**Understanding Genetic Modification TIME:** 60 minutes total within 2-3 Days

**ESSENTIAL QUESTION:** How can humans influence the genetic outcomes of traits using technology and innovation?

**EXPECTATIONS:** Complete the instructions below in order. You can break it up in 20-30 minute sessions OR do as much as you prefer, then take a break. Since your goal is to be able to gather information to show the cause and effect relationship between humans genetically modifying DNA to produce specific outcomes, you need to study resources that will help this make sense. If the resources provided in the lesson don’t help you, check out the other resources below instead.

**PART 1 (20-30 minutes)**

**WARM-UP:**  Answer the questions below after watching one of these videos

Video Link: [***https://www.youtube.com/watch?v=vribRyVQ6G8***](https://www.youtube.com/watch?v=vribRyVQ6G8)

Video Link: [***https://www.youtube.com/watch?v=rx953M-tpp4***](https://www.youtube.com/watch?v=rx953M-tpp4)

Answer these questions to prepare for what you’re about to learn. (It’s okay not to know the answers yet. Thinking about them first helps prepare your brain for learning).

Q1: ***How is artificial selection different from natural selection?***

Q2:  ***When might “Genetic Modification” be a good thing for the advancement of science?***

**RESEARCH:**  Read this article and complete the directions below.

Article Link: [**https://www.southuniversity.edu/news-and-blogs/2016/08/genetically-modified-foods-explained-80625**](https://www.southuniversity.edu/news-and-blogs/2016/08/genetically-modified-foods-explained-80625)

Next:   **Make a T-Chart. On the left write, “Pros of genetically modified food” and on the right write, “The cons of genetically modified food”. Use the article to create your T-chart. Research more on the internet to evaluate the accuracy of the article.**

Q1: ***Do you trust the article? Support why or why not with evidence from the other sites you found on the internet.***

**REVIEW:** Try to answer the questions again. (They should make more sense now).

Q1: ***How is artificial selection different from natural selection?***

Q2:  ***When might “Genetic Modification” be a good thing for the advancement of science?***

*Q3:* ***What are other applications genetic modification can be used other than for food?***

**FINISHED EARLY? GOT QUESTIONS? NEED DIFFERENT RESOURCES?**

Video Link:[**https://www.exploregenetherapy.com/how-gene-replacement-therapy-works?utm\_source=google&utm\_medium=cpc&utm\_campaign=pep-unbranded-search-gene-therapy-201903&utm\_content=consumer-patient-grt-103&gclid=CjwKCAjwq832BRA5EiwACvCWsWQSNCtwospjbpWGpt-wRh3wvQAejCtJfPDc9LVkRJHhQjip0kvy-BoC5wMQAvD\_BwE**](https://www.exploregenetherapy.com/how-gene-replacement-therapy-works?utm_source=google&utm_medium=cpc&utm_campaign=pep-unbranded-search-gene-therapy-201903&utm_content=consumer-patient-grt-103&gclid=CjwKCAjwq832BRA5EiwACvCWsWQSNCtwospjbpWGpt-wRh3wvQAejCtJfPDc9LVkRJHhQjip0kvy-BoC5wMQAvD_BwE)

Article Link: [**https://www.nature.com/scitable/topicpage/genetically-modified-organisms-gmos-transgenic-crops-and-732/**](https://www.nature.com/scitable/topicpage/genetically-modified-organisms-gmos-transgenic-crops-and-732/)

**PART 2 (20-30 minutes)**

**RESEARCH:** Watch this video to look for examples of how technology can be used to modify genes. Write notes and questions as you go.

Video Link: [**https://thekidshouldseethis.com/post/crispr-dna-chrysalis-time-lapse**](https://thekidshouldseethis.com/post/crispr-dna-chrysalis-time-lapse)

Q1: ***What is CRISPR?***

Q2: ***Why are the scientists interested in studying butterfly wings?***

Q3: ***How might this technology help humans suffering from diseases?***

**PART 3 (20-30 minutes)**

**PRACTICE:**  Become the **Space Doctor** and design a gene therapy for one of the three given patients.
**Resource Link:**[***https://learn.genetics.utah.edu/content/genetherapy/doctor/***](https://learn.genetics.utah.edu/content/genetherapy/doctor/)Write the following information in your notebook:

 **Patient: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
 **Disease/Disorder: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
 **Tissue targeted*: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

 ***Vector chosen: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

 ***(consult the toolbox if you need a refresher):*** [***https://learn.genetics.utah.edu/content/genetherapy/tools/***](https://learn.genetics.utah.edu/content/genetherapy/tools/) ***Q1: Was your therapy successful?***
 ***Q2: Why or why not? (Explain)***

**REVISED THOUGHTS:** Complete these reflection questions to see how much you’ve grown your learning and email your teacher a copy so they know how to help you.

 Q1: ***What was surprising about genetic modification?***

 Q2: ***What did you already know but see in a new way?***

 *Q3:* ***What do you still need help with?***

**FINISHED EARLY? GOT QUESTIONS? NEED DIFFERENT RESOURCES? WANT A CHALLENGE?**

**Explore:** [***https://learn.genetics.utah.edu/content/genetherapy/***](https://learn.genetics.utah.edu/content/genetherapy/)

**Video:** [***https://www.youtube.com/watch?v=qgTeDS2mNko***](https://www.youtube.com/watch?v=qgTeDS2mNko)