

What you will learn in this course



BIOTECHNOLOGY

1a: INTRODUCTION

BIOTECHNOLOGY 1A: INTRODUCTION

How is technology changing the way we live? Is it possible nature can provide all the answers to some of science's most pressing concerns? In Biotechnology 1a: Introduction, you'll learn the basics of biotechnology and evolutionary theory, explore the various ways we store and preserve food, and discover the process of fermentation and microbiology. This course will also cover the importance of breeding plants and hybridization and how early breeding programs led to the study of genetics and an understanding of the function of genes. Finally, you'll delve into early industrial discoveries and explore the developments in biotechnology during the industrial revolution.

Unit 1: Biotechnology Basics

Biotechnology refers to techniques that rely upon living organisms or the products of those organisms to make or modify products, to improve animals or plants, or to develop

microorganisms for medical, agricultural, or industrial use. In this unit, you will review the essential foundations for biotechnology, specifically the biology behind biotechnology.

What will you learn in this unit?

- Recognize different types of cells.
- Categorize organisms.
- Define taxonomy and scientific naming of organisms.
- Explain the basics of evolutionary theory.

| UNIT 1 Assignments | |
|---------------------------|-------------|
| Assignment | Type |
| Unit 1 Text Questions | Homework |
| Unit 1 Lab | Homework |
| Unit 1 Discussion 1 | Discussion |
| Unit 1 Discussion 2 | Discussion |
| Unit 1 Quiz | Discussion |

Unit 2: The Beginning of Biotechnology

The first human experiments and work in biotechnology came as humans made the transition from hunting and gathering to an agricultural means of food production. Domestication of plants and animals led to significant changes through active human interference and selection. Changes in human society, including sedentism, would lead to many early innovations in biotechnology.

What will you learn in this unit?

- Explain the differences between the Paleolithic and Neolithic.
- Describe how humans domesticated plants and animals.
- Categorize the regional variances in agriculture and domestication.
- Summarize the changes that occurred as humans domesticated plants and animals.

UNIT 2 Assignments

| Assignment | Type |
|-----------------------|------------|
| Unit 2 Text Questions | Homework |
| Unit 2 Lab | Homework |
| Unit 2 Activity | Homework |
| Unit 2 Discussion 1 | Discussion |
| Unit 2 Discussion 2 | Discussion |
| Unit 2 Quiz | Discussion |

Unit 3: Food Preservation and Fermentation

The first use of biotechnology, as you learned in Unit 2, was to improve the food supply.

Biotechnology continued to be used for food production as early peoples learned how to ferment their foods, produce alcohol and vinegar, make cheese, and bake bread. These changes in foods improved the food supply and made it safer, and reduced the risk of food-borne illness.

What will you learn in this unit?

- Classify the various ways to store and preserve food.
- Describe the different types of fermentation.
- Explain the process of fermentation.
- Discuss the study of microbiology and the work of Pasteur.

UNIT 3 Assignments

| Assignment | Type |
|-----------------------|------------|
| Unit 3 Text Questions | Homework |
| Unit 3 Lab | Homework |
| Unit 3 Discussion 1 | Discussion |
| Unit 3 Discussion 2 | Discussion |
| Unit 3 Quiz | Discussion |

Unit 4: Collection and Breeding

Modern biotechnology requires an understanding of genetics; however, that understanding is relatively recent. Before biologists, microbiologists, and botanists understood genetics, they learned how to crossbreed plants and produce hybrids of their own creation. In many ways, this built upon the domestication of plants discussed in Unit 2 but was far more complex and innovative.

What will you learn in this unit?

- Discuss the importance of early collectors and their collections.
- Describe how collectors bred plants.
- Illustrate the importance of hybridization and the impact of hybrids.
- Explain how early breeding programs led to genetics.

| UNIT 4 Assignments | |
|---------------------------|-------------|
| Assignment | Type |
| Unit 4 Text Questions | Homework |
| Unit 4 Lab | Homework |
| Unit 4 Activity | Homework |
| Unit 4 Discussion 1 | Discussion |
| Unit 4 Discussion 2 | Discussion |
| Unit 4 Quiz | Discussion |

Biotechnology 1a Midterm Exam

- Review information acquired and mastered from this course up to this point.
- Take a course exam based on material from the first four units in this course (Note: You will be able to open this exam only one time.)

| MIDTERM Assignments | |
|----------------------------|-------------|
| Assignment | Type |

| | |
|--------------------|------------|
| Midterm Exam | Exam |
| Midterm Discussion | Discussion |

Unit 5: The Beginning of Genetics

The study of genetics could not begin until the basic processes of inheritance were well understood. In the middle of the 19th century, an amateur scientist, Gregor Mendel, undertook the first defined scientific experiments in genetics, carefully recording the ratios of inheritance. While his work received little recognition at first, the study of genetics moved quickly from the 20th century onward. Within the first 50 years of the 20th century, DNA was identified and, by 1977, the first gene sequencers opened up new opportunities for the study of genetics.

What will you learn in this unit?

- Understand the function of genes.
- Recognize the historical development of the study of genetics.
- Understand Mendel's experiments and their significance.
- Create a timeline describing the history of genetics from Mendel through the late 20th century.

| UNIT 5 Assignments | |
|---------------------------|-------------|
| Assignment | Type |
| Unit 5 Text Questions | Homework |
| Unit 5 Lab | Homework |
| Unit 5 Discussion 1 | Discussion |
| Unit 5 Discussion 2 | Discussion |
| Unit 5 Quiz | Discussion |

Unit 6: Early Industrial Discoveries

In this unit, you will learn about industrial biotechnology advancements between 1800 and World War II. These innovations required new achievements in microbiology, a new understanding of enzymes and fermentation, as well as the ability to identify bacteria. They

fueled industrial growth in various industries, from ammunition production to paints and varnishes, providing key ingredients needed for a growing and changing world.

What will you learn in this unit?

- Recognize the developments in biotechnology that accompanied the industrial revolution.
- Understand the changes that occurred during the period defined as classical biotechnology.
- Explain the role of enzymes in an industrial setting.
- Recognize how war drove productivity and innovation in biotechnology.

| UNIT 6 Assignments | |
|---------------------------|-------------|
| Assignment | Type |
| Unit 6 Text Questions | Homework |
| Unit 6 Lab | Homework |
| Unit 6 Activity | Homework |
| Unit 6 Discussion 1 | Discussion |
| Unit 6 Discussion 2 | Discussion |
| Unit 6 Quiz | Discussion |

Unit 7: Regulation of Biotech

Food, drugs, the environment—biotechnology is everywhere! The industry is producing life-changing products across the globe and in our lives. Biotech has an effect on the foods we eat, on the drugs that promote healing, and on the products that protect our environment. The future of biotech is bright but comes with a responsibility to safeguard consumers and our environment. This safeguarding responsibility is known as regulation. Regulation is sometimes seen as a negative, but as we’ll see, it actually helps protect us while providing pathways to innovation and change.

What will you learn in this unit?

- Discuss the purpose and development of biotechnology regulation in the United States
- Identify and describe the primary regulatory agencies in the United States
- Explain the roles of product development, regulation, and society
- Consider the need for a balance between regulation and innovation

- Describe the basic regulatory process and the challenges in the regulatory environment
- Analyze the on-going process of modernizing biotechnology regulation

| UNIT 7 Assignments | |
|---------------------------|-------------|
| Assignment | Type |
| Unit 7 Text Questions | Homework |
| Unit 7 Lab | Homework |
| Unit 7 Discussion 1 | Discussion |
| Unit 7 Discussion 2 | Discussion |
| Unit 7 Quiz | Discussion |

Unit 8: Healing, Feeding, Fueling

The world of biotechnology is an area of science that does not concentrate on just one scientific area. Biotech applications and innovations heal humans and animals. Biotech supports agriculture by increasing crop yields, improving plant life, and preventing damage to our food chain from pests and insects. We even see biotech developing applications to combat climate change through products such as biofuels that use plant-based formulas instead of fossil-based fuel. Biotech is even in our laundry detergents and dishwashing liquids in the form of special enzymes that replace environmentally harmful chemicals!

What will you learn in this unit?

- Describe the long journey of biotech and major advances in three key areas
- Identify and describe major advances of biotech in medicine and healthcare
- Explain the key areas and uses of agricultural biotech
- Discuss the social and economic impacts of agricultural biotech
- Consider why environmental and industrial biotech are described as “the third wave of biotech”
- Identify the key areas and uses of industrial and environmental biotech

| UNIT 8 Assignments | |
|---------------------------|--|
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| Assignment | Type |
|-----------------------|-------------|
| Unit 8 Text Questions | Homework |
| Unit 8 Lab | Homework |
| Unit 8 Discussion 1 | Discussion |
| Unit 8 Discussion 2 | Discussion |
| Unit 8 Quiz | Discussion |

Biotechnology 1a Final Exam

- Review information acquired and mastered from this course up to this point.
- Take a course exam based on material from units five to eight in this course – the last four units. (Note: You will be able to open this exam only one time.)

| FINAL Assignments | |
|-----------------------------|-------------|
| Assignment | Type |
| Final Exam | Exam |
| Class Reflection Discussion | Discussion |