

# CELL AND MOLECULAR PHYSIOLOGY (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.

## Related Programs

### Master's

- Cell and Molecular Physiology (MS) (<https://catalog.luc.edu/graduate-professional/graduate-school/health-sciences/biomedical-sciences/cell-molecular-physiology-ms/>)
- Cellular and Molecular Oncology (MS) (<https://catalog.luc.edu/graduate-professional/graduate-school/health-sciences/biomedical-sciences/cellular-molecular-oncology-ms/>)

### Combined

- Cell and Molecular Physiology (MD/PhD) (<https://catalog.luc.edu/graduate-professional/dual-degree-programs/cell-molecular-physiology-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 whom 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 required 48 credit hours.

| Code                               | Title                                      | Hours     |
|------------------------------------|--|-----------|
| <b>Core Curriculum</b>             |  |           |
| 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         |
| <b>Track Specific Requirements</b> |  |           |
| Track Required Coursework          |  | 15        |
| Research <sup>1</sup>              |  | 19        |
| Seminar                            |  |           |
| Journal Club                       |  |           |
| Dissertation Supervision           |  | 0         |
| <b>Total Hours</b>                 |  | <b>48</b> |

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

## Cell and Molecular Physiology Track Specific Course Requirements

The PhD in Cell and Molecular Physiology requires 48 credit hours made up of the IPBS Core Curriculum, 15 credit hours of Cell and Molecular Physiology courses, Research, Seminar, Journal Club, a comprehensive examination, and completion of a dissertation.

| Code   | Title                                       | Hours     |
|--|---|-----------|
| <b>IPBS Core Curriculum (see above)</b>              |   | <b>14</b> |
| <b>Cell and Molecular Physiology Courses</b>         |   |           |
| PIOL 401   | Physiology                                  | 4         |
| PIOL 412   | Research <sup>1</sup>                       | 1-6       |
| or BMSC 499  | Research                                    |           |
| PIOL 416   | Research Seminar <sup>2</sup>               | 1         |
| PIOL 446   | Cardiovascular Journal Club <sup>1</sup>    | 2         |
| Select Three Cell and Molecular Physiology Electives |   | 11        |
| PIOL 425   | Physiology of Aging                         |           |
| PIOL 420   | Methods/Technical in Physiological Research |           |
| PIOL 414   | Graduate Colloquy                           |           |
| PIOL 418   | Teaching of Physiology <sup>2</sup>         |           |
| PIOL 470   | Excitability & Ion Transport                |           |
| PIOL 472   | Structure/Function Membrane Proteins        |           |
| BMB 490  | Special Topics in Molecular Biology         |           |
| PIOL 600   | Dissertation Supervision                    |           |
| <b>Total Hours</b>                                   |   | <b>48</b> |

<sup>1</sup> Hours Vary

<sup>2</sup> 1 credit for first year; subsequent years of study are 0 credits for Research Seminar

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 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.

## 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 cell and molecular physiology.
- 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.