



**A Professional Science Master's (PSM)
Degree Program**

STUDENT HANDBOOK



MASTER OF BIOTECHNOLOGY
A Professional Science Master's (PSM) Degree

<https://www.huck.psu.edu/graduate-programs/master-of-biotechnology>

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 ground and train students in the science and state-of-the-art technology behind biotechnology, its business and legal aspects, intellectual property and regulatory 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 integrate professional development emphasizing team-working and communication skills, networking and other valuable transferrable skills in any workplace. Graduates of this program are prepared for diverse career options: as research scientists in industry, government and academic laboratories, as educators, as members of decision-making business and management teams in the

biotechnology industry and in government, as bioentrepreneurs, and as members and leaders of government, public, and private organizations that deal with social, ethical, legal and intellectual property issues in biotechnology. Because of their broad knowledge in biotechnology, graduates of this program are able to fill niches where knowledge and ability to interphase and communicate with various functional groups within the organization or workplace are required.

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

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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 and higher*. Students are required 17 credits from core courses, including 3 credits of the capstone MCIBS 594. Additional credits are from elective courses chosen from course offerings of various academic departments; depending on the student's area of interest they may elect courses related to agricultural applications, medical applications, business, or diversified. All Master of Biotechnology degree candidates are required a capstone research project culminating in a research paper. The capstone research project, in practice, is done off-campus hosted by industry, academic, non-government, or government organizations as a cooperative education (co-op)/internship activity (see *MCIBS 594*).

**NB: Only courses numbered 400 and above count towards graduate credits. A 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 a course, as well as from any course graded as Pass/Fail, will not count towards the Master's degree requirements.*

Revised August 5, 2021



RESPONSIBLE CONDUCT OF RESEARCH TRAINING

All 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). This online course will supplement in-class, discussion-based RCR training provided in MCIBS 591, Ethics. Rigor, Reproducibility and Conduct of Research in the Life Sciences, a required 2-credit course.

First year students must complete the online CITI RCR course at the start of their first semester. To register, go to the Penn State CITI website <http://citi.psu.edu/> where you will find instructions. Select your campus (University Park), then select Pennsylvania State University Courses and register for the Biomedical Responsible Conduct of Research 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 date announced and a copy of the student's Completion Report must be submitted to the Program administrative office (101 Life Sciences Building or e-mailed to ajs6938@psu.edu or jep32@psu.edu).

CURRICULUM

CORE COURSES

MCIBS 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.

MCIBS 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, regulatory, intellectual property, legal, social, ethical and professional aspects of biotechnology.

MCIBS 591. Ethics. Rigor, Reproducibility and Conduct of Research in the Life Sciences (2 credits). 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.

MCIBS 590. COLLOQUIUM SEMINAR SERIES (2 credits). A monthly colloquium that will present current 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.

MCIBS 594. RESEARCH PROJECT IN BIOTECHNOLOGY (3-5 credits). Supervised individual projects either in industry, academic or government laboratory. A written research report and supervisor evaluation of student performance are required. Evaluation may also involve an oral presentation in addition to the written report. Any proprietary information involved, can 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 student's interest and career objectives. A sample list of elective courses previously taken by Master of Biotechnology students is distributed to the incoming students to give them an idea of possible choices. A strongly recommended elective is a 596 course (Individual Studies) which **can be registered under any department** or as MCIBS 596.

MCIBS 596* or other 596 courses listed in any department (**Individual Studies**, 1-3 credits). This is a course that allows students to gain additional research experience and technical skills in laboratories on campus. Students must first seek permission from the faculty member whose research is of interest to them and agree on a work schedule in the host faculty's laboratory prior to registering a 596 course. Students interested in learning the technologies in the core research facilities on campus may also register MCIBS 596 after consultation with the academic adviser and the core facility concerned.

**NB: Students can take any 596course offered by any department on campus where the host faculty resides, instead of MCIBS 596.*

PROGRAM OF STUDY

Year 1

Fall Semester

MCIBS 590. Colloquium. Seminar Series (2)

MCIBS 593. Molecular Biology Laboratory (3)

Electives (8-10)

Submit CITI RCR Course Completion Report to Ms. Ashley Smith (ajs6938@psu.edu), 101 Life Sciences

Spring Semester

BIOTC 479 Methods in Biofermentation (3) **or** **BE 468** Microbiological Engineering (3).

BMB 400. Molecular Biology of the Gene (2)

MCIBS 571. Current Issues in Biotechnology (2)

MCIBS 591. Ethics. Rigor, Reproducibility and Conduct of Research in the Life Sciences (2)

Electives (5-8)

Summer*

MCIBS 594 (Research Project) (0-1)

Year 2

Fall Semester*

MCIBS 594. Research Project cont'd (2-5)

**Students must have a minimum of 12 credits for full-time status except in the Summer-Fall semesters when they are doing full-time research co-ops. Students must consult with the academic adviser prior to registering for research co-op in Summer-Fall.*

CAPSTONE RESEARCH PROJECT

The capstone research project is a full-time immersion in a workplace for a minimum of six months designated as cooperative education (co-op). Registration to this course must be done in consultation with the student's academic adviser.

MCIBS 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 is generally done off-campus on any topic that relates to the student's specific area of interest and on any of the following aspects of biotechnology: scientific/technical, business, intellectual property, legal, social, and ethical aspects. A research paper is required at the end of the co-op.

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 degree program. It is the student's responsibility to talk to the faculty or unit concerned, find out what is available in terms of support for the student and the project, and understand the expectations of the project.

Evaluation of the research project will be the responsibility of the graduate faculty member in charge of MCIBS 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 MCIBS 594 syllabus as well as on the evaluation of the research supervisor; an oral research report may also be involved in the evaluation at the discretion of the faculty or supervisor concerned. Any proprietary information involved in the work, can be uncoupled from the written report or the oral presentation, but the student must inform the academic adviser or instructor in-charge early in the co-op period so that alternative written assignment can be arranged, if necessary.

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

In practice, students start preparing a brief resume near the end of their first Fall semester in preparation for the co-op applications in the Spring semester.

Objective:

The primary objective of the research project is to allow students a meaningful practical experience in the work

related to biotechnology. Student immersion in the dynamics and expectations of the real-world workplace is meant to enhance their preparation and qualification for entry-level employment. In the process, students are expected to learn not only about their host institution or laboratory but also the work expectations within the context of the organization in which they are doing research, the techniques involved in their specific research project, 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.

COVID-related specific requirement on MCIBS 594 (*updates to be issued as necessary*): All students must submit the Internship Exception Web Form and Acknowledgement Form that can be found in <https://studentaffairs.psu.edu/career/virtual/policy>, before they leave campus for co-ops, unless notified otherwise.

WEBSITES OF INTEREST

PENN STATE UNIVERSITY

STUDENT LIFE RESOURCES

<https://www.psu.edu/current-students>

<http://www.studentaffairs.psu.edu/career/>

<https://nittanylioncareers.psu.edu/>

THE GRADUATE SCHOOL

<http://www.gradsch.psu.edu/>

GRADUATE STUDENT POLICIES AND ACADEMIC INTEGRITY

<http://www.gradschool.psu.edu/current-students/student/>

COMMENCEMENT INFORMATION

<https://www.commencement.psu.edu/>

BIOTECHNOLOGY

(a sample listing only, not an exhaustive list)

<https://www.bio.org/>

<https://www.ncbi.nlm.nih.gov/>

<https://www.genengnews.com/>

<https://www.biospace.com/jobs/>