

Case Study on Tuberculosis and Antibiotic Resistance

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for the STEM Education Center at WPI's Summer 2022 Research Experience for Teachers program

Subject: Science

Grade Level: 7

United Nations Sustainable Development Goal 3: Good Health and Well Being

Overview

You have been assigned a mutation that our lab needs your help figuring out.

By the end of the week, you will need to tell us; what type of mutation this is, what structure or function it changes, and whether it is positive, negative, or neutral. You will have to present your findings with your group at our mutation madness conference.

Standards & Learning Targets

8.MS-LS3-1. Develop and use a model to describe that structural changes to genes (mutations) may or may not result in changes to proteins, and if there are changes to proteins there may be harmful, beneficial, or neutral changes to traits.

Vocabulary	Tier 1	Tier 2	Tier 3
	Develop	Model structural changes Harmful Beneficial Neutral Function	Protein Gene Mutation Insertion Deletion SNP Transversion
What do students need to KNOW ?	<ol style="list-style-type: none"> DNA makes up genes that code for proteins which cause a specific function <ol style="list-style-type: none"> For example gene makes a protein that makes eyes green Genes can undergo changes that lead to different proteins 		
What do students need to DO ?	<ol style="list-style-type: none"> Students will need to discuss their ideas with their peers Students will need to model 4 different types of mutations 		
What will students CREATE ?	<ol style="list-style-type: none"> Students will create a model of a mutation that leads do a different result (function/protein) 		



ELA Standard: Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate vocabulary, eye contact, volume, and pronunciation			
Vocabulary	Tier 1	Tier 2	Tier 3
	Present		
What do students need to KNOW ?	<ol style="list-style-type: none"> 1. Students will use the following vocabulary words in context: 2. How to effectively present ideas 3. How to critique and give feedback 4. How to keep focus in conversations 		
What do students need to DO ?	<ol style="list-style-type: none"> 1. Present Research Findings 2. Critique and Evaluate Peers 		
What will students CREATE ?	<ol style="list-style-type: none"> 1. A note page of their research findings 2. A presentation of their findings/ end result 		

Prior Knowledge

- DNA structure
- Research Questions
- Feedback/Critiques
- Give feedback to an official in your country
- Constraints

Materials/Resources

- Chromebooks
- [UNSDGs](#)



Timeline of Activities

Duration	Activity	Instructions	Product
5 min	Introducing Phenomena	<p>Present Students with the problem:</p> <p>Hello 8th-grade class we need your help,</p> <p>You have been assigned a mutation that our lab needs your help figuring out.</p> <p>By the end of the week, you will need to tell us; what type of mutation this is, what structure or function it changes, and whether it is positive, negative, or neutral. You will have to present your findings with your group at our mutation madness conference.</p>	
5-10 min	<p>Introducing Phenomena</p> <p>Something to introduce the concept of bacteria and antibiotic resistance</p>	<p>How do changes in the number of resources affect populations?</p> <p>Students will watch the mega plate video to introduce some of the vocabularies for the lesson as well as to make a visual connection to the vocabulary.</p> <p>They will do this twice, once first just watching and then they will be told to watch it the second time while filling out a notice and wonder T-Chart</p> <ul style="list-style-type: none"> - The chart will help us form our driving question board <p>Turn and Talk with your groupmates and try and figure out what is going on in the video that you just watched.</p>	Notice Wonder T-chart
20 min	Mutation Making	<p>Students will receive a Ziploc bag with color-coded DNA strands that match the ones displayed on the screen at the front of the classroom</p> <p>As a class, we will model 4 different types of mutations (transverse, insertions, deletions, and SNPs)</p> <p>Turn and Talk with your groups: Will these have a negative impact? Or a positive? Which do you think will have the biggest impact?</p>	Notes on Mutations



Start of Day 2			
10 min	Navigation from Yesterday	<p>Students will be paired with one another and each given a strand of DNA</p> <p>A sequence of DNA will be put on their worksheet and the students will have to determine what type of mutation from yesterday their DNA underwent.</p> <p>Students will be instructed to fill out their worksheets independently, and they will be collected at the end of class.</p> <p>Discuss:</p> <p>Do you think your mutation will be positive/negative, or neutral and why?</p>	
5 min	How do mutations happen?	Students will be asked to come up with a hypothesis of how their mutation happened.	Class discussion
10-15 min	Mutations Video	<p>Students will watch a video describing how mutations occur (bigger picture connection)</p> <p>They will be asked to make a notice/wonder T-chart, and see if they can answer their hypothesis</p>	Notice/wonder T-chart
Day 3			
15-20 min	Putting things together	<p>They will have to take a folder from the front of the room to reveal the protein (simply labeled) and determine whether their mutation is positive, negative, or neutral</p> <p>They will also have to use the information in the folder to determine how their mutation occurred</p>	
		The remainder of Class will be used for making presentations	

Culturally Responsive Teaching Strategies

Allowing students to pick their method of presentation	Students are able to pick a country that means something to them, perhaps has a cultural significance and allows them to see themselves in science, and real world issues.
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Career Connections

Laboratory scientists are highlighted, as well as genetics.

Assessment

