BIOCHEMISTRY, MOLECULAR, AND CANCER BIOLOGY (MD/PHD)

The PhD program in Biochemistry, Molecular, & Cancer Biology is part of the Integrated Program in Biomedical Sciences at Loyola University's Health Sciences campus. The goal of this program to train students as independent investigators who will go on to post-doctoral fellowships following the completion of the degree, and eventually become independent academic researchers and teachers.

Related Programs

Master's

- Biochemistry and Molecular Biology (MS) (https://catalog.luc.edu/graduate-professional/graduate-school/health-sciences/biomedical-sciences/biochemistry-molecular-biology-ms/)

Combined

- Biochemistry, Molecular, and Cancer Biology (MD/PhD) (p. 1)
- Microbiology and Immunology (MD/PhD) (https://catalog.luc.edu/graduate-professional/dual-degree-programs/microbiology-immunology-md-phd/)

MD/PHD at Loyola University Chicago

Loyola University Chicago Stritch School of Medicine offers a program designed for exceptional students to earn both an MD and a PhD degree, in preparation for a career in academic medicine. The program is flexible, individually tailored, and provides an opportunity to work concurrently toward an MD and a PhD degree in one of the six academic tracks available to Integrated Program in Biomedical Science (IPBS) PhD students:

- Biochemistry, Molecular, and Cancer Biology
- Cell and Molecular Physiology
- Integrative Cell Biology
- Molecular Pharmacology and Therapeutics
- Microbiology and Immunology
- Neuroscience

Ideal candidates for this program should demonstrate a strong interest in and exceptional motivation toward research. Our MD/PhD candidates undergo a challenging and excellent research training experience tailored to the interests and goals of each student. Students actively participate in presenting their respective research and/or clinical work at appointed monthly MD/PhD meetings.

The MD/PhD Program benefits from all the biomedical science disciplines of the Graduate School located at Loyola University Chicago Health Sciences Campus. Their teaching programs are integrated with those of the medical school. The PhD degree may be earned in any of the academic tracks listed for the IPBS.The ultimate goal is for the student to achieve both degrees in seven to eight years, depending on the student's goals, background, workload, and specific course schedule.

Curriculum

The MD/PhD curriculum consists of the first two years of medical school, then three to four years of graduate school in one of the IPBS tracks, followed by two more years of medical school. MD/PhD students must complete all degree requirements for the MD degree and the PhD degree with the IPBS. In addition, MD/PhD students must submit a competitive NIH F30/F31 or similar fellowship or funding consideration. The MD curriculum can be found on the Stritch School of Medicine website (https://www.luc.edu/stritch/education/doctorofmedicine/). The degree requirements for the PhD in Biochemistry, Molecular, and Cancer Biology portion of this dual degree program can be found below.

Course Requirements

The PhD in Biochemistry, Molecular, and Cancer Biology requires a total of 48 credit hours. Students in the MD/PhD program will complete at least 24 credit hours in the PhD program and transfer 24 hours from their MD coursework to fulfill PhD requirements. Core IPBS requirements and track courses are detailed below.

Code	Title	Hours
Foundational Curriculum		
BMSC 402	Statistical Methods for Biomedical Science	3
BMSC 405	Ethics in Biomedical Sciences	1
BMSC 416	Methods Biomedical Science	1
BMSC 418	Presentation skills	1
Track Required Courses		
Select two Biochemistry, Molecular, and Cancer Biology Electives		*6*
BMB 417	Molecular Biology	
BMB 490	Special Topics in Molecular Biology	
BMB 590	Molecular Biology of Oncogenesis	
ICB 403	Graduate Histology	
MIIM 411	Basic Molecular Microbiology	
MIIM 413	Basic Concepts of Immunology	
MIIM 431	The Molecular Biology of Viruses	
MIIM 442	Cell & Molecular Immunology	
NRSC 410	Cellular & Molecular Neurobiology	
PIOL 401	Physiology	
PIOL 417	Cellular Physiology	
PIOL 421	Function of the Human Body I	
PIOL 422	Function of the Human Body II	
PIOL 423	Biochemical Physiology	
PIOL 450	Fundamentals Of Neurophysiology	
PIOL 461	Introduction to Human Pathophysiology	
PHAR 408	Molecular Basis of Disease and Therapeutics	
PHAR 409	Principles of Pharmacology	
PHAR 410	Signal Transduction	
BMB 499	Research in Molecular Biology	1-9
BMB 501	Molecular Biology Journal Club	1
BMB 502	Seminar in Molecular Biology	0
BMB 600	Dissertation Supervision	1
Total Hours		**24**

Comprehensive Examination

In addition to the course work, students must pass a Comprehensive Exam which involves preparing a mock grant proposal. The

Comprehensive Exam also tests the student's understanding of the scientific method, oral and written communication skills and general biomedical research knowledge. The Comprehensive Exam usually is taken during the summer of the first year of their PhD coursework for MD/PhD students. The written mock grant proposal is presented to the student's Comprehensive Exam Committee and evaluated during a meeting with the Committee. Students who pass their Comprehensive Exam are permitted to continue in the IPBS.

Research and Dissertation

The Integrated Program in Biomedical Sciences is a research-intensive PhD program. Students are expected to undertake an independent, original experimental study resulting in new and significant contributions to knowledge in the biomedical sciences.

Lab Rotations: Students undergo one laboratory rotation, usually during the summer between their first and second year of medical school to identify a research advisor. Students select a rotation laboratory from a list of available advisors and in consultation with the Director of the MD/PhD program and the Associate Dean for Graduate Education. After identifying an advisor, students select a specialization track and begin attending the Journal Clubs, Seminars and taking track-specific electives. Each track has a Graduate Program Director to advise students.

Dissertation Research: After students pass their Comprehensive Exam, they form a Dissertation Committee and meet with the Committee starting in the second year to receive approval of their Dissertation Proposal. Research on the dissertation continues with regular Dissertation Committee meetings until the completion of the dissertation. The final dissertation must be presented in a public seminar, approved by the Dissertation Committee and deposited in a public database.

Suggested Sequence of Courses

Course	Title	Hours
Year 1		
Fall		
BMSC 405	Ethics in Biomedical Sciences	1
BMSC 416	Methods Biomedical Science	1
BMB 499	Research in Molecular Biology	2
BMB 501	Molecular Biology Journal Club	0
BMB 502	Seminar in Molecular Biology	0
Elective 1 [2]		3
	Hours	**7**
Spring		
BMSC 402	Statistical Methods for Biomedical Science	3
BMSC 418	Presentation skills	1
BMB 499	Research in Molecular Biology [1]	2
BMB 501	Molecular Biology Journal Club	0
BMB 502	Seminar in Molecular Biology	0
Elective 2 [2]		3
	Hours	**9**
Summer		
GSSM S61	Doctoral Study-Summer	1
	Hours	**1**
Year 2		
Fall		
BMB 499	Research in Molecular Biology [1]	3
BMB 501	Molecular Biology Journal Club [3]	0
BMB 502	Seminar in Molecular Biology [3]	0
BMB 600	Dissertation Supervision [3]	1
	Hours	**4**
Spring		
BMB 499	Research in Molecular Biology [1]	2
BMB 501	Molecular Biology Journal Club [3]	0
BMB 502	Seminar in Molecular Biology [3]	0
BMB 600	Dissertation Supervision [3]	1
	Hours	**2**
Summer		
GSSM S60	Dissertation Supervision-Summer	1
	Hours	**1**
	Total Hours	**24**

1. Research credits are variable (1-9 credit hours) and fewer can be taken to accommodate additional elective courses.
2. Elective Courses (6 credits hours) may be taken in anytime in the first three years of the program, depending on their offering.
3. Students enroll in BMB 501 Molecular Biology Journal Club, BMB 502 Seminar in Molecular Biology, and BMB 600 Dissertation Supervision each semester for the remainder of time in the program.

Dual Degree Programs

Students in dual degree programs are responsible for abiding by academic policies and graduation requirements of both academic units to which they are enrolled. It is strongly recommended that students schedule regular meetings with academic advisors from both units to ensure timely degree completion. Dual degree programs may have slightly different degree requirements from the standard for one or both of the degrees earned. Students should closely read through all degree requirements and ask for clarification as needed.

Graduate & Professional Standards and Regulations

Students in graduate and professional programs can find their Academic Policies in Graduate and Professional Academic Standards and Regulations (https://catalog.luc.edu/academic-standards-regulations/graduate-professional/) under their school. Any additional University Policies supersede school policies.

Learning Outcomes

Upon completion of the MD/PhD program, students will be able to:

- Demonstrate a general knowledge base in the biomedical sciences with an understanding of fundamental biochemical, molecular and cellular processes and common biomedical research methods.
- Demonstrate a deep knowledge in Biochemistry, Molecular Biology and/or Cancer Biology.
- Propose original biomedical research questions and design experiments to address these questions.
- Execute critical experiments to address the relevant biomedical research questions.
- Search and critically evaluate the scientific literature and scientific data.

- Clearly and effectively communicate scientific information in both oral and written forms.
- Incorporate high standards of ethics into research design, execution, data interpretation and presentation.