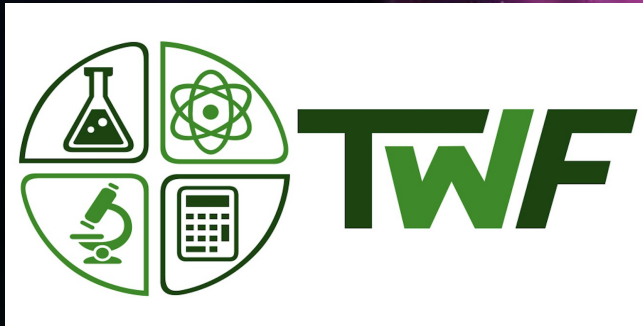


DNA Manipulation and GMOs

5E Lesson

The 5E model is a scientifically proven method to improve student engagement and learning in your classroom

- ✓ Engagement
- ✓ Exploration
- ✓ Explanation
- ✓ Elaborate
- ✓ Evaluate



Complete Teacher Instructions

DNA Manipulation and GMOs 5E Lesson

Grades 7-10	DNA Manipulation and GMOs	Ongoing Lesson
Lesson Objective: Students will learn about: • Diabetes • Genetic engineering • Methods of DNA insertion • Biopharming • Transgenic organisms • Knockout mice • Cloning		
Possible Student Misconceptions: • Genetic modification of food is new. • GMOs are just a modern version of selective breeding. • GM foods definitely cause cancer. • GM crops are dangerous because they contain toxic substances. • Altered genes from GM plants will spread and cause problems. • You can be sued if patented GM seeds grow on your property. • GM crops are responsible for honeybee population collapses. • Almost all today's crops have been genetically modified.		
Materials: • 1 device (smartphone, Chromebook, laptop, tablet, or computer) per 3 • A means of projecting a PowerPoint presentation • Internet access • General classroom objects		
Teacher Notes: ➢ All videos can be accessed directly from the PowerPoint. To retrieve the icon while in slideshow mode and it will automatically open for you. If it reason, right-click on the image and click Edit Hyperlink or something ➢ I've created a video walkthrough if needed. It can be accessed here - https://youtu.be/oCIKIP9SaDQ ➢ I don't believe in long lessons. If you feel your students are losing their Stop the PowerPoint and give them a 5-minute break. If you'd like to sl recommend my video collection here - http://www.teachwithferav.com/ are tons of brain-break videos to choose from all grouped by category.		

DNA Manipulation and GMOs – 5E Lesson

Engagement Phase Your students will complete the GMO Research Activity. Teacher Notes: - A grading rubric is included with the activity.	Duration: 1 hour Teacher Role – Facilitate learning and keep students focused Goal ☐ Students use their newly obtained knowledge to propose solutions and extend their learning to new situations
Exploration Phase Exploration – Lab Station Activity • In groups of 2-3, have your students complete <i>Exploration – Lab Station Activity</i>. Once they're done, they will submit their passport to you. Teacher Notes: • The complete instructions for my Lab Station activity can be found in the <i>START HERE – Instructions</i> file.	Duration: 30 min Teacher Role – Distribute and collect evaluation Goal ☐ Students are given the opportunity to demonstrate their understanding and evaluate their own progress
Explanation Phase PowerPoint Lessons • The lesson is found in the folder – <i>Explanation – DNA Manipulation and GMOs Lesson</i> • This lesson is designed to be completed over one day • There are multiple embedded videos and plenty of opportunity to engage, interact and check for your students' understanding throughout the lesson • The lesson covers the following topics: ➢ Diabetes ➢ Genetic engineering of animals and plants ➢ Bacterial plasmid ➢ Biopharming ➢ Transgenic organisms ➢ Knockout mice ➢ Cloning Teacher Notes: • All videos can be accessed directly from the PowerPoint. To retrieve them, click on the video icon while in slideshow mode and it will automatically open for you. If they don't open, right-click the image and select Edit Hyperlink or something similar. • I've created a video walkthrough if needed. It can be accessed here - https://youtu.be/oCIKIP9SaDQ • I have also enclosed a .PDF version of both the teacher and student versions.	

Elaborate Phase Elaborate – Reading Your students will complete – <i>Elaborate – Genetically Modified Organisms Reading</i> . This reading will require your students to move beyond what was covered directly in the lesson and allow them to further develop their understanding. Teacher Notes: - Students will work individually or in small groups - This reading contains 9 comprehension questions and 2 extension questions. It is fully editable, so I encourage you to remove any question(s) in order to meet the needs of your students as well as your time frame.	Duration: 1 hour Teacher Role – Facilitate learning and keep students focused Goal ☐ Students use their newly obtained knowledge to propose solutions and extend their learning to new situations
Evaluate Phase Quiz Have your students complete – <i>Evaluate – DNA Manipulation and GMOs Quiz</i> Teacher Notes: ➢ It's sometimes best to have the students peer evaluate ➢ Placing students in small groups and having them exchange papers to mark will accomplish two things 1) Provide immediate feedback on the questions they just completed 2) Significantly reduce your marking time ➢ Peer evaluation is not needed, only suggested when appropriate	Duration: 30 min Teacher Role – Distribute and collect evaluation Goal ☐ Students are given the opportunity to demonstrate their understanding and evaluate their own progress

Each phase is clearly described

A Complete Lesson

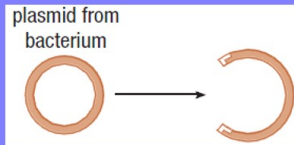
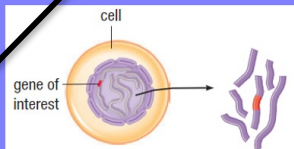
Diabetes

- Diabetes mellitus is a disease caused by the inability to properly use insulin, resulting in elevated blood glucose levels
- Many people require insulin injections to survive
- Insulin allows glucose to be transferred from the blood into cells
- Approximately 5% of all deaths are caused by diabetes.

← Make sure your students are on track

Student copies with blanks
Videos embedded right into
your slideshow

- The first step in genetic recombination is to isolate, or cut out, a DNA fragment that contains the desired gene.
- You must also cut the circular plasmid (from the bacteria) to make it linear



Genetically Engineered Animals



Drugs from Genetically Engineered Animals



Interactive and Engaging Activities

Genetically Modified Organisms

Scientific Reading Comprehension Article and Extension Activity

Genetically Modified Organisms

What are Genetically Modified Organisms?

Genetically modified organisms, or GMOs, are organisms such as plants or animals whose DNA has been artificially changed. This type of genetic manipulation allows for very precise introduction of genetic traits rather than the wholesale transfer of genetic material that occurs when one simply breeds two animals or cross-pollinates two plants to produce a desired trait. With traditional breeding, that target characteristic may come with some unintended and potentially harmful traits. There are many benefits to GMOs but there are also a lot of concerns as well.

History of Genetically Modified Organisms

The idea behind genetic modification is an ancient one. Our ancestors engaged in what is known as **selective breeding** by choosing specific animals to mate in order to produce offspring with desired characteristics. In this way, wolves gave rise to domesticated dogs, and more muscular - and thus higher meat-producing - cattle were developed. Similar selection was carried out on plants, resulting in larger ears of corn and sweeter apples, among other advancements.

Modern genetic engineering performed in a laboratory began in 1973, when Herbert Boyer and Stanley Cohen successfully inserted a gene from one bacterium into another, thus transferring the donating bacterium's antibiotic resistance. The first GMO animal, a mouse, was produced in 1974. Since its origin, GMO technology has expanded to include the production of medicines, the creation of bacteria for cleaning up oil spills, and the alteration of plants for agricultural means. This last category is the most widely known and most controversial class of GMO.

How Are Organisms Genetically Modified?

There are several ways to insert genetic material from one organism into another. These include the gene gun, *Agrobacterium tumefaciens*, microinjection, and electroporation.

The delivery of genetic material with a gene gun (particle acceleration or microprojectile bombardment) involves the use of high-pressure gas to propel DNA-coated particles (the naked eye) particles of either gold or tungsten of copies of the target gene and shut into cells. The genes separate from the carrier and potentially attach to the cell's DNA. This method is used because why so many genes are shut into the cell at once - of one successfully inserting itself.



Improve your students' **Literacy** and **Analysis Skills**, use as an **Emergency Substitute Plan**, or create **Applicability** in your classroom

DNA Manipulation and GMOs

Lab Station Activity



7 Lab Station Activities to get your kids out of their seats and engaged in their learning

Get away from tired practices and unengaged students



Provide a Scientifically-Proven means of instruction



Incorporate Technology and Increase Collaboration

