

# MOLECULAR CELL AND DEVELOPMENTAL BIOLOGY

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<http://biomed.med.miami.edu/graduate-programs/molecular-cell-and-developmental-biology> (<http://biomed.med.miami.edu/graduate-programs/molecular-cell-and-developmental-biology/>)

## Overview

The graduate program in Molecular Cell and Developmental Biology offers graduate training towards the PhD degree in the fields of molecular cell biology, cell biology, developmental biology and cancer biology. In order to provide a wide range of current research opportunities, this program is interdisciplinary, comprised primarily of faculty from the department of Cell Biology and includes additional faculty from several other Departments and Centers at the Miller School of Medicine. These include: the Departments of Microbiology & Immunology, Molecular & Cellular Pharmacology, Medicine, Ophthalmology, Urology, Surgery, Neurosurgery and Neurology, the Sylvester Comprehensive Cancer Center, and the Miami Project to Cure Paralysis.

Students have the opportunity to do research in the many areas of modern cell, molecular and developmental biology. Research topics including the cytoskeleton, cell surface molecular biology, stem cells, lens, corneal and retinal biology, protein processing and sorting, signal transduction, airway biology, regulation of gene expression in development, podocyte biology, cancer biology, neuromuscular development, malignant transformation, growth factors, epithelial cell biology, organogenesis and tissue repair, pattern formation in early development, RNA localization, mitochondrial molecular biology and cancer therapeutics.

The primary objective of this interdisciplinary graduate program is to prepare students for careers as independent, PhD level researchers and educators, in both academic institutions and in the biotechnology industry and other venues.

## Contact Information

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## Admission Requirements

Applicants to biomedical programs should have a bachelor degree in a biological or related discipline (e.g., psychology, chemistry, engineering, physics). Although there are no prerequisite requirements, courses in general biology, cell/molecular biology, calculus, general physics, organic chemistry, physical chemistry, and biochemistry are encouraged. Applications are generally accepted from September to December for fall entry only. Select applicants will be offered an interview.

### COMPETITIVE CANDIDATES WILL HAVE THE FOLLOWING:

- Excellent academic record
- Competitive GRE exam scores
- Research experience in a laboratory setting
- Publications of abstract and / or papers
- Co-authorship in a peer-reviewed journal is recommended
- Strong letters of recommendation from research scientists who know the candidate well
- Motivation to pursue state-of-the-art biomedical research

### APPLICANTS MUST SUBMIT THE FOLLOWING:

- Online Application
- Application Fee
- Official Academic Transcripts
- GRE General Test
- English Proficiency Exam (non-native speakers)
- Statement of Purpose
- Resume / CV

Full application instructions can be found here (<http://biomed.med.miami.edu/apply/>).

## Curriculum Requirements

Code	Title	Credit Hours
<b>Biomedical Science Core</b>		
PIB 700	Journal Club	1
PIB 701	Introduction to Biomedical Sciences	5
PIB 702	Scientific Reasoning	3
PIB 705	Biostatistics for the Biosciences	3
PIB 731	Laboratory Research	3-5
PIB 780	Research Ethics	1
PIB 782	Professional Development: Skills for Success I	1
PIB 783	Professional Development: Skills for Success II	1
PIB 785	PIBS Bioinformatics Workshop	1
PIB 830	Doctoral Dissertation <sup>3</sup>	1
<b>Molecular Cell and Developmental Biology Required Courses</b>		
MDB 701	Seminar <sup>1</sup>	1-2
MDB 710	Readings in Cell Biology <sup>1</sup>	1-6
MDB 751	Advanced Cell Biology Approaches to Molecular Medicine	3
MDB 752	Current Topics in Mammalian Development	3
MDB 753	Histology	1
MDB 763	Stem Cell Biology and Genetic Engineering for Regenerative Medicine	3
MDB 765	Tumor Biology <sup>2</sup>	3
<b>Research Credits</b>		<b>23</b>
MDB 830	Doctoral Dissertation <sup>3</sup>	
MDB 850	Research in Residence <sup>3</sup>	
MDB 840	Doctoral Dissertation- Post Candidacy <sup>3</sup>	
<b>Total Credit Hours</b>		<b>60</b>

<sup>1</sup> Throughout the program the students are expected to attend department seminars (Tuesdays at noon), journal club (on select Wednesdays at noon), and student presentations (on Wednesdays at noon).

<sup>2</sup> may be replaced by any graduate level course in human disease or neuronal cell biology

<sup>3</sup> The student should be working in the laboratory where he/she intends to do his/her thesis research by the summer, first year. Nearly all of the student's time is spent on original laboratory research – with a minimum total of 24 credit hours of research for graduation.

## Plan of Study

The program's Graduate Studies Committee assists each entering student in tailoring a program to match his/her interests. First year students take courses in a core curriculum taught by faculty from the medical basic science departments. Courses are taught not only by formal lectures, but also as seminars and informal discussions. The curriculum is designed to provide broad knowledge in the various aspects of modern cell biology, developmental biology, molecular biology and biochemistry in addition to intensive training in certain specialized areas of research according to the student's interests. In the remaining years of study, nearly all of the student's time is spent on original laboratory research. Students are usually admitted in the Fall semester.

Minimum credit requirements for the PhD degree are set by the University at 36 course credits (including specific required courses) and 24 credit hours of research (for a total of 60 credits). The course credits must be earned in graduate level (600 and above) courses. Students may elect to take any of the graduate courses offered by the MDB program, in addition to the mandatory courses, or choose from a large variety of advanced courses offered by other basic science programs at the University of Miami Miller School of Medicine.

Mandatory courses for the program include Biostatistics (PIB 705 (<http://bulletin.miami.edu/search/?P=PIB%20705>)), Advanced Cell Biology: Approaches to Molecular Medicine (MDB 751 (<http://bulletin.miami.edu/search/?P=MDB%20751>)), Current Topics in Mammalian Development (MDB 752 (<http://bulletin.miami.edu/search/?P=MDB%20752>)), Histology (MDB 753 (<http://bulletin.miami.edu/search/?P=MDB%20753>)), and \*Tumor Biology (MDB 765 (<http://bulletin.miami.edu/search/?P=MDB%20765>)). The latter may be replaced by any graduate level course in human disease or neuronal cell biology. \*These courses are electives for MD/PhD students.

Throughout the program the students are expected to attend department seminars (Tuesdays at noon), journal club (select Wednesdays at noon), and student presentations (on Wednesdays at noon).

The student should be working in the laboratory where he/she intends to do his/her thesis research by the summer, first year. At the end of the Fall semester of the second year, students are required to take the Qualifying Exam (QE). The goals of the QE are (1) to assess the scientific proficiency of the student, especially his/her ability to design experiments and to write a competitive grant application; and (2) to aid the student and mentor in the process of obtaining extramural funds to support the student's stipend.

The thesis proposal is expected to be passed during the second year, Summer semester. It is important to note that in the MDB program this is not the Qualifying Exam. Rather, it is a collegial meeting with the thesis committee where the student discusses his/her preliminary data and plans for the thesis. Students normally meet with the committee for progress meetings every 6-9 months.

The thesis is defended in front of the entire program and also in a meeting with the committee. The average time-to-completion is 5.5 years.

**Please note that the following is a sample curriculum plan. Current students must discuss their plan with their program coordinator to make adjustments as needed.**

<b>Year One</b>		<b>Credit Hours</b>
<b>Fall</b>		
PIB 700	Journal Club	1
PIB 701	Introduction to Biomedical Sciences	5
PIB 702	Scientific Reasoning	3
PIB 731	Laboratory Research (1 credit per lab rotation)	2
PIB 780	Research Ethics	1
PIB 782	Professional Development: Skills for Success I	1
<b>Credit Hours</b>		<b>13</b>
<b>Spring</b>		
PIB 700	Journal Club	1
PIB 705	Biostatistics for the Biosciences	3
PIB 731	Laboratory Research (1 credit per lab rotation)	1
PIB 783	Professional Development: Skills for Success II	1
MDB 752	Current Topics in Mammalian Development (Spring A)	3
MDB 751	Advanced Cell Biology Approaches to Molecular Medicine (Spring B)	3
MDB 753	Histology	1
<b>Credit Hours</b>		<b>13</b>
<b>Summer</b>		
PIB 785	PIBS Bioinformatics Workshop	1
PIB 830	Doctoral Dissertation	1
<b>Credit Hours</b>		<b>2</b>
<b>Year Two</b>		
<b>Fall</b>		
MDB 701	Seminar	1
MDB 710	Readings in Cell Biology	1
MDB 763	Stem Cell Biology and Genetic Engineering for Regenerative Medicine	3
MDB 765	Tumor Biology	3
MDB 830	Doctoral Dissertation	3
<b>Credit Hours</b>		<b>11</b>
<b>Spring</b>		
MDB 701	Seminar	1
MDB 710	Readings in Cell Biology	1
MDB 830	Doctoral Dissertation	3
Students may elect to take an additional basic science graduate course.		
<b>Credit Hours</b>		<b>5</b>
<b>Summer</b>		
MDB 830	Doctoral Dissertation	1
<b>Credit Hours</b>		<b>1</b>

<b>Year Three</b>		
<b>Fall</b>		
MDB 701	Seminar	1
MDB 710	Readings in Cell Biology	1
MDB 830	Doctoral Dissertation	3
Students may elect to take an additional basic science graduate course.		
<b>Credit Hours</b>		<b>5</b>
<b>Spring</b>		
MDB 701	Seminar	1
MDB 710	Readings in Cell Biology	1
MDB 840	Doctoral Dissertation- Post Candidacy	3
Students may elect to take an additional basic science graduate course.		
<b>Credit Hours</b>		<b>5</b>
<b>Summer</b>		
MDB 840	Doctoral Dissertation- Post Candidacy	1
<b>Credit Hours</b>		<b>1</b>
<b>Year Four</b>		
<b>Fall</b>		
MDB 701	Seminar	1
MDB 710	Readings in Cell Biology	1
MDB 840	Doctoral Dissertation- Post Candidacy	3
<b>Credit Hours</b>		<b>5</b>
<b>Spring</b>		
MDB 701	Seminar	1
MDB 710	Readings in Cell Biology	1
MDB 840	Doctoral Dissertation- Post Candidacy	3
<b>Credit Hours</b>		<b>5</b>
<b>Summer</b>		
MDB 840	Doctoral Dissertation- Post Candidacy	1
<b>Credit Hours</b>		<b>1</b>
<b>Year Five</b>		
<b>Fall</b>		
MDB 701	Seminar	1
MDB 710	Readings in Cell Biology	1
MDB 840	Doctoral Dissertation- Post Candidacy	1
<b>Credit Hours</b>		<b>3</b>
<b>Spring</b>		
MDB 701	Seminar	1
MDB 710	Readings in Cell Biology	1
MDB 850	Research in Residence	1
<b>Credit Hours</b>		<b>3</b>
<b>Total Credit Hours</b>		<b>73</b>

## Mission

The mission of the Graduate Program in Molecular Cell and Developmental Biology is to educate students in molecular cell and developmental biology and to train highly qualified scientists for independent careers in scientific research and education.

## Goals

The program objectives is to provide our students with:

- A solid foundation in the fundamentals of modern molecular, cell and developmental biology through formal courses;
- An understanding of scientific theory, methods, and current research literature through scientific seminars and journal clubs; and

- Intellectual and technical expertise in modern methods of cell and molecular biology through structured laboratory research and scientific writing skills for both scientific papers and grant applications.

## Student Learning Outcomes

- Students will demonstrate an overall knowledge and understanding of the core concepts in Molecular Cell and Developmental Biology, including the essential technical skills to conduct research in the Molecular Cell and Developmental Biology.
- Students will demonstrate critical thinking skills, the capability to develop conjectures, the ability to evaluate their Hypotheses, paying attention to responsible conduct of research as appropriate.
- Students will demonstrate the ability to write effective scientific reports and to present scientific results orally.

### **MDB 701. Seminar. 1-2 Credit Hours.**

Students are required to present their research findings as well as attend Department Faculty seminars.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

### **MDB 707. Principles of Mammalian Development and Organogenesis. 4 Credit Hours.**

The course will cover principles and emerging topics in mammalian development including embryonic stem cells, gene regulation, and organogenesis. The goal is to provide students with essential knowledge useful for their research in advanced cell and developmental biology and application to study diseases and health science. The class will have an interactive format, starting with basic lectures in mammalian development; subsequent sessions will include an overview of the selected topic by faculty, followed by round table discussions of current paper(s) in the field.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

### **MDB 710. Readings in Cell Biology. 1-6 Credit Hours.**

Current and classical research papers in cell, developmental, and molecular biology. Critical evaluation of papers and the methodologies used is included.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

### **MDB 713. Topics in Cell Biology. 1-6 Credit Hours.**

Formal seminar course in which each student presents a lecture relating to a specific theme. Topic areas include cell, developmental, and molecular biology with the subject changing each term.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall, Spring, & Summer.

### **MDB 751. Advanced Cell Biology Approaches to Molecular Medicine. 2-3 Credit Hours.**

Structure, function, and biogenesis of cellular organelles and the cytoskeleton, including their regulation and dynamic interactions. The course is taught in seminars, followed by student-led discussion of recent relevant papers in the literature. The goal of the course is to lead the students to in-depth conceptual and methodological analysis of selected topics up the understanding of current leading-edge research in specific topics in Cell Biology. The course is designed to cover knowledge beyond the text books and to enable the students to design and criticize experimental approaches in Cell Biology acceptable for current peer-review criteria.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

### **MDB 752. Current Topics in Mammalian Development. 2-3 Credit Hours.**

The course will cover central emerging topics in mammalian development today including embryonic stem cells, micro RNA gene regulation, and organogenesis. The class will have an interactive format, starting with basic lecture in mammalian development; subsequent sessions will include an overview of the selected topic by faculty, followed by round table discussions of current paper(s) in the field.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

### **MDB 753. Histology. 1 Credit Hour.**

This course will offer the student a virtual slide collection of histology with interactive lectures to support image-based learning. The course covers basic tissues, organs, and systems (vascular; heart; pancreas; eyes; brain; spinal cord; liver; lung; mouse embryo; GI track). The course will meet once a week for one hour. Instructor: Dr. Thomas Champney

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Spring.

**MDB 763. Stem Cell Biology and Genetic Engineering for Regenerative Medicine. 3 Credit Hours.**

This course is designed to provide a current overview on the cell and molecular biology of stem cells, their identification and analysis, and the current status of their use for the repair and regeneration of a variety of tissues including heart, lung, muscle, pancreatic, neuronal and others.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall & Spring.

**MDB 765. Tumor Biology. 3 Credit Hours.**

This course, comprised of lectures and student-led literature discussion, is intended to provide broad-based instruction on the modern molecular and cellular aspects of cancer biology, basic and translational research. The course highlights multiple areas including cell cycle, apoptosis, epidemiology, angiogenesis, and meets two times weekly.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Fall.

**MDB 810. Master's Thesis. 1-6 Credit Hours.**

Current and classical research papers in cell, developmental, and molecular biology. Critical evaluation of papers and the methodologies used is included.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**MDB 820. Research in Residence. 1-6 Credit Hours.**

Direct laboratory experience as determined by the Departmental Graduate Committee.

**Components:** LEC.

**Grading:** GRD.

**Typically Offered:** Offered by Announcement Only.

**MDB 830. Doctoral Dissertation. 1-12 Credit Hours.**

Required of all candidates for the Ph.D. The student will enroll for credit as determined by his/her advisor but not for less than a total of 24. Not more than 12 hours of MDB 730 may be taken in a regular semester, nor more than six in a summer session. Where a student has passed his/her (a) qualifying examinations, and (b) is engaged in an assistantship, he/she may still take the maximum allowable credit stated above.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**MDB 840. Doctoral Dissertation- Post Candidacy. 1-12 Credit Hours.**

Required for all PhD candidates. The student will enroll for credits as determined by their advisor/ Office of Graduate and Postdoctoral Studies but not less than a total of 24. No more than 12 hours of research may be taken in a regular semester, and no more than six in a summer session.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.

**MDB 850. Research in Residence. 1-12 Credit Hours.**

Student must be registered in the semester they plan to defend. Used to establish research in residence for the PhD after the student has been enrolled for the permissible cumulative total in appropriate doctoral research. Student may be regarded as full-time residence as determined by the Dean of the Graduate School.

**Components:** THI.

**Grading:** SUS.

**Typically Offered:** Fall, Spring, & Summer.