DUAL-DEGREE BS/MHS IN BIOMEDICAL SCIENCES (4+1)

Program Contact: Martine Mirrione (martine.mirrione@qu.edu)
203-582-8117

The Department of Biomedical Sciences offers a five-year program leading to a Dual-Degree BS in Biomedical Sciences/MHS in Biomedical Sciences (4+1) with concentrations in Medical Sciences or Microbiology. The curriculum for this dual-degree program provides a solid foundation in the basic and biomedical sciences, which allows students to pursue many different avenues of opportunity depending upon their goals and interests. Students completing this graduate program may qualify for employment in the pharmaceutical and biotechnology industries; the medical diagnostics industry; university-based biomedical research; and city, state and federal health/research laboratories. Additionally, a student with this degree may wish to continue their education in graduate/professional school in: biomedical sciences, medicine, dentistry, veterinary medicine, physician assistant, pathologists' assistant, cardiovascular perfusion, microbiology and immunology, molecular biology, biotechnology, neurobiology, pharmacology, toxicology, cancer biology, plus many other areas.

To remain in good standing within the program, students must maintain a GPA of 3.00 overall, as well as in math and science for the remainder of their undergraduate careers. Students also must maintain an overall GPA of 3.00 for the graduate portion and successfully pass the comprehensive examination in their final semester of their graduate year.

This is a *recommended* plan of study as course plans are subject to change. Course availability, potential transfer credits, and course prerequisite completion may influence the final course schedule for each program. To remain in good academic standing within the **Dual-Degree BS/MHS program**, the student must maintain a GPA of 3.00 overall, as well as in math and science.

Students interested in graduate or professional school can also investigate research and/or an independent study.

Undergraduate Phase (Bachelor of Science in Biomedical Sciences)

Dual-degree students replace up to three undergraduate classes (9-12 credits) with graduate-level courses in the third or fourth year. In the example course plan below, BMS undergraduate students can replace required Pathophysiology (BMS 318) and Immunology (BMS 375 & BMS 375L) with graduate level Pathophysiology (BMS 518) and Immunology (BMS 522 & BMS 522L), along with an additional graduate science elective.

However, the path to the graduate program is very flexible and is accessible to other undergraduate science majors at Quinnipiac, as students may enroll in any three graduate level courses (https://catalog.qu.edu/graduate-studies/health-sciences/medical-laboratory-sciences-mhs/#coursestext) applicable to the graduate BMS degree (https://catalog.qu.edu/graduate-studies/health-sciences/medical-laboratory-sciences-mhs/#curriculumtext) in replacement of undergraduate electives.

Course	Title	Credits
First Year		
Fall Semester		
BIO 150	General Biology for Majors	4
CHE 110 & 110L	General Chemistry I and General Chemistry I Lab	4
EN 101	Introduction to Academic Reading and Writing	3
FYS 101	First-Year Seminar	3
MA 140 or MA 141	Pre-Calculus [1] or Calculus of a Single Variable	3
	Credits	**17**
Spring Semester		
BIO 151	Molecular and Cell Biology and Genetics	4
CHE 111 & 111L	General Chemistry II and General Chemistry II Lab	4
EN 102	Academic Writing and Research	3
BMS 275	Introduction to Biomedical Research	2
UC Disciplinary Inquiry		3
	Credits	**16**
Second Year		
Fall Semester		
BIO 211 & 211L	Human Anatomy and Physiology I and Human Anatomy and Physiology Lab I	4
CHE 210 & 210L	Organic Chemistry I and Organic Chemistry I Lab	4
MA 275	Biostatistics	3
UC Disciplinary Inquiry		3
	Credits	**14**
Spring Semester		
BIO 212 & 212L	Human Anatomy and Physiology II and Human Anatomy and Physiology II Lab	4
CHE 211 & 211L	Organic Chemistry II and Organic Chemistry II Lab	4
BMS 370 & 370L	General Microbiology and General Microbiology Lab	4
UC Disciplinary Inquiry		3
	Credits	**15**
Third Year		
Fall Semester		
CHE 315 & 315L	Biochemistry I and Biochemistry I Lab	4
PHY 110 & 110L	General Physics I and General Physics I Lab	4
BMS Elective(s)		4
UC Personal Inquiry		3
	Credits	**15**
Spring Semester		
PHY 111 & 111L	General Physics II and General Physics II Lab	4
Choose one of the following		4
BMS 472	Biotechnology ((Lecture & Lab Combined))	
BIO 471 & 471L	Molecular Genetics and Molecular Genetics Lab	
BMS Elective(s)		3

Open Elective(s)		4
	Credits	**15**
Fourth Year		
Fall Semester		
BMS 522 & 522L	Immunology and Immunology Lab	4
UC Personal Inquiry		3
UC Personal Inquiry		3
Open Elective(s)		4
	Credits	**14**
Spring Semester		
BMS 518	Pathophysiology	3
Graduate BMS Specialization/Elective(s)		3
SHS 420	Integrative Capstone	3
UC Personal Inquiry		3
Open Elective(s)		2
	Credits	**14**
	Total Credits	**120**

[1] Minimum mathematics requirement: MA 140. For those interested in graduate or professional schools, MA 141 is recommended.

Post-Baccalaureate Phase (Master's)

Students earn a Master of Health Science in Biomedical Sciences (https://catalog.qu.edu/graduate-studies/health-sciences/medical-laboratory-sciences-mhs/#curriculumtext) by combining the graduate-level credits taken as an undergrad with additional credits during the fifth year. Students choose between concentrations in **Medical Sciences** or **Microbiology** with differing core and specialization elective options (see *Areas of Specialization* below). The program offers a variety of science electives including independent study research or internships for a tailored experience.

The preceding undergraduate phase example course plan applies 10 credits (BMS 522, BMS 522L, BMS 518, and a 500-600 level elective (https://catalog.qu.edu/graduate-studies/health-sciences/medical-laboratory-sciences-mhs/#coursestext)) to the graduate degree. The following master's phase example course plan would require an additional 28 credits in the fifth year to follow **non-thesis** track (38 credits). Medical core classes are shown in the example, along with comprehensive exam in the final semester.

Course	Title	Credits
Fifth Year		
Fall Semester		
BMS 502	Research Methods	4
BMS 532	Histology and Lab	4
Graduate BMS Specialization/Elective(s)		6
	Credits	**14**
Spring Semester		
BMS 670	Comp Exam/Biomedical Sciences [1]	2
Graduate BMS Specialization/Elective(s)		12
	Credits	**14**
	Total Credits	**28**

[1] The comprehensive exam must be completed by April 15 of the fifth year.

Comprehensive Examination

The comprehensive examination in biomedical sciences (2 credits) is a requirement for the non-thesis option in the Biomedical Sciences program. The purpose of the exam is two-fold. First, the student must demonstrate broad and specific knowledge expected of someone holding a master's degree. Second, the student must be able to integrate knowledge obtained from individual courses into unified concepts which link the student's own specialization to other fields of study. The student is given two opportunities to demonstrate competency. A written essay exam is administered by a designated faculty member. Students should schedule an appointment with the program director before registering for the comprehensive exam.

Thesis Option

Undergraduate students engaged in a faculty-mentored research project may also have the opportunity to continue the work as a master's thesis (https://catalog.qu.edu/graduate-studies/health-sciences/medical-laboratory-sciences-mhs/#curriculumtext) in the graduate year. A student following **thesis** track (35 credits) would take one fewer open elective and would be required to successfully write and defend a master's thesis.

Areas of Specialization

Students in the thesis or non-thesis track may choose between concentrations in **Medical Sciences** or **Microbiology** with differing core and specialization elective options.

Medical Sciences

Code	Title	Credits
Core Courses		
BMS 502	Research Methods	4
BMS 518	Pathophysiology	3
BMS 522 & 522L	Immunology and Immunology Lab	4
BMS 532	Histology and Lab	4
Specialization Electives		
BIO 515	Advanced Biochemistry	4
BIO 568	Molecular and Cell Biology	4
BIO 571	Molecular Genetics	4
BMS 508	Advanced Biology of Aging	3
BMS 519	Computational Biomedicine	3
BMS 520	Neuropharmacology	3
BMS 521	Advances in Hematology	3
BMS 527	Pharmacology	3
BMS 535	Histochemistry and Lab	3
BMS 536	Endocrinology	3
BMS 552	Toxicology	3
BMS 561	Immunohematology	3
BMS 562	Blood Coagulation and Hemostasis	3
BMS 563	Anemias	3
BMS 564	Fundamentals of Oncology	4
BMS 565	Leukemia	3
BMS 569	Antimicrobial Therapy	3
BMS 571	Human Anatomy & Dissection	4

BMS 576	Drug Discovery and Development	3
BMS 579	Molecular Pathology	3
BMS 583	Forensic Pathology	3
BMS 598	Synaptic Organization of the Brain	3
BMS 599	Biomarkers	3
BMS 622	MED Cross-Listed Selective	3
PA 515	Human Physiology	4

Microbiology

Code	Title	Credits
Core Courses		
BMS 502	Research Methods	4
BMS 522 & 522L	Immunology and Immunology Lab	4
BMS 570	Virology	4
BMS 572	Pathogenic Microbiology	4
Specialization Electives		
BIO 568	Molecular and Cell Biology	4
BIO 571	Molecular Genetics	4
BMS 525	Vaccines and Vaccine Preventable Diseases	3
BMS 526	Epidemiology	3
BMS 528	Advanced Clinical Parasitology	4
BMS 569	Antimicrobial Therapy	3
BMS 573	Mycology	3
BMS 575	Food Microbiology	4
BMS 576	Drug Discovery and Development	3
BMS 579	Molecular Pathology	3
BMS 584	Emerging and Re-emerging Infectious Diseases	3
BMS 585	Outbreak Control	3
BMS 595	Transplantation Immunology	3

Graduate Science Electives

Open electives in all tracks are fulfilled with any graduate BMS Science electives (https://catalog.qu.edu/graduate-studies/health-sciences/medical-laboratory-sciences-mhs/#coursestext) offered. The course list below includes additional **Biology** and **Pathologist Assistant** courses that may also apply to the traditional MHS in BMS degree (limited seats, based on space availability).

Code	Title	Credits
Open Electives		
BIO 500	Special Topics in Molecular and Cell Biology	3
BIO 505	Writing and Science	3
BIO 515	Advanced Biochemistry	4
BIO 562	Bioinformatics	3
BIO 568	Molecular and Cell Biology	4
BIO 571	Molecular Genetics	4
BIO 589	Molecular and Cell Neurobiology	3
BIO 605	DNA Methods Laboratory	4
BIO 606	Protein Methods Laboratory	4
PA 515	Human Physiology	4
PA 516	Clinical Pathology	4
PA 535	Disease Mechanisms	4

Mission Statement

The mission of Quinnipiac University's Dual-Degree BS/MHS in Biomedical Sciences (4+1) program (with concentrations in Medical Sciences or Microbiology) is to provide students with the cutting-edge skills they need to manage the more complex operations carried out today in hospitals and research facilities, as well as allowing students to develop their critical thinking skills and knowledge of the biomedical sciences, sought after by PhD programs, medical schools, dental schools, physician assistant programs, and allied health professions. The program provides the student with a comprehensive knowledge to meet the education and technical needs of the biomedical profession in pharmaceutical, biotechnology, diagnostics and medical research. Students are guided in the principles and methods of scientific research, and they gain knowledge of the latest advances in biomedical, biotechnological and laboratory sciences—all directly applicable to real-world work environments, medical research, and healthcare.

Student Learning Outcomes

Upon completion of the Dual-Degree BS/MHS in Biomedical Sciences (4+1) program, students will demonstrate the following competencies:

1. **Foundational Knowledge**: Demonstrate advanced knowledge of the major disciplines in the Biomedical Sciences (Biology, Chemistry, Physics, Physiology, Microbiology, Immunology, Pathophysiology).
2. **Disease Mechanisms**: Identity factors that influence human health and disease.
3. **Translational Science**: Critically analyze how new research discoveries can be translated into effective patient treatments/interventions.
4. **Professional Skills**: Master the essential technical skills critical for success in a laboratory environment.
5. **Effective Scientist**: Engage in scientific research and effectively communicate the dissemination of results to various audiences.
6. **Responsible Citizen**: Evaluate the social and ethical impact of scientific discoveries on medical practice.

Admission to the Program

Students interested in applying to the Dual-Degree BS/MHS in Biomedical Sciences (4+1) with concentrations in Medical Sciences or Microbiology must meet with the program contact. It is encouraged that interested students work with the graduate BMS program director, in addition to their academic adviser, to plan for taking graduate courses during junior or senior year. In the fall of the senior year, the student may apply for admission into the program. Admission into the program is dependent on the applicant's potential to pursue a university program and on past academic performance. At the time of application submission, students must have a GPA of 3.00 overall, as well as in math and science. To remain in good standing within the program and be eligible to enter the graduate curriculum, the student must maintain a GPA of 3.00 overall, as well as in math and science for the remainder of their undergraduate careers.

Students in other science programs at Quinnipiac such as Health Sciences, Behavioral Neuroscience, Biology or Chemistry who successfully complete a rigorous undergraduate science curriculum may

be eligible for admittance into the graduate portion of the program and should contact the program director.

Pre-Medical Studies

The Pre-Medical Studies Designation is designed for undergraduate students who are interested in pursuing doctoral or advanced professional degrees in medicine such as MD, DO, DDS/DMD, PharmD, OD, DPM, DPT or DVM and allows students to enroll in and track typical medical or professional school course requirements. Students in any major may pursue the Pre-Medical Studies designation. Interested students should refer to the Pre-Medical Studies page for more information.