

CELL AND MOLECULAR PHYSIOLOGY (MD/PHD)

Physiology is the study of the function of living organisms. The PhD in Cellular and Molecular Physiology trains students to acquire, analyze and integrate data obtained from their basic research into a physiological context to understand the molecular basis of cell function and dysfunction within the organism. With cardiovascular research and neurosciences & metabolism as main research topics, students receive a solid integrated training in basic medical sciences including biochemistry, biophysics, cell biology, molecular biology, physiology and pathophysiology.

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 Cellular and Molecular Physiology portion of this dual degree program can be found below.

Course Requirements

The PhD in Cell and Molecular Physiology requires a total of 48 credit hours. Students in the MD/PhD program will complete 24 credit hours in

the PhD program and transfer 24 hours from their MD coursework. Core IPBS requirements and track courses are detailed below.

Code	Title	Hours
Core 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 Required Coursework		
PIOL 401	Physiology	4
PIOL 412	Research	1-6
PIOL 416	Research Seminar ¹	1
PIOL 446	Cardiovascular Journal Club (taken twice)	1
PIOL 600	Dissertation Supervision	0
<i>Select Three Cell and Molecular Physiology Electives</i>		11
PIOL 414	Graduate Colloquy	
PIOL 418	Teaching of Physiology	
PIOL 420	Methods/Technical in Physiological Research	
PIOL 425	Physiology of Aging	
PIOL 470	Excitability & Ion Transport (or approved substitute)	
PIOL 472	Structure/Function Membrane Proteins (or approved substitute)	
BMB 490	Special Topics in Molecular Biology	
Total Hours		48

¹ One (1) Credit for first year; subsequent years of study are zero (0) credits.

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.

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 supercede school policies.

Learning Outcomes

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

1. Demonstrate a general knowledge base in the biomedical sciences with an understanding of fundamental biochemical, molecular and cellular processes and common biomedical research methods.
2. Demonstrate a deep knowledge of cell and molecular physiology.
3. Propose original biomedical research questions and design experiments to address these questions.
4. Execute critical experiments to address the relevant biomedical research questions.
5. Search and critically evaluate the scientific literature and scientific data.
6. Clearly and effectively communicate scientific information in both oral and written forms.
7. Incorporate high standards of ethics into research design, execution, data interpretation and presentation.