**Pop-Out Essential Question:** *How do we decide what is most ethical in science?*

Scientific discoveries can often offer new solutions for problems that were previously very difficult to solve. However, sometimes these scientific discoveries have downfalls that come with their benefits. When a scientific discovery helps some people and hurts others, how do we decide what to do?

In this unit, you are learning about how organisms change over time. In recent decades, scientists have made some great discoveries that allow them to intentionally change how organisms change over time. However, with these interesting technologies come many ethical questions of how we determine what is most right and wrong. In this Pop-out task, we will work together to examine the complexity of a couple different ethical dilemmas in science.

**Engage**

1. Individually, take a couple minutes to read the imaginary case below.

A new medicine, called *Apoptosis*, shows a promising ability to cure lung cancer. It slows the growth of cancer cells and actively kills cancer cells. In studies so far, *Apoptosis* cures 82% of early stage lung cancer. The medicine has many ingredients, one of which is a heavy metal. To get the metal in the form it needs to be in for *Apoptosis*, it has to go through an extraction process that has very negative environmental side effects. The metal is mined and cleaned in a process that uses a series of large, man-made lakes close to the mine. In the process of separating the metal from everything else, this water is polluted with chemicals. The water is then recycled into the community water system. Environmentalists fear that the water pollution will increase illness rates for nearby communities.

1. In partners, discuss the questions below and then use the table below to record your opinions. You may be asked to share your ideas in a class discussion.

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| --- | --- |
| **What are benefits of the medicine?** |  |
| **What are downsides of the medicine?** |  |
| **Would you make the medicine? *Why or why not?*** |  |

**Explore**

The last case was an imaginary case to get you thinking about complicated ethical situations created by scientific discoveries. Now let’s explore a scenario that happened in the real world.

1. Individually, read the Zambia Food Crisis article. While reading:
   * Use the annotation strategies your teacher gives you to help you learn from the reading.
2. In partners, discuss the following questions. Record your responses in the table below.

|  |  |
| --- | --- |
| **Approximately how many people needed food in Zambia? Why?** |  |
| **What is genetically modified food?** |  |
| **There are some people who fear GM foods. Why?** |  |
| **In Zambia, who supported taking the GM foods? Why?** | . |
| **Who was against taking the GM foods? Why?** |  |

**Explain**

1. Discussing in partners, consider the following questions to help you think about the ethical dilemma in Zambia:

* What is the problem? What is the solution? Who will be helped and who will be hurt? What are the benefits of the solution you would choose? What is the cost of the solution you would choose? What are the short-term and long-term effects of the solution you would choose?

1. Answer this question: If you were the President of Zambia, would you accept the genetically modified food? Why or why not? You’ll be asked to use evidence to justify your opinion in a class-wide discussion

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**Elaborate**

Even though the Zambia food crisis took place in 2002, GMOs are still debated in various forms today. And, GMOs extend beyond the realm of food. Designer babies (genetically modified fetuses) are a current-day example of that. Ethical considerations will only continue to increase as technology improves to make more designer babies.

1. Individually, read the article provided to learn about designer babies. As you’re reading, think about the reasons for and the reasons against designer babies.
2. Your teacher will then read statements aloud to the class related to designer babies. Individually, move to the corner that best represents your opinion on that statement, and be prepared to share why you chose that corner.
3. Based on the article and the Four Corners activity, individually record your ideas in the table below:

|  |  |
| --- | --- |
| **What are the reasons for designer babies?** | **What are the reasons against designer babies?** |
|  |  |
| **Do you think designer babies should be allowed?**  ***Why or why not?*** | |

**Evaluate and Reflection**

You have read, talked, and thought a lot about different perspectives on Genetically Modified Organisms, as they relate to both food and humans. This final writing assignment lets you share your thoughts on how these two issues are connected. You are encouraged to use evidence from both dilemmas to make your argument.

1. Based on what you’ve learned in this pop-out, individually write a statement that explains both sides of Genetically Modified Organisms, such as crops and designer babies. Your argument should include:
   * Both sides of the argument with evidence from the articles
   * Your opinion on this ethical issue
   * A conclusion statement that explains why it is sometimes challenging to decide what is ethical (right or wrong) in science

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