



SCHOOL DISTRICT OF MONROE

Preparing for the Future, One Child at a Time

Biofuels & Biotechnology

Course Description:

The curriculum for this elective course is developed from [Wisconsin Standards for Agriculture, Food and Natural Resources](#). This course is a laboratory-based class that guides students through all topics related to renewable energy and alternative fuels. Students will also discuss issues related to biofuels and the biotechnology applications used to produce them. The information in this course overview outlines what students should understand and be able to do by the end of the trimester.

Mastery Standards:

Students will recognize the historical, social, cultural and potential applications of biotechnology. (BT1)

Students will demonstrate laboratory skills as applied to biotechnology. (BT2)

Students will use analytical procedures to plan and evaluate environmental service systems while assuming the impact of policies and regulations on environmental service systems. (ESS1)

Students will apply scientific principles to environmental service systems. (ESS2)

Students will examine the relationship between energy sources and environmental service system with a basic understanding of the tools, equipment, machinery and technology to accomplish tasks in environmental service systems. (ESS4)

Unit	Description of Unit and Learning Targets
<p>Unit Title: 1. Energy in Agriculture</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • What are potential energy sources used in the United States? • What are renewable energy sources available in your area? • What factors are considered when choosing a fuel? • What are the similarities and differences between fossil and renewable fuels? 	<p>Students will.....</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • Develop an educational display describing an energy source and the impact agriculture has on that source. • Measure electrical power used to power a light and motor. • Compare fuel consumption costs for agricultural production. • Construct a solar energy system and compare the production of electricity under different light conditions. • Compare the energy content of two common fuels used for energy production.
<p>Unit Title: 2. Foundations of Biotechnology</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • How does biotechnology impact agriculture? • Why is biotechnology a controversial subject? • How will biotechnology influence the future of agriculture? • What misunderstandings about biotechnology influence public opinion? 	<p>Students will...</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • Write a definition of biotechnology. • Determine the date and significance of a biotechnological discovery. • Work collaboratively to develop a timeline of biotechnology discoveries. • Explore their personal beliefs and knowledge to gain perspective on practices in biotechnology.
<p>Unit Title: 3. Cell Basics and DNA</p>	<p>Students will...</p>

<p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • Why are model organisms valuable in biotechnology? • Do all DNA base pairs code for genes? • How can a specific gene be identified in the genetic sequence of an organism? 	<p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • Prepare culture plates using proper sterile and streaking techniques. • Observe differences in growth patterns of prokaryote and eukaryote model organisms. • Develop a model of a DNA strand as a class and using simulation materials. • Research DNA replication and develop a visual representation of the replication process.
<p>Unit Title: 4. Diving in to DNA</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • Why does DNA need to be extracted from a cell? • What are applications of gel electrophoresis? 	<p>Students will...</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • Write an experiment to extract DNA from kiwi fruit. • Extract DNA from kiwi fruit using procedures developed. • Demonstrate the action of restriction enzymes using paper DNA strands. • Digest a DNA sample using restriction enzymes and conduct gel electrophoresis to analyze the results.
<p>Unit Title: 5. Genetically Modified Organisms</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • How does consumer perception affect acceptance of GM foods? • How do genetic modifications occur? • Why should I be concerned about GM as an agricultural biotechnician? 	<p>Students will...</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • Reflect upon the term genetically modified and develop personal perceptions and beliefs pertaining to the term. • Research published perceptions of genetically modified organisms of different groups and organizations and discuss in class. • Conduct a public perception survey of genetically modified foods. • Conduct a polymerase chain reaction to determine the presence of genetic modifications in a common food item. • Complete the annotated bibliography, the rough draft, and a peer review of the A. tumefaciens research paper.
<p>Unit Title: 5. Everyday Biotechnology</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • How is biotechnology used in non-food producing applications? • What is bioremediation? • How does the production of biofuels influence the amount of energy resources available? • What does a precautionary approach to science include? • Why are guidelines and oversight of scientific research important? 	<p>Students will...</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • Design and conduct an experiment determining the effectiveness of oil-eating microbes in various environmental conditions. • Research a type of biofuel. • Determine a method of producing the fuel in a laboratory. • Review a case study and interpret the application of the precautionary principle by interest groups.