

KANSAS CORN STEM



Kansas Corn: G. M. Whoa

This breakout is made possible with the support and content contributions of the Kansas Corn Commission.



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Grade Level: Middle School / High School

Overview

When people refer to genetically modified organisms (GMOs), they are talking about crops that have been created through genetic engineering. This can also be thought of as a more pinpointed approach to plant breeding. Genetic engineering allows plant breeders to take a preferred trait existing in nature and share it to a plant or organism they are seeking to improve. Some examples of desirable traits commonly transferred include resistance to insects and disease and tolerance to herbicides that allow farmers to better control weeds. This breakout compliments the Kansas Corn STEM labs “Genetically Modified Information?” and “G.M.O. or G.M. No” found at www.kansascornstem.com. It can be used as an introductory to one or all of those labs or this activity can be altered to serve as more of an assessment following the completion of the Genetically Modified Information? and “G.M.O. or G.M. No labs.

Next Generation Science Standards (NGSS)

Middle School Science

- **LS1-7.** Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
- **LS1-5.** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

High School Science

- **LS1-7.** Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
- **LS1-5.** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Learning Objectives

- Students will understand what G.M.O stands for.
- Students will understand some of the reasons why genetic modification takes place.
- Students will engineer a crop resistant to insects.

Materials

- Engineer A Crop cards
- Internet access with Adobe Flash capability
- Ancient Versus Present cards
- Genetic Traits Expressed in GMOs in the U.S. infographic (available at kansascornstem.com)
- Genetic Traits Expressed record sheet
- Large question card
- GMO Answers – Challenge (Level 2) QR Code
- GMO Answers – Easy (Level 1) QR Code

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Breakout Edu Tips

If this is your first time using a Breakout Edu box, you are in for a treat. Once you've done one breakout box your students will be ready for the next time.

- You can use breakout boxes as a whole class, in addition to small group.
- You have the opportunity to give students hints. Every box comes with at least two hint cards. If you have a higher performing group, you may want to challenge them with less hints, while a different group may need more hints.
- Having a visual timer for students while they are working is really helpful. It allows them to budget their time and when they may want to use their hints.
- As the teacher, you have the discretion to hide things wherever best fit in your room. Feel free to make adjustments! Just make sure the clues for the locks don't change, otherwise students may not be able to get in.
- Note when programming the locks, there is a starter ring that has mini teeth. This ring needs to come first.

Breakout Activity

Game Name

G.M. Whoa

Game Designer

Kansas Corn Commission and Jessica Sadler

Content Areas

STEM, Agriculture, Corn, Science, GMOs

Recommended Ages

K-Adult

Ideal Group Size

Can be used in small groups or whole class

Suggested Time

30-40 minutes

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Grade Level: Middle School / High School

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Story

You've been complaining about never having anything good to eat at home. As a challenge, you've been sent to the grocery store to buy items to make dinner for your family. While walking down the aisles to choose what you want, you see a label that says, "Non GMO". You've heard this term before but aren't sure what it means and wonder if you should go back and check the other items that you've already put in your cart. Before you continue shopping take a quick break to test your knowledge on GMOs, but hurry ... dinner needs to be ready in a few hours.

Lock Combinations

The following codes will open the locks on the box:

3-Digit Lock - 3 Numbers

7, 4, 2

4-Digit Lock - 4 Numbers

1, 9, 9, 5

Shape Lock

☆, →, ◇, ○, △

(Vector, Growth Media, Tomato Leaf, Growth Medium Plants, Growth Chamber)

Directional Lock

Right, Down, Left, Up, Right

Key Lock -

Teacher Choice of Book Jacket

Kansas Corn: G. M. Whoa

Grade Level: Middle School / High School

Setup Instructions

Steps

1. For the shapes lock, students will need one copy of the Engineer A Crop Cards as well as internet access. Students will go to <http://www.pbs.org/wgbh/harvest/engineer/transgen.html>. This website does need to have access to Adobe Flash. Students will take themselves through the steps of creating a caterpillar-resistant tomato crop. As they work through, they can put the cards into the correct order. Then, they will notice that the five pink shapes will be in order and open the shape lock. The other four cards have green shapes but will not allow access to any locks. This lock will go on the outside of the large box.
2. Use the Ancient Versus Present cards to help students solve the directional lock. These cards will be printed off and placed in the small lock box and locked with the key lock. Once students get into this box, they will need to use the “ancient” and “present” cards to help sort. Students will also find a clue card to help them place the plant cards correctly. When students have the ancient species matched to their current counterparts, they can input the five arrows into the directional lock and will be able to get in.
3. Students will need to use the Genetic Traits Expressed in GMOs in the U.S. infographic. Students will need to identify what are the three most frequent genetic traits in GMOs. They should use the Genetic Traits Expressed record sheet to collect this data. When they have identified the top three traits, they will be able to use them to open the three-digit lock. The answer will be 7, 4, 2. This lock will go on the outside of the large box.
4. Post the large question card, “What year did the first genetically modified crop become available for purchase?” On the back of this card, either print or cut and glue the QR code labeled GMO Answers (see note below). Students will be able to scan the code and search for the correct answer, while learning the availability dates for the other nine commercially available crops. This year will be the answer for the 4-digit lock. This lock will go on the outside of the large box.

**There are two QR codes. You may give students the one that is more challenging (Level 2) or the easier one (Level 1). The challenge one will require them to look at more of the website. The easier one will take them straight to the page that they need. They are labeled “Level 1” for easy and “Level 2” for challenging.*

5. Use one or more of the three different book jacket covers. These covers will be placed on the outside of any educator electing to perform demonstrations is expected to follow *NSTA Minimum Safety Practices and Regulations for Demonstrations, Experiments, and Workshops*, which are available at <http://static.nsta.org/pdfs/MinimumSafetyPracticesAndRegulations.pdf>, as well as all school policies and rules and three genetically modified crops that can currently be purchased in the United States. The jacket covers relate to all state and federal laws, regulations, codes and professional standards. Educators are under a duty of care to make laboratories and demonstrations in and out of the classroom as safe as possible. If in doubt, do not perform the demonstrations.
6. The small box and the large box will be placed on the table. When students unlock the main box, inside they will find a prize, typically candy. You can also include the questions below on half sheets of paper for students to turn in as exit tickets.
7. It is also possible to include other supplies that would lead your students into completing other Kansas Corn STEM labs.



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E



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A



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O

Old and new
can you tell?
ABC order will
help you
as well.

Ancient

Present

Genetic Traits	Modified Organism(s)	Tallys
Non Browning		
Reduced Bruising		
Low Acrylamide		
Blight Resistance		
Insect Resistance		
Herbicide Tolerance		
Drought Tolerance		
Disease Resistance		

Circle your three biggest tally numbers and order them from greatest to least below

Genetic Traits	Modified Organism(s)	Tallys
Non Browning	Apple Potato	II
Reduced Bruising	Potato	I
Low Acrylamide	Potato	I
Blight Resistance	Potato	I
Insect Resistance	Field Corn Soybean Cotton Sweet Corn	IIII
Herbicide Tolerance	Field Corn Soybean Canola Sweet Corn Alfalfa Cotton Sugar Beets	IIII II
Drought Tolerance	Field Corn	I
Disease Resistance	Papaya Squash	II

Circle your three biggest tally numbers and order them from greatest to least below

7 4 2

What year did the first
genetically modified crop
become available
for purchase?

What year did the first
genetically modified crop
become available
for purchase?

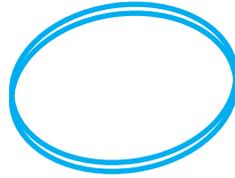


Start

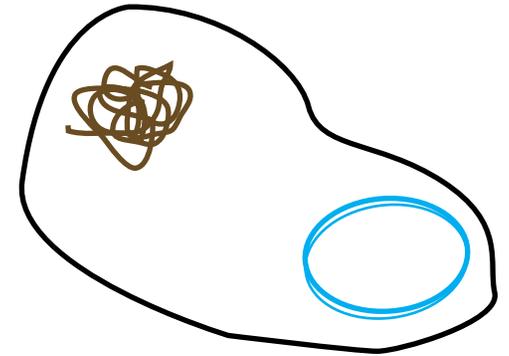
Bt



Vector



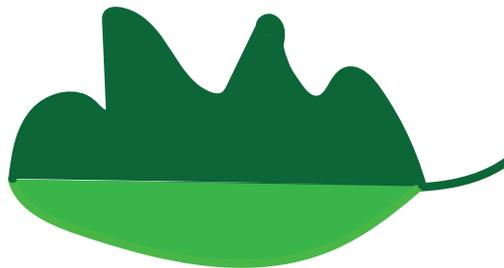
Bacterium



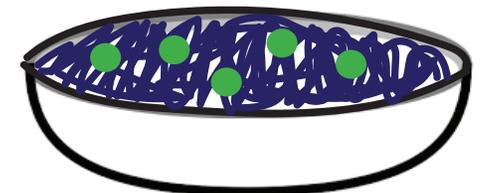
Growth
Medium
Bacteria



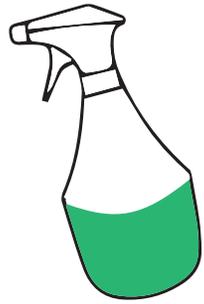
Tomato Leaf



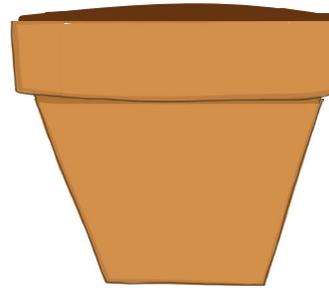
Growth
Medium
Plants



Herbicide



Growth Chamber



Examine



Genetic Traits

Insect Resistance

Herbicide Tolerance

*Drought Tolerance

**field corn*

V.1

CREATING CORN

CREATING

CORN

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Genetic Traits

Reduce Bruising and Black Spots

Non Browning

Low Acrylamide

Blight Resistance

PERFECTING POTATOES

PERFECTING POTATOES

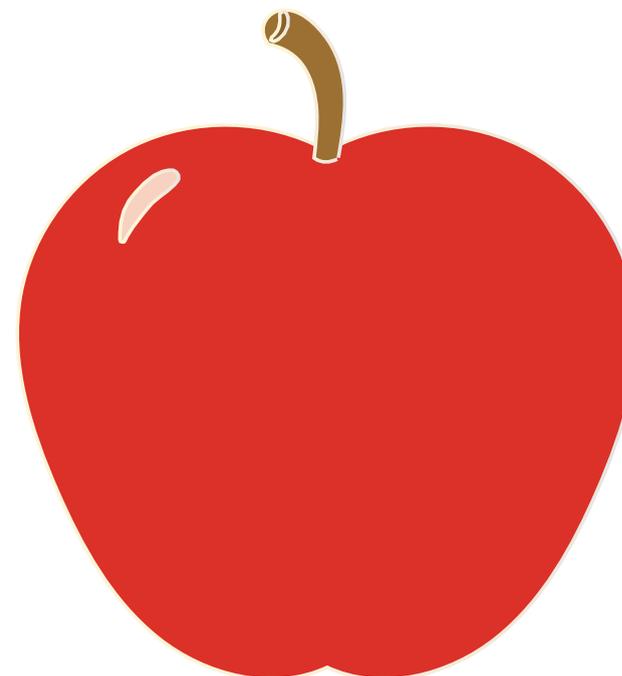


Genetic Traits

Non Browning

AWESOME APPLES

AWESOME



APPLES