A Professional Science Master’s (PSM) Degree Program

STUDENT HANDBOOK

http://www.huck.psu.edu/education/biotechnology
MASTER OF BIOTECHNOLOGY
A Professional Science Master’s (PSM) Degree

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INTRODUCTION

The **Master of Biotechnology** at Penn State University is a Professional Science Master’s (PSM) degree program offered by the Department of Biochemistry and Molecular Biology in collaboration with the Huck Institutes of the Life Sciences. It is a multidisciplinary program involving faculty members from different academic departments and colleges at Penn State University as well as *ad hoc* mentors from the academic faculty and from industry. The Master of Biotechnology curriculum is designed to give students broad knowledge and training in the scientific and practical aspects of biotechnology. It involves innovative, hands-on, and multidisciplinary learning approaches to educate and train students in the science behind biotechnology, its business and legal aspects, and the ethical and social issues that it brings about. In addition, the courses and the activities required of all students in this program intend to develop team-working and communication skills that are very important particularly in industry. Graduates of this program are expected to have the preparation for diverse career options: as research scientists in industry, academic and government laboratories, as academic educators, as members of decision-making business and management teams in government and biotechnology industries, as bioentrepreneurs, and as members and leaders of governmental, public, and private organizations that deal
with social, ethical, legal and intellectual property issues in biotechnology. Furthermore, because of their broad knowledge in biotechnology, graduates of this program are expected to fill niches in industry and government where knowledge and ability to interphase and communicate with various functional groups within the organization are required.

For questions about the Master of Biotechnology degree program, please contact:

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E-mail: LJE6@PSU.EDU  
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DEGREE REQUIREMENTS

The Master of Biotechnology degree requires a minimum of 30 graduate credits, 18 credits of which must be from courses in the 500 level. Students are required to take 16-18 credits from core courses. Additional credits are earned from industry internship and other elective courses chosen from course offerings of various academic departments depending on the student's area of interest and the career track the student decides to pursue: biotechnology related to agricultural applications, medical applications, or diversified. All Master of Biotechnology candidates are required a research project and a written research paper about the project. The research project can be done in industry, academic or government hosts. Internship is a practically required elective in the degree program.

NB: Only courses numbered 400 and above count towards graduate credits. Any student can take any course below 400 level if it is of special interest or relevance, but must be aware that the credits from such course will not count towards the Master’s degree requirements.
RESPONSIBLE CONDUCT OF RESEARCH TRAINING

All new students in Master of Biotechnology graduate program are required to complete the online CITI (Collaborative Institutional Training Initiative) Biomedical Science Responsible Conduct of Research (RCR) training course during their first semester. This online course will supplement in-class, discussion-based RCR training provided in IBIOS 591, Ethics in the Life Sciences, a required 1-credit course.

First year students should complete the online CITI RCR course as soon as possible in the Fall semester. To register, go to the Penn State CITI website http://citi.psu.edu/ where you will find instructions. Select your campus, then select Pennsylvania State University Courses and register for the CITI Biomedical Sciences course. Students must work on their own to complete the course modules and pass the on-line quizzes. All modules must be completed by the end of the first Fall semester; and a copy of the student’s Completion Report must be submitted to the Program administrative office before January 15th.
CURRICULUM

CORE COURSES

IBIOS 593. MOLECULAR BIOLOGY LABORATORY (3 credits). An intensive lecture/laboratory course on the principles and techniques in molecular biology research.

BIOTC 479. METHODS IN BIOFERMENTATIONS (3 credits). Bioprocessing principles and development; uses and operation of biofermentors, determination of biomass; problems of scale-up.

OR

BE 468. MICROBIOLOGICAL ENGINEERING (3 credits). Application of basic engineering principles and designs in biochemical and biological processes.

IBIOS 571. CURRENT ISSUES IN BIOTECHNOLOGY (2 credits). Group projects and lecture series by academic and industry speakers dealing with the state-of-the-art scientific developments in biotechnology, and the business, legal, social and ethical aspects of biotechnology.

IBIOS 591. ETHICS IN THE LIFE SCIENCES (1 credit). An examination of integrity and misconduct in life sciences research. The online CITI (Collaborative Institutional Training Initiative) Biomedical Science Responsible Conduct of Research (RCR) training course must complement this course.
IBIOS 590. COLLOQUIUM SEMINAR SERIES (2 credits). A monthly colloquium that will present life science topics of general interest.

BMB 400. MOLECULAR BIOLOGY OF THE GENE (2 credits). The molecular biology of procaryotic and eukaryotic genes and genetics.

IBIOS 594. RESEARCH PROJECT IN BIOTECHNOLOGY (3-6 credits). Supervised individual projects either in an academic or government laboratory or in industry. A written research report is required and will be used as a basis for evaluating student performance in this course. Evaluation may also involve an oral presentation in addition to the written report. If proprietary issues are involved, these could be uncoupled from the written report or the oral presentation. (See below for more information).

ELECTIVE COURSES

These courses are chosen from offerings in various academic departments based on students' interest or track and career objectives. These include:

IBIOS 595. INTERNSHIP (2 credits). Supervised off-campus, nongroup instruction, including field experience, practicum, or internship. Written and oral critique of activity required.
IBIOS 596. Individual Studies (1-3 credits) This is a course that allows students to gain additional research experience and technical skills in laboratories on campus on areas of study that are of specific interest to them. This may be a pre-arranged research assignment with any faculty member offering the course or laboratory experience in shared core facilities, for example Flow Cytometry and Digital Microscopy, Mass Spectrometry, X-ray crystallography, and others. This is another recommended elective, especially for students who intend to pursue research and development careers. 

**NB:** Alternatively, students can take any 596 course offered by any department on campus, instead of IBIOS 596.
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<th>PROGRAM OF STUDY</th>
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<td>IBIOS 593. Molecular Biology Laboratory (3)</td>
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<td>IBIOS 591. Ethics in the Life Sciences (1)</td>
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<td>IBIOS 590. Colloquium. Seminar Series (2)</td>
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<td>BIOTC 479 or BE 468. Methods in Biofermentation (3)</td>
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<tr>
<td>IBIOS 571. Current Issues in Biotechnology (2)</td>
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<td>Electives (4-7)</td>
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<td>Submit CITI RCR Course Completion Report to Ms. Terrie Young, 101C Life Sciences, by January 15</td>
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<td><strong>Summer</strong></td>
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<td>IBIOS 595 or IBIOS 594 (Research Project) (2)</td>
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**NB:** In practice, students finish a minimum of 25 credits of on-campus courses in the first Fall and Spring semesters then spend the following Summer and Fall semesters doing the research project.
INTERNERSHIP AND RESEARCH PROJECT

When applicable, the research project requirement is usually integrated with the off-campus internship and completion of both span the Summer-Fall semesters. Registration to these courses must be done in consultation with the student’s academic adviser.

IBIOS 594. RESEARCH PROJECT

The research project is any work done by a student that requires hands-on involvement in the generation and analysis of data relating to a specific research problem or hypothesis. This project can be conducted on-campus or off-campus on any topic that relates to the student’s specific area of interest and preparation, and to any of the following aspects of biotechnology: scientific/technical, business, intellectual property, legal, social, and ethical. A written research paper is required.

A student who decides to do his/her research project on campus must start the process of locating a host laboratory or unit working in his/her area of interest early on, usually at the start of his/her first semester in the program. It is the student’s responsibility to talk to the laboratory or unit concerned to explore the possibility of doing a research project with that laboratory or unit, find out what is available in terms of support for the student and the project, and the time commitment.
required for the research project. Any arrangement or agreement pertaining to the actual conduct of the research must be between the laboratory/unit and the student.

Evaluation of the research project will be the responsibility of the graduate faculty member in charge of IBIOS 594, in consultation with the research supervisor, and/or a member of the biotechnology graduate faculty who has interest and expertise in the research project of the student. Grade will be based on the written research report following guidelines described in the IBIOS 594 syllabus as well as on the evaluation of the research supervisor; in addition, an oral research report may also be involved in the evaluation. *If proprietary issues are involved, these could be uncoupled from the written report or the oral presentation, but the student must promptly inform the academic adviser or instructor in-charge so that alternative requirements can be made.*

Regardless of whether the research is done on- or off-campus, the student must make it clear to the host laboratory/unit that a written report will be required and will need to be completed at a specific date determined by the student’s curriculum.

**Objective:**
The primary objective of the research project is to allow students a meaningful practical experience in work or
research related to biotechnology. This experience is meant to enhance the student’s preparation and qualifications for diverse employment opportunities. In the process, students are expected to learn not only the techniques involved in their specific research project, but also the proper conduct of research within the context of the organization in which they are doing research, the existing knowledge that underlies the research problem, the skills involved in gathering, analyzing, organizing, and presenting data, and how to properly and effectively communicate the research in writing.

IBIOS 595. INTERNSHIP

The internship is a collaboration between the Master of Biotechnology degree program and the Science Career and International Education (SCIE) office of the Eberly College of Science. Although IBIOS 595 is not listed as a core requirement in the degree program, students are encouraged to take advantage of internship opportunities available through the SCIE office. Master of Biotechnology students getting internship placements through the SCIE office must register IBIOS 595 and should discuss the internship with the academic adviser.

The internship is meant to help the student gain relevant experience in non-academic work environment and enhance the students’ preparation and qualification for entry-level employment. Internships are usually sought for Summer-Fall duration to integrate the research
project requirement and give students sufficient time to complete a meaningful off-campus research experience. In practice, students start preparing a brief resume near the end of their first Fall semester in preparation for internship applications in the Spring Semester. The students should check with the SCIE office as to availability of internship positions before the end of their first Fall semester in the program; placement is competitive, so students are encouraged to be resourceful and be pro-active in locating potential internship hosts to maximize the opportunity for internship placement and the opportunity to access internships optimal to the student’s career goals.

**SCIE Contact Information:**
Science Career and International Education Office  
112 Ritenour, University Park, PA 16802  
(814) 865-5000 – phone  
(814) 863-8466 – fax  
E-mail: [career@science.psu.edu](mailto:career@science.psu.edu)  
Website: [http://science.psu.edu/cie/](http://science.psu.edu/cie/)

**Staff Members:**
Paul W. Shaffner, Director ([pxs913@psu.edu](mailto:pxs913@psu.edu))  
Jamie Corman, Career Experiences Coordinator ([jzc3@psu.edu](mailto:jzc3@psu.edu))
WEBSITES OF INTEREST

PENN STATE UNIVERSITY

STUDENT LIFE RESOURCES
www.psu.edu/current-students
www.studentaffairs.psu.edu/career/

THE GRADUATE SCHOOL
www.gradsch.psu.edu

GRADUATE STUDENT POLICIES
www.gradsch.psu.edu/current-students/student

COMMENCEMENT INFORMATION
commencement.psu.edu

BIOTECHNOLOGY
(a sample listing only, not an exhaustive list)

www.bio.org
www.genengnews.com
www.biospace.com/jobs/homepage