

BIOT 107: BIOTECHNOLOGY: TRANSFORMING SOCIETY THROUGH BIOLOGY

Citrus College Course Outline of Record

Heading	Value
Effective Term:	Fall 2021
Credits:	3
Total Contact Hours:	54
Lecture Hours :	54
Lab Hours:	0
Hours Arranged:	0
Outside of Class Hours:	108
Strongly Recommended:	ENGL 101.
District General Education:	B1. Natural Sciences - Life Sciences
Transferable to CSU:	Yes
Transferable to UC:	Yes - Approved
Grading Method:	Standard Letter

Catalog Course Description

This lecture course serves as an introduction to biology concepts and their application in the field of biotechnology. Lecture content will emphasize the biology, business, and legal/ethical issues surrounding biotechnology. The course is appropriate for a wide range of students, including non-majors, who would like to explore how biological solutions may be employed to address today's societal issues. Topics include molecular and cellular biology, genetic engineering, drug development, GMOs, and biofuels. 54 lecture hours.

Course Objectives

- Describe basic biological and chemical principles underlying biotechnology.
- Demonstrate an understanding of the nature of scientific inquiry, especially the role of the scientific method.
- Define and distinguish among the four major classes of biological molecules.
- Compare and contrast structural and functional differences between prokaryotic and eukaryotic cells.
- Construct a flow diagram of gene expression from DNA to protein.
- Identify factors that regulate the expression of genes in a cell.
- Explain the effect of mutations on cell function and the role single nucleotide polymorphisms have on human health/disease.
- Describe how the genome of an organism can be modified using current biotechnology tools.
- Demonstrate an understanding of recombinant DNA technology used in the production of genetically-modified organisms.
- Demonstrate knowledge of a wide range of biotechnology applications to address societal challenges, including environmental and medical issues.
- Compare and contrast metabolic processes and activities in animal, plant, and fungal cells.

- Demonstrate an understanding of the seminal experiments that resulted in the first genetically-modified organisms and the birth of the biotechnology industry.
- Explain how living systems can be used to manufacture products.
- Demonstrate knowledge of basic upstream and downstream processing activities.
- Apply knowledge of protein structure to explain the activity of enzymes and sensitivity of proteins to environmental factors.
- Outline the major steps involved in drug discovery and FDA approval in the United States.
- Explain evolution from a genetic perspective.
- Evaluate a recent development in the field of biotechnology from an ethical perspective.
- Evaluate sources of scientific information.

Major Course Content

Scientific method and fostering scientific literacy

Characterizing life and its diversity

Biological molecules and their functions

1. Carbohydrates
2. Lipids
3. Proteins
4. Nucleic acids

Cellular organization

1. Cell theory
2. Prokaryotic cells: structure and function
3. Eukaryotic cells: structure and function

Energy production

1. Photosynthesis
2. Cellular respiration/fermentation

Reproduction

1. Cell division
2. Control of cell cycle and cancer

Gene expression

1. DNA structure and function
2. DNA replication
3. Transcription
4. Translation
5. Mutations
6. Regulation of gene expression/Epigenetics

Evolution

1. Definition of evolution and natural selection
2. Examples of evolution

Ecology

1. Ecosystems
2. Effects of humans on natural systems

Biotechnology tools

1. Recombinant DNA
2. Blue-white screening
3. cDNA and genomic libraries
4. PCR/RT-PCR/qPCR
5. Agarose gel electrophoresis
6. SDS-PAGE
7. ELISA
8. DNA microarrays
9. DNA sequencing (chain termination and next generation)
10. CRISPR-Cas9
11. Stem cells/gene therapy (ex vivo/in vivo)
12. Immune system stimulation/modulation and immunotherapy (CAR-T cells)

Applications of biotechnology

1. Human Genome Project and GenBank
2. Microbial
3. Plant/agricultural
4. Animal (production of animal models/transgenic animals)
5. Forensics
6. Bioremediation
7. Fuels/Industrial
8. Medical/Pharmaceutical

Ethical, legal, and business aspects of biotechnology

1. Regulatory oversight and current good manufacturing practices (cGMPs)
2. RAC (Recombinant Advisory Committee)
3. Drug development and approval process
4. Intellectual property rights and patents

Suggested Reading Other Than Required Textbook

Students will read popular science articles and entries on authoritative websites regarding recent biotechnology advancements and ethical considerations.

Examples of Required Writing Assignments

Students will be provided articles and/or videos to review and will answer questions related to material presented in the assignment which will require students to demonstrate their understanding of a particular biotechnology tool/application that was discussed in the assigned material and to reflect on the ethical/societal implications of the biotechnology tool/application.

Examples of Outside Assignments

Students will answer in-class and homework questions, such as: (1) Explain how *E. coli* was genetically engineered to produce human insulin. (2) Describe why microalgae are an ideal source for biofuels. (3) Propose one way to use biotechnology approaches to address the crisis of antibiotic resistance in bacteria.

Instruction Type(s)

Lecture, Online Education Lecture