

M.S. IN BIOMEDICAL SCIENCES

Overview

Our Master of Science in Biomedical Sciences (MiBS) program is a full-time program that packs a core curriculum in biochemistry, molecular biology, cell biology and physiology, along with several optional courses in three customized tracks – Medicine, Research or Drug Discovery. Our courses are taught by the same faculty that teach our medical and graduate students and will be tailored to meet your needs. In addition, students participate in physician and clinical shadowing or directed research to prepare you for a career in the biomedical sciences.

MiBS prepares recent undergraduates for medical or graduate school or a career in the biomedical industry. Our master's degree is an ideal way to use your gap year to build credentials and experience to propel yourself to any advanced degree. Students will have access to include hands-on faculty advising and mentoring to help you do your best and submit compelling applications. Students can begin our gap year program after their spring graduation and finish in time to start medical or graduate school the following August.

Contact Information

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Admission Requirements

Applicants to the MiBS program should have a bachelor's degree in a biological or related discipline (e.g., psychology, chemistry, engineering, physics). Although there are no prerequisites, courses in general biology, cell/molecular biology, calculus, general physics, organic chemistry, physical chemistry and biochemistry are encouraged. Applicants can submit applications here (<http://biomed.miami.edu/apply/apply-biomedical-sciences-masters/>).

Competitive candidates will have the following:

- Excellent academic record of 3.0 GPA or above
- Competitive GRE, MCAT or DAT exam scores
- Three strong letters of recommendation
- Motivation to learn biomedical sciences
- Personal statement focused on educational interests and career goals

Curriculum Requirements

Code	Title	Credit Hours
Journal Club		2
MBS 600	Journal Club ¹	
Required Courses		
MBS 601	Biochemistry for the Biosciences	3
MBS 602	Molecular Biology for the Biosciences	3
MBS 603	Gross Anatomy and Histology	3
MBS 604	Advanced Molecular and Cell Biology	3
MBS 605	Cell Physiology	2
MBS 608	Basic Pathobiology	3
Laboratory Research or Physician Shadowing		6
MBS 631	Laboratory Research or Physician Shadowing ²	
Electives		5
Total Credit Hours		30

Elective Courses

Code	Title	Credit Hours
MBS 606	Human Physiology	2
MBS 607	Human Cardiovascular Physiology	2
MBS 611	Mechanisms of Drug Action	2
MBS 612	Structural Biology and Drug Design	2
MBS 613	Biostatistics for the Biosciences	3

MBS 614	Bioinformatics for Biosciences	3
MBS 631	Laboratory Research or Physician Shadowing	3

¹ Students in this degree program take MBS 600 two times, at 1 credit each for a total of 2 credits.

² Students in this degree program take MBS 631 two times, at 3 credits each for a total of 6 credits.

Sample Plan of Study

Year One		Credit Hours
First Semester		
MBS 601	Biochemistry for the Biosciences	3
MBS 680	Professional Development Workshop	1
MBS 631	Laboratory Research or Physician Shadowing	3
Credit Hours		7
Second Semester		
MBS 600	Journal Club	1
MBS 602	Molecular Biology for the Biosciences	3
MBS 603	Gross Anatomy and Histology	3
MBS 604	Advanced Molecular and Cell Biology	3
MBS 631	Laboratory Research or Physician Shadowing	3
Credit Hours		13
Third Semester		
MBS 600	Journal Club	1
MBS 605	Cell Physiology	2
MBS 608	Basic Pathobiology	3
MBS 631	Laboratory Research or Physician Shadowing	3
Electives		4
Credit Hours		13
Total Credit Hours		33

Mission

The Miller School of Medicine offers an intensive 10-month Master of Science in Biomedical Sciences (MiBS) designed to fit perfectly in your gap year.

Our courses are taught by the same faculty that teach our medical and graduate students and are tailored to meet your needs. In addition, students participate in physician and clinical shadowing and laboratory research to prepare them for a career in the biomedical sciences.

Goals

1. Students will learn about various science disciplines such as biochemistry, molecular biology, cell biology, and physiology.
2. Students will focus in any of the three customized tracks – Medicine, Research or Drug Discovery.
3. Students will participate in physician and clinical shadowing or directed research to prepare them for a career in the biomedical sciences.

Student Learning Outcomes

1. Students will draw from advanced biomedical knowledge within specific science disciplines to investigate fundamental processes and mechanisms of health and disease.
2. Students will be able to critically evaluate the scientific literature pertinent to the field of study.
3. Students will demonstrate research skills, including the development of sound hypotheses, design of experiments, and interpretation of results.
4. Students will apply quantitative reasoning and statistical analysis techniques in the exploration and testing of theories and hypotheses.
5. Students will demonstrate knowledge of current and emerging technologies in their respective field of study.
6. Students will demonstrate problem-solving skills in addressing specific research problems.
7. Students will apply laboratory skills such as planning of experiments, data acquisitions, data management, analysis and interpretation to a specific research problem.

MBS 504. GEN BIOLOGIC OCEAN. 3 Credit Hours.**Components:** LEC.**Grading:** GRD.**Typically Offered:** Fall, Spring, & Summer.**MBS 505. GEN BIOLOGIC LAB. 1 Credit Hour.****Components:** LEC.**Grading:** GRD.**Typically Offered:** Fall, Spring, & Summer.**MBS 600. Journal Club. 1 Credit Hour.**

To develop insights into the practice of biomedical research and medical practice, MBS students will be required to attend one research seminar, journal club or grand round of their choice per week. Students will prepare a written summary of the main points discussed in each event attended, and these will be monitored by their faculty advisor.

Components: SEM.**Grading:** GRD.**Typically Offered:** Fall & Spring.**MBS 601. Biochemistry for the Biosciences. 3 Credit Hours.**

MBS 601 covers Biochemistry in three parts. In Part 1, you will examine the biochemical composition and structure of the four basic types of biological macromolecules: carbohydrates, nucleic acids, proteins, and lipids. This part also introduces enzymes, and the composition and function of dietary nutrients and vitamins. In Part 2, you will study how genetic information flows from its storage as DNA sequence to its expression as functional RNA and protein molecules. In Part 3, you will learn how metabolic pathways are used to convert food molecules into energy and chemical intermediates used for biosynthesis of our own cellular materials

Components: LEC.**Grading:** GRD.**Typically Offered:** Summer.**MBS 602. Molecular Biology for the Biosciences. 3 Credit Hours.**

To introduce students to the molecular basis of life, this course is organized around the “mother of all biological questions” – How does life arise from stochastic associations between molecules acting in networks? While the course is organized around origins of life, it actually presents the basic properties of living things, the composition and properties of biomolecules, and how each individual property arises through diffusion, mass action and affinity.

Components: LEC.**Grading:** GRD.**Typically Offered:** Fall.**MBS 603. Gross Anatomy and Histology. 3 Credit Hours.**

Designed to cover topics such as gross anatomy, histology, embryology, and neuroanatomy.

Components: LEC.**Grading:** GRD.**Typically Offered:** Fall.**MBS 604. Advanced Molecular and Cell Biology. 3 Credit Hours.**

Structure, function, biogenesis of cellular organelles, and the cytoskeleton including its regulation and dynamic interactions are discussed.

Components: LEC.**Grading:** GRD.**Typically Offered:** Fall.**MBS 605. Cell Physiology. 2 Credit Hours.**

General principles of cell physiology, chemical and physical structure of membranes, membrane transport and electrical phenomena, action potentials, muscle contraction, energy transduction, nerve impulse conduction and synaptic transmission.

Components: LEC.**Grading:** GRD.**Typically Offered:** Spring.**MBS 606. Human Physiology. 2 Credit Hours.**

Physiology of the human nervous system. Physiology of vision, taste, and smell. Mechanoreceptors, nociception and pain. Spinal reflexes, hypothalamus, and autonomic nervous system.

Components: LEC.**Grading:** GRD.**Typically Offered:** Spring.

MBS 607. Human Cardiovascular Physiology. 2 Credit Hours.

Physiology of the human cardiovascular systems. Heart as a mechanical pump, electrical activity of the heart, vascular system, regulation of blood pressure and response to stress.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

MBS 608. Basic Pathobiology. 3 Credit Hours.

This course will cover essential nomenclature, causes of disease, cell injury and adaptation, tissue regeneration and repair, and neoplasia. The pathogenesis of diseases in major organs will be presented.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

MBS 611. Mechanisms of Drug Action. 2 Credit Hours.

Mechanisms underlying the therapeutical and pharmacodynamic properties of pharmacological agents. Emphasis is placed on cellular and molecular aspects and the quantitative factors governing equilibration within multicompartment systems and drug control of nervous and muscular function in relation to therapeutic action.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

MBS 612. Structural Biology and Drug Design. 2 Credit Hours.

This course provides an introduction to structural biology, and illustrates how understanding the relationship between structure and function of biological macromolecules drives drug discovery.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

MBS 613. Biostatistics for the Biosciences. 3 Credit Hours.

This course introduces students to the fundamentals of statistics from a biomedical perspective, with an emphasis on the practical application of statistical tools and the R software package for analysis and interpretation of biological datasets.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

MBS 614. Bioinformatics for Biosciences. 3 Credit Hours.

This course introduces graduate students to basic bioinformatics data retrieval and analysis as relevant to biomedical research.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

MBS 616. Basis of Mitochondrial Medicine. 2 Credit Hours.

Overall, the course aims to integrate basic knowledge in mitochondrial structure and function with our current understanding of the role mitochondria play in human health and disease. The first part of the course provides a core introduction to the major aspects of mitochondrial biology, including mitochondrial metabolism, genetics and biogenesis. The second part of the course focus on the role of mitochondrial and metabolic dysfunction in specific human disorders.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

MBS 623. INVERTEBRATE EMBRYO. 4 Credit Hours.

Components: LEC.

Grading: GRD.

Typically Offered: Fall, Spring, & Summer.

MBS 631. Laboratory Research or Physician Shadowing. 1-3 Credit Hours.

This course will consist of rotations (minimum 2-3 hours per week for each credit hour) in selected laboratories or shadowing with UMMSM physicians. Students will be rigorously monitored for progress by faculty advisors, and present their work at a rotation symposium at the end of the semester.

Components: EXP.

Grading: GRD.

Typically Offered: Fall, Spring, & Summer.

MBS 680. Professional Development Workshop. 1 Credit Hour.

Survival Skills, Responsible Conduct of Research (RCR), Learning Skills, Lab & Animal Safety, Collaborative Institutional Training Initiative (CITI), Ethics

Components: WKS.

Grading: GRD.

Typically Offered: Summer.

MBS 700. Biomedical Internship. 1-3 Credit Hours.

Students may earn academic credit through a pre-approved internship related to biomedical sciences. Requires the creation of a learning contract between the MSOM, the students, and the internship host.

Components: PRA.

Grading: SUS.

Typically Offered: Fall, Spring, & Summer.