MS-LS4-5 Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

- Indicates opportunities for integrated English language development (reading, writing, listening & speaking).

Lesson 5: Genetic Modification - The Debate Over GMOs

Engage

The debate over GMOs (Genetically Modified Organisms) is a huge and heated topic that currently surrounds the food that we eat. Throughout this lesson students will explore and research the topic of GMOs to eventually pick a side to argue, debate, and support with evidence: Are GMOs harmful or not?

In-person or online activity:
Introduce Phenomenon
Begin this lesson by first showing students this picture:

GMO Corn

After showing them the picture ask students ***"What do you notice, what do you wonder? What do you think this poster is trying to tell you?"***

REFRAIN FROM DEFINING GMO (genetically modified organism) AT THIS POINT. You simply want students to get curious about the idea and the picture they are seeing. In virtual learning, discussions can take place in a whole-group Zoom meeting or in breakout rooms.

Give students time to think about and write down their own, individual answers. After giving them plenty of time to work individually, have them come together with a partner or group and share their answers with one another. Students can record their responses on individual Notice & Wonder posters or a Jamboard.

After giving students ample time to discuss what they notice and wonder in the first picture, repeat the same process with the picture below:

Negative GMO Corn

After allowing them ample time to repeat the same procedures with

the second picture, ask students to begin sharing their thoughts about what they believe to be the better choice, so far: “GMO or no?”

After giving brief discussion time, ask them to continue to think about their stance as they look at the next two pictures:
Life with no GMO
GMO Tomato

Finally after showing the students the two pictures, and allowing them, in any way you want, to express their preliminary stance on the issue, end the first part of the lesson by asking them what they think about the following picture:

GMO Nutrition

After gathering final thoughts about the last picture, inform students that they will be learning more about this concept of a “GMO” and will work to gather evidence to eventually argue a side to the class: “GMO or NO”

Explore

In-person or online activity:
Student Exploration
Once students have begun to choose a side just based on the pictures you have shown them in the Engage phase of the lesson, we now want to give them time to explore what a GMO is and whether or not they are harmful for human beings.

Allow students to explore the following websites (2 of them are pro-GMO and 2 of them are non-GMO)

Pro GMO Website #1

Pro GMO Website #2

Non GMO Website #1

Non GMO Website #2

Do not direct them to a particular place, but allow them to explore and figure out two things on their own:

- **What is a GMO?**
- **Are GMO’s safe?**

Give the students ample time with their group or partner to explore GMO's and what they are. As students are researching, have them chart key pieces of information that they find from each of the websites. Have them create a T- Chart poster with at least 4-5 key details that they find for both the pro-GMO side and the non-GMO side of the poster.

Explain

In-person or online activity:
During the first part of the Explain phase of the lesson, students should share out the things that they charted on their comparison T-Chart.

This can be done in different ways:

- You can have students share their poster with the entire class during a **synchronous** meeting.
- Students can share posters in small group breakouts.
- You can have students conduct a virtual gallery walk to review each poster, asynchronously. Posters can be placed in a Padlet for student viewing.
- Have students conduct a gallery walk and leave feedback on each poster that they visit.

Additional activity options:
BrainPOP- Students can watch the movie and complete the review or graded quiz as a check for understanding. There are additional activities and related readings that can be assigned as well.
DNA

Zingy Learning- Students can complete the interactive lessons and quizzes as a check for understanding. There are additional short answer questions that can be used in a Google Form or Doc if desired.
MS, Subject-specific, Life Science, Unit 33, Lessons 1-3: Artificial Selection

Once students have had a chance to review each of the posters and review the information that their classmates have found, have them review the following two articles.

Achieve 3000 - Have students complete the article & discussion and 5-step lesson. As the teacher, you will facilitate the learning through the lesson. Be sure to have students read both pages of the

article(s).
Editing Nature **(6-12)**
Sugar Not Always Sweet **(6-8)**

In-person or online activity:
Class Discussion

GMO or NO!

After reading the articles, hold a short class discussion about what GMOs are and whether or not students believe they are harmful or helpful for human beings.

All students should be given a short amount of time to argue for their side, but remind them that they must back their pro or con argument with evidence from one of the sources that they have explored. This is also a great chance to relate GMOs (or genetically modified organisms) back to concepts taught in previous lessons like genetic mutation. This lesson should not move on until all students understand what a GMO is and have information about both sides of the stance (for or against GMOs).

Extension: The following videos have also been attached in case additional information needs to be given to the students outside of the Achieve 3000 articles or other resources.
What is a GMO? (3;13)
Are GMOs good? (9:02)

Elaborate

In-person or online activity:
Student projects - GMO or No

Once students enter the Elaborate phase of the lesson they need to decide, with their partner or group, what side they are going to choose, Pro-GMO or Non-GMO. ***Alternatively, students can complete the assignment individually at teacher discretion.***

Once the group/pairs or individual students have taken a definitive stance on the issue they must create two things:

- A short argumentative piece in which they use pieces of evidence sourced from the websites and articles to help back their argument for the side (GMO or NO).
- A Propaganda poster OR commercial that they will present to

the class

For the propaganda poster, students should create a type of poster or infographic with visuals and a saying or slogan that supports their side of the argument.

Students can either create a physical poster on chart paper (in-person) or can use Google Drawing (virtual learning) as a tech resource to create their poster. Teacher may want to show example propaganda posters to students before students start on their assignment.

If students choose to do an argumentative commercial, they can use Screencastify or WeVideo (and use a green screen background) to help set up a commercial in which they argue their side for or against GMOs. In virtual learning, ***WeVideo now has a collaborative feature where students can collaborate remotely on projects.***

Teacher may select other avenues of creation, but the main point is that students use the research and evidence gathered in the other phases of the lesson to help argue their point for or against GMOs. Every argument or point made must be grounded in some kind of evidence.

Evaluate

In-person or online activity:
Student Presentations
During the evaluate phase of the lesson, students should present whatever product they created to help argue their side of the debate "GMO or No"

 If all students created posters, students could conduct a gallery walk or present their posters in front of the class. In virtual learning, students can add their posters to a Padlet for a virtual gallery walk. Students can be encouraged to "like" and comment on the posters at teacher discretion.

If commercials were created, students should be able to show their commercials in front of the class or during a **synchronous** meeting.

Regardless of the product created, the presentations should be staggered so that Pro GMO products are shown immediately after No GMO posters and vice versa.

After students present their sides, teacher may want to hold a small debate or perhaps take a vote or tally of which side students stand for.

Regardless of the outcome of the debate, the main point should be that all students in the class are correct because they have taken the time to educate themselves on the issue and ground their arguments in evidence. For this reason there is no losing side, just more popular choices than others.