

Dive Like a Dolphin



Objective

Students make predictions, then plan and conduct an investigation. They discuss whether their evidence is consistent with a proposed explanation and communicate the steps and results from their investigation.

Materials

- Stopwatches or watches with a second hand
- Pens or pencils

Background

Hemoglobin is a protein molecule in blood. It transports oxygen from the lungs throughout the body. Myoglobin is a similar protein molecule in muscles. Myoglobin stores oxygen. When you exercise vigorously, your heart pumps blood very fast, and you breathe rapidly to increase your intake of oxygen. But at some point, you may not be able to transport oxygen fast enough to meet the needs of your muscles. When blood isn't bringing sufficient oxygen to the muscles, myoglobin molecules release oxygen. The muscles of diving mammals—such as whales, dolphins, and seals—have much higher concentrations of myoglobin than our muscles do. Why? This “emergency supply” of oxygen is an adaptation for breath-holding and deep diving. It allows these mammals to remain under water for long periods.

Action

1. Ask students to predict how long they would be able to flex their index finger repeatedly before they could no longer make it move.
2. Working in groups, students plan and conduct investigations to test their predictions. (If they need help, guide students to record their methods and their data, and to perform multiple trials.)
3. Read the BACKGROUND information (above) aloud (or make copies for students to read). Discuss the role of oxygen, hemoglobin, and myoglobin. Explain that muscles need oxygen to work.
4. Use these questions to guide a discussion with your students:
 - How long (minutes and seconds) could students flex their fingers?
 - Why did their fingers stop “working”?
 - What can they infer about myoglobin in their fingers? Is their data consistent with this explanation?
 - Why do marine mammals require more myoglobin than humans do?
 - Humans have one muscle that has an extremely high level of myoglobin.
 - Can they guess which muscle it is? (the heart) How does a high myoglobin level in the heart adapt us for survival? (The heart can work even when blood oxygen levels are low.)
5. Students prepare a written report of their methods, data, and conclusions.