SN EDUCATOR GUIDE

August 14, 2021

How Muscle Cells Keep Otters Warm

Student Discussion Worksheet

Directions: Answer the first set of questions as directed by your teacher, then read the online *Science News* article "Sea otters stay warm thanks to leaky mitochondria in their muscles." Answer the second set of questions on your own and then work with a partner to answer the third set of questions. A version of the story, "How muscles keep otters warm," appears in the August 14, 2021 issue of *Science News*.

Defining a cell's powerhouse

1. List some of the main components, or organelles, found in many animal cells.

2. Which organelle is in charge of energy production? Describe it.

3. How does that organelle produce energy? What type of energy is produced and how is that energy used?

How sea otters do energy differently

1. Explain how mitochondria in the sea otters that scientists studied help keep the animals warm.

2. Draw a simple diagram of a sea otter's mitochondrion to visualize how the organelle generates heat as described by the *Science News* article. Then, draw a second diagram of a mitochondrion that belongs to a different species of marine mammal. This mitochondrion should not leak protons across its inner membrane. Use arrows to show the movement of heat energy in each diagram.

3. Building on the diagrams you created, draw the body of a sea otter and the body of a larger marine mammal, such as a seal or a whale, around the appropriate mitochondrion. (Note: this drawing will not be to scale.) For the sea otter, draw and label at least one additional adaptation that the animal relies on to stay warm in cold ocean environments. For the other animal of your choice, draw and label an adaptation that the animal may use to keep warm, assuming that this animal does not have leaky mitochondria like sea otters do. Use arrows to represent the flow of heat energy from the animal to the ocean water. Explain your diagrams in the space below.

4. Name an alternative adaptation that might have helped sea otters stay warm in cold water. Had the adaptation occurred, how might it have affected sea otters' bodies and behavior?

What comes next?

1. What are some questions the scientists in the article have about the outcomes of the study?

2. What is a question you have about the study and/or its implications?

3. Brainstorm a research question that would help answer your questions or those of the scientists.