

BIOCHEMISTRY, MOLECULAR AND CELLULAR BIOLOGY MAJOR (B.S.)

<https://colsa.unh.edu/molecular-cellular-biomedical-sciences/program/bs/biochemistry-molecular-cellular-biology-major>

Description

The Biochemistry, Molecular & Cellular Biology (BMCB) major provides you with conceptual competence, analytical skills, and laboratory experiences to understand life at the molecular and cellular level. Your BMCB degree will prepare you for immediate employment as a research associate in industry, for entry into graduate or professional programs in medicine, dentistry or other allied health professions, and other career tracks.

The BMCB program offers advanced coursework and laboratories in diverse research areas of modern biology

- Cancer biology
- Cell biology
- Cell culture & tissue engineering
- Endocrinology
- Molecular biology
- Pharmacology
- Physical biochemistry
- Protein structure, function & proteomics

BMCB majors participate in experiential learning activities

- Many courses have integrated laboratory experiences to foster inquiry-based learning and to train creative and critical thinkers
- Independent research experiences are available in faculty research laboratories
- Many courses provide exposure to cutting-edge techniques and instrumentation
- Job preparation can be enhanced by internships with regional biotechnology and pharmaceutical companies
- Summer undergraduate research fellowships at U.S. or international academic institutions combine travel with research opportunities outside UNH

BMCB graduates have been successful in many careers

- Research associates and laboratory technicians
 - Biotechnology and pharmaceutical companies
 - Government agencies
 - Forensics laboratories
 - Academic research laboratories
 - Hospitals
- Science journalists and technical writers
- Healthcare workers
- Pharmaceutical sales and marketing staff
- Regulatory agency staff

- Primary and secondary school educators (with additional coursework in education)

BMCB graduates are well prepared for post-baccalaureate education

- Masters and doctoral programs in a wide variety of disciplines
- Professional health programs
 - Medical
 - Dental
 - Pharmacy
 - Physician's Assistant and other allied health programs

Note: The BMCB major is designed so you can complete all of the prerequisite courses needed to seek admission to graduate schools or health professional schools in four years.

Requirements

Degree Requirements

Minimum Credit Requirement: 128 credits

Minimum Residency Requirement: 32 credits must be taken at UNH

Minimum GPA: 2.0 required for conferral*

Core Curriculum Required: Discovery & Writing Program Requirements

Foreign Language Requirement: No

All Major, Option and Elective Requirements as indicated.

**Major GPA requirements as indicated.*

Major Requirements

Students in the Biochemistry, Molecular and Cellular Biology (BMCB) major take eight Foundation courses, four Bioscience Core courses, five BMCB Core courses, one Laboratory Techniques course, and three Major Elective courses. One capstone experience, supervised and approved within the major, is required of all seniors. In addition, all other University academic requirements must be completed, including those for the Discovery Program and the University Writing Requirement.

A grade of C- minus or better is required in all Foundation Core, Bioscience Core, BMCB Core, Laboratory Techniques, and Major Elective courses.

Code	Title	Credits
Foundation Core Courses		
CHEM 403	General Chemistry I ¹	4
CHEM 404	General Chemistry II	4
CHEM 547 & CHEM 549	Organic Chemistry I and Organic Chemistry Laboratory ²	5
CHEM 548 & CHEM 550	Organic Chemistry II and Organic Chemistry Laboratory ²	5
MATH 424B	Calculus for Life Sciences ^{3, 4}	4
BIOL 528	Applied Biostatistics I ⁴	4
PHYS 401	Introduction to Physics I ⁵	4
PHYS 402	Introduction to Physics II ⁵	4

¹ Fulfills Physical Science Discovery requirement

² CHEM 651/CHEM 653 & CHEM 652/CHEM 654 can be substituted for CHEM 547/CHEM 549 & CHEM 548/CHEM 550.

³ Fulfills Quantitative Reasoning Discovery requirement

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- 4 MATH 425 and MATH 426 can be substituted for MATH 424B and BIOL 528
- 5 PHYS 407 and PHYS 408 can be substituted for PHYS 401 and PHYS 402

Code	Title	Credits
Bioscience Core Courses		
BIOL 411	Introductory Biology: Molecular and Cellular ⁶	4
BIOL 412	Introductory Biology: Evolution, Biodiversity and Ecology	4
BMS 503 & BMS 504	General Microbiology and General Microbiology Laboratory	5
GEN 604	Principles of Genetics	4

- 6 BIOL 411 fulfills the Biological Science Discovery requirement, Discovery Laboratory requirement, and Discovery Inquiry requirement

Code	Title	Credits
BMCB Core Courses		
MCBS 401	Professional Perspectives in Molecular, Cellular, and Biomedical Sciences	1
BMCB 605	Principles of Cell Biology	4
BMCB 751	Principles of Biochemistry I	4
BMCB 752	Principles of Biochemistry II	4
GEN 704 or GEN 771	Microbial Genetics and Genomics Molecular Genetics	4-5

Code	Title	Credits
Laboratory Techniques Courses		
Select one course from the following:		
BMCB 753	Cell Culture	5
BMCB 754	Molecular Biology Research Methods	5
BMCB 755	Protein Biochemistry Laboratory	5
BMS 725	Cell Phenotyping and Tissue Engineering Laboratory	4
CHEM 741	Chemical Biology Laboratory	4

Code	Title	Credits
BMCB Major Electives		
Select three courses from the following: (A total of three unique major electives are required.)		
BMCB 750	Physical Biochemistry	3
BMCB 753	Cell Culture ⁷	5
BMCB 754	Molecular Biology Research Methods ⁷	5
BMCB 755	Protein Biochemistry Laboratory ⁷	5
BMCB 760	Pharmacology	4
BMCB 763	Biochemistry of Cancer	4
BMCB 794	Protein Structure and Function	4
BMCB 795	Investigations in Molecular and Cellular Biology (4-credit minimum) ⁸	1-4
BMCB 795W	Investigations in Molecular and Cellular Biology (4-credit minimum) ⁸	1-4
BMCB 799	Senior Thesis (4-credit minimum) ⁸	1-4
BMCB 799H	Honors Senior Thesis (4-credit minimum) ⁸	1-4
BMS 507 & BMS 508	Human Anatomy and Physiology I and Human Anatomy and Physiology II	8
BMS 650	Molecular Diagnostics	4
BMS 702	Endocrinology	4
BMS 704	Pathologic Basis of Disease	4
BMS 705 & BMS 715	Immunology and Immunology Laboratory	5
BMS 706 & BMS 708	Virology and Virology Laboratory	5
BMS 718	Mammalian Physiology	4
BMS 725	Cell Phenotyping and Tissue Engineering Laboratory ⁷	4
BMS 735	Molecular and Cellular Parasitology	4
BMS 740	Human Microbiome	4
BIOL 706	Data Science with R for the Life Sciences	4
CHBE 755	Computational Molecular Bioengineering	4
CHEM 740	Chemical Biology	3
CHEM 755	Advanced Organic Chemistry	3
GEN 704	Microbial Genetics and Genomics ⁷	5
GEN 705	Population Genetics ⁹	3
GEN 706	Human Genetics	4

GEN 711	Genomics and Bioinformatics	4
GEN 712	Programming for Bioinformatics	5
GEN 715	Molecular Evolution	4
GEN 717	Molecular Microbiology	5
GEN 721	Comparative Genomics	4
GEN 771	Molecular Genetics ⁷	4
NUTR 750	Nutritional Biochemistry	4

- 7 If course is used to fulfill BMCB Core or Laboratory Technique requirement, course cannot count as BMCB Major Elective.
- 8 Choose no more than ONE of the following courses to fulfill a major elective: BMCB 795, BMCB 795W, BMCB 799, BMCB 799H
- 9 Taking GEN 725 Population Genetics Lab is recommended, but not required.

Approved BMCB Capstone Courses

The capstone explores areas of interest based on the integration of prior learning. The capstone requirement may be satisfied through a course, created work or product, or some form of experiential learning (e.g., honors thesis, mentored research project, or other special student activity). Students may take more than one capstone course. If a second Lab Techniques course is taken, the second Lab Techniques course may count as a Capstone. Capstone completion is never displayed on Degree Works; your advisor will certify capstone completion at the time of graduation. Students must have 90 credits or more when completing their capstone requirement. See your advisor for questions about capstones.

Code	Title	Credits
BMCB 750	Physical Biochemistry	3
BMCB 760	Pharmacology	4
BMCB 763	Biochemistry of Cancer	4
BMCB 794	Protein Structure and Function	4
BMCB 795	Investigations in Molecular and Cellular Biology (4-credit minimum)	1-4
BMCB 795W	Investigations in Molecular and Cellular Biology (4-credit minimum)	1-4
BMCB 799	Senior Thesis (4-credit minimum)	1-4
BMCB 799H	Honors Senior Thesis (4-credit minimum)	1-4
BMS 702	Endocrinology	4
INCO 790	Advanced Research Experience (4-credit minimum)	1-4

For a Capstone experience not listed above, such as an internship, submit a [Capstone Approval form](#) **prior** to beginning the experience.

Degree Plan

Sample Degree Plan

This sample degree plan serves as a general guide; students collaborate with their academic advisor to develop a personalized degree plan to meet their academic goals and program requirements.

First Year		
Fall		Credits
MCBS 401	Professional Perspectives in Molecular, Cellular, and Biomedical Sciences	1
ENGL 401	First-Year Writing	4
CHEM 403	General Chemistry I	4
BIOL 411	Introductory Biology: Molecular and Cellular Discovery Course	4
Credits		17
Spring		
CHEM 404	General Chemistry II	4

BIOL 412	Introductory Biology: Evolution, Biodiversity and Ecology	4
MATH 424B	Calculus for Life Sciences	4
Discovery Course		4
Credits		16
Second Year		
Fall		
CHEM 547 & CHEM 549	Organic Chemistry I and Organic Chemistry Laboratory	5
BMS 503 & BMS 504	General Microbiology and General Microbiology Laboratory	5
BIOL 528	Applied Biostatistics I	4
PHYS 401	Introduction to Physics I	4
Credits		18
Spring		
CHEM 548 & CHEM 550	Organic Chemistry II and Organic Chemistry Laboratory	5
GEN 604	Principles of Genetics	4
PHYS 402	Introduction to Physics II	4
Discovery Course		4
Credits		17
Third Year		
Fall		
BMCB 605	Principles of Cell Biology	4
BMCB 751	Principles of Biochemistry I	4
BMCB Core or Lab Techniques course		4-5
Discovery Course		4
Credits		16-17
Spring		
BMCB 752	Principles of Biochemistry II	4
BMCB Core or Lab Techniques course		4-5
Discovery Course		4
Elective (any course)		4
Credits		16-17
Fourth Year		
Fall		
BMCB Major Elective (possible Capstone)		4
Discovery Course		4
BMCB Major Elective (any course)		4
Elective (any course)		4
Credits		16
Spring		
Elective (any course)		4-5
BMCB Major Elective		4
Elective (any course)		4
Credits		12-13
Total Credits		128-131

Student Learning Outcomes

Program Learning Outcomes Core Knowledge in Biochemistry, Molecular Biology, and Cell Biology

- Students will be able to explain the structure and function of macromolecules, including key functional groups, higher order structure and function of macromolecules, catalysis and enzyme kinetics.
- Students will be able to explain matter and energy conversion, including thermodynamics, catalysis, biological energy, ATP and its function in metabolism.
- Students will be able to explain cellular homeostasis, including major metabolic pathways for carbohydrates, lipids, proteins and nucleic acids, key regulatory steps in these pathways and the organization of metabolic enzymes.
- Students will be able to explain the flow of biological information, including detailed replication, transcription and translation processes in the context of homeostasis and development.

Quantitative Literacy, Inquiry & Analysis

- Students will be able to apply the scientific method to examine experimental evidence and draw informed conclusions.
- Students will be able to use graphs to represent scientific data.
- Students will be able to apply statistical methods to interpret scientific data.

Critical Thinking & Problem Solving

- Students will be able to use data to troubleshoot an unexpected outcome.
- Students will be able to apply core knowledge to critically interpret scientific data.

Written Communication

- Students will demonstrate written skills to communicate scientific knowledge and experimental data.

Oral Communication

- Students will be able to demonstrate oral presentation skills to communicate scientific knowledge and experimental data.