

Find *your* Future in Agriculture

AgExplorer and Syngenta Virtual Field Trip
Capture Sheet

Engage: Prior to the Virtual Field Trip

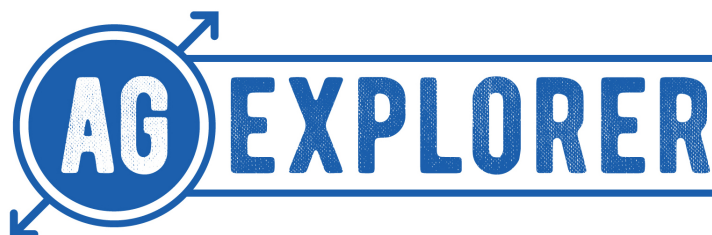
1. What do you notice about the birth and death rates on the world population clock?

2. Brainstorm some challenges that increasing world populations may pose for our communities.

3. Goal of AgExplorer and Syngenta Virtual Field Trip:
 - *Meet different professionals during the AgExplorer and Syngenta Virtual Field Trip who are working to solve some of the challenges you just brainstormed.*
 - *Examine how skills and knowledge from biology, chemistry, mathematics, agricultural science, and marketing work together to help to solve these challenges.*
 - *Explore different strategies to meet the world's food requirements, such as breeding more efficient crops, matching seed varieties with specific climates, and utilizing beneficial genes from native crops.*
 - *Explain how many different careers, combined with innovative technology, can make major contributions to food production.*

Using the information above, complete the OWL chart below.

What I OBSERVED <i>What did you learn in the engage activity?</i>	What I WONDER <i>What question do you hope to answer at the end of the virtual field trip?</i>	What I need to LEARN <i>What topics will you need to learn about during the virtual field trip?</i>



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During the Virtual Field Trip

Applying Your Knowledge and Skills to Careers in Agriculture

Many careers in agriculture involve working with food science and technology. The demands of a growing population are resulting in strong job opportunities in this area. Your interests, abilities, and goals all influence your career choices.

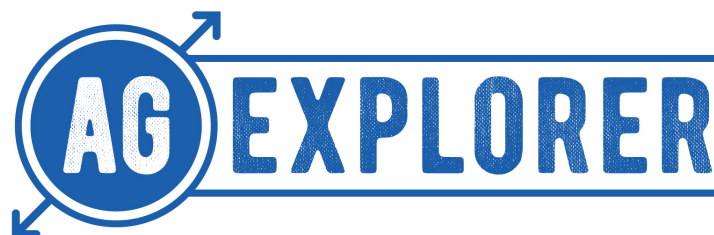
What are your talents and skills? List at least five.

What are interests or hobbies you enjoy? List at least five.

While watching the AgExplorer and Syngenta Virtual Field Trip, match some of your talents and interests related to each career highlighted.

	Computational Biologist	Biochemist	Entomologist	Agronomist	Marketing Technologist Manager	List the two careers that best match to your talents and/or interests
List two skills the professional highlighted as being critical to their work.						
List two talents or interests that you have related to this job.						

As you meet these different professionals, you will be introduced to two different vocabulary words. See if you can define them below as you watch.



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Conventional Breeding	
Biotechnology	

After the Virtual Field Trip

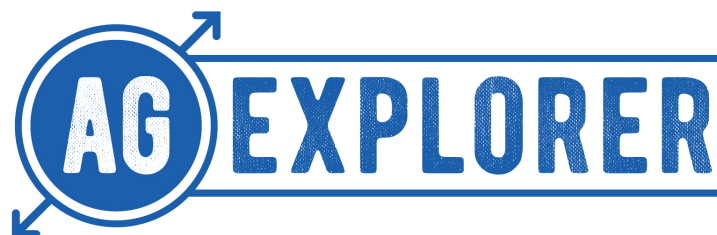
You learned during the Virtual Field Trip about how both Conventional Breeding and Biotechnology are used to improve crop yields. *Can you distinguish between the two techniques?*

Label each example below either conventional breeding or biotechnology.

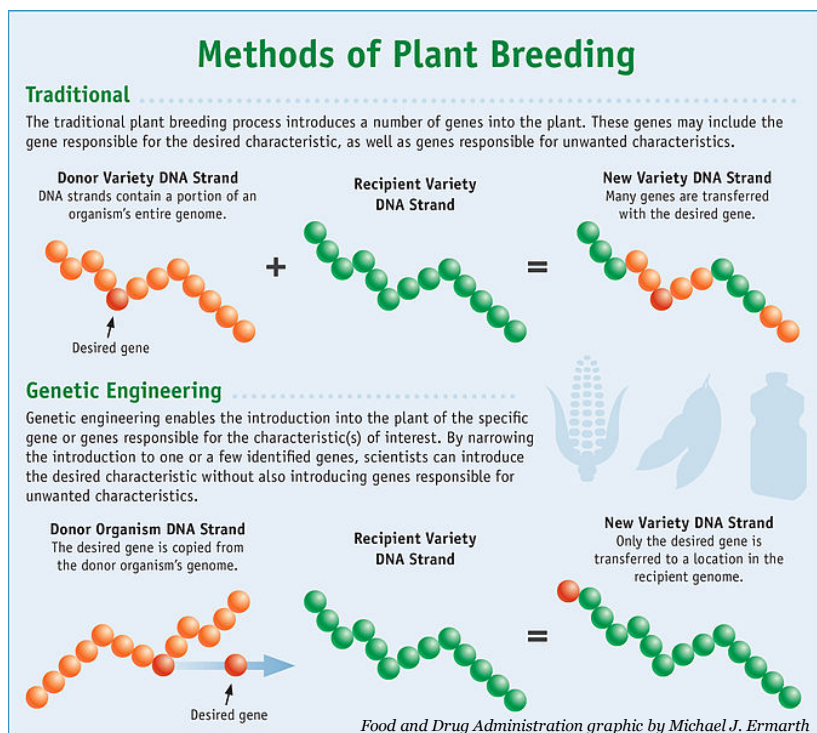
Type of Technique	Example
	Mathematicians build an algorithm to find desirable genes in order to select the best variety of corn for a specific climate.
	Agronomists recommend the Sunningdale™, a variety of hybrid barley bred for specific traits, for Scotland as it will best perform in that climate.
	Geneticists transfer a piece of DNA with a beneficial trait from a native plant to an agricultural variety.
	Biologists perform test trials for a corn variety that includes an insecticidal trait, the Agrisure Viptera™ gene, which offers resistance to certain corn pests.

Biotechnology includes innovations that use biological processes or organisms to create products. Genetic Engineering is a form of biotechnology where the genes of an organism are altered. *List a biotechnology product you learned about in the Virtual Field Trip.*

But, what are the advantages of using biotechnology over conventional breeding? *Analyze the diagram below and then complete the question boxes.*



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Describe the process for conventional (traditional) breeding using the picture on the left:

Describe the process for Genetic Engineering using the picture on the left:

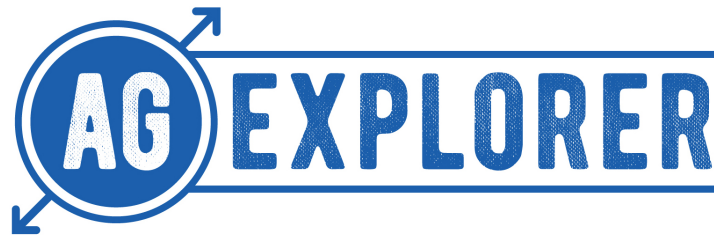
*Evaluate genetic engineering using the information above.
What advantages does this technology have as a strategy to improve crop yields?*

Activity #1

Biotechnology is often used to genetically engineer or modify plants to create recombinant DNA. The diagram in the previous section showed a simple model of this process. Biotechnology uses a lot of vocabulary though that can be confusing. *Read the definitions below before analyzing the diagram depicting the process of genetic engineering.*

Vocabulary Review

Biotechnology	A range of technologies that use biological processes or organisms to create a product.
Genetic Engineering or Genetically modified	A process that includes the direct manipulation of an organism's genome through Biotechnology. Genetically modified organisms (like crops), or GMOs, are plants whose DNA is altered by humans to produce a desired trait. This includes using DNA from one species that is inserted into another.
Gene editing	Changing an organism's DNA by inserting, deleting or changing genes.
Recombinant DNA	DNA comprised of genes from different organisms.



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As you analyze the diagram below, write a description of what happens during each step of the genetic engineering process.

Step #1 Description:

Step #2 Description:

Step #3 Description:

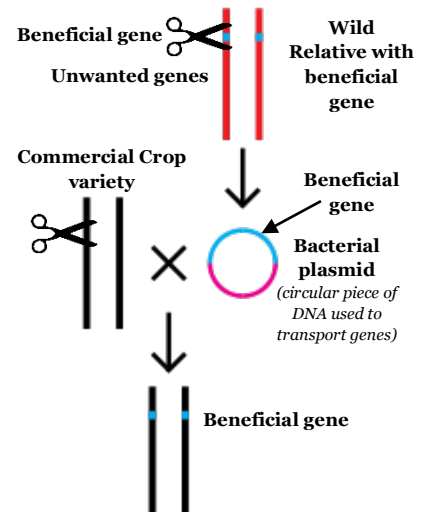


Diagram by Smartse [GFDL (<http://www.gnu.org/copyleft/fdl.html>)] with modification.

Answer the questions below using both the provided definitions, as well as the diagram above.

1. The diagram above shows the process of _____.
2. The DNA created in step 3 is called _____,
because _____.
3. Steps 1 through 3 show gene editing, because _____.
4. This is an example of biotechnology. What is an example of a beneficial gene that may have been inserted into this commercial crop variety? What product would be created? _____

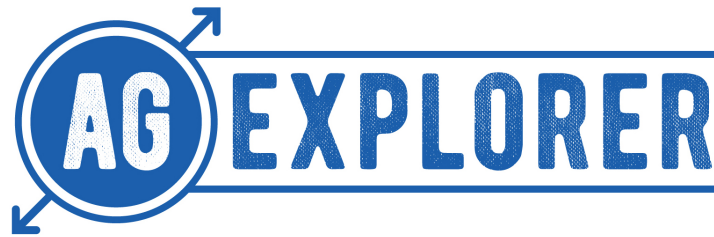


Activity #2

Innovative techniques, such as gene editing and native trait breeding, can greatly improve crop efficiency. Whether scientists are using conventional breeding or biotechnology, they need to know if their products are successful. How do companies like Syngenta test these new varieties for effectiveness? Advanced solutions require a state-of-the-art testing facility- the Advanced Crop Lab.

Watch the introductory video of the *Advanced Crop Lab at the Syngenta RTP Innovation Center*.

1. What are some variables the lab controls?
2. How does this control allow Syngenta to test new crop varieties?
3. Why is accurately controlling different variables important when evaluating a new crop variety in a scientific study?
4. Pretend you are a scientist at the Advanced Crop Lab. What conditions would you need to set up in a growth room to test new crop varieties for your area?
5. Explain how replicating the growing conditions in your area would help local farmers increase crop yield.
6. During the Virtual Field Trip, you met many different professionals combining biology, chemistry, mathematics, agricultural science, and marketing in a variety of careers. Imagine that you work at the Advanced Crop Lab. Choose one career and consider what role you would play at the Advanced Crop Lab. How can this state of the art facility help you meet the



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challenge of a growing world population? Fill out the Twitter profile below for your career. After you complete your Twitter profile, you will share it with 3 other students who chose a different career.

Name: _____

Career: _____

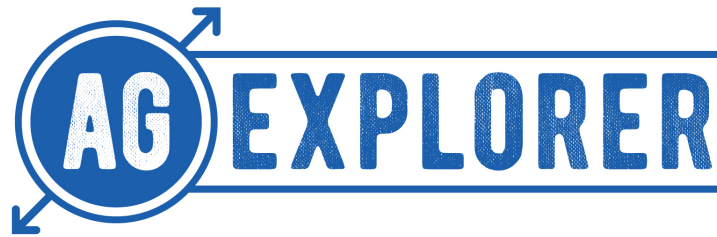
Twitter handle/username: @ _____

Twitter Bio: _____

Hashtag that summarizes your career: # _____

Role at the Advanced Crop Lab: _____





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7. Create a drawing that communicates a world without genetic engineering in plants. Consider the quantity of crops and global impact as you visually express your thinking and ideas.

A large, empty rectangular box with a thin black border, intended for a student to draw their response to the prompt.