Lesson Plan: The Evolution of Lactase Persistence in Some Groups

**Where in the Unit Sequence:** Week 1: Lesson 2

**Duration of Lesson:** (1-2) 40 minute periods

**Objective:** To discover how the lactase persistence gene allele evolved independently in different populations based on the availability of milk in the diet.

**Key Content:** Lactase persistence is a mutation that was selected for by the availability of milk in the diet so some populations in the world have evolved to have this gene allele.

**Key Vocabulary:** Lactase, enzyme, adaptation, lactase persistence, mutation, chromosome, genes, alleles)

**Key Skill (Standards).**

NGSS.LS.1.3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

NGSS.LS.3.1 Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

NGSS.LS.1.1 Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

PCSS.3.1.10.B1.5 Explain how mutations can alter genetic information and the possible consequences on cells.

PCSS.3.1.10.A3 Compare and contrast the life cycle of different organisms

PCSS.3.1.10.C2.2 Explain that mutations can alter a gene and are the original source of new variations in a population.

**Detailed Facilitation Teacher will do**… Direct students the activity handout-a google document which has the links to resources they can use to learn from and then type their answers to the questions. Walk around the room helping anyone needing it and engaging students in individual conversations about the content. In the last quarter of the class period lead a follow up discussion.

**Detailed Activities Students will do**: Students will use the video link and links to other resources to learn about this topic then they will fill in answers to the questions on the online document.

**Assessment:** Teacher observation of student participation in using the resources, completion of handout and in the discussion

**Resources needed:** google handout, student laptops

**Homework:** Students needing extra time or a modification to complete the handout

**Teacher Notes:**

Lead a Discussion after the students have had time to work individually on the handout.

Essential Questions for the Discussion:

* What environmental factor caused some groups of people to evolve to be lactase persistent?
* How do groups of people who are 100% lactose intolerant survive and thrive?
* What do you think would happen if all European Americans suddenly became lactose intolerant and everyone else developed lactase persistence? Would that change anything?

**Student Handout Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_**

Evolution of Lactase Persistence (lactose Tolerance) in Some Groups

Lactose intolerance is probably familiar to most of you. Normally, organisms lose the ability to digest milk as they grow to adulthood. This lack of tolerance has little effect on most organisms as there really is no milk source for them as adults. However, the case with *Homo sapiens* is a little different. A ways back in our history, some humans took to raising livestock to supplement their diet and with this change in behavior a new resource became available, along with a benefit for anyone who could exploit it. As you may have surmised, this new resource was milk and all the products which can be made from milk.

Learn how changes in DNA affect lactose tolerance.

* Watch this video: **New Lactose Tolerance Mutation Found** from AMNH <http://www.youtube.com/watch?v=y-WDBbldlwI>
* Use the list of resources below to research and answer the following questions:

Use the resources below to answer the following questions:

1. Does having lactose intolerance mean that you cannot tolerate any lactose at all? How did this situation help lactose tolerant genes increase in the human population? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. What kind of mutation in chromosome 2 was found to convey lactase persistence into adulthood? Are you surprised that such a mutation could cause such a big change? Why or why not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Is the new East African mutation the same as previous mutations found in Middle Eastern and European populations? Why is it believed these types of mutations were selected for in human populations? What evidence is there to support this hypothesis? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Resources:

* <http://www.youtube.com/watch?v=y-WDBbldlwI>
* <http://digestive.niddk.nih.gov/ddiseases/pubs/lactoseintolerance/>
* <http://www.elmhurst.edu/~chm/vchembook/546lactose.html>
* <http://www.scientificamerican.com/podcast/episode.cfm?id=africans-did-dairy-seven-millennia-12-06-20>
* <http://www.nutritionecology.org/panel5/intro.html>
* <http://www.stolaf.edu/depts/environmental-studies/courses/es-399%20home/es-399-05/Projects/dairy%20research/socialhistory.html>