

Biotechnology, Semester A

Credits: 0.5

Course Overview and Goals

Biotechnology, Semester A, is the first part of a two-semester biotechnology course. The course begins with an introduction to biotechnology. You will trace the history of biotechnology and learn about its impact on modern society. You will gain the essential skills needed to work in the field of biotechnology. As the course progresses, you will be introduced to the fundamentals of cell biology and molecular biology. Additionally, you will learn about breakthroughs in the field of biotechnology such as the polymerase chain reaction, recombinant DNA technology, and protein engineering. You will explore the significance of safety protocols in the laboratory. And finally, you will apply biotechnology laboratory techniques to perform an experiment.

This course consists of 16 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:

- ❖ Evaluate the impact of biotechnology on society.
- ❖ Use the scientific process and document results.
- ❖ Identify and practice the skills required to work in the field of biotechnology.
- ❖ Articulate how biology and biochemical principles apply to biotechnology.
- ❖ Demonstrate knowledge of laboratory safety and common procedures.

UNIT 1: INTRODUCTION TO BIOTECHNOLOGY (DAYS 1 – 19)

In this unit, you will trace the history of biotechnology and understand the impact of biotechnology on society. You will define science, explain the tentative nature of science, and list the steps of the scientific method. You will distinguish between hypotheses, theories, laws, and facts. You will also identify basic laboratory equipment used in biotechnology and explain

how to use various measurement instruments. You will practice the skills required to work in the field of biotechnology such as designing and performing an experiment, doing calculations, and documenting laboratory results.

Lesson	Lesson Objective
Syllabus and Orientation	Review the Student Orientation and Course Syllabus at the beginning of this course.
The Discovery of Biotechnology	Define biotechnology and understand its impact on society.
The Scientific Process	Summarize the scientific process.
Essential Skills for Biotechnology	Identify and practice the skills required to work in the field of biotechnology.

UNIT 2: CELL BIOLOGY (DAYS 20 – 44)

In this unit, you will learn about the structure of matter and describe the levels of organization of matter. You will list the major biomolecules and explain their roles in cellular processes. Next, you will describe the structure of a cell and its significance as the basic unit of life. Then, you will compare prokaryotic cells and eukaryotic cells. You will explain how cells and viruses differ and describe the process of cell growth and reproduction. You will also learn about the life cycles of bacteria, yeast, mammalian cells, and viruses. Next, you will recognize the significance of microbes in biotechnology. Finally, you will identify microorganisms using staining methods.

Lesson	Lesson Objective
Structure of Matter	Recognize the structure of matter and its role in the chemical processes of cells and organisms.
Biomolecules	Identify the structure and function of the macromolecules that compose cells.
The Cell	Recognize the cell as the basic unit of life.
Cellular Reproduction	Review cell growth and reproduction.
Microbiology	Apply biotechnology to microbiological processes.

UNIT 3: MOLECULAR BIOLOGY (DAYS 45 – 59)

In this unit, you will learn about the different phases of metabolism and the biochemical reactions that are responsible for those phases. You will explore how different biochemical reactions within the body are regulated through enzyme activity and availability. You will describe the structure and function of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) in cells and viruses. You will also learn about the structure and function of proteins. You will explain the biological synthesis of a protein using the central principles of biology.

Lesson	Lesson Objective
Biochemistry	Identify the biochemical principles that govern biochemical reactions during body processes.
DNA: Structure and Function	Recognize the structure and function of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) in cells and viruses.
Proteins: Structure and Function	Identify the structure and function of proteins.
Course Project	CRISPR

UNIT 4: BIOTECHNOLOGY IN THE LABORATORY (DAYS 60 – 90)

In this unit, you will learn about common hazards in the laboratory, safety signs and symbols, guidelines and protocols, and good laboratory practices. You will interpret safety data sheets. You will learn about the process of polymerase chain reaction (PCR) and perform a virtual PCR. You will analyze the impact that recombinant DNA technology has had on the field of biotechnology. You will examine how proteins are engineered and list the applications of protein engineering. You will explain how to express and purify an engineered protein. Finally, you will learn to apply advanced biotechnology laboratory techniques to perform an experiment.

Lesson	Lesson Objective
Safety in the Laboratory	Review the importance of laboratory safety protocols.
Polymerase Chain Reaction	Identify the process and importance of polymerase chain reaction (PCR).
Recombinant DNA Technology	Relate the importance of recombinant DNA technology to biotechnology.
Protein Engineering	Review the various techniques used in protein engineering.

Lesson	Lesson Objective
Course Activity	Protein Purification
Advanced Laboratory Techniques	Apply advanced biotechnology laboratory procedures to perform an experiment.