

# BIOTECHNOLOGY

## Channeling scientific curiosity to fuel discovery and innovation

You're a scientist at heart — curious about how everything works, right down to the smallest detail. Exploring topics like biochemistry, molecular biology and genetics, our Biotechnology program puts you at the heart of one of the newest and fastest-growing scientific fields.

Whatever your scientific passion, studying biotechnology can bring you to its doorstep — preparing you to create advancements that can change lives and improve the world around you.

### Programs

- [Biotechnology Major \(B.S.\)](#)
- [Biotechnology Minor](#)

### Courses

## Biotechnology (BIOT)

### BIOT 415 - Millyard Scholars Seminar

**Credits:** 2

Through in-class activities, workshops and guest speakers, students in the Millyard Scholars Program will explore career paths, and develop resources and skills for academic success. All student work, planning and experiences will be showcased in a digital portfolio.

**Equivalent(s):** BSCI 415

**Grade Mode:** Letter Grading

### BIOT 418 - Phage Bioinformatics Lab

**Credits:** 2

In the course, students undertake a hands-on undergraduate research experience to describe, document, and publish the discovery of new bacteriophages (bacterial viruses). In doing so, students will elucidate how the genome codes biological information. The aim of the course is for students to develop further research and computational analysis skills while preparing to publish their scientific discoveries. The course will focus on research data analysis and presentation of research data to scientists and the public.

**Equivalent(s):** BSCI 418

**Grade Mode:** Letter Grading

### BIOT 422 - Biotechnology and Society

**Credits:** 4

Provides a basic understanding of genetic engineering. Techniques discussed include cloning, gene transfer, the polymerase chain reaction (PCR), in vitro fertilization, organ transplants, and paternity testing. Ethical issues involved with each technological advance are examined.

**Attributes:** Biological Science(Discovery)

**Equivalent(s):** BSCI 422

**Mutual Exclusion:** No credit for students who have taken BIOL 444A.

**Grade Mode:** Letter Grading

### BIOT 501 - Ethical Issues in Biology

**Credits:** 4

This course is an introduction to the ethical issues associated with current and future use of biotechnology. Students will think critically about different ethical problems that emerge from scientific research and its applications to medical technology. The focus will be on personal and public policy decision making.

**Attributes:** Writing Intensive Course

**Prerequisite(s):** (BIOL 413 with a minimum grade of C- and BIOL 414 with a minimum grade of C-) or (BIOL 411 with a minimum grade of C- and BIOL 412 with a minimum grade of C-).

**Equivalent(s):** BSCI 501

**Grade Mode:** Letter Grading

### BIOT 502 - Introduction to Biotechnology Manufacturing

**Credits:** 4

Introduction to the terminology and practices of the biotechnology industry, with an emphasis on the business, regulatory, legal, and basic scientific underpinnings of modern biotechnology in the commercial and government sectors.

**Equivalent(s):** BSCI 502

**Grade Mode:** Letter Grading

### BIOT 510 - Introduction to Biofabrication

**Credits:** 4

This project-based course introduces students to the techniques and challenges of biofabrication. Students learn how additive manufacturing is used to combine cells with a variety of biolinks to create living tissues such as skin, cartilage, vascularized bone, and blood vessels. During this process students learn how to design for and operate 3D printing and bioprinting equipment. An emphasis will be placed on the ways in which this emerging technology impacts our society.

**Attributes:** Environment,TechSociety(Disc)

**Equivalent(s):** BSCI 510

**Grade Mode:** Letter Grading

### BIOT 515 - Second Year Millyard Scholars Seminar

**Credits:** 2

The Millyard Scholars Second Year Seminar will introduce students to a series of data analytics methods employed in biotech research and clinical settings in order to promote problem solving and critical thinking skills. Recent data generated from the biotech research and from clinical trials will form the basis of the data analyzed during the course. Guest speakers will help inform discussions about the importance of data analytics in biotechnology and in clinical settings.

**Grade Mode:** Credit/Fail Grading

### BIOT 655 - Advanced Phage Biology

**Credits:** 4

Students undertake an advanced exploration of bacteriophage biology through wet-lab and/or bioinformatic investigation of previously-discovered bacterial viruses. In the setting of bacteriophage genome study, students develop working fluency with coding of genetic information, annotation of genomes, publication and presentation of discoveries, and design of experiments to assess questions in viral structure and function.

**Prerequisite(s):** BSCI 418 with a minimum grade of C- or BMS 503 with a minimum grade of C-.

**Repeat Rule:** May be repeated for a maximum of 8 credits.

**Grade Mode:** Letter Grading

**BIOT 704 - New and Emerging Biotechnology****Credits:** 4

In this course students investigate emerging technologies, innovations and new products in the biotechnology industry, through case studies and scientific literature. Modern biotechnology focuses mainly on medicine. New treatments for rare and complex diseases as well as genetic testing to identify genetically-inherited diseases are continually being developed and discovered. Technology that makes these and other advances possible is the focus of this course.

**Attributes:** Writing Intensive Course**Prerequisite(s):** GEN 604 with a minimum grade of C-.**Grade Mode:** Letter Grading**BIOT 747 - Industrial Microbiology and Fermentation****Credits:** 0 or 5

Production of biologics and food by the biotechnology and agribusiness industries is the major focus of this course. Development of procedures for fermentation and bioprocessing, from proof of concept through scale-up stages will be emphasized, utilizing both theory and quantitative understanding as well as hands-on wet lab experience with modern bioprocessing equipment. Troubleshooting, safety, and QC considerations will be addressed.

**Prerequisite(s):** BMS 503 with a minimum grade of C- and BMS 504 with a minimum grade of C-.**Equivalent(s):** BSCI 606, BSCI 747**Grade Mode:** Letter Grading**Special Fee:** Yes**BIOT 753 - Cell Culture Lecture****Credits:** 3

Fundamental biological principles that underlie cell culture and its applications are the foundation of the lecture component of this course. Applications of cell culture techniques to current research areas in academic and biopharmaceutical settings will be discussed.

**Co-requisite:** BIOT 754**Prerequisite(s):** BMS 503 with a minimum grade of C- and BMS 604 with a minimum grade of C-.**Equivalent(s):** BENG 620, BMCB 753, BMS 620**Grade Mode:** Letter Grading**BIOT 754 - Cell Culture Lab****Credits:** 2

Fundamental biological principles that underlie cell culture and its applications are the foundation of the lecture component of this course. Applications of cell culture techniques to current research areas in academic and biopharmaceutical settings will be discussed.

**Co-requisite:** BIOT 753**Prerequisite(s):** BMS 503 with a minimum grade of C- and BMS 504 with a minimum grade of C-.**Equivalent(s):** BENG 620, BMCB 753, BMS 620**Grade Mode:** Letter Grading**Special Fee:** Yes**BIOT 755 - Advanced Therapies****Credits:** 4

In this course students will gain an understanding of the fundamentals of biomaterials, gene therapy, cell therapy, and tissue engineering. We will cover chemical, structural, and biological aspects of therapeutic materials along with systemic literature reviews involving advanced therapy medical products (ATMPs) utilizing molecules, genes, cells, and tissues. We will also discuss synthetic polymers and biomolecules such as peptides, proteins, polysaccharides and oligonucleotides. No credit for students who have taken BSCI 797 "SpcTop/Advanced Therapies".

**Prerequisite(s):** CHEM 404 with a minimum grade of C- and (BIOL 414 with a minimum grade of C- or BIOL 412 with a minimum grade of C-).**Grade Mode:** Letter Grading**BIOT 760 - Numerical & Statistical Analysis in Biotechnology****Credits:** 0 or 4

In this course, students will gain an understanding of how best to conduct data analysis experiments utilizing data specific to biotechnology applications. Hands-on exercises involve using computer software programs such as Matlab and JMP. Data input/manipulation, descriptive and inferential statistics, hypothesis testing, curve fitting, and Matlab coding will be covered. Upon completion of the course, students should be able to conduct data analysis experiments within the context of biotech. No credit for students who have taken BSCI 797 "SpcTop/Num & Statistical Analysis".

**Prerequisite(s):** CHEM 403 with a minimum grade of C- and (BIOL 413 with a minimum grade of C- or BIOL 411 with a minimum grade of C-).**Grade Mode:** Letter Grading**BIOT 765 - Nucleic Acid Techniques****Credits:** 4

Laboratory course focused on application of molecular biology techniques for the extraction, detection, and use of nucleic acids. Emphasis is on recombinant DNA cloning and bioengineering techniques in biotechnology.

**Prerequisite(s):** GEN 604 with a minimum grade of C-.**Equivalent(s):** BMCB 754, BMS 650, BSCI 765**Grade Mode:** Letter Grading**Special Fee:** Yes**BIOT 766 - Protein and Immunologic Techniques****Credits:** 0 or 4

Laboratory course focused on application of molecular biology techniques for the isolation, quantitation, detection, analysis, and use of proteins. Substantial emphasis on the use of immunoassays and antibodies in protein work. Modern proteomics techniques are also discussed. Emphasis on recombinant protein expression in the field of biotechnology.

**Prerequisite(s):** GEN 604 with a minimum grade of C-.**Equivalent(s):** BSCI 766**Grade Mode:** Letter Grading**Special Fee:** Yes

**BIOT 770 - Stem Cell and Biomaterials Engineering Laboratory****Credits:** 0 or 4

Introduction to stem cells and how biomaterials are utilized in their applications involving biotechnology and biomedical engineering. Lab topics such as aseptic technique, stem cell cultures, biomaterials engineering, bioprinting, biocompatibility and bioactivity analyses will be covered. Lectures will focus on the current literature while the lab portion involves inquiry-based projects that will investigate how biomaterials and molecules modulate stem cell proliferation and differentiation.

**Prerequisite(s):** CHEM 403 with a minimum grade of C- and (BIOL 414 with a minimum grade of C- or BIOL 412 with a minimum grade of C-).

**Grade Mode:** Letter Grading**BIOT 772 - Pluripotent Stem Cell Laboratory****Credits:** 0 or 4

Introduction to human pluripotent stem cells (hPSCs) and how they are utilized in biomedical applications. Lab topics such as aseptic techniques, pluripotent stem cell cultures, stem cell differentiation, and cellular analyses will be covered. Lectures will focus on the current literature while the lab portion involves inquiry-based projects that will investigate how pluripotent stem cells proliferate and differentiate. Special focus will be given to induced pluripotent stem cell (iPSC) cultures.

**Prerequisite(s):** (BIOT 753 with a minimum grade of D- and BIOT 754 with a minimum grade of D-) or BIOT 770 with a minimum grade of D-.

**Grade Mode:** Letter Grading**Special Fee:** Yes**BIOT 775 - Biopharmaceutical Production Processes****Credits:** 0 or 5

This course will provide students with an overview of biopharmaceutical production processes through lectures. The course begins by introducing students to the proteins and biotechnology companies and to cGMP. During lab, students will use mammalian cells to produce and monoclonal antibody, by developing manufacturing SOPs, including upstream and downstream processing, and quality control and assurance. Students will also gain experience with T-cell culture as part of the CAR-T technology utilized in personal medicine.

**Prerequisite(s):** CHEM 651 with a minimum grade of C- and CHEM 653 with a minimum grade of C-.

**Mutual Exclusion:** No credit for students who have taken ANSC 651, CHBE 651, CHE 651.

**Grade Mode:** Letter Grading**BIOT 777 - Molecular Biology and Biotechnology****Credits:** 0 or 5

The organization, expression, and control of RNA and protein-coding genes in prokaryotic and eukaryotic cells. The focus of the course is on mechanisms of genetics at the molecular level and the application of modern techniques to laboratory biotechnology projects.

**Prerequisite(s):** GEN 604 with a minimum grade of C-.

**Equivalent(s):** BSCI 777**Grade Mode:** Letter Grading**Special Fee:** Yes**BIOT 780 - Techniques in Microscopy and Image Analysis****Credits:** 0 or 4

Laboratory course focused on application of microscopy techniques (light, fluorescent, confocal) and the subsequent analysis strategies for investigating biological specimens. Special focus will be directed towards cellular microscopy-based assays, both structural and functional. Image analysis topics will touch on filtering, segmentation, and registration.

**Prerequisite(s):** BMS 504 with a minimum grade of C-.

**Grade Mode:** Letter Grading**BIOT 788 - Advanced Studies****Credits:** 1-2

Advanced scholarly work at the undergraduate level supervised by a graduate faculty member for students enrolled in Accelerated Masters programs. The particular area of study will vary according to the semester or the specific course offering with which this course is paired.

**Repeat Rule:** May be repeated for a maximum of 8 credits.

**Grade Mode:** Letter Grading**BIOT 799 - Seminar in Biotechnology****Credits:** 2

The seminar in biotechnology will run from time to time with different topics, including the following: 1) Cutting-edge issues facing the biotechnology industry. 2) Instrumentation and technologies utilized in the biotechnology industry.

**Repeat Rule:** May be repeated for a maximum of 4 credits.

**Grade Mode:** Credit/Fail Grading

## Faculty

Biotechnology Faculty