

Agriculture Biotechnology

18308

Rationale Statement:

Our lives are increasingly touched by technological advances in biology from discoveries in disease and pest control to reproductive capabilities in plants and animals as well as biological benefits in environmental sciences. Agricultural biotechnology will experience a 55% growth rate in the next five years particularly in the areas of crop and livestock genetic engineering. Biotechnology in Agriculture is designed to provide students with basic lab skills and skills in biotechnology applications in plant and animal sciences. Classroom and laboratory content may be enhanced by utilizing appropriate equipment and technology. Mathematics, English, biology, and human relations skills will be reinforced in the course. Work-based learning strategies appropriate for this course are school-based enterprises and field trips. Opportunities for application of clinical and leadership skills are provided by participation in FFA through activities, conferences and skills competition such as science-related career development events and proficiency awards. Each student will be expected to complete a Supervised Agricultural Experience Program/Internship.

Suggested grade level: 11-12

Topics covered:

- Life processes as affected by biotechnology
- Lab procedures related to biotechnology
- Cellular biology
- Genetic theory
- Plant and animal genetics
- Plant and animal reproduction
- Plant and animal diseases and disease control
- Genetic engineering of plants and animals
- Biotechnology in the environment
- Controversies with biotechnology

Indicator #1: Illustrate the importance of biotechnology and the scientific processes involved in biotechnology discoveries.

Bloom's Taxonomy Level	Standard and Examples
Applying	<p>B1.1 Illustrate the meaning and effects of biotechnology for human benefit.</p> <p>Examples:</p> <ul style="list-style-type: none"> • Examine Biotechnology in its application to plants, animals and the environment. • Illustrate the historical development of biotechnology from the beginning of history to present. • Examine the value of biotechnology in contributions to society.
Applying	<p>B1.2 Employ proper protocol for aseptic technique.</p> <p>Examples:</p> <ul style="list-style-type: none"> • Demonstrate safety procedures with chemicals and lab apparatus. • Demonstrate proper lab procedures necessary to conduct a scientific experiment. • Conduct research into biotechnology innovations. • Illustrate steps of scientific method and write a lab report.

Indicator #2: Illustrate the functions and importance of biotechnology at the cellular level.

Bloom's Taxonomy Level	Standard and Examples
Understanding	<p>B2.1 Recognize components of cells and their application to genetic improvement.</p> <p>Examples:</p> <ul style="list-style-type: none"> • Sketch plant cells and parts. • Illustrate major processes of the cell. • Differentiate between the two types of cells. • Explain the importance of DNA.

Applying	<p>B2.2 Illustrate the role of cell structures in genetic theory.</p> <p>Examples:</p> <ul style="list-style-type: none"> • Illustrate functions of cell parts in passing on traits. • Demonstrate Mendelian genetics with crop seeds. • Solve Punnett Squares for genetic outcomes.
<p>Indicator #3: Demonstrate developments and procedures used in biotechnology affecting plants, plant growth and genetic alteration.</p>	
Bloom's Taxonomy Level	Standard and Examples
Applying	<p>B3.1 Apply procedures used in biotechnology to plant processes.</p> <p>Examples:</p> <ul style="list-style-type: none"> • Demonstrate the absorption process. • Apply the photosynthesis and respiration processes. • Demonstrate the transpiration process.
Applying	<p>B3.2 Demonstrate procedures used in biotechnology to plant propagation.</p> <p>Examples:</p> <ul style="list-style-type: none"> • Write steps in variety development and carry them out through experimentation. • Demonstrate plant tissue culture. • Apply the genetic engineering process. • Demonstrate the genetic mapping process.

Indicator #4: Evaluate developments and procedures used in biotechnology affecting animals, animal growth and genetic alteration.

Bloom's Taxonomy Level	Standard and Examples
Evaluating	<p>B4.1 Evaluate procedures used in biotechnology in animal reproduction.</p> <p>Examples:</p> <ul style="list-style-type: none"> • Draw the parts of an animal's reproductive system. • Evaluate reproductive cycles of animals for specific farm or domestic animals. • Evaluate artificial insemination, embryo transfer and cloning. • Defend chromosome theory of inheritance using Punnett's square.
Analyzing	<p>B4.2 Examine procedures used in biotechnology in animal disease management.</p> <p>Examples:</p> <ul style="list-style-type: none"> • Differentiate disease causing pathogens and contrast between modes of disease transmission. • Compare common animal diseases and write a paper on a selected disease. • Evaluate technologies used in disease control by matching methods of control for a chosen disease.
Evaluating	<p>B4.3 Evaluate procedures used in biotechnology in animal systems alteration.</p> <p>Examples:</p> <ul style="list-style-type: none"> • Appraise growth hormones for animals. • Evaluate the purpose for each hormone. • Defend the use of growth hormones in agricultural production.

Indicator #5: Interpret developments and procedures used in biotechnology affecting the environment.

Bloom's Taxonomy Level	Standard and Examples
Applying	<p>B5.1 Apply procedures used in biotechnology in the environment.</p> <p>Examples:</p> <ul style="list-style-type: none"> • Detect environmental pollutants. • Examine methods of bioremediation. • Dramatize environmental concerns of genetically altered organisms. • Demonstrate bio research methods to process renewable raw materials.

Indicator #6: Defend/Argue the ethical issues in biotechnology and identify the benefits and concerns to society.

Bloom's Taxonomy Level	Standard and Examples
Evaluating	<p>B6.1 Evaluate controversial issues of biotechnology as they apply to the human race.</p> <p>Examples:</p> <ul style="list-style-type: none"> • Evaluate ethical dilemmas caused by biotechnology discoveries using current news issues. • Defend/Argue ethics in cell and cloning research. • Support labeling of genetically altered products. • Evaluate the process in obtaining biotechnology patents.