

Dairy challenges

Focus questions	What food production challenges have we solved in the dairy industry? What other challenges in food production still need to be solved? How might farmers use genetics to solve on-farm challenges?
Vocabulary	Genetics, heredity, inheritance, allele, DNA, genetic modification, selective breeding/artificial selection, hybridization, induced mutation/mutagenesis, recombinant DNA, genetic engineering, genome editing/CRISPR

Agriculture and the dairy industry are filled with challenges. Brainstorm your own answers to each of these questions, then brainstorm with your group.

1. What challenges have we faced in growing food throughout human history?
2. What are the current challenges in agriculture or food production?

Share your answers with the class.

By 2050, it is estimated that there will be over 9 billion people on the planet. We do not have additional land on which to produce more food. Currently, nearly 1 billion people are food insecure (don't have regular access to nutritious food). What might we do to produce enough food in efficient ways to feed all the people?

One option is to change the genetics of crops and livestock. We have used many biotechnology tools to achieve this. One of the more recent tools that we have used is genetic modification, better known as genetically modified organisms (**GMOs**). The modification is a method of genetic engineering, where genetic material from one organism is inserted into the genome of another. The United States Department of Agriculture (USDA) refers to GMOs as bioengineered foods. Three agencies regulate GMOs: USDA, the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA).

Genetic modification more generally describes the process of modifying the genetic material of an organism and can be accomplished through a variety of methods. You will find that we have been doing this for thousands of years. In this lesson, you will learn more about some of these methods and get a chance to determine the best tool(s) to use to meet current challenges.

Fill out the chart to record what you already **know** about the five methods of genetic modification listed and **what** you would like to know more about. As the lesson continues, write in what you have **learned**.

KWL chart

	What do you know about the topic?	What do you want to know?	What did you learn?
Selective breeding			
Hybridization			
Induced mutation/ mutagenesis			
Genetic engineering			
Genome editing			

Day 1

Assigned genetic modification method:

Facts you learn:	Reference for facts:

Day 2

Share your information with others. Take note of what you learn from others above on your KWL chart.

Dairy challenge # _____

Discuss the challenge with your group.

1. Research the particular problem.
2. Brainstorm ideas for how to solve it.
3. Write your proposed solution using a claim based on evidence and reasoning to persuade others that yours is the best solution. Use a slide presentation or other digital format to share your solution.

Rubric for self-assessment

Skill	Yes	No	Unsure
I can communicate how genetic technologies impact agriculture and food production.			
I can describe selective breeding.			
I can describe gene editing/CRISPR.			
I can describe hybridization.			
I can describe induced mutation.			
I can describe genetic engineering			
I can name one agency that regulates GMOs.			