**Ms. DiSantis - Honors Biology Biotechnology Unit Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

A Whale of a Tale Activity: Using BLAST to identify the Source of Mitochondrial DNA from Whales

Lesson Source – This Lesson was modified and taken from MBARI: Monterey Bay Aquarium Research Institute EARTH Lesson Plans Published. <https://www.mbari.org/products/educational-resources/earth/earth-lesson-plans/>

# Summery and Background Information;

# In this lesson, students will be using the BLAST bioinformatics tool to compare mitochondrial DNA (mtDNA) samples from unknown whale species to known sequences of (mtDNA).

**Mitochondrial DNA: What is it?**

Not only is DNA found in the nucleus, but a special type of DNA called Mitochondrial DNA (mtDNA) is found inside of mitochondria. It is unlike the DNA inside the nucleus in that all of it comes from our mothers. This is because mtDNA is transmitted through the female egg.  In other words, unlike the DNA inside the nucleus, it is not a mixture of our parent’s DNA, and each person’s mtDNA is nearly identical to his or her mother’s mtDNA. mtDNA contains a small number of genes (37 in all). That’s not very many compared to the number in the nucleus (about 20,000).

A common public use for mtDNA in DNA testing is in determining ancestry.  Because mtDNA does not change as rapidly as nuclear DNA, and because it is not mixed with the father’s (paternal) DNA, it leaves a clearer record of distant ancestry – although only through the mothers’ (maternal ancestry).  Analysis of mtDNA is what allowed scientists to trace the maternal ancestry of all human beings to East Africa and to a time roughly between 100,000 and 200,000 years ago. mtDNA testing can provide some kinds of information about ancestry not always apparent from regular DNA testing.

# The Scenario:

After receiving a tip that a restaurant in New York City was serving whale meat, the police conducted a raid and found containers in the refrigerator. The Marine Mammal Protection Act of 1972 makes it illegal for any person residing in the United States to:

* Kill, hunt, injure or harass all species of marine mammals, regardless of their population status
* Import marine mammals or products made from them into the United States

Possession of the whale meat is a serious crime. For violating the Marine Mammal Protection Act, the restaurant owners could be facing a civil penalty and criminal penalties. If the whale meat came from an endangered species, the penalties are even steeper, including larger fines. The restaurant owners claim the confiscated meat pieces were actually venison. The restaurateurs claim they were deceiving customers by passing off the much less expensive deer meat as whale meat, which people say has a similar flavor. You be the judge!

You are part of the NOAA (National Oceanic and Atmospheric Administration) Law Enforcement

team. Your task is to identify if these samples are, in fact, whale meat. If they are, you will also need to determine the species of whale from which the meat samples came in order to properly prosecute the restaurant owners. To do this, you will take mitochondrial DNA sequences from the suspected whale meat samples and compare them to the known sequences of different whale species using BLAST (Basic Local Alignment Search Tool) from the National Center for Biotechnology Information (NCBI). You will also determine if in fact it is whale meat, if any of the identified species are on the threatened and endangered species list.

Read and follow the directions that are on a separate sheet. Once you have done this complete the table and answer the questions. You may have to use the links to help you with your research.

**Data: -** Complete the following table using the information you complied using the BLAST tool.

**Sources of the Unknown mtDNA Samples**

|  |  |  |
| --- | --- | --- |
| Specimen # | Species Name | Common name |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

**Questions:**

1. Was the unknown meat New Zealand Venison or Whale meat? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Was any of the meat you identified species that are on the threatened and endangered species list? If so, list them.

3. Explain in detail what the civil and criminal penalties are of capturing and using whale meat?

4. Explain in detail what the penalties are of capturing and using a threatened and endangered species?

5. Do you agree that whales should be protecting if so why? If not, why?

# 6. What is mitochondrial DNA, where do you get it and why do they use it?

# Resources

Laws Protecting Whales

https://[www.animallaw.info/article/overview-laws-and-regulations-protecting-whales](http://www.animallaw.info/article/overview-laws-and-regulations-protecting-whales)

Endangered Species Act

<http://www.gc.noaa.gov/documents/gces/6-ESA/esa_1208.pdf>

<http://www.endangeredspecieshandbook.org/legislation_endangered.php>

NOAA Law Enforcement

<http://www.nmfs.noaa.gov/stories/2012/10/10_02_12mmpa_enforcment_story.html>

Case of Whale Meat at a Santa Monica Restaurant

<http://www.latimes.com/local/lanow/la-me-ln-sushi-chef-whale-meat-20150518-story.html>