

BIOCHEMISTRY, MOLECULAR AND CANCER BIOLOGY (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) (<https://catalog.luc.edu/graduate-professional/dual-degree-programs/biochemistry-molecular-biology-md-phd/>)
- Microbiology and Immunology (MD/PhD) (<https://catalog.luc.edu/graduate-professional/dual-degree-programs/microbiology-immunology-md-phd/>)

Curriculum

The Graduate School at the Health Sciences Campus offers a PhD degree program in the biomedical sciences through the Integrated Program in Biomedical Sciences (IPBS). IPBS is an umbrella admission program in which students are admitted and undergo laboratory rotations before choosing an advisor and specialization track.

The following six tracks are offered in the IPBS:

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

Students receive rigorous training in the fundamentals of the scientific method, oral and written scientific communication, data analysis and presentation, critical analysis of scientific literature, and practical laboratory skills through a combination of coursework and dissertation research. Dissertation research is conducted under the direction of an advisor and Dissertation Committee.

IPBS Course Requirements

The PhD program consists of 48 credit hours of course work in the first two to three years plus research culminating in a dissertation. The course work consists of a Core Curriculum of 14 credit hours, at least 15 credit hours of electives and up to 19 credits hours of Research.

Students who take more than 15 credits of electives can reduce the number of Research credits accordingly. The electives include track-specific courses plus specialized courses offered by any track. Details about the electives required for each track can be found in the individual IPBS PhD track catalog pages. IPBS students also enroll in a Seminar and Journal Club course every semester. Students enroll in Dissertation Supervision after they have completed the Comprehensive Exam.

Code	Title	Hours
Foundational Curriculum		
BMSC 402	Statistical Methods for Biomedical Science	3
BMSC 405	Ethics in Biomedical Sciences	1
BMSC 410	Biochemistry and Molecular Biology	4
BMSC 412	Cell Biology	4
BMSC 416	Methods Biomedical Science	1
BMSC 418	Presentation skills	1
Track Specific Requirements		
Track Required Coursework		15
Research ¹		19
Seminar		
Journal Club		
Dissertation Supervision		0
Total Hours		48

¹ Students can choose to take more than 15 credits of electives and reduce research credits accordingly.

Biochemistry, Molecular, and Cancer Biology Track Specific Course Requirements

The PhD in Biochemistry, Molecular and Cancer Biology requires 48 credit hours and consists of the IPBS Core Curriculum plus Biochemistry, Molecular, and Cancer Biology Electives, Research, Journal Club, Seminar, a comprehensive examination, and completion of a dissertation.

Code	Title	Hours
IPBS Foundational Courses (see above)		14
Biochemistry, Molecular, and Cancer Biology Courses		
BMB 417	Molecular Biology	3
<i>Select four Biochemistry, Molecular, and Cancer Biology Electives</i>		<i>15</i>
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	
PHAR 408	Molecular Basis of Disease and Therapeutics	
PHAR 409	Principles of Pharmacology	
PHAR 410	Signal Transduction	
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	
BMB 499	Research in Molecular Biology (total hours varies)	1-9
BMB 501	Molecular Biology Journal Club	1
BMB 502	Seminar in Molecular Biology	0
BMB 600	Dissertation Supervision	0

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 spring/summer of the second year. 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 three laboratory rotations beginning in the first semester to identify a research advisor. Students select laboratories for each rotation from a list of available advisors and in consultation with 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 third 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 410	Biochemistry and Molecular Biology	4
BMSC 412	Cell Biology	4
BMSC 416	Methods Biomedical Science	1
BMB 499	Research in Molecular Biology ¹	2
Hours		12
Spring		
BMSC 402	Statistical Methods for Biomedical Science	3
BMSC 418	Presentation skills	1
BMB 417	Molecular Biology	3
BMB 499	Research in Molecular Biology ¹	2
BMB 501	Molecular Biology Journal Club	0
BMB 502	Seminar in Molecular Biology	0
Elective 1 ²		3
Hours		12
Year 2		
Fall		
BMB 499	Research in Molecular Biology ¹	6
BMB 501	Molecular Biology Journal Club	0

BMB 502	Seminar in Molecular Biology	0
Elective 2 ²		3
Elective 3 ²		3
Hours		12
Spring		
BMB 499	Research in Molecular Biology ¹	5
BMB 501	Molecular Biology Journal Club	0
BMB 502	Seminar in Molecular Biology	0
Elective 4 ²		3
Hours		8
Year 3		
Fall		
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	0
Hours		2
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	0
Hours		2
Total Hours		48

¹ Research credits are variable (1-9 credit hours) and fewer can be taken to accommodate additional elective courses.

² Elective Courses (12 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.

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 this 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 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.