BioTechnology (P.S.M.)

About The Program:

The Professional Science Master's (P.S.M.) program in Biotechnology is a two-year degree program hosted by the Department of Biology, with coursework taught by diverse faculty from Temple University, industry, and government. Students work directly with our research faculty on real-world projects, gaining hands-on skills necessary to solve emerging problems. The program culminates in an independent research project based at Temple or one of its industry and government partners in Philadelphia.

Career Options: Official job placement is not offered, but prospects are good. Philadelphia and the surrounding Delaware Valley constitute a primary hub for integrative biotechnology since the area is a major center for pharmaceutical companies, chemical industries, and the health sciences. Philadelphia has also exhibited an increasing leadership presence in the emerging Green City movement. Given recent growth in the Biotechnology sector, the demand for a highly trained workforce with a strong science background has soared.

Prerequisites for Admission: Prior coursework in Physics, Chemistry or Biology with a GPA of 3.0 or above.

Areas of Specialization:

- Bioinformatics in Biotechnology, which entails decision making based on data accession, as well as manipulation and analysis over a broad range of fields
- Biotechnology in Biomedicine and Drug Discovery, including target identification of disease to drug design, discovery, and optimization
- Biotechnology in Industrial and Environmental Engineering, in partnership with the College of Engineering

Requirements of Programs:

- **Total Credit Hours**: 30
- **Culminating Events**:
  Independent Research Project:
  The P.S.M. program in Biotechnology at Temple University offers technical and leadership training to address environmental priorities and human health. In this vein, students select an independent research project (BIOL 9995 Capstone Project) by the end of their first year with mentors at Temple and/or approved co-mentors at any off-campus sites, including pharmaceutical companies and government agencies.

  Project proposals, which are approved by the P.S.M. Steering Committee, foster technical and intellectual skill building. At the end of the program, the project is presented in written and oral formats to further develop communication skills. These features provide graduates with knowledge and leadership skills to help tackle real-world problems using Biotechnology.

Required Courses

Biotechnology – This course is designed to survey current issues in technologies including therapeutics and diagnostics, and to examine consequences of developments in this area. The course is designed in a Problem Based Learning format, where students research critical areas and provide oral and written reports for other members in the class. The course is organized by topics including Concepts in Genetics, Cloning and Ethics, Gene Therapy, Prenatal Diagnosis, Gene Therapy for Cancer, Cell Replacement Therapy, Genomics and Proteomics, Vaccines, Forensics, Plant Biotechnology, and Instrumentation. At the end of the course, each student makes a formal presentation on a specific advance in biotechnology.

Analytical Biotechnology – This course provides a comprehensive survey of current techniques of biomolecule measurement and analysis using biochemical testing as the basis of measurement in a biotechnology laboratory. The detection, purification, and characterization of biomolecules (proteins, nucleic acids, carbohydrates, and lipids) are major goals in biotechnological research and development. Specific biomolecules serve as markers for the accurate and sensitive diagnosis of disease, and afford drug targets for disease treatment. Biomolecules also can be indicators of harmful (or beneficial) environmental agents and conditions. New, highly sensitive and accurate analytical methods are now available for the detection of diverse biomolecules. Note: Biochemistry Majors who have completed CHEM 4375 or CHEM 4404 with a minimum grade of C may register for BIOL 5501 with permission from instructor.

Microbial Biotechnology – Course covers use of microorganisms in biotechnology. Includes recombinant DNA methodology and application of these approaches to production of medicines and for environmental remediation. Synthetic biology and metabolic engineering will also be covered (theory and concepts).

Biotechnology Laboratory I – The biotechnology laboratory course is designed for students in the Professional Science Master's Program in Biotechnology. Students in the program will be recruited from Science, Technology, Engineering and Math (STEM) undergraduate majors and this hands-on course is designed with this understanding. The course will introduce students to some of the basic laboratory approaches used in the analysis of biologically-active environmental contaminants and in the synthesis of new and existing drugs. The first part of the course will emphasize molecular biological tools useful in drug design and contaminant analysis. The second part of the course will emphasize the chemical analysis of biologically-active compounds. The course will be problem-oriented with small team participation. The course will prepare students for a research project as part of the requirements for completion of the Professional Science Master's in Biotechnology.

Biotechnology Laboratory II – The biotechnology laboratory course is designed for students in the Professional Science Master's Program in Biotechnology. Students in the program will be recruited from Science, Technology, Engineering and Math (STEM) undergraduate majors and this hands-on course is designed with this understanding. The first part of the course will introduce students to microorganisms relevant to human and environmental health, for example pathogenic organisms as well as antibiotic-producing organisms. The second part of the course will focus on genomic and proteomic techniques and the use of bioinformatics in drug design, bioremediation and related challenges. The course will be problem-oriented with small team participation. The course will prepare students for a research project as part of the requirements for completion of the Professional Science Master's in Biotechnology.

Ethics Regulation and Policy in Biotechnology – The Bioethics, Policy and Regulation course is designed for students in the Professional Science Master's Program in Biotechnology. This course will provide an understanding of ethical decisions, governmental regulations and policies in biotechnology. A case study approach will be used to provide a framework for discussions of policy and ethical decision making. Guest speakers will provide insights from legal and governmental perspectives on emerging and current biotechnology applications.

Professional Development Seminar for PSM in Biotechnology – The PSM program prepares graduates for careers in biotechnology-related fields with a strong emphasis on skill areas that include management, policy and regulation in addition to scientific discovery. This course will provide students with career exposure through interviews with professionals in government and industry and will assist students in developing a career plan. Students will develop a white paper on the current state of Biotechnology based on new advances and challenges in the past year. Members of the advisory board will participate in facilitating the course.

Nucleic Acid Technologies – This course provides a focused examination and analysis of the basic structures and properties of RNA and DNA; the enzymes that synthesize or modify these biomolecules; and biotechnological applications. The synthesis and purification of DNA and RNA will be reviewed along with detection methodologies, including enzymatic amplification, array analysis, and amplification-free (direct) approaches. Nucleic acid sequencing technologies, including the analysis of ancient or degraded DNA and emerging nanopore-based sequencing approaches, will be surveyed. Finally, the course will examine how the inherent ability of DNA and RNA to self-assemble can be harnessed to provide novel nanostructures with complex architectures, and that show promise in biomedical and biotechnological applications. Note: Biochemistry Majors who have completed CHEM 4375 or CHEM 4404 or BIOL 5501 with a minimum grade of C may register for BIOL 5521 with permission from instructor.

Capstone Project – Capstone project for master's students including students in PSM, MA or MS. This class will provide full-time status. Students in PSM programs need to register for at least one credit of this course to fulfill program requirements. Additional credits may be required for specific programs. Students in the MA program may satisfy this course requirement by completing a library thesis. This course will confer full-time status at the minimum credit hour registration limit of one credit.

Environmental Biotechnology – Biotechnology plays a central role in environmental science and engineering, including wastewater treatment, pathogen control, and biodegradation. The objective of the course is to provide environmental engineers and scientists with advanced concepts and quantitative tools that are necessary for understanding environmental processes and designing environmental protection systems.

Any Bioinformatics or Genomics 5000-level course

Elective (Worth 3 Credits)

Courses:

Click HERE for more information on the courses below.

- Evolution
- Genomics in Medicine
- Fundamentals of Genomic Evolutionary Medicine
- Evolutionary Ecology
- Genomics and Infectious Disease Dynamics
- Evolutionary Genetics Genomics
- Innovative Biomodels and Concepts
- Biomarkers and Biotargets: Research and Commercialization
- Epigenetics, Genetics: Applications in Drug Design and Drug Response
- Systems Biology: Principles and Applications
- Behavioral Genetics
- Effective Dissemination of Bio-discoveries through Traditional and New Media
- Bioinnovation Seminar
- Milestones in Clinical Translation of Biodiscoveries
- Bioadvanced Screening in Health Disparity
- Virtual Reality in Bioindustry and Medicine
- Dissemination of Biodiscoveries and Virtual Reality in Medicine
- Genomics and Evolutionary Biology of Parasites and Other Dependent Species.
- Animal Behavior
- Ecology of Invasive Species
- Cell Biology
- Conservation Biology
- Herpetology
- Biostatistics
- Plant Community Ecology
- Biology of Plants
- Research Techniques in Molecular Biology
- Polar Biology - Life at the Extremes
- Comparative Biomechanics
- Epigenetics
- Cellular/Molecular Neuroscience
- Stem Cell Biology
- Genomics
- Structural Bioinformatics I
- Tropical Marine Biology: Belize
- Immunology
- Virology
- Developmental Genetics
- Advanced Techniques in Microscopy
- Freshwater Ecology
- Systems Neuroscience
- Neurological Basis of Animal Behavior
- Organization and Development of the Nervous System
- Biochemistry of Embryogenesis
- Mammalian Development
- Contemporary Biology
- Endocrinology
- Molecular Biology
- Cell Proliferation
- Physical Biochemistry
- General Biochemistry I
- General Biochemistry II
- Biotechnology
- Analytical Biotechnology
- Microbial Biotechnology
- Biotechnology Laboratory I
- Biotechnology Laboratory II
- Ethics Regulation and Policy in Biotechnology
- Professional Development Seminar for PSM in Biotechnology
- Computational Genomics
- Ethics in Bioinformatics
- Nucleic Acid Technologies

- Introduction to Scientific and Regulatory Writing
- Introduction to Grant Writing
- Communicating Science to a Broader Audience / Non-Scientists
- Graduate Independent Study
- Teaching of Biology
- Introduction to Graduate Research
- Seminar in Neuroscience
- Research Techniques
- Teaching in Higher Education: Life Sciences
- Preliminary Examination Preparation
- Master's Thesis Research