

## **Professional Master's Degree Program in BioMolecular Technology**

Department of Biochemistry and Molecular Biology

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Mission Category: Education

Life science-related Master's degree-granting programs tend to focus on a narrow area of science without providing students with opportunities to learn critical thinking skills, which are essential to effectively function in life-science-related business. Therefore, it is paramount importance to establish a Master's program where students obtain broad training and skills in life science-related fields. Here **I propose to establish an interdisciplinary MS program in BioMolecular Technology** that encompasses applied biochemistry, biotechnology, molecular biology, cell biology, and genetics. This program offers a non-thesis professional Master's degree focusing on cutting-edge technology in molecular biosciences useful in life science-related business. Through broad education in molecular biosciences and biomedical sciences, students will learn how to apply and integrate existing information to synthesize new knowledge, which is necessary for them to effectively function in interdisciplinary and multidisciplinary teams in life sciences- and biomedical sciences-related fields. **Thus, students will have opportunities to advance their careers and to become more marketable for employment in biotech and pharmaceutical industries and governmental agencies.**

This career-oriented graduate program emphasizes internship experience in an industrial setting, although, if they wish, students are also allowed to perform academic research under the guidance of our graduate faculty who are at forefront of new advances in life and biomedical sciences. Students will have opportunities to integrate research and professional experience in the rapidly expanding fields of molecular biosciences.

Most coursework can be completed online; however, students in this program must participate in some in-person training programs and classes that are required for graduation. In total, students must complete approximately 40 credits to earn their Master's degree in Molecular Biosciences and Biotechnology.

For this new MS program, it is essential to develop new curricula to improve the education and marketability of students. New curricula include but not limited to the following:

- 1) Develop an alternative CORE curriculum that will be available online.
- 2) Establish cooperative arrangements across College of Medicine and University to provide students with multi-disciplinary education.
- 3) New rotation research/internship arrangement with industries in Greater Philadelphia Area to provide students with relevant industrial/academic experience.
- 4) Develop/select complementary courses that are useful for professional development, business, ethic, and public policies.
- 5) Develop a part-time MS track for individuals who are already employed by industry.

Additional course work provides students with a cross-disciplinary education necessary to excel in their career in life science related fields.

# BioMolecular Technology Master's Program

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## Abstract

Life science-related Master's degree-granting programs tend to focus on a narrow area of science without providing students with opportunities to learn critical thinking skills, which are essential to effectively function in life-science-related business. Therefore, it is paramount importance to establish a Master's program where students obtain broad training and skills in life science-related fields.

We will establish an interdisciplinary MS program in **BioMolecular Technology** that encompasses applied biochemistry, biotechnology, molecular biology, cell biology, and genetics. This program offers a non-thesis professional Master's degree focusing on cutting-edge technology in molecular biosciences useful in life science-related business. Through broad education in molecular biosciences and biomedical sciences, students will learn how to apply and integrate existing information to synthesize new knowledge, which is necessary for them to effectively function in interdisciplinary and multidisciplinary teams in life sciences- and biomedical sciences-related fields. **Thus, students will have opportunities to advance their careers and to become more marketable for employment in biotech and pharmaceutical industries and governmental agencies.**

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## Background and Significance

### Graduate Education in BioSciences and BioMedical Sciences

**Missing and Vision:**

- Integrated Education and Research Activities:
  - To nurture the next generation of teachers and scientists.
  - To help accommodate students specific needs and interests.
  - To enhance education for professional and personal growth.

**Project:**

- New Professional Master's Degree Program:
  - We will develop a student-focused educational program. We will provide broad education in molecular biosciences and biomedical sciences. Students will learn how to apply and integrate existing information to synthesize new knowledge, which is necessary for them to effectively function in interdisciplinary and multidisciplinary teams in life sciences- and biomedical sciences-related fields.

**Benefits:**

- Benefits to Stakeholders:
  - Students become more marketable for employment in industries.
  - Drexel will benefit from tuition revenue to support research activities.
  - Industries will have a base for training future employees.



## Goal

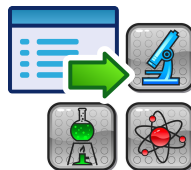
### BioMolecular Technology Master's Program

- Problem:** *Traditional Research Intensive Master's Program:*
- Tend to focus on a narrow area of science specific to each laboratory.
  - Scarce opportunities to learn critical thinking skills and to develop life skills
- Need:** *Need to Establish New Professional Master's Program:*
- Students obtain broad training and skills in life science-related fields.
  - Students develop skills to effectively function in life-science-related business.
- Goal:** *BioMolecular Technology Program:*
- Offers a non-thesis professional Master's degree focusing on cutting-edge technology in molecular biosciences useful in life science-related business.
  - Emphasizes internship experience in an industrial setting
  - Provide a variety of career/professional development courses.

## Objectives

### 1. Develop Overall Curriculum:

- Provide broad education in biomedical sciences in both didactic and hands-on sessions.
- Encompasses applied biochemistry, biotechnology, molecular biology, cell biology, and genetics.



### 2. Online CORE Courses:

- Students can take courses while working at a company.



### 3. Research Internship Arrangement:

- Students obtain real-life experience at industries.
- Employers will have opportunities to train future employees and increase their employee pool.



4. Develop Complementary Courses for Career/Professional Development.

5. Develop a Part-time MS track.

We expect to complete Objectives 1, 2, and 3 during this fellowship year. Objectives 4 and 5 will be achieved during the next year.

## Methods and Approaches

### 1. Develop Overall Curriculum:

- Use existing courses that are in line with the mission of BioMolecular Technology, to build a new curriculum.
- Search career/professional-development-related courses available from other academic units within Drexel University.
- Integrate internship experience into the curriculum.

### 2. Online CORE Courses

- Rearrange the current two-semester Core Curriculum to create a one-semester Core Curriculum.
- Select essential lectures/sessions from the current Core Curriculum.
- Use the Camta software to record lectures/sessions.

### 3. Research Internship Arrangement:

- Offers a non-thesis professional Master's degree focusing on cutting-edge technology in molecular biosciences useful in life science-related business.
- Emphasizes internship experience in an industrial setting
- Provide a variety of career/professional development courses.

## Progress

### 1. Develop Overall Curriculum: Planned Program Curriculum

Semester	Year 1		Summer	Year 2
	I (Fall)	II (Spring)	III (Summer)	
Didactic Session	Core Curriculum (Fundamentals)	Biochemical Data		IV (Fall)
Research	Advanced Topics in Biochem Mol Biol	Advanced Cell Biology		
Research	Research Practicum 1 (20 h/week)	Research Practicum 2 (20 h/week)	*Research Internship (40 h/week: ~8 months)	
Seminar	Seminar	Seminar		
Ethic/ Career	LEAP I	LEAP II		**Elective 1
		Responsible Conduct of Research		**Elective 2

### 2. Online CORE Courses

Section	Subject	Contents	Lecture Sources
Section I	Biochemistry	Fundamentals	Biomedical Science Core I Summer Biochemistry
	6 Lectures		
Section II	Molecular Biology	Central Dogma (genes to proteins)	Biomedical Science Core I Summer Biochemistry
	6 Lectures		
Section III	Molecular Technology	Techniques used in Biomolecular Sciences	Biomedical Science Core I Summer Biochemistry
	6 Lectures		
Section IV	Metabolism	Metabolic processes	Biomedical Science Core I Summer Biochemistry
	8 Lectures		
Section V	Cell Biology	Cell Structure and Functions, Cellular Processes	Biomedical Science Core I Summer Biochemistry
	7 Lectures		

### 3. Research Internship Arrangement

Companies on Board	
LifeSensor	
Rockland Immunochemicals	
Vironika	
JBS-Science	
Companies under Consideration	
Sanofi Pasteur	
Integral Molecular	
Inovio Pharmaceuticals	
Alliance Discovery	

## Challenges

### 1. Curriculum/Program Development

Cost benefit analysis and market analysis need to be conducted.

### 2. Online Core Curriculum

Assigned lecturers need to film their lecture(s) using Camtasia. Although all lecturers took Camtasia training, this is the first attempt for most of them. Therefore, some issues associated with filming are expected.

### 3. Internship Arrangement

Small to medium-sized companies are on board; however, no response from large companies. It is important to list large/well-known companies on the program website, in order to attract applicants to the program.

## Evaluation/Discussion

### 1. Curriculum/Program Development

Students are required to take two Career/Professional Development Courses. Students can choose courses provided by College of Medicine and other colleges/schools within Drexel University

Host companies may have recommendations for students to take certain career development courses

### 2. Online Core Curriculum

All session (except for Practice Question Sessions and Exams) will be available online.

Initially, only the Core Curriculum will be offered. However, we plan to have all courses available online in the future.

### 3. Internship Arrangement

Eight month-internship (Summer + Fall) is recommended; however students can choose to perform Summer only or Fall only internship.

Memorandum of understanding for each company is needed to cover liability issues.

## Impact

### BioMolecular Technology for

#### Career Development



- Students become more marketable for employment in industries.
- Drexel will benefit from tuition revenue to support research activities.
- Industries will have a base for training future employees.

