

High School Genetics		
Lesson: Genetic Variation		
Essential Question(s):		
<p>Which impacts people more, nature (genetic make-up) or nurture (environment)?            In what ways do elements of culture affect who we are?            What are traits specific to the Oceti Sakowin people?            How has the Euro-American culture impacted the Oceti Sakowin people?</p>		
Materials/Resources	Essential Vocabulary	
<p><b>Teacher:</b>            OSEU #2 video by Lydia Whirlwind Soldier  <a href="http://www.wolakotaproje.ct.org/oseu-two-no-generic-indian-lydia-whirlwind-soldier/">http://www.wolakotaproje.ct.org/oseu-two-no-generic-indian-lydia-whirlwind-soldier/</a></p> <p>Article or information on disorders caused by genetic mutations, such as NAM  <a href="https://www.medicaldaily.com/genetic-clue-found-native-american-myopathy-devastating-muscle-disorder-246473">https://www.medicaldaily.com/genetic-clue-found-native-american-myopathy-devastating-muscle-disorder-246473</a></p> <p>OSEU #2 video by Janelle Williams  <a href="http://www.wolakotaproje.ct.org/oseu-two-janelle-williams-this-is-who-we-are/">http://www.wolakotaproje.ct.org/oseu-two-janelle-williams-this-is-who-we-are/</a></p>	<p><b>Student:</b></p> <ul style="list-style-type: none"> <li>● Computer access</li> <li>● Twizzlers (2 per student, 2 different colors)</li> <li>● Poster paper</li> <li>● Markers</li> </ul>	<p>Mitakuye Oyas'in            Unci Maka            Meiosis            Independent-Assortment            Crossing Over            Genetic Linkage            Mutation            Replication            Mutagen            Identity            Resiliency</p>

## Learning Experience

<b>Standard and Practice:</b>	<p>Content Standards</p> <p>HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.</p> <p>OSEU</p> <p>Standard 2.1 Demonstrate knowledge of the Oceti Sakowin people's understanding of the interrelationship of spiritual, physical, social, and emotional health.</p> <p>Standard 2.2 Describe the impact of Euro-American ideals, values, rights, philosophy, and beliefs upon Oceti Sakowin people as tribal, state, and US citizens.</p> <p>Standard 2.3 Recognize there is a continuum of tribal identity, ranging from assimilated to traditional lifestyle, that includes each unique subculture or individual member within the Oceti Sakowin.</p> <p>This lesson supports the topics in biology:</p> <p>DNA replication</p> <p>Meiosis</p> <p>Mendelian Genetics</p>
<b>Cultural Integration:</b>	<p>Lakota identity and resiliency are incorporated into this lesson through the sharing of stories and identification and discussion of contemporary issues facing Lakota people. Students will conduct research and consider the Lakota values of identity and resiliency to form opinions on what is more impactful to a person's identity (the lense in which they see, act, and experience the world), their genetic makeup or the environment in which they experience the world.</p>
<b>I Can Statement(s):</b>	<p>I can explain how meiosis contributes to genetic variation.</p> <p>I can describe how mutations are caused by errors in DNA replication and mutagens.</p> <p>I can explain that the environment contributes to the wide variety of Native people living in the plains and that the Oceti</p>

	<p>Sakowin people strongly identify with their tribal groups through tribal enrollment, common origin, history, culture, and language.</p>
<p><b>Engage: Activating Strategy/Hook:</b></p>	<p>Launch activity: Begin the lesson by having students do a circle continuum activity. Ask students to line up in a circle by a variety of traits (e.g., by age, height, ability to Round Dance, athletic ability, etc.). Have the students line up in a few different ways and point out how unique each person is, yet we are all connected by being part of the circle. Link this to the Lakota concept of Mitakuye Oyas'in (all my relatives).</p> <p>Once back in their seats, ask the students, Which has a greater impact on how a person sees, acts, and experiences the world? Nature (genetic makeup) or nurture (the environment)?</p> <p>Have students watch the OSEU #2 video by Lydia Whirlwind Soldier  <a href="http://www.wolakotaproject.org/oseu-two-no-generic-indian-lydia-whirlwind-soldier/">http://www.wolakotaproject.org/oseu-two-no-generic-indian-lydia-whirlwind-soldier/</a></p> <p>Discussion:</p> <p>What are traits specific to Native American/Oceti Sakowin people?</p> <p>How has the past and current Euro-American culture impacted the Oceti Sakowin people?</p>
<p><b>Explore: Learning Experiences</b></p>	<p>Part 1</p> <ol style="list-style-type: none"> <li>1. Give each student two coins and genotypes for a mom and dad. Ask students to label the coins, one allele on each side.</li> <li>2. Students should flip the coins 50 times and record their results. Then, find the percent of genotypes and phenotypes for their data.</li> </ol> <p>How do these results compare to expected results (students can use a Punnett square for expected results)? What do you think contributes to genetic variation?</p>

	<p>3. Have students draw out Prophase I in Meiosis and consider how independent assortment can impact genetic variation. Just looking at independent assortment of 23 pairs of chromosomes, that is <math>2^{23}</math> assortments. Considering mom and dad, <math>2^{23} \times 2^{23} = 70</math> trillion different possibilities.</p> <p>4. Genes are further varied during crossing over, which can occur numerous times.</p>
<p><b>Explain: Learning Experiences</b></p>	<p>Have students model a several recombinations using two different flavors of Twizzlers. Students should share their recombinations with another student, making note of where the recombinations were most likely to occur. Considering each gene has a locus, are some genes more likely to cross than others?</p> <p>Class discussion on genetic linkage and how this might contribute to similar traits among ethnic groups and families, despite the apparent diversity of genetic combinations.</p> <p>Part 2</p> <p>1. Have students review or conduct their own research on a disorder caused by genetic mutation, such as Native American Myopathy (NAM), sickle cell anemia or cystic fibrosis. Class discussion- how would your life be impacted if you were diagnosed with such a disease? Would you want to have genetic testing in advance to see if you had the gene for a disorder, or that you are a carrier?</p> <p>2. Have students view OSEU #2 video by Janelle Williams <a href="http://www.wolakotaproject.org/oseu-two-janelle-williams-this-is-who-we-are/">http://www.wolakotaproject.org/oseu-two-janelle-williams-this-is-who-we-are/</a> Discuss, what environmental factors impacted the Oceti Sakowin people since colonization? What factors did Janelle Williams point out as mainstays of the Lakota identity?</p>

	<p>3. Students should work in small groups, each taking a different topic below. Students will make an informational poster on a related topic (suggestions bulleted below) and present it to the class.</p> <ul style="list-style-type: none"> <li>● How do mutations arise during DNA replication?</li> <li>● How do factors in the environment cause mutations (mutagens)? What are some examples of factors in the environment that can lead to mutations?</li> <li>● How did major changes in the environment impact the Oceti Sakowin people, post-colonization?</li> <li>● What sorts of environments do different members of the Oceti Sakowin people live in today? What are risk factors for environmental mutations?</li> </ul>	
<p><b>Elaborate: Extending &amp; Defining</b></p>	<p>Ask students to consider how historical trauma could impact genes passed on over the generations, recalling that female gametes are produced while the female is still a child in her mother's womb.</p>	
<p><b>Evaluate: Summarizing Strategy</b></p>	<p>Class will engage in a final group discussion answering the following questions:</p> <ul style="list-style-type: none"> <li>● What makes us who we are and how is that expressed in the world that we live in?</li> <li>● What steps can be taken to prevent some mutations?</li> <li>● How can we honor and respect the identity of every member of the Oceti Sakowin and their nonnative neighbors?</li> </ul>	
<p><b>Differentiation Strategies</b></p>		
<p><b>Extension</b></p>	<p><b>Intervention</b></p>	<p><b>Language Development</b></p>
<p>Have students complete a family tree, going back as far as possible. See if there are</p>		

<p>patterns indicating trauma or mutation, two generations after major traumatic events (e.g., boarding school era, Wounded Knee).</p>		
Assessment(s)		
Formative	Summative	
	<p>Students will write a short evidence-based opinion in essay form responding to the question, “Which has a greater impact on how a person sees, acts, and experiences the world? Nature (genetic makeup) or nurture (the environment)?”</p> <p>Class will move their chairs into a circle and hold a roundtable discussion, sharing and discussing their opinions. Students should be encouraged to discuss the diverse cultures and environments within the Oceti Sakowin, all having a shared identity.</p>	
<p><b>Teacher Reflection:</b> (Next steps?)</p> <p>The roundtable discussion can bring up numerous personal issues, such as disabilities that impede life quality, cancer/diabetes/obesity, historical trauma, generational poverty, drug addiction and alcoholism, and fetal alcohol syndrome. Setting ground rules before the roundtable discussion will help foster a safe, respectful space for students to learn from and about one another.</p>		