

# BIOTECHNOLOGY (BIOT)

# Course numbers with the # symbol included (e.g. #400) have not been taught in the last 3 years.

## BIOT 804 - New and Emerging Biotechnology

**Credits:** 3

This course is a graduate-level investigation of emerging technologies, innovations and new products in the biotechnology industry, taught using 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.

**Grade Mode:** Letter Grading

## BIOT 825 - Biotech Products and Regulation

**Credits:** 3

The biopharma industry begins with foundations in basic science and works through various stages to turn ideas into marketable therapies. The business, clinical, and regulatory steps that are required to bring a product to market are important to understand in order to maximize ones effectiveness in any department in a biopharma setting. This course draws upon field experts to help deliver the content and tackle important discussions about the processes involved in drug development.

**Grade Mode:** Letter Grading

## BIOT 835 - Cell Biology

**Credits:** 3

This course is an upper level biology class that expands on the basic knowledge of cellular structure and function. The focus will be on molecular biology and cell signaling. Research methods and experiments but preeminent scientists will be explored and analyzed.

**Grade Mode:** Letter Grading

## BIOT 837 - Microbial Genomics

**Credits:** 0 or 3

Microbial genomes (primarily bacteria and bacteriophages) and genome-scale approaches to addressing questions in microbial physiology and pathogenesis will be the focus of this course. Large-scale sequencing projects, genome structure and evolution, metagenomics, and other challenges in comparative genomics, will be discussed. Hands-on wet laboratory and bioinformatics projects will be included in this laboratory-lecture course.

**Grade Mode:** Letter Grading

## BIOT 840 - Antibiotic Discovery Research

**Credits:** 0 or 3

Students will identify antibiotic-producing bacterial isolates from environmental samples. They will participate in a self-directed research project that will involve working with faculty to generate hypotheses. Students will also perform one or more antibiotic discovery and/or antibacterial chemical experiments and use advanced lab techniques including the UHPLC to fractionate and analyze chemical extracts. Cannot earn credit if already taken BIOT 897 Special Topic "Antibiotic Discovery".

**Grade Mode:** Letter Grading

## BIOT 847 - Industrial Microbiology and Fermentation

**Credits:** 3

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.

**Grade Mode:** Letter Grading

## BIOT 850 - Cancer Biology: From Benchtop Research to Therapeutic Interventions

**Credits:** 3

The development and progression of cancer can be defined by several molecular and cellular biological characteristics. In this course, we will utilize primary literature to begin to understand (1) how specific cellular processes are altered during cancer initiation and progression; (2) how different cancers and the genetic landscape underlying them are being studied using models in the laboratory; and (3) how innovative therapeutics are being designed to target tumors based upon their individual molecular signatures.

**Grade Mode:** Letter Grading

## BIOT 853 - Cell Culture

**Credits:** 0 or 3

Principles and technical skills fundamental to the culture of animal cells. Introduction to the techniques of sub-culturing, establishing primary cultures, karyotyping, cloning, growth curves, and cryopreservation. Techniques involving culturing mammalian cells in bioreactors will be introduced. Application of cell culture to contemporary research in biotechnology through independent projects.

**Grade Mode:** Letter Grading

**Special Fee:** Yes

## BIOT 855 - Advanced Therapies

**Credits:** 3

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 BIOT 897 "Top/Advanced Therapies".

**Grade Mode:** Letter Grading

## BIOT 860 - Numerical & Statistical Analysis in Biotechnology

**Credits:** 0 or 3

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 BIOT 897 "Top/Num & Statistical Analysis".

**Grade Mode:** Letter Grading

**BIOT 865 - Nucleic Acid Techniques****Credits:** 3

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

**Grade Mode:** Letter Grading**BIOT 866 - Protein and Immunological Techniques****Credits:** 0 or 3

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

**Grade Mode:** Letter Grading**Special Fee:** Yes**BIOT 870 - Stem Cell and Biomaterials Engineering Laboratory****Credits:** 0 or 3

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.

**Grade Mode:** Letter Grading**BIOT 872 - Pluripotent Stem Cell Laboratory****Credits:** 0 or 3

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. Students must have previous cell culture experience.

**Grade Mode:** Letter Grading**Special Fee:** Yes**BIOT 875 - Biopharmaceutical Production Processes****Credits:** 0 or 3

This course will provide the 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 a 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.

**Grade Mode:** Letter Grading**BIOT 877 - Molecular Biology and Biotechnology****Credits:** 0 or 3

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.

**Grade Mode:** Letter Grading**Special Fee:** Yes**BIOT 880 - Techniques in Microscopy and Image Analysis****Credits:** 0 or 3

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.

**Grade Mode:** Letter Grading**BIOT 889 - Biotech Career Planning****Credits:** 1

This course is intended for any student seeking internship, co-op, and/or employment opportunities. Participants research and evaluate biotech-related career opportunities related to their interests, create application portfolios, conduct interviews, use networking and job search resources, and participate in employer-based resume reviews and/or mock interviews. This course cannot be repeated for credit.

**Grade Mode:** Graduate Credit/Fail grading**BIOT 890 - Training Workshop****Credits:** 1-3

Through the Graduate Training Workshop, students will gain experience in emerging topics and techniques relevant to careers in the biotech industry. These will include, but not be limited to: flow cytometry, various chromatography techniques, and high-throughput sample processing.

**Repeat Rule:** May be repeated up to 6 times.**Grade Mode:** Letter Grading**BIOT 891 - Applied Research****Credits:** 3-6

The applied research experience enhances the student's academic achievements with real-world, professional industry projects through placement at biopharma industry organizations. The student is expected to apply knowledge and skills acquired through other coursework in the major to address and solve new, authentic problems identified by the employer. Under the direction of a faculty advisor and workplace supervisor, the student is expected to contribute effectively within a team at the organization.

**Repeat Rule:** May be repeated for a maximum of 6 credits.**Grade Mode:** Graduate Credit/Fail grading**BIOT 892 - Graduate Internship****Credits:** 3-6

The internship experience enhances the student's academic achievements with real-world, professional industry projects through placement at biopharma industry organizations. The student is expected to apply knowledge and skills acquired through other coursework in the major to address and solve new, authentic problems identified by the internship employer. Under the direction of a faculty advisor and workplace supervisor, the student is expected to contribute effectively within a team at the organization.

**Repeat Rule:** May be repeated for a maximum of 6 credits.**Grade Mode:** Graduate Credit/Fail grading**BIOT 893 - Directed Graduate Research****Credits:** 3-6

The research project experience enhances the student's academic achievements with a project-based experience in an academics lab. The student is expected to apply knowledge and skills acquired through other coursework in the major to address and solve new, authentic basic or applied science questions under the direction of a faculty advisor. The student is expected to contribute effectively within a lab team.

**Repeat Rule:** May be repeated for a maximum of 6 credits.**Grade Mode:** Graduate Credit/Fail grading

**BIOT 895 - Graduate Co-op Experience****Credits:** 1-9

This intensive internship experience enhances the student's academic achievements with real-world, professional industry projects through placement at biopharma industry organizations. The student is expected to apply knowledge and skills acquired through other coursework in the major by working in an industry setting alongside professionals to hone their technical and business skills. Under the direction of a faculty advisor and workplace supervisor, the student is expected to contribute effectively within a team at the organization.

**Repeat Rule:** May be repeated for a maximum of 9 credits. May be repeated up to 2 times.

**Grade Mode:** Graduate Credit/Fail grading

**BIOT 896 - Graduate Seminar in Biotechnology****Credits:** 1

The graduate seminar in biotechnology will run each semester with different topics. For example: 1) Cutting-edge issues facing the biotech industry will be encountered through case studies in order to apply what is being learned in other courses, hone communication skills, and stay up to date in the fields. 2) Instrumentation and technologies utilized in the biotechnology industry will be described through lectures, readings, and site visits to nearby facilities.

**Repeat Rule:** May be repeated for a maximum of 3 credits.

**Grade Mode:** Graduate Credit/Fail grading

**BIOT 897 - Special Topics in Biotechnology****Credits:** 1-3

This course explores and investigates advanced topics in biotechnology that would not normally be covered in other courses in the curriculum.

**Repeat Rule:** May be repeated for a maximum of 9 credits.

**Grade Mode:** Letter Grading

**Special Fee:** Yes

**BIOT 898 - Special Laboratory Topics in Biotechnology****Credits:** 0-3

This laboratory course explores and investigates advanced topics in biology that would not normally be covered in other courses in the curriculum.

**Repeat Rule:** May be repeated for a maximum of 9 credits.

**Grade Mode:** Letter Grading