular-biology-major-bs>)
- Biochemistry, Molecular and Cellular Biology Minor (<http://catalog.unh.edu/archives/2017-2018/undergraduate/life-sciences-agriculture/programs-study/biochemistry-molecular-cellular-biology/biochemistry-molecular-cellular-biology-minor>)

Courses

Biochemistry, Molecular & Cellular Biology (BMCB)

BMCB 401 - Professional Perspectives in Biochemistry, Molecular and Cellular Biology

Credits: 1

Introduction to the fields of biochemistry, molecular and cellular biology. Explores professional opportunities for BMCB majors. Guest speakers from on- and off-campus present seminars and lead discussions on contemporary issues in subject area. Development of strategies for achieving professional goals. Cr/F.

BMCB 405 - Biotechnology Research Internship

Credits: 2

A 4-week (minimum) experiential learning internship in which students conduct independent laboratory-based research in an area of shared interest with a faculty mentor in the College of Life Sciences and Agriculture. Students gain first-hand experience conducting original research, incorporating direct observation, reflection, evaluation, and discussion. Permission required. Open to high school students only.

BMCB 501 - Biological Chemistry

Credits: 5

Survey of the molecular basis of life with a focus on the mechanisms of biochemical reactions in metabolic pathways, beginning with an overview of functional groups and organic reactions relevant for living organisms. Bioenergetics of carbohydrate, lipid, and nitrogen metabolic pathways. Prereq: CHEM 403 and CHEM 404 or CHEM 411. No credit earned if credit received for BMCB 658 or BMCB 751 and BMCB 752.

BMCB 600 - Field Experience

Credits: 1-4

A supervised experience providing the opportunity to apply academic experience in settings associated with future professional employment and/or related graduate opportunities. Must be approved by a faculty advisor selected by the student. May be repeated to a maximum of 8 credit hours. Permission required. Cr/F.

BMCB 605 - Eukaryotic Cell and Developmental Biology

Credits: 4

Cell and developmental biology of multicellular eukaryotic organisms. Structure and function of major cellular compartments; mechanisms of cellular communication and dynamics; embryonic development. Special topics: subcellular organization and function; membrane biogenesis; signal transduction; mitogenesis; apoptosis; autophagy; tumor suppressors and cell cycle regulation; cytokinesis; cytoskeletal dynamics; cellular shape and motility; stem cell biology; organogenesis; morphogenesis and patterning. Prereq: BIOL 411 and BIOL 412; CHEM 403 and CHEM 404.

BMCB 658 - General Biochemistry

Credits: 3

Comprehensive, introductory course emphasizing the cellular metabolism and the structure and function of proteins, nucleic acids, carbohydrates, and lipids. Prereq: BIOL 411; CHEM 545 and CHEM 546, or CHEM 547 and CHEM 548, or CHEM 651 and CHEM 652. Coreq: BMCB 659.

BMCB 659 - General Biochemistry Lab

Credits: 2

Structured laboratory experiments that provide training in analytical and preparative techniques fundamental to modern biochemistry and molecular biology. Coreq: BMCB 658. Special fee.

BMCB 659W - General Biochemistry Lab

Credits: 2

Structured laboratory experiments that provide training in analytical and preparative techniques fundamental to modern biochemistry and molecular biology. Coreq: BMCB 658. Special fee. UNHM only. Writing intensive.

Attributes: Writing Intensive Course

BMCB 750 - Physical Biochemistry

Credits: 3

Structure, interactions, and physical-chemical properties of biomolecules. Thermodynamic, kinetic, and spectroscopic methods for the study of proteins and nucleic acids. Prereq: CHEM 547 and CHEM 549 and CHEM 548 and CHEM 550 or equivalent; MATH 424B or equivalent; or permission.

BMCB 751 - Principles of Biochemistry

Credits: 4

In-depth survey of biochemistry: macromolecular structure; structure and function of proteins, nucleic acids, carbohydrates, and lipids; introduction to metabolic pathways. Prereq: CHEM 547 and CHEM 548 or CHEM 651 and CHEM 652; or permission.

BMCB 752 - Principles of Biochemistry

Credits: 4

In-depth survey of biochemistry: metabolism of amino acids, nucleotides, carbohydrates and lipids; macromolecules synthesis and regulation; molecular biology of the eukaryotic cell. Prereq: BMCB 751 or permission.

BMCB 753 - Cell Culture

Credits: 5

Principles and technical skills fundamental to the culture of animal and plant cells, tissues, and organs. Introduction to the techniques of sub-culturing, establishing primary cultures, karyotyping, serum testing, cloning, growth curves, cryopreservation, hybridoma formation and monoclonal antibody production, and organ cultures. Application of cell culture to contemporary research in the biological sciences. Prereq: BMS 503 and 504. Special fee. Lab.

BMCB 754 - Molecular Biology Research Methods

Credits: 5

Theory and application of current technologies to manipulate DNA. Hands-on research experience that includes DNA isolation and quantitation methods, cloning, PCR, DNA sequencing, and analysis of gene products. Prereq: GEN 604. Special fee. Lab. Writing intensive.

Attributes: Writing Intensive Course

BMCB 755 - Laboratory in Biochemistry and Molecular Biology

Credits: 5

Application of modern techniques to the characterization and purification of biomolecules, with an emphasis on proteins and nucleic acids.

Analysis of enzyme kinetics and basic techniques used in molecular biology. Prereq: BMCB 751 or permission. Special fee. Writing intensive.

Attributes: Writing Intensive Course

BMCB 760 - Pharmacology

Credits: 4

Introduction to the basic principles and fundamental concepts of pharmacology, with a focus on molecular mechanisms and pathological basis of therapeutics and their curative effects. Topics include: foundations of pharmacology including pharmacodynamics and pharmacogenomics; drugs affecting other systems; chemotherapeutic drugs. No credit if credit earned for BSCI 680. Prereq: BMCB 658 or BMCB 751, or permission.

BMCB 763 - Biochemistry of Cancer

Credits: 4

Evaluation of the hallmarks of cancer, including molecular mechanisms of carcinogenesis, roles of oncogenes and dysregulated cell development, function and metabolism, tumor immunology, and the biological basis of cancer therapy. Prereq: BMCB 658 or BMCB 751, or permission.

BMCB 783 - Proteomics for Biological Discoveries

Credits: 4

Large-scale, high throughput study of proteins; characterization of entire set of proteins in a biological sample (proteome); quantification of changes in protein composition, interactions and post-translational modifications; major technology platforms; pharmaceutical and biomedical applications. Develop skills in processing samples from research projects; analysis of mass spectrometric data. Prereq: BMCB 658 or BMCB 751 or permission.

BMCB 790 - Undergraduate Teaching Experience

Credits: 1-4

Provide academic support to graduate teaching assistants or faculty in preparing, presenting, and executing Biochemistry, Molecular and Cellular Biology lectures or labs. May be repeated to a maximum of 4 credits. Permission required.

BMCB 794 - Protein Structure and Function

Credits: 4

Analysis of how the three-dimensional architecture of soluble and membrane proteins contributes to their biochemical function; methods for determining the structure of proteins; protein folding; protein targeting; mechanisms of enzyme catalysis. Computer resources will be used for protein modeling and structural prediction. Prereq: BMCB 658 or BMCB 751.

BMCB 795 - Investigations in Molecular and Cellular Biology**Credits:** 1-4

Advanced research or scholarly projects developed and conducted under the supervision of a faculty member. Provides the opportunity to apply advanced knowledge and techniques of the major to a specific problem or question. Permission required. May be repeated for a maximum of 8 credits.

BMCB 795W - Investigations in Molecular and Cellular Biology**Credits:** 1-4

Advanced research or scholarly projects developed and conducted under the supervision of a faculty member. Provides the opportunity to apply advanced knowledge and techniques of the major to a specific problem or question. Permission required. May be repeated for a maximum of 8 credits. Writing intensive.

Attributes: Writing Intensive Course**BMCB 799 - Senior Thesis****Credits:** 1-4

Independent research project under the direction of a faculty sponsor for seniors in biochemistry, molecular and cellular biology. Final product is a written thesis. One or two semesters. May be repeated to a maximum of 8 credits. Permission required. Writing intensive.

Attributes: Writing Intensive Course**BMCB 799H - Honors Senior Thesis****Credits:** 1-4

Independent research project under the direction of a faculty sponsor for seniors in biochemistry, molecular and cellular biology and in the Honors Program. Final product is a written thesis. One or two semesters. May be repeated to a maximum of 8 credits. Permission required. Writing intensive.

Attributes: Writing Intensive Course**BMCB 814 - Electron Microscopy****Credits:** 5

Theory and principles involved in preparing plant and animal tissue for observation with the transmission (TEM) and scanning (SEM) electron microscopes; shadow casting; photographic techniques; stereology; and presentation of micrographs for publication. Prereq: permission. Special fee. Lab.

Faculty

<http://colsa.unh.edu/faculty/all>