

# BIOTECHNOLOGY

## Department of Biology: Biotechnology Major

The Biotechnology major is housed in the Biology Department but is sponsored jointly by the departments of Biology and Chemistry. The Biotechnology major is designed to meet the need for skilled laboratory associates in the experimental laboratory and manufacturing facilities of the biotechnology industry. Biotechnology graduates are trained in tissue culture, molecular biology, protein purification, analytical chemistry, and regulatory affairs and are eligible for internships in local biotechnology companies. Graduates are qualified for careers in research and development, quality assurance, quality control, and manufacturing as well as for further graduate or professional education. Students who meet the requirements for the 4+1 Program in Biotechnology may complete both B.S. and M.S. degrees in Biotechnology in 5 years, beginning to take graduate courses in their fourth year of study. Students interested in the health professions may opt for a major in Biotechnology with a concentration in Pre-medicine, and those interested in applying computer-based analysis to biological problems may complete a concentration in Bioinformatics, sponsored jointly with the Computer Science Department. Biotechnology majors are not eligible for a Chemistry minor.

- 4+1 BS/MS Program in Biotechnology
- Biotechnology
- Honors Program in Biotechnology
- Major in Biotechnology and prerequisites for the Accelerated Pharmacy Program with Massachusetts College of Pharmacy and Health Sciences
- Major in Biotechnology, Concentration in Bioinformatics
- Major in Biotechnology, Concentration in Pre-Medicine

## Faculty

Roger S. Greenwell, Co-Coordinator of the Biotechnology Program, Associate Professor (2014), B.S., Western Kentucky University; Ph.D., University of Wisconsin-Madison

Jeffrey C. Nichols, Professor (2006), B.A., Texas Tech University; Ph.D., Rice University

Maura Pavao, Professor (2001), B.S., Worcester Polytechnic Institute; M.S., Ph.D. Rutgers University

Weichu Xu, Co-Coordinator of the Biotechnology Program, Associate Professor (2016), B.S., Suzhou University Suzhou China; M.S., Ph.D., Chinese Academy of Sciences

## Courses

### BT-101 Introduction to Forensic Sciences

**LASC Categories:** NSP, HBS, LAB

**Prerequisites:** Math placement code of 3 or higher.

Survey of forensic case studies and the laboratory techniques used to solve crimes including microscopy, chromatography, ballistics and DNA analysis.

Every year. 4 Credits

### BT-240 Research Experience for Undergraduates

Lab and/or field based research on a specific research topic under the supervision of a faculty member. Permission of instructor and department chair required.

Fall and Spring. 1-6 Credits

### BT-350 Genomics

**Prerequisites:** BI-141 and BI-203.

This course will examine the structure and function of genomes, as well as the tools and techniques of this multidisciplinary and growing field, with emphasis on how bioinformatic approaches can be utilized to address biological problems at the level of the entire genome. A major topic will be the application of computer-based techniques for the identification, comparison, and analysis of genomes and their products. Three lecture hours and three laboratory hours per week.

Fall and Spring and every 2-3 years. 4 Credits

### BT-360 Introduction to Bioprocessing

**LASC Categories:** NLL

**Prerequisites:** BI-204 as a pre-requisite, or CH-410 as a co-requisite.

This laboratory course covers the process development and manufacturing of biologics. It includes process development, upstream, downstream and other topics central to large scale production. At the end of the course, students will see the importance of every step from discovery to bulk fill in providing safe drugs to market.

Fall only and every 2-3 years. 4 Credits

### BT-375 Tissue Culture

**LASC Categories:** NLL

**Prerequisites:** BI-204 and CH-210 with a grade of C- or above.

A review of the methods of animal and plant tissue culture. Media preparation, aseptic techniques and cell culture technology. Three lecture hours and three laboratory hours per week.

Spring only and every year. 4 Credits

### BT-376 Biotechnology

**LASC Categories:** NLL

**Prerequisites:** CH-120, CH-121, BI-141 and BI-204 with a grade of C- or above.

Principles, applications of recombinant DNA (molecular/microbial aspects). The Biotechnology industry including bioreactor manufacturing standards and government rules. Three lecture hours and three laboratory hours per week.

Fall only and every year. 4 Credits

### BT-377 Fermentation Technology

**LASC Categories:** NLL

**Prerequisites:** BI-141 and BI-204 with a grade of C- or above.

Explores the application of biological and engineering principles involved in manufacturing pharmaceutical products.

Every 2-3 years. 4 Credits

### BT-378 Bioinformatics

**LASC Categories:** NLL

**Prerequisites:** BI-141 and BI-203 with a grade of C- or above.

Provides an overview of Bioinformatics including database structure, genomics, computational biology and proteomics. Three lecture hours and three laboratory hours per week.

Every 2-3 years. 4 Credits

### BT-408 Directed Study: Biotechnology

Directed study offers students, who because of unusual circumstances may be unable to register for a course when offered, the opportunity to complete an existing course with an established syllabus under the direction and with agreement from a faculty member.

Other or on demand. 3 Credits

### **BT-410 Biotechnology Seminar**

**LASC Categories:** CAP

Up-to-date developments in Biotechnology; preparation and presentation of technical literature. Students will study new techniques and procedures used by the industry.

Spring only and every year. 1-4 Credits

### **BT-440 Advanced Research Experience**

**Prerequisites:** BI-205. Instructor permission required. Junior/Senior standing required.

Advanced lab and/or field based research on a specific research topic under the supervision of a faculty member. Permission of instructor and department chair required.

Fall and Spring. 1-6 Credits

### **BT-450 Internship in Biotechnology**

Qualified upper-level biotechnology majors can learn experimental techniques by working in a company laboratory or a professional manufacturing environment. Permission of faculty sponsor and department chair required.

Fall and Spring. 3-6 Credits

## **Program Learning Outcomes**

- Apply broad knowledge of the sciences as they apply to biotechnology, including the following core content areas:
  - Cell biology
  - General chemistry principles
  - Molecular biology and genomics
  - Biochemistry
  - Physics and mathematics
  - The application of cells and organisms for industrial purposes
- Think critically and apply analytical skills
  - Gather, organize, interpret and evaluate data
  - Design appropriate experiments to test a hypothesis
  - Employ reason and logic, analyze pros and cons, and evaluate the validity of conclusions
- Perform laboratory techniques and practices used in the field
  - Proper use of tools, equipment/instrumentation, and materials
  - Demonstration of safety procedures.
- Effectively communicate scientific information to lay and scientific audiences using written and oral forms of communication.
  - Prepare poster presentation
  - Prepare written material (reports, SOPs, etc.)
  - Prepare oral presentations
- Exhibit an awareness of the social implications of biotechnology including how biotechnology shaped human development and the ethics of biotechnology, by addressing
  - The effect of biotechnology on the environment
  - The ethical issues that influence decisions related to biotechnology
  - The impact of biotechnology on society