

Biotechnology in Agriculture - 51035

Course Description:

- Suggested grade level: 10th – 12th
- Pre-requisite: Biology I and II
- Text: *Introduction to Biotechnology: An Agricultural Revolution*; Delmar Learning
- Available Credit: ½ credit (science and agriculture)
- A comprehensive study of the history of biotechnology, DNA, genetic engineering and transfer, cloning of plants and animals, and reproductive biotechnology. Students will also look at how biotechnology has transformed the food and health industries as well as discuss consumer concerns and ethical issues that have surfaced.

Core Technical Standards and Examples

| Indicator #1: Explain the importance of biotechnology and the scientific process involved in biotechnology discoveries. | | | |
|---|---|---|---|
| Bloom's Taxonomy Level | Standard | Supporting Concepts/Skills | Assessment and Resources |
| Evaluation | B1.1 Explain the meaning and effects of biotechnology for human benefit. | <ul style="list-style-type: none"> • Define biotechnology in its application to plants, animals, and the environment. • Trace historical development of biotechnology from the beginning of history to present. • Describe the value of biotechnology in contributions to society. | <ul style="list-style-type: none"> • What is Biotechnology? Lab • Phenomena of Biotechnology (Chp. 1) • Biotechnology Timeline Lab |
| Application | B1.2 Perform laboratory exercises using laboratory equipment in aseptic settings. | <ul style="list-style-type: none"> • Practice safety procedures with chemicals and lab apparatus. • Follow proper lab procedures necessary to conduct a scientific experiment. • Conduct research into biotechnology innovations using experimentation. • Practice steps of scientific method and write a lab report for an experiment. | <ul style="list-style-type: none"> • Zymotechnology Lab • Root Beer Lab • Principles of Scientific Research (Chp. 3) • Cells Lab • Extracting DNA Lab • Selective Breeding Lab • Plant Cloning Labs • Herbicide-Resistant Transgenic Plants Lab • Feed Preservation – Silage Lab • Biogas Generator Lab • Bioremediation (Wastewater Treatment) Lab • Bioremediation (Tertiary Treatment) Lab • Phytoremediation Lab • Transgenic Manipulation Simulation |

| Indicator #2: Explain the functions and importance of biotechnology at the cellular level. | | | |
|---|--|---|---|
| Bloom's Taxonomy Level | Standard | Supporting Concepts/Skills | Assessment and Resources |
| | B2.1 Recognize components of cells and their application to genetic improvement. | <ul style="list-style-type: none"> • Sketch plant cells and parts. • Describe major processes of the cell. • Differentiate between the two types of cells. • Explain the importance of DNA. | <ul style="list-style-type: none"> • Cells: The Foundation of Life (Chp. 4) • Cells Lab • Extracting DNA Lab • Mitosis and Meiosis Lab • Producing Genetically Modified Organisms (Chp. 6) |
| | B2.2 Explain the role of cell structures in genetic theory. | <ul style="list-style-type: none"> • Identify functions of cell parts in passing on traits. • Demonstrate Mendelian genetics with crop seeds. • Predict genetic outcomes using a Punnett Square. | <ul style="list-style-type: none"> • Cells: The Foundation of Life (Chp. 4) • Principles of Genetic Transfer (Chp. 5) • Punnett Squares Practice • Transcription and Translation Lab |

| Indicator #3: Research developments and procedures used in biotechnology affecting plants, plant growth, and genetic alteration. | | | |
|---|---|--|--|
| Bloom's Taxonomy Level | Standard | Supporting Concepts/Skills | Assessment and Resources |
| Application | B3.1 Apply procedures used in biotechnology to plant processes. | <ul style="list-style-type: none"> • Demonstrate the absorption process through experimentation. • Apply the photosynthetic/respiration processes through experimentation. • Demonstrate the transpiration process through experimentation. | <ul style="list-style-type: none"> • Biotechnology in Plant Science (Chp. 9) |
| Evaluation | B3.2 Compare procedures used in biotechnology to plant propagation. | <ul style="list-style-type: none"> • Explain steps in variety development and carry out through experimentation. • Demonstrate plant tissue culture through experimentation. • Apply the genetic engineering process through experimentation. • Demonstrate the genetic mapping process through experimentation. | <ul style="list-style-type: none"> • Plant Cloning (Chp. 8) • Plant Cloning Labs (Cuttings, Layering, Separation, Division, Grafting, Tissue Culture) • Herbicide-Resistant Transgenic Plants Lab |

| Indicator #4: Research developments and procedures used in biotechnology affecting animals, animal growth, and genetic alteration. | | | |
|---|---|---|---|
| Bloom's Taxonomy Level | Standard | Supporting Concepts/Skills | Assessment and Resources |
| Evaluation | B4.1 Determine procedures used in biotechnology in animal reproduction methods. | <ul style="list-style-type: none"> Identify parts of animal reproductive system from a drawing. Compare reproductive cycles of animals for specific farm or domestic animals. Summarize technologies used in animal reproduction such as artificial insemination, embryo transfer and cloning. Determine chromosome theory of inheritance using Punnett's square. | <ul style="list-style-type: none"> Animal Cloning (Chp. 7) Cloning Educational Project Cloning WebQuest Biotechnology in Animal Reproduction (Chp. 10) Punnett Squares Practice Chp. 10 Student Learning Activity Chp. 7 Student Learning Activity |
| Evaluation | B4.2 Determine procedures used in biotechnology in animal disease management. | <ul style="list-style-type: none"> Research disease causing pathogens and contrast between modes of disease transmission. Assess common animal diseases and write a paper on a selected disease. Explain technologies used in disease control by matching methods of control for a chosen disease. | <ul style="list-style-type: none"> Biotechnology in Animal Reproduction (Chp. 10) |
| Evaluation | B4.3 Determine procedures used in biotechnology in animal systems alteration. | <ul style="list-style-type: none"> Identify growth hormones for animals. Research the purpose for each hormone. | <ul style="list-style-type: none"> Biotechnology in Animal Reproduction (Chp. 10) Pharming for Pharmaceuticals Article |

| Indicator #5: Research developments and procedures used in biotechnology affecting the environment. | | | |
|--|---|---|---|
| Bloom's Taxonomy Level | Standard | Supporting Concepts/Skills | Assessment and Resources |
| Evaluation | B5.1 Apply procedures used in biotechnology in the environment. | <ul style="list-style-type: none"> Detect environmental pollutants. Implement methods of bioremediation. Understand environmental concerns of genetically altered organisms. Review bioresearch methods to process renewable raw materials. | <ul style="list-style-type: none"> Biotechnology in the Environment (Chp. 13) Biogas Generator Lab Bioremediation (Wastewater Treatment) Lab Bioremediation (Tertiary Treatment) Lab Phytoremediation Lab Bio-Plastics Articles |

| Indicator #6: Debate the ethical issues in biotechnology and identify the benefits and concerns to society. | | | |
|--|---|--|--|
| Bloom's Taxonomy Level | Standard | Supporting Concepts/Skills | Assessment and Resources |
| Evaluation | B6.1 Research controversial issues of biotechnology as they apply to affects on the human race. | <ul style="list-style-type: none"> • Understand ethical dilemmas caused by biotechnology discoveries using current news issues. • Discuss ethics in cell and cloning research. • Discuss labeling of genetically altered products. • Map out the process in obtaining biotechnology patents. • Review bioresearch methods to process renewable raw materials. | <ul style="list-style-type: none"> • Animal Cloning (Chp. 7) • Biotechnology in Plant Science (Chp. 9) • Biotechnology in Medicine (Chp. 11) • Consumer Concerns about Biotechnology (Chp. 14) • Ethical Issues in Biotechnology (Chp. 15) • Evaluating Biotech Crops for Safety in U.S. Article • Should We Grow GM Crops WebQuest |

Science - Core Technical Standards and Examples

| Indicator #1: Explain the importance of biotechnology and the scientific process involved in biotechnology discoveries. | | | |
|--|---|-----------------------------------|---------------------------------|
| Bloom's Taxonomy Level | Standard | Supporting Concepts/Skills | Assessment and Resources |
| Evaluation | N1.1 Students are able to evaluate a scientific discovery to determine and describe how societal, cultural, and personal beliefs influence scientific investigations and interpretations. | • | • |
| | | • | • |