# Selective breeding and GMOs lesson plan

This unit focuses on selective breeding and genetic modification. The definition of genetic modification is used to describe many different techniques and it can be confusing what it encompasses. This lesson attempts to define the terms related to genetic modification more clearly.

***Sequence***
Lesson 1 of unit: Selective breeding and GMOs (Lesson 2 follows on page 2)

***Time***
45 minutes (may need an additional period for the sharing of research, if needed)

***Grade Level***
6-12

***Materials***
Selective breeding and GMOs deck
Selective breeding and GMOs student handout
Jimmy Kimmel clip (https://www.youtube.com/watch?v=EzEr23XJwFY)
Discussion diamond
Timeline cards of biotech events

***Objectives***
Students learn the various advancements in the history of technology that have led to the modification of organisms.

***Vocabulary***
genetic modification, selective breeding, GMOs, biotechnology

***Prior Knowledge***
Students should have a basic understanding that populations of plants and animals adapt to changing conditions and humans can impact those adaptations by choosing plants or animals that have desirable characteristics.

**5E Plan**
**Engage**
Start to show the deck. Hand out the Selective breeding and GMOs student handout. Ask students to define what a GMO is. Allow time for them to write down an answer. Show the Jimmy Kimmel clip. After watching, ask them to check their definition and share their definitions with their table group. Have each group create their own definition, on the discussion diamond using the ideas of all participants then have them share with the class.

**Explore**
Continue through the deck to the timeline activity slide. Students receive a timeline card either with the date or the event and try to find their match, then line up in order from oldest to newest. The events show many different aspects of “genetic modification” and biotechnology that have allowed us to create solutions to many problems.

**Explain**
Ask students to complete additional research on their event or teacher selected events to help them understand the technologies employed and the solutions that have resulted. (Example: Recombinant DNA allowed for the movement of a specific gene for a specific trait from a different organism to be inserted into the DNA of a plant to convey that trait. A bacterial gene from *Bacillus thuringiensis* that produces a toxin was removed from the bacteria and inserted into the DNA of corn. *Bt* corn is a result of that genetic engineering.)

**Elaborate**
Have students share their research and information.

## Selective Breeding and GMOs

**Evaluate**
Have the advances researched resulted in genetic modification? What are some of the differences between the advancements on the timeline in terms of techniques? Have students write answers as their exit ticket.

***Sequence***
Lesson 2 of unit: Selective Breeding and GMOs

***Time***
45 minute period

***Grade Level***
6-12

***Materials***
Selective breeding and GMOs deck
Modeling selective breeding handout
candies of different colors (Starburst® are ideal as they are individually wrapped and come in a combination of colors with the added bonus that students can eat them once the activity is done.)
opaque cups (1 for each pair of students)

***Objectives***
Students complete a simulation that models selective breeding for aphid resistance.

***Vocabulary***
*soybean aphids, invasive species, stacked traits, host plant resistance, traits, alleles*

***Prior Knowledge***
Students should understand the difference between traits (phenotype) and alleles (genotype).

**5E Plan**
**Engage**
Show the case study on the deck. Ask students if they have an idea of how to address the soybean aphid problem just by reading about the case.

**Explore**
Distribute the Modeling Selective Breeding handout. Distribute candy and opaque cups. Ask students to follow the instructions on the handout or walk them through step-by-step using the deck. There are stopping points with questions on the deck and in the handout.

**Explain**
Students have the opportunity to create a new cross with “maximum resistance to soybean aphids.” After they have tried, ask about their process. Whom did they choose to cross traits with?

**Elaborate**
Students then continue to the next section of the handout Modeling Advanced Selective Breeding. (There are no accompanying slides for this activity.) Have students complete the activity.

**Evaluate**
Have students discuss the reflection questions on slide 12 of the deck. Talk about the advantages of genetic engineering. Show the 14 genetically modified organisms approved for commercial use in the United States and emphasize that the USDA, the EPA and FDA all have some regulatory oversight of GMOs

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