

Biotechnology, Semester B

Credits: 0.5

Course Overview and Goals

Biotechnology, Semester B, is the second part of a two-semester biotechnology course. The lessons in this semester will help you understand genetics and the applications and importance of biotechnology. You will learn what drives mutation and learn about the structure and function of chromosomes. You will also learn about genetic engineering, genomics and its applications, and the role of biotechnology in different sectors. As the course progresses, you will learn about regulations that apply to biotechnology products and processes, and discuss ethical and moral issues related to biotechnology. Additionally, you will learn about various biotechnology careers, important workplace skills, and the potential for entrepreneurship. Finally, you will learn about the biotechnology product-development process, the application of bioinformatics, and the impact of biotechnology and new trends.

This course consists of 14 lessons organized into four units, four Unit Activities, and four Discussions. Additionally, there is one Course Activity and one Course Project that you need to work on throughout the course. Each lesson contains one or more Lesson Activities. You will grade your work in the Lesson Activities by comparing it to sample responses. You will submit the Unit Activities, Course Activity, and Course Project to your teacher for grading.

By the end of this course, you will be able to do the following:

- ❖ Relate genetics and the study of genomes to biotechnology.
- ❖ Analyze the ethical, moral, and legal issues in biotechnology research and applications.
- ❖ Evaluate the product development process in biotechnology.
- ❖ Interpret the qualities and skills needed for biotechnology careers and career advancement.
- ❖ Predict biotechnology trends and the impact of biotechnology on the world.

UNIT 1: GENETICS AND GENOMICS (DAYS 1 – 24)

In this unit, you will learn about the contributions of Mendel and other scientists to the field of genetics, the importance of the discovery of DNA, and the significance of genetic diversity. You

will learn about the basic structure and function of a chromosome and the role of chromosomes in genetic inheritance. You will also compare plant- and animal-tissue cultures and procedures and describe the importance of tissue culture for various fields of biotechnology. Additionally, you will trace the history of sequencing the human genome, learn its importance, and examine the consequences of genomic damage or chromosomal rearrangements.

Lesson	Lesson Objective
Syllabus and Orientation	Review the Student Orientation and Course Syllabus at the beginning of this course.
Course Project	Biotechnology: An Overview
The Birth of Modern Genetics	Identify how genetics is driven by mutation and selective pressure and is responsible for all life on Earth.
Chromosomes	Review the basic structure and function of a chromosome.
Tissue Culture	Identify the importance of tissue culture for genetic engineering.
Genomics and the Human Genome	Recognize the importance of the study of genomes and its practical applications.

UNIT 2: BIOTECHNOLOGY SECTORS (DAYS 25 – 44)

In this unit, you will first learn about the types and functions of businesses in the field of biotechnology. Then, you will analyze the role of biotechnology in industrial power production and describe the advantages of products produced with biological processes. You will also describe the role of biotechnology in biofuel production, nutrient supplementation, and pest resistance. Additionally, you will learn about the roles of biotechnology in medicine, gene therapy, and pharmaceutical therapies. You will also describe laboratory procedures in the industrial, agricultural, and pharmaceutical sectors.

Lesson	Lesson Objective
Biotechnology in Industry	Analyze the application of biotechnology to industrial processes.
Biotechnology in Agriculture	Apply knowledge of biotechnology to agricultural processes.
Biotechnology in Medicine	Review the application of biotechnology in medicine and pharmaceutical processes.

UNIT 3: REGULATIONS AND CAREERS (DAYS 45 – 68)

In this unit, you will identify local, state, and federal agencies responsible for regulating the biotechnology industry and describe regulations that affect the industry. You will describe standard operating procedures (SOPs), good manufacturing practices (GMPs), and the International Organization for Standardization (ISO). You will also describe the different types of intellectual property. You will discuss the ethical, moral, and legal issues related to biotechnology and the purpose, impacts, and responsibilities of holding clinical trials. You will also learn about various career opportunities in biotechnology and the qualities and skills needed for these careers. Finally, you will describe important workplace skills, learn the characteristics of effective teamwork, identify leadership qualities, and learn strategies that can be used to resolve problems and conflicts.

Lesson	Lesson Objective
Regulating Biotechnology	Identify regulations that affect processes for biotechnology product development.
Bioethics	Analyze the ethical, moral, and legal issues related to biotech research, product development, and use in society.

Lesson	Lesson Objective
Course Activity	The Pros and Cons of Biotechnology
Careers in Biotechnology	Identify careers in biotechnology.
Workplace Skills	Review important qualities and skills needed for employability and career advancement.

UNIT 4: APPLICATION OF BIOTECHNOLOGY (DAYS 69 – 90)

In this unit, you will first describe the biotechnology product development process. Then, you will learn about traditional pharmaceuticals, herbal remedies, and recombinant pharmaceuticals. You will also explain how the biotechnology revolution has affected current science and manufacturing practices and, in turn, how discoveries in science have affected biotechnology. You will define bioinformatics, describe its scope and applications, and examine the role of computers in biotechnology. Finally, you will describe biotechnology trends, describe the applications and impact of biotechnology, and analyze the impact of robotics and automation on biotechnology.

Lesson	Lesson Objective
Product Development and Movement	Review the biotechnology product development process.
Bioinformatics	Identify the applications of bioinformatics.
The Impact of Biotechnology	Analyze the applications and impact of biotechnology and examine biotechnology trends.