



## Apple Seed Advancements

### *Educator Guide for the Farm360 Video*

#### **Overview:**

The *Apple Seed Advancements* 360 experience provides an overview of how genetic breeding can create more sustainable, delicious, reliable, and cost-efficient apple varieties. The 360 experience describes the work at Cornell University to use artificial selection through cross-pollination and molecular techniques to create new apple varieties with desirable traits- from matching a variety to a soil condition to increasing the vitamin-C content.

#### **Objectives:**

- Students will be able to describe why artificial selection is an important technique in apple breeding.
- Student will be able to explain how artificial selection can create apples with desirable traits by analyzing the information in the *Apple Seed Advancements* 360 experience.

#### **Boot up (pre-activity)**

Distribute the capture sheet and ask students to imagine that they are an apple farmer, grocery store owner, and consumer. Prompt students to consider how each perspective would interact with an apple. One is growing and selling, one is displaying and advertising, and the other is assessing and selecting the apple to consume. Guide students to brainstorm a list of traits each perspective might be specifically looking for in an apple. Invite students to share out their ideas to the class. Then, guide students to complete the two follow-up questions before starting the *Apple Seed Advancements* 360 experience.

#### **Experience (during)**

Guide students to complete the Innovations on the Farm graphic organizer by taking notes as they move through the 360 experience. Students will be asked to define what genetic breeding is, describe how artificial selection solves problems, explain the products of artificial selection, and analyze the benefits by completing the graphic organizer as they navigate around the 360 experience.

#### **Reorient and Download (reflection and post-activity)**

*Two activity options are available for students to apply and summarize their learning.*

**Reorient #1:** In groups of 2, have students read each statement and decide whether it is true or false. Then, instruct students to justify their choice by using evidence from the 360 experience.

**Reorient #2:** In groups of 2, have students explain the POMS (Points Of Most Significance) for each of the topics listed using information from the 360 experience. For example, a student may explain the POMS for genetics is that artificial selection includes breeding apple varieties together to combine their genetic material to produce offspring with desirable traits.

**Optional: Level-up (extension)**

Direct students to read the article (linked below) to learn more about Cornell's apple orchard and meet Susan Brown, a Cornell professor of agriculture specializing in growing apples for over 15 years. Then, have students answer the summary questions.

[http://www.syracuse.com/living/index.ssf/2013/09/cornell\\_university\\_researchers.html](http://www.syracuse.com/living/index.ssf/2013/09/cornell_university_researchers.html)

**National Standards**

Science	<p>HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.</p> <p>HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.</p>
Technology Education	<p>Agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemicals, and other useful products.</p> <p>Describe biotechnology and its applications in such areas as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering.</p>
English Language Arts	<p>CCSS.ELA-LITERACY.RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</p> <p>CCSS.ELA-LITERACY.RST.9-10.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</p> <p>CCSS.ELA-LITERACY.RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p>

**Boot up:**  
**Multiple Perspectives**

With a partner, brainstorm a list of traits an apple farmer, a grocery store manager, and a consumer might look for in an apple.

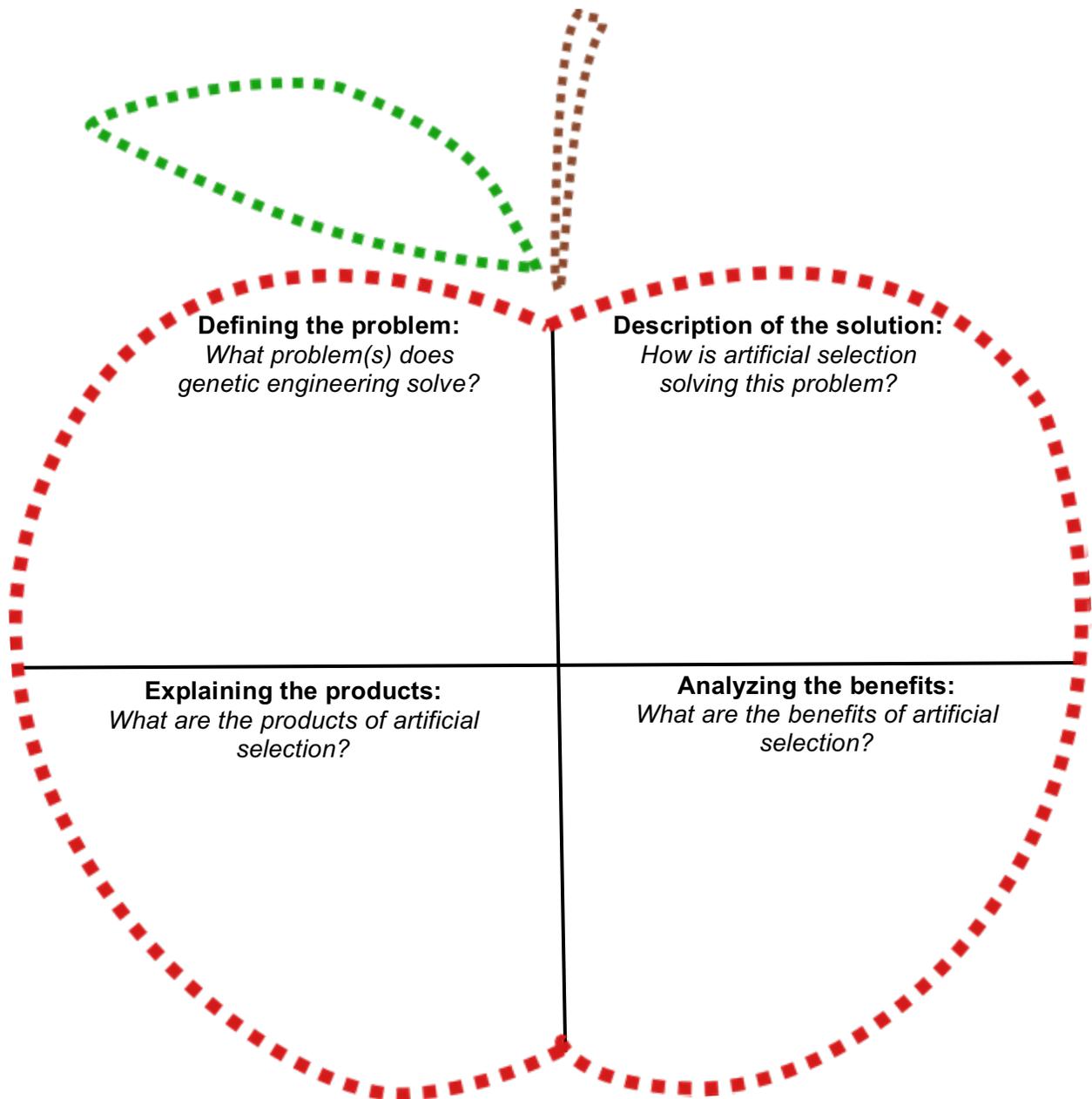
Apple Farmer	Grocery Store Manager	Consumer

1. Where do our traits come from? In other words, how do we acquire our hair or eye color?

2. How might a farmer acquire the apple traits that you brainstormed in question #1?

## Innovations on the Farm

Complete the graphic organizer below by taking notes as you move through the 360 Experience.



**Reorient #1:** Read each statement and decide whether it is true or false. Then, justify your choice by using evidence from the 360 experience.

Statement	T	F	Why I think so...
1. Artificial breeding can make apple orchards more sustainable.			
2. Artificial breeding changes the traits of plants and animals in order to produced desired characteristics.			
3. Artificial breeding requires different careers from geneticists to farmers to agricultural professors.			
4. New apple varieties grow best in one type of climate.			
5. Artificial breeding can create new species of apples.			
6. Artificial breeding improves apple quality and health.			

**Reorient #2:** In groups of 2, explain the POMS (Points Of Most Significance) for each of the topics below using information from the 360 experience.

Topic	POMS
Genetics	
Cornell Orchards	
New apple varieties	
Careers involved	
Technology required	

**Level-up:** Read more about Cornell's apple orchard and meet Susan Brown, a Cornell professor of agriculture specializing in growing apples for over 15 years. Then, answer the questions below.

[http://www.syracuse.com/living/index.ssf/2013/09/cornell\\_university\\_researchers.html](http://www.syracuse.com/living/index.ssf/2013/09/cornell_university_researchers.html)

1. How long does it take to bring a new apple variety to market? Why do you think that is?
2. What are some of the traits Susan Brown breeds for that may have surprised you?
3. *"But just like a mom and dad can have children who are very different from each other, new apples can fall far from the tree, figuratively speaking. Research assistant Kevin Maloney says about 95 percent of the seedlings they plant are discarded."*

Explain the quote above using terms such as genetics, DNA, and cross-pollination. Why would 95% of the seedlings be discarded?

4. How do consumers shape the type of apples that Cornell University breeds for?