Biotechnology 1B: Unlocking Nature's Secrets Course Syllabus

What you will learn in this course

Biotechnology 1B: Unlocking Nature's Secrets

The fusion of biology and technology creates an amazing process and offers humanity a chance to significantly improve our existence, while simultaneously creating new challenges. In Biotechnology 1B: Unlocking Nature's Secrets, you'll build on your knowledge from Biotechnology 1A and learn how this field seeks to cure such deadly diseases as cancer and malaria, develop innovative medicine, and effectively feed the world through improved agricultural systems. Learn about some of the challenges biotechnology faces today, such as the growth of antibiotic resistant bacteria and questions about the safety of commercially produced genetically modified organisms (GMOs). You'll research new biotechnologies and learn how they are changing the world we live in, including the environmental benefits of industrial biotechnology.

Unit 1: The Discovery of Antibiotics

Antibiotics revolutionized medicine. For the first time, the medical profession had a tool to combat infection, reduce the risks of surgical operations, and prevent many medical complications, like scarlet fever and gangrene. From the early research into penicillin to modern antibiotics, the existence of anti-bacterial drugs has changed medicine and altered the course of human life.

What will you learn in this unit?

- Understand the origin of antibiotics.
- Recognize the timeline of antibiotic development.
- Understand how antibiotics treat bacterial infections.
- Recognize the concerns about antibiotic resistance and possible solutions to antibiotic resistance.

Unit 2: Agricultural Biotechnology through the Green Revolution

Agricultural biotechnology has moved far beyond early experiments in hybridization, leading to higher yields of food, less labor-intensive food production, and reduced famine throughout the world. Advances in biotechnology and botanical science have created plants that produce more, in less time and with fewer resources, through hybridization and early efforts at genetic modification.

What will you learn in this unit?

- Recognize the changes in agricultural biotechnology in the late 19th century.

- Understand how double cross breeding changed plants.
- Recognize the developments that led to the Green Revolution.
- Understand how technological advances led to genetic modification in modern agriculture.

Unit 3: Mapping the Human Genome

Having developed the technology to sequence DNA, researchers began to contemplate creating a complete map of the human genome. This project would eventually involve laboratories around the world, working together to create a complete map of the 3 billion bases in the human genome. With this data, new projects and research began, looking toward a genetic understanding of cancer, various diseases, and genetic variation between individuals.

What will you learn in this unit?

- Understand the history of the Human Genome Project.
  Recognize the accomplishments of the Human Genome Project.
  Understand developments since the completion of the Human Genome Project.
  Recognize the potential for genetic research and understanding.

Unit 4: Modern Industrial Biotechnology

Industrial biotechnology offers environmentally friendly, renewable solutions to a number of industrial problems. Enzymes, fermentation and the manipulation of other biological products can produce various products, ranging from biofuels to polymers and plastics. Enzymes can replace chemicals, reduce waste, and reduce energy use in the production of various consumer and industrial goods, from paper to laundry detergent. In this unit, you will learn about various applications of biotechnology in production, industry, and manufacturing, while looking at other applications of the genetic technology studied in past units.

What will you learn in this unit?

- Understand the modern industrial uses for enzymes.
- Recognize the role of genetics in modern industrial biotechnology.
- Understand how and why biofuels are important.
- Recognize the environmental benefits of industrial biotechnology.

Biotechnology 1B 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.)

Unit 5: Modern Agricultural Biotechnology

Modern agricultural biotechnology is centered on genetic technology and genetic modification. The use of transgenics allows scientists to combine genes from different organisms to achieve desirable traits, from pest resistance to increased vitamin content. These changes are often controversial and may not be accepted by the public. While a great deal of discussion about genetic modification and genetically modified organisms, or GMOs, continues, they are a prevalent part of the food supply, particularly in the United States.

What will you learn in this unit?

- Understand how organisms are genetically modified.
- Recognize the prevalence of GMOs.
- Understand the risks and benefits of GMOs.
- Develop an educated opinion about the role of GMOs in our food supply.

Unit 6: Modern Pharmaceutical Biotechnology

In this unit, you will learn about recent advances in pharmaceutical biotechnology, including the development of new types of drugs, cancer treatments, and vaccines. These include a variety of biotechnological advancements, many relying upon the growth in understanding of genetics, genetic modification, and gene therapies. While some forms of biotechnology, like industrial biotechnology, impact your life only in distant ways, you may have a more personal understanding of pharmaceutical biotechnology. You've had vaccinations and taken medication. You may have used recombinant insulin or have had a genetically modified vaccination, like the HPV vaccination. Or you may know someone who relies upon the discoveries in pharmaceutical biotechnology to live and thrive.

What will you learn in this unit?

- Explain innovations in pharmaceutical biotechnology.
- Define the importance of genetically modified hormones, insulin, and other compounds typically produced in the body.
- Recognize the potential for new treatments for cancer and other illnesses.
- Describe the importance of vaccines.

Unit 7: The Future of Biotech: Innovation

If you want to be part of a highly innovative industry and change the world, choose biotech! The biopharmaceutical, agricultural, and environmental segments are out-pacing and expanding faster than other industries, including electronics and technology. Let's take a look at these three sprawling diverse segments to get a better idea of how they're positioned to alleviate pain and suffering and help save our planet.

What will you learn in this unit?

- Identify the drivers of innovation in biotechnology and their interrelationships.
- Describe how biotechnology innovations are funded.

- Discuss major advancements in medical biotech innovations.
- Explain areas of agricultural biotechnology that are being developed.
- Recognize key areas of industrial and environmental biotechnology that represent advances in innovation.

Unit 8: The Role of Ethics and Public Policy

Biotechnology is a high-visibility area of science affected by public policy as well as ethics. Researchers, scientists, and healthcare providers are impacted daily by the public policy issues in biotechnology as well as in bioethics. At some point, a professional working in biotech will come face-to-face with decisions related to public policy as well as ethical conduct. Each primary area of biotechnology—medicine, agriculture, industrial/environmental biotechnology—is touched by those two factors.

What will you learn in this unit?

- Define ethics and bioethics
- Discuss the role of bioethics in medicine, agriculture, and industrial/environmental biotech
- Evaluate the meaning of public policy and its relationship to biotech
- Describe public policy principles and practices
- Explain the roles of regulation and the law as public policy

Biotechnology 1B 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.)