Secondary Curriculum Maps

Cumberland Valley School District

Soaring to Greatness, Committed to Excellence

Animal and Plant Biotechnology

Animal and Plant Biotechnology, a specialization course in the CASE Program of Study, provides resources to the teacher to facilitate rigorous instruction and increase the level of student understanding related to biotechnology concepts. Students will complete hands-on activities, projects, and problems designed to build content knowledge and technical skills in the field of biotechnology. Students are expected to become proficient at projects involving micropipetting, bacterial cultures and transformations, electrophoresis, and polymerase chain reaction. Research and experimental design will be highlighted as students develop and conduct industry appropriate investigations.

CASE

Animal and Plant Biotechnology Course Description

Animal and Plant Biotechnology, a specialization course in the CASE Program of Study, provides students with experiences in industry appropriate applications of biotechnology related to plant and animal agriculture. Students will complete hands-on activities, projects, and problems designed to build content knowledge and technical skills in the field of biotechnology. Students are expected to become proficient at biotechnological skills involving micropipetting, bacterial cultures and transformations, electrophoresis, and polymerase chain reaction.

Students will maintain a research level *Laboratory Notebook* throughout the course documenting their experiences in the laboratory. Research and experimental design will be highlighted as students develop and conduct industry appropriate investigations.

Students will develop and conduct a research project following the National FFA Agriscience Fair guidelines. From background research through data collection and analysis, students will investigate a problem of their choice and conclude the project by reporting their results in the forms of a research paper and a research poster.

Animal and Plant Biotechnology includes the following units of study:

- Introduction to Biotechnology
- DNA Technologies
- Proteins
- Agricultural Biotechnology
- Research Methods

CASE

APB Detailed Course Outline

Unit 1 Introduction to Biotechnology

Lesson 1.1 Foundations of Biotechnology

1. Modern biotechnology has foundations in historical technologies, such as fermentation and selective breeding, while utilizing newer fields, such as molecular biology, bioengineering, and bioinformatics.
2. Organization and record keeping are important to success in biotechnology.
3. Innovations in biotechnology have led to more efficient production of agricultural goods and may support sustainable agricultural practices in the future.
4. Ethical questions surrounding applications of biotechnology, which generate discussions and varying opinions that drive policy and regulation, are based on personal beliefs.

Lesson 1.2 Standard Operating Procedures

1. Working in a biotechnology laboratory requires diligence in following safety procedures and rules.
2. Knowledge of the location of safety equipment is essential when working in the laboratory.
3. Safety Data Sheets (SDS) contain important information related to the proper use and cleanup of biological and chemical materials.
4. Proper and accurate measurement is important for laboratory investigation.
5. Good Laboratory Procedures (GLPs) ensure the quality and integrity of laboratory data used to support registration of a product.

Lesson 1.3 Basics of Cells and DNA

1. Culturing research specimen in the laboratory requires the use of sterile techniques to limit contamination.
2. Prokaryotic and eukaryotic cells, which are used for biotechnological applications, can be cultured and observed easily in the laboratory.
3. Understanding DNA structure is essential for bioengineering processes.
4. DNA is studied in order to understand how living things work.

Unit 2 DNA Technologies

Lesson 2.1 Diving into DNA

1. DNA is extracted from cellular matter to be studied.
2. Restriction enzymes are used to cut DNA in order to compare organisms, isolate and transfer genes, and genetically modify organisms.
3. DNA profiles are created using fragments produced through Restriction Fragment Length Polymorphism.

Lesson 2.2 Genetic Transformers

1. Transformation is used to synthetically produce proteins for increased animal and plant production.
2. Plasmids are used to insert the genes for desired traits into bacterial cells.
3. Proteins of interest can be purified from bacterial cultures for further study.
4. Conducting background research is important to identify what is already known about the research objective.

Unit 3 Proteins

Lesson 3.1 Protein Processes

1. Transcription and translation are processes that produce proteins of which all living things are made.
2. Colorimetric assays can be used to identify and determine the amount of protein in a biological sample extract.
3. The presence of specific proteins in a biological sample can indicate the presence of disease, exposure to disease, or identify genetically modified products.

Unit 4 Agricultural Biotechnology

Lesson 4.1 Genetically Modified Organisms

1. Ethical and moral questions arise from the science of genetically modifying organisms.
2. Genetic testing, such as polymerase chain reactions and lateral flow tests, is used to make production based decisions and identify genetically modified organisms.
3. Organisms are genetically modified to improve agricultural products by inserting genes into cells.

Lesson 4.2 Performance Enhanced Plants

1. Plants are genetically modified to improve agricultural products by inserting genes into cells.
2. The totipotency of plants allows a minute portion of tissue to be cultured into a complete plant.
3. A sterile environment, including media, work area, equipment, and lab technician is required to produce viable plants by micropropagation.
4. Deoxyribonucleic acid (DNA) can be cut, replicated, and inserted into the genome of an organism for the improvement of agricultural production.

Lesson 4.3 Animal Applications

1. The immune response of mammals can be used to detect proteins of interest.
2. Animal reproductive technologies are used by producers in order to achieve management goals.
3. Markers are used to identify the successful insertion of genes.
4. Genetic testing and disease diagnosis are used to make production based decisions.

Lesson 4.4 Everyday Biotechnology

1. Biotechnological practices, such as bioremediation, use naturally occurring processes to provide industrial applications.
2. Biofuels are a source of renewable energy derived from organisms.

3. Fermentation and esterification are processes in which agricultural products are converted into biofuels.
4. The precautionary principle serves as a guiding statement for determining the ethical considerations of biotechnology and other scientific endeavors.

Unit 5 Research Methods

Lesson 5.1 Independent Researchers

1. Research is driven by questions and backed by literature reviews, experimentation, and communication of results.
2. Conducting background research is important to identify what is known about the research question.
3. Experiments are designed in such a way that the control is apparent and the researcher can conduct multiple trials.
4. Results of research experiments include interpretation of data in the form of posters, papers, or oral presentations.

Lesson 5.2 From Lab to Production

1. The genome of multiple organisms can be analyzed in order to understand genetic variations.
2. Regulatory agencies monitor research and development, production, and use of biotech products in order to ensure safety for consumers and the environment.
3. Results of research undergo multiple steps and trials before reaching consumers.
4. Ethical questions surrounding applications of biotechnology, which generate discussions and varying opinions, are based on personal feelings and beliefs.
5. Biotechnology is a fast growing industry with many emerging technologies and future career opportunities.