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CTE Standards Unpacking
Ag Biotechnology

Course: Ag Biotechnology
Course Description: 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 large 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. Utilizing appropriate equipment and technology may enhance classroom and laboratory content; 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 maintain a Supervised Agricultural Experience Program (SAE).
Career Cluster: Agriculture, Food and Natural Resources
Prerequisites: Recommended: Introduction to AFNR
Program of Study Application: Ag Biotechnology is an upper level pathway course in the Animal Systems, Food Product and Processing Systems, Plant Systems, and Natural Resources and Environmental Science Systems pathways in the Agriculture, Food and Natural Resources Cluster. Ag Biotechnology would follow a cluster course in any of those pathways, and would precede a capstone experience.

INDICATOR #AB 1: **Assess factors that have influenced the evolution of biotechnology in agriculture. [National AFNR BS.01.]**		
SUB-INDICATOR 1.1 (Webb Level: 3 Strategic Thinking): Investigate and explain the relationships among past, current and emerging applications of biotechnology in agriculture.		
SUB-INDICATOR 1.2 (Webb Level: 3 Strategic Thinking): Evaluate the scope and implications of regulatory agencies on applications of biotechnology in agriculture and protection of public interests.		
SUB-INDICATOR 1.3 (Webb Level: 4 Extended Thinking): Analyze the relationships and implications of bioethics, laws and public perceptions on applications of biotechnology in agriculture.		
Knowledge (Factual): -FDA and other government agency regulations -Biotechnology uses in agriculture	**Understand (Conceptual):** -Grasp the necessity of future biotechnology -Evaluate the issues related to bioethics in agriculture	**Do (Application):** -Participate in the Ag Issues, Biotechnology, and/or Agriscience Fair -Present GMO alterations - Research uses of

		biotechnology in agriculture -Analyze the role of bioethics in agriculture

Benchmarks:
Students will be assessed on their ability to:

- Create a timeline of major biotechnological advances.
- Compare and contrast genetically modified crops and livestock past and present.
- Defend the current and emerging biotechnology in agriculture.
- Analyze current biotech regulations and create new regulations to fit the current biotech needs in agriculture.

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
English: 9-12.W.6 - Using technology to produce a written product.	-Defend a biotechnology case study in a research paper.

INDICATOR #AB 2: **Illustrate the functions and importance of biotechnology at the cellular level.**

SUB-INDICATOR 2.1 (Webb Level: 1 Recall): Recognize components of cells and their application to genetic improvement.

SUB-INDICATOR 2.2 (Webb Level: 1 Recall): Illustrate the role of cell structures in genetic theory.

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Components of cells -DNA and RNA structures -Genetic theory -Knowledge of GMOs	-Comprehend the differences between (compare and contrast) plant and animal cells -Apply genetic theory to agricultural commodities	-Extract DNA from bananas, strawberries, etc. -Demonstrate Mendelian genetics with crop seeds

Benchmarks:

Students will be assessed on their ability to:

- Sketch plant cells and parts.
- Illustrate the functions of cell parts.
- Create a model of the major processes within a cell.
- Solve Punnett Squares for genetic outcomes.

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
Science: 1) HS-LS1-4 – Illustrate cellular division 2) HS-LS1-1 – Illustrate how the structure of a cell's DNA is essential to its function.	-Create a model of the major processes within a cell. -Create an infographic for a GMO food product.

INDICATOR #AB 3: **Safely apply appropriate skills to complete tasks in a biotechnology research and development environment.**

SUB-INDICATOR 3.1 (Webb Level: 2 Skill/Concept): Read, document, evaluate and secure accurate laboratory records of experimental protocols, observations and results.

SUB-INDICATOR 3.2 (Webb Level: 3 Strategic Thinking): Implement standard operating procedures (SOP) for the biotechnology sector.

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Proper lab procedures -Scientific method -Standard operating procedures (SOP)	-Safely conduct biotechnology research	-Participate in Agriscience Fair CDE -Design a science fair board from experiment

Benchmarks:

Students will be assessed on their ability to:

- Develop and write steps to carry out an experiment.
- Demonstrate a science experiment using SOP.

Academic Connections

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ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
English: 1) 9-12 W.4 - Produce writing that is appropriate for the task or audience.	-Write a lab report for a given experiment.

INDICATOR #CE 4: **Analyze the application of biotechnology to solve problems in Agriculture, Food and Natural Resources (AFNR) systems. National AFNR BS.03**		
SUB-INDICATOR 4.1 (Webb Level: 3 Strategic Thinking): Investigate biotechnology principles, techniques and processes to enhance plant systems.		
SUB-INDICATOR 4.2 (Webb Level: 3 Strategic Thinking): Investigate biotechnology principles, techniques and processes to enhance animal systems.		
SUB-INDICATOR 4.3 (Webb Level: 3 Strategic Thinking): Investigate biotechnology principles, techniques and processes to enhance food products and processing systems.		
SUB-INDICATOR 4.4 (Webb Level: 3 Strategic Thinking): Investigate biotechnology principles, techniques and processes to enhance natural resources and environmental service systems.		
Knowledge (Factual): -Plant processes -Animal husbandry techniques -Food products environmental and health concerns -Effects of biotechnology on the environment	**Understand (Conceptual):** -Understand biotechnology principles within plant, animal, food and the environmental systems	**Do (Application):** -Propagate plants by various techniques -Defend different breeding techniques within livestock -Create an Ag Issues forum on GMO foods -Implement methods of bioremediation
Benchmarks:		

Students will be assessed on their ability to:

- Test the levels of respiration in plants and write a formal lab report.
- Research artificial insemination, embryo transfer, and cloning.
- Defend/argue ethics in cell and cloning research.
- Evaluate environmental pollutants and formulate a plan to combat them.
- Demonstrate bioresearch methods to process renewable raw materials.
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Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
Science: 1) HS-LS1-5 – Plant processes	-Use Vernier probes to test levels of respiration in plants and write formal lab report.

INDICATOR #AB 5: **Develop employability skills related to the Animal, Food Product and Processing, Plant, and Natural Resources and Environmental Science Systems.**

SUB-INDICATOR 5.1 (Webb Level: 2 Skill/Concept): Develop soft skills to enhance employability.

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Proper communication skills	-Importance of employability skills in careers -Differentiate appropriate behaviors between work(formal) and informal environments	-Job shadow -Tour industry

Benchmarks:

Students will be assessed on their ability to:

- Perform mock interview.
- Create professional questions for an industry tour.
- Compose a cover letter and resume.

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ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
English: 1) 9-12 SL.1 - Participate in collaborative discussion	-Perform a mock interview.

Additional Resources
OSHA Training
Lab Safety Manuals
CDE: Biotechnology
Agriscience Fair
Outdoor Lab/Test Plot with local producer or Research Company
Text: Introduction to Biotechnology, Ray Herren (has lab activities and chapter reviews in each chapter)
https://www.biologycorner.com/category/worksheets/cell-biology/
Please list any resources (e.g., websites, teaching guides, etc.) that would help teachers as they plan to teach these new standards.