BIOMEDICAL SCIENCE MAJOR: MEDICAL MICROBIOLOGY OPTION (B.S.)

https://colsa.unh.edu/molecular-cellular-biomedical-sciences/program/bs/biomedical-science-major-medical-microbiology-option

Description

The **Biomedical Science: Medical Microbiology (BMS:MM) program** explores the world of microorganisms and how they interact with both humans and animals. This major provides you with excellent academic training and laboratory experiences in the areas of microbiology, infectious disease, and public health. BMS:MM graduates are prepared for successful careers in biotechnology or public health, or entry into graduate school or health professional programs.

The BMS:MM program includes course work and laboratories in:

- infectious disease
- immunology
- epidemiology and community health
- molecular biology
- microbial ecology and evolution

Students in the BMS:MM program may participate in a variety of experiential learning activities including:

- independent research experiences in laboratories of UNH biomedical science faculty
- work at the NH Veterinary Diagnostic Laboratory located on the UNH campus
- internships at biotechnology companies in the Greater Boston area
- internships at the NH Department of Public Health Laboratories

BMS:MM graduates have been successful in attaining careers as:

- **research scientists/laboratory technicians**
  - biotechnology and pharmaceutical companies
  - academic biomedical research programs
  - brewing industry
- **primary and secondary school educators** (requires additional coursework in education)
- **state and federal government employees**
  - public health laboratories
  - regulatory agencies (e.g., U.S. Food and Drug Administration)

BMS:MM graduates are prepared for post-baccalaureate education in:

- **professional health programs**
  - medical school
  - dental school
  - allied health programs (physician assistant, pharmacist, nursing, or pathologist's assistant programs)
- **graduate programs**
  - biomedical science
  - public health
  - forensic science

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 Medical Microbiology (MM) option take seven Foundation courses, six Bioscience Core courses, four BMS:MM Core courses, and five BMS:MM 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 Bioscience Core, BMS:MM Core, and Major Elective courses.

Foundation Courses

Code	Title	Credits
CHEM 403	General Chemistry I [1]	4
CHEM 404	General Chemistry II	4
CHEM 545 & CHEM 546	Organic Chemistry and Organic Chemistry Laboratory [2]	5
MATH 424B	Calculus for Life Sciences [3]	4
BIOL 528	Applied Biostatistics I [4]	4
PHYS 401	Introduction to Physics I	4
PHYS 402	Introduction to Physics II	4

Bioscience Core Courses

Code	Title	Credits
BIOL 411	Introductory Biology: Molecular and Cellular [5]	4
BIOL 412	Introductory Biology: Evolution, Biodiversity and Ecology [2]	4
or BMS 508	Human Anatomy and Physiology II	
BMS 503 & BMS 504	General Microbiology and General Microbiology Laboratory	5
GEN 604	Principles of Genetics	4
BMCB 605	Principles of Cell Biology	4
BMCB 658 & BMCB 659	General Biochemistry and General Biochemistry Lab	5

1 CHEM 403 fulfills the Physical Science Discovery requirement
2 Students applying to health profession schools need a full year of Organic Chemistry, a full year of Introductory Biology, and a full year of English. CHEM 651/CHEM 653 and CHEM 652/CHEM 654 should be taken in place of CHEM 545/CHEM 546; ENGL 502 or ENGL 503 is suggested in addition to ENGL 401.
3 MATH 424B fulfills the Quantitative Reasoning Discovery requirement.
4 PSYC 402 and SOC 402 are acceptable alternatives.

[5] BIOL 411 fulfills the Biological Science Discovery requirement, Discovery Laboratory requirement, and the Discovery Inquiry requirement.

BMS-MM Core Courses

Code	Title	Credits
BMS 602 & BMS 603	Pathogenic Microbiology and Pathogenic Microbiology Laboratory	5
BMS 705 & BMS 715	Immunology and Immunology Laboratory	5
BMS 706 & BMS 708	Virology and Virology Laboratory	5
MCBS 401	Professional Perspectives in Molecular, Cellular, and Biomedical Sciences	1

[6] Required for first-year students only.

BMS-MM Major Elective Courses

A total of five **unique** major elective courses is required. At least one course must be taken in each of the following subject areas: Host-Microbe Interaction Electives, Molecular Biology Electives, and Community Electives. Two additional courses are taken from any of the major elective subject areas.

Host-Microbe Interaction Electives

Code	Title	Credits
BMS 655	Human and Animal Parasites [7]	3
BMS 703	Infectious Disease and Health	4
BMS 704	Pathologic Basis of Disease	4
BMS 719	Host-Microbe Interactions [7]	4
BMS 720	Mycology, Parasitology, and Virology	3
BMS 735	Molecular and Cellular Parasitology [7]	4
BMS 740	Human Microbiome [7]	4

Molecular Biology Electives

Code	Title	Credits
BMS 623	Histology: Microscopic Cellular Structure and Function	4
BMS 650	Molecular Diagnostics	4
BMS 655	Human and Animal Parasites [7]	3
BMS 711	Toxicology	4
BMS 719	Host-Microbe Interactions [7]	4
BMS 725	Cell Phenotyping and Tissue Engineering Laboratory	4
BMS 735	Molecular and Cellular Parasitology [7]	4
BMS 740	Human Microbiome [7]	4
BMCB 753	Cell Culture	5
BMCB 754	Molecular Biology Research Methods	5
BMCB 763	Biochemistry of Cancer	4
GEN 704	Microbial Genetics and Genomics	5
GEN 717	Molecular Microbiology	5
GEN 721	Comparative Genomics	4

[7] Course may be used as either a Host-Microbe Interaction elective or Molecular Biology elective, but not both.

Community Electives

Code	Title	Credits
ANSC 602	Animal Rights and Societal Issues	4
ANTH 685	Gender, Sexuality and HIV/AIDS in Africa	4
BIOL 706	Data Science with R for the Life Sciences	4
BMS 730	Ethical Issues in Biomedical Science	4
GEN 705	Population Genetics [8]	3
GEN 713	Microbial Ecology and Evolution	4
HMP 501	Epidemiology and Community Medicine	4
SOC 635W	Medical Sociology	4

[8] Enrolling in GEN 725 concurrently is encouraged but not required

Other Major Electives

Code	Title	Credits
BMS 795	Investigations in Biomedical Science (4-credit minimum)	1-8
BMS 795W	Investigations in Biomedical Science (4-credit minimum)	1-8
BMS 799	Senior Thesis (4-credit minimum)	1-4
BMS 799H	Senior Honors Thesis (4-credit minimum)	1-4
INCO 790	Advanced Research Experience (4-credit minimum)	1-4

BMS:MM Capstone

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. 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.

Approved BMS:MM Capstone Courses

Code	Title	Credits
BMS 719	Host-Microbe Interactions	4
BMS 730	Ethical Issues in Biomedical Science	4
BMS 735	Molecular and Cellular Parasitology	4
BMS 740	Human Microbiome	4
BMS 795	Investigations in Biomedical Science (4-credit minimum)	1-8
BMS 795W	Investigations in Biomedical Science (4-credit minimum)	1-8
BMS 799	Senior Thesis (4-credit minimum)	1-4
BMS 799H	Senior Honors Thesis (4-credit minimum)	1-4
GEN 704	Microbial Genetics and Genomics	5
GEN 717	Molecular Microbiology	5
INCO 790	Advanced Research Experience (4-credit minimum)	1-4

For a Capstone experience not listed above, such as an internship, submit a Capstone Experience 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
BIOL 411	Introductory Biology: Molecular and Cellular	4
ENGL 401	First-Year Writing	4
CHEM 403	General Chemistry I	4
Discovery Course		4
	Credits	**17**

Spring		
BIOL 412	Introductory Biology: Evolution, Biodiversity and Ecology	4
MATH 424B	Calculus for Life Sciences	4
CHEM 404	General Chemistry II	4
Discovery Course		4
	Credits	**16**
Second Year		
Fall		
BMS 503 & BMS 504	General Microbiology and General Microbiology Laboratory	5
GEN 604	Principles of Genetics	4
CHEM 545 & CHEM 546	Organic Chemistry and Organic Chemistry Laboratory	5
Discovery Course		4
	Credits	**18**
Spring		
BMS 602 & BMS 603	Pathogenic Microbiology and Pathogenic Microbiology Laboratory	5
BMCB 605	Principles of Cell Biology	4
BIOL 528	Applied Biostatistics I	4
Discovery Course		4
	Credits	**17**
Third Year		
Fall		
BMS 705 & BMS 715	Immunology and Immunology Laboratory	5
PHYS 401	Introduction to Physics I	4
BMCB 658 & BMCB 659	General Biochemistry and General Biochemistry Lab	5
Discovery Course		4
	Credits	**18**
Spring		
BMS 706 & BMS 708	Virology and Virology Laboratory	5
PHYS 402	Introduction to Physics II	4
Major Elective		4
Discovery Course		4
	Credits	**17**
Fourth Year		
Fall		
Major Elective (possible Capstone course)		4
Major Elective		4
Elective (any course)		3-4
Elective (any course)		3-4
	Credits	**14-16**
Spring		
Major Elective		4
Major Elective		4
Elective (any course)		3-5
Elective (any course)		3-5
	Credits	**14-18**
	Total Credits	**131-137**

Student Learning Outcomes

Program Learning Outcomes

Core Knowledge

- Students will demonstrate an understanding of core knowledge in biochemistry, molecular biology, cell biology, genetics & biomedical sciences.

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.

Biomedical Science: Medical Microbiology option

- Students will be able to compare and contrast cellular and non-cellular microorganisms.
- Students will understand basic structure-function relationships of microorganism components, and explain how specific microbial components contribute to a microorganism's growth and survival.
- Students will be able to discuss basic metabolic pathways that allow microorganisms to grow, thrive, and survive in numerous environments
- Students will understand how genetic information is maintained and transferred, how mutation can affect viability and contribute to evolution, and how gene expression is regulated.
- Students will be able to discuss the role of microorganisms in human and animal health and explain, using specific examples, how microbes can be both harmful and beneficial.