BIOMEDICAL SCIENCE MAJOR: MEDICAL LABORATORY SCIENCES OPTION (B.S.)

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

Description

The Biomedical Science: **Medical Laboratory Science (BMS:MLS) program** provides you with the medical knowledge and understanding of diagnostic testing needed for a fulfilling career in the biomedical sciences, including as an American College of Clinical Pathology-certified Medical Laboratory Scientist.

As a Biomedical Science: Medical Laboratory Science major, you will:

- learn to determine the presence, extent, or absence of human disease through understanding the diagnostic testing that medical professionals use to make these determinations (*70% of physician decisions are based on diagnostic testing results*)
- obtain hands-on experience by performing immunological, biochemical, molecular, and microbiological procedures that aid in the diagnosis, treatment, and prevention of disease

Unique features of the MLS option include:

- the only 4-year degree program in NH that includes a path for students to become certified as Medical Laboratory Scientists (MLS) by the American Society of Clinical Pathology (ASCP) and that is accredited by the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS)
- ***Certified Medical Laboratory Scientists*** are in high demand and easily find employment in hospitals and medical centers throughout the country
- the MLS program is affiliated with Dartmouth Hitchcock Medical Center and NorDx/Maine Medical Center

Careers or post-baccalaureate education of previous Medical Laboratory Science graduates include:

- **certified medical laboratory scientists (ASCP) in diagnostic testing laboratories in hospitals and industry**
- **research scientists/laboratory technicians**
  - biotechnology and pharmaceutical companies
  - biomedical research facilities
  - forensic laboratories
  - hospital reference laboratories
  - government public health laboratories
- **secondary school educators** (with additional coursework in education)
- **diagnostic product development**
- **sales and marketing**
- **state and federal government agencies** (e.g., U.S. Food and Drug Administration).
- **professional health programs**
  - medical school
  - allied health programs (physician assistant, pathologists' assistant, pharmacy)
- **graduate programs**
  - microbiology
  - biomedical science
  - biochemistry
  - nursing
  - public health
  - business administration

Requirements

The Medical Laboratory Sciences (MLS) program is NAACLS accredited and follows accreditation requirements. Students in this option take four Foundation courses, five Bioscience Core courses, six BMS:MLS core courses, and five Major Elective courses. One capstone experience, supervised and approved within the major, is required of all seniors. The capstone explores areas of interest based on the integration of prior learning. In addition, all other University academic requirements must be completed, including those for Discovery Program and the University Writing Requirement.

A grade of C-minus or above is required in BMS:MLS Core 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
Select one of the following statistics courses: [3]		
BIOL 528	Applied Biostatistics I	4
or PSYC 402	Statistics in Psychology	
or SOC 402	Statistics	
or MATH 439	Statistical Discovery for Everyone	

Bioscience Core Courses

Code	Title	Credits
BMS 508	Human Anatomy and Physiology II	4
GEN 604	Principles of Genetics	4
BMCB 658 & BMCB 659	General Biochemistry and General Biochemistry Lab	5
Select one of the following:		
BMS 503 & BMS 504	General Microbiology and General Microbiology Laboratory	4-5
or BMS 501	Microbes in Human Disease	
Select one of the following:		
BMS 507	Human Anatomy and Physiology I	4
BIOL 411	Introductory Biology: Molecular and Cellular [2, 4]	0 or 4

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. See Pre-Professional Health Program Advising.

3 Statistics fulfills the Quantitative Reasoning Discovery requirement.

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

BMS-MLS Core Courses

Code	Title	Credits
BMS 401	Professional Perspectives in Biomedical Sciences	1
BMS 560 & BMS 561	Body Fluids and Body Fluids Laboratory	4
BMS 602 & BMS 603	Pathogenic Microbiology and Pathogenic Microbiology Laboratory	5
BMS 642 & BMS 643	Clinical Immunology and Serology and Clinical Serology Laboratory	4
BMS 650	Molecular Diagnostics	4
BMS 720	Mycology, Parasitology, and Virology [5]	3

[5] If BMS 721 is taken concurrently with BMS 720, it may count as one of the two required Laboratory Electives. However, BMS 721 is not a Major Elective course, so five Major Electives must still be completed, at least one of which includes a lab component, plus four additional Major Electives with or without lab.

BMS-MLS Major Electives

A total of five **unique** Major Electives is required. Two courses must have a laboratory component.

Code	Title	Credits
Choose TWO Major Electives with a Laboratory		
BMS 623	Histology: Microscopic Cellular Structure and Function	4
BMS 644 & BMS 645	Clinical Hematology and Clinical Hematology Laboratory [6]	5
BMS 656 & BMS 657	Immunohematology and Blood Banking Laboratory [6]	4
BMS 658 & BMS 659	Medical Biochemistry and Clinical Chemistry Laboratory [6]	5
BMS 706 & BMS 708	Virology and Virology Laboratory	5
BMS 721	Mycology, Parasitology, and Virology Laboratory [5,6]	2
BMS 725	Cell Phenotyping and Tissue Engineering Laboratory	4
BMS 740	Human Microbiome	4
BMCB 753	Cell Culture	5

Code	Title	Credits
Choose THREE Major Electives from the list below (FOUR if BMS 721 is counted as a Laboratory course)		
BMS 610	Biomedical Lab Management [6]	4
BMS 623	Histology: Microscopic Cellular Structure and Function	4
BMS 635	Preceptorial in Prehospital Care	2
BMS 640	Phlebotomy Theory [6]	2
BMS 641	Phlebotomy Clinical Internship [6]	1-2
BMS 644	Clinical Hematology [6]	3
BMS 644 & BMS 645	Clinical Hematology and Clinical Hematology Laboratory [6]	5
BMS 644 & BMS 646	Clinical Hematology and Clinical Hemostasis [6]	4
BMS 656 & BMS 657	Immunohematology and Blood Banking Laboratory [6]	4
BMS 658 & BMS 659	Medical Biochemistry and Clinical Chemistry Laboratory [6]	5
BMS 702	Endocrinology	4
BMS 703	Infectious Disease and Health	4
BMS 704	Pathologic Basis of Disease	4
BMS 706 & BMS 708	Virology and Virology Laboratory	5
BMS 711	Toxicology	4
BMS 719	Host-Microbe Interactions	4
BMS 725	Cell Phenotyping and Tissue Engineering Laboratory	4
BMS 730	Ethical Issues in Biomedical Science	4
BMS 735	Molecular and Cellular Parasitology	4
BMS 740	Human Microbiome	4
BMS 749	Case Studies in Hematology and Immunology	2
BMS 750	Case Studies in Microbiology [6]	2
BMS 751	Advanced Clinical Microbiology Internship [6]	5
BMS 752	Advanced Hematology Internship [6]	5
BMS 753	Advanced Immunohematology Internship [6]	5
BMS 754	Advanced Clinical Chemistry Internship [6]	5
BMS 761	Clinical Microbiology Internship	20
BMS 790	Undergraduate Teaching Experience	1-4
BMS 795	Investigations in Biomedical Science	1-8
BMS 795W	Investigations in Biomedical Science	1-8
BMS 799	Senior Thesis (4-credit minimum)	1-4
BMS 799H	Senior Honors Thesis (4-credit minimum)	1-4
BMCB 605	Principles of Cell Biology	4
BMCB 753	Cell Culture	5
BMCB 760	Pharmacology	4
GEN 706	Human Genetics	4
GEN 721	Comparative Genomics	4
SOC 635W	Medical Sociology	4
Other Internships [7]		

[6] Required for students interested in MLS clinical generalist internship

[7] A 20 credit Clinical Hematology Internship covering advanced instruction in hematology and hemostasis at a local hospital or reference laboratory is also available. Please see your advisor for information.

Approved BMS:MLS 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. 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
BMS 635	Preceptorial in Prehospital Care	2
BMS 656	Immunohematology	3
BMS 658	Medical Biochemistry	3
BMS 719	Host-Microbe Interactions	4
BMS 725	Cell Phenotyping and Tissue Engineering Laboratory	4
BMS 740	Human Microbiome	4
BMS 747	Case Studies in Bloodbanking	1
BMS 748	Case Studies in Medical Biochemistry	1
BMS 749	Case Studies in Hematology and Immunology	2
BMS 750	Case Studies in Microbiology	2
BMS 751	Advanced Clinical Microbiology Internship	5
BMS 752	Advanced Hematology Internship	5
BMS 753	Advanced Immunohematology Internship	5
BMS 754	Advanced Clinical Chemistry Internship	5
BMS 761	Clinical Microbiology Internship	20
BMS 790	Undergraduate Teaching Experience (2 semesters, including lab presentation or instruction)	1-4
BMS 795	Investigations in Biomedical Science	1-8
BMS 795W	Investigations in Biomedical Science	1-8
BMS 799	Senior Thesis (4-credit minimum)	1-4
BMS 799H	Senior Honors Thesis (4-credit minimum)	1-4
BMCB 753	Cell Culture	5
INCO 790	Advanced Research Experience (4-credit minimum)	1-4
Other Internships [7]		

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 Course Sequence for Medical Laboratory Science

Course	Title	Credits
First Year		
Fall		
BMS 401	Professional Perspectives in Biomedical Sciences	1
ENGL 401	First-Year Writing	4
BMS 507 or BIOL 411	Human Anatomy and Physiology I or Introductory Biology: Molecular and Cellular	4
CHEM 403	General Chemistry I	4
Discovery Course		4
	Credits	**17**
Spring		
BMS 508	Human Anatomy and Physiology II	4
CHEM 404	General Chemistry II	4
Statistics		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
Discovery Course		4
Discovery Course		4
	Credits	**17**
Spring		
BMS 602 & BMS 603	Pathogenic Microbiology and Pathogenic Microbiology Laboratory	5
BMS 560 & BMS 561	Body Fluids and Body Fluids Laboratory	4
CHEM 545 & CHEM 546	Organic Chemistry and Organic Chemistry Laboratory	5
Major Elective		4
	Credits	**18**
Third Year		
Fall		
Major Elective with lab		4-6
BMCB 658 & BMCB 659	General Biochemistry and General Biochemistry Lab	5
BMS 650	Molecular Diagnostics	4
	Credits	**13-15**
Spring		
BMS 642 & BMS 643	Clinical Immunology and Serology and Clinical Serology Laboratory	4
BMS 720	Mycology, Parasitology, and Virology	3
Major Elective with lab		4-5
Elective (any course)		4
	Credits	**15-16**
Fourth Year		
Fall		
Major Elective (WI)		4
Major Elective (Capstone)		4
Discovery Course		4
Elective (any course)		4
	Credits	**16**
Spring		
Four Electives (any courses) or BMS 751, BMS 752, BMS 753, and BMS 754		16-20
	Credits	**16-20**
	Total Credits	**128-135**

Student Learning Outcomes

SLO: Core Knowledge

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

Biomedical Science: Medical Laboratory Science option

- Students will be able to correlate patient history, symptoms and laboratory test results with the diagnosis and treatment of clinical disease state
- Students will be able to interpret, analyze, and identify clinical laboratory results.
- Students will be able to define the mechanisms that give rise to human diseases and/or organ system dysfunction, including hypersensitivity, renal disease, acid-base disorders, etc.
- Students will be able to recognize risk factors for the development of disease
- Students will be able to identify and explain the underlying principle(s) of appropriate testing methodologies and assays for diagnosis of clinical diseases and organ system dysfunction.

SLO: 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.

SLO: 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.

SLO: Written Communication

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

SLO: Oral Communication

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