



Grade 8 Teacher Resource- Ancient DNA/ Permafrost Lab

Curricular Outcome: Science 8 “Life Processes Are Performed at the Cellular Level”

Core Concepts:

Students investigate how:

Cells store genetic information

DNA can survive in frozen environments

Permafrost preserves biological materials

Scientists use ancient DNA to study extinct organisms

Keywords and Connections: cells, DNA, preservation, decomposition, Ice Age ecosystems, Yukon fossil discoveries

Big Questions: How can we study animals that went extinct thousands of years ago? What can frozen cells tell us about the past?

Introduction:

Thousands of years ago, much of the Yukon was a cold, grassy landscape filled with mammoths, steppe bison, and predators. Among all these creatures roamed a young woolly mammoth named Nun cho ga. Life wasn't easy in Beringia with long winters, frozen ground, and powerful storms impacting everything that lived there. One day, Nun cho ga wandered just a few steps away from her mother to graze and drink from a stream. She became stuck in a muddy silt, which quickly killed Nun cho ga, burying her into the permafrost. She would lay in this permanently frozen ground, preserving her body for thousands of years.

This was until June 2022, when miners working near Dawson City uncovered her remains while digging through layers of permafrost. Scientists, knowledge holders, and Yukon First Nations groups knew just how significant this discovery was. Found on Tr'ondëk Hwëch'in territory, Nun cho ga was given her name, meaning “big baby animal” in the Hän language. While most fossils are just bones, this creature was different. Nun cho ga had preserved skin, hair, and soft tissue, which gave scientists a rare opportunity to study Ice

Age life in incredible detail. Today, Nun cho ga is undergoing conservation and analysis in Ottawa before she will eventually return to the Yukon.

Introduction Question: How did Nun cho ga stay so well preserved?

Mini Lesson

DNA Extraction Activity

This activity is designed to show the visibility and tangibility of DNA to students, and to connect DNA to living cells. We tried this experiment ourselves and even with errors made, were still able to extract the DNA. It's very easy and great for students!!

Materials Needed:

2 fresh or frozen strawberries per student/group (remove green leaves)

Zip-Loc Plastic Bag per student/group

½ cup water per student/group

½ cup rubbing alcohol

2 tsps. liquid dish detergent per student/group

1 tsp. table salt per student/group

1 Coffee filter per student/group

1 coffee stirrer per student/group

2 cups for mixing per student/group

Instructions

1. Place strawberries in plastic bag and seal it, releasing most of the air. Crush for 2 minutes or until completely pulpy.
2. In a cup, thoroughly mix 2 tsps. of detergent, 1 tsp. of salt, and ½ cup of water. This will be the DNA extraction liquid

3. Pour the liquid mixture into the plastic bag with the strawberries.
4. Reseal the bag and gently smash for another minute. Avoid making too many soap bubbles.
5. Place the coffee filter so it is gently resting at the top of the other cup. Ensure that it will not fall out of the cup during the next step.
6. Pour the strawberry liquid into the filter. Grab the filter and twist it just above the liquid. Gently squeeze the remaining liquid into the cup. The purpose of this is to ensure no solids enter the cup.
7. Pour a (roughly) equal amount of rubbing alcohol as there is strawberry liquid down the side of the cup. DO NOT MIX OR STIR.
8. Within a minute, a white cloudy substance should develop a layer at the top. This is DNA from the strawberry which is now isolated from the rest of the materials contained in the cells of the strawberry.
9. Tilt your cup and pick up the DNA using your coffee stirrer.

If you prefer video instructions, that is available at the link below. If you have your materials ready, skip to 2:34 where the instructions for the experiment begin. ***Note: In the video, they stir the mixture after adding the alcohol. Please do not mix yours, unless the cloudy substance doesn't appear:** <https://www.youtube.com/watch?v=zMw44VDqf2s>

Next Steps

Preservation Experiment

Place DNA samples in frozen, refrigerated, and room temperature conditions. Over the course of days or weeks, students can track texture, smell, appearance, and the breakdown rate of each sample. (Observation Chart at end of document) This is where comparisons can be made to permafrost DNA and how it is preserved for thousands of years.

Students can be prompted with the following questions:

Which conditions preserve cells best?

What conditions slow decomposition and why?

What happens to DNA over time?

How does this experiment relate to scientists exploring extinct species?

Connections

Tie the findings of the preservation experiment to local anchors. Resources are available for information on Nun cho ga, our preserved wolf pup Zhur, Yukon permafrost, Ice Age fossils, Beringian ecosystems, and more. The purpose of the strawberry DNA experiment is simply to make biology feel real.



COMPARISON CHART:

FROZEN DNA EXPERIMENT



Day/Week	Room Temperature Observations	Refrigerated Observations	Frozen Observations

