

## The Science of an Extreme Animal Athlete

### INTRODUCTION

This worksheet explores concepts shown in the Scientists at Work video [The Science of an Extreme Athlete](#). The video investigates adaptations that allow deer mice living at high elevations to stay warm and active during the winter.

Through watching the video and completing this worksheet, you'll learn how two different populations of mice survive in their respective environments: one on top of a mountain and the other close to sea level. You will also apply your knowledge of the body functions and adaptations in other species. The topics in this worksheet relate to all mammals, not just mice. You will be able to apply what you learn to your own eating and physical activity habits, including how to use certain types of foods to help you meet any goals.

### PROCEDURE

Answer the following questions based on the information provided and what you learned from the video. You may want to use the video's transcript as a reference.

- The video discusses how a deer mouse's diet helps it survive. Like mice, humans also eat diets that contain carbohydrates (sugars) and fats.
  - Carbohydrates, also called "carbs," include sugars, starches, and fibers. Give an example of a food with carbohydrates (for example, your favorite carbohydrate to eat if you have one).
  - The "fats" mentioned in the video are examples of **lipids**: a group of molecules that includes fats, waxes, steroid hormones, and oils. Give an example of a food with lipids (for example, your favorite lipid to eat if you have one).
- The video focuses on highland deer mice. If the scientists wanted to learn more about highland deer mice, why were they also collecting data from lowland deer mice?
- Identify the major differences between highland and lowland deer mice by filling out the following table:

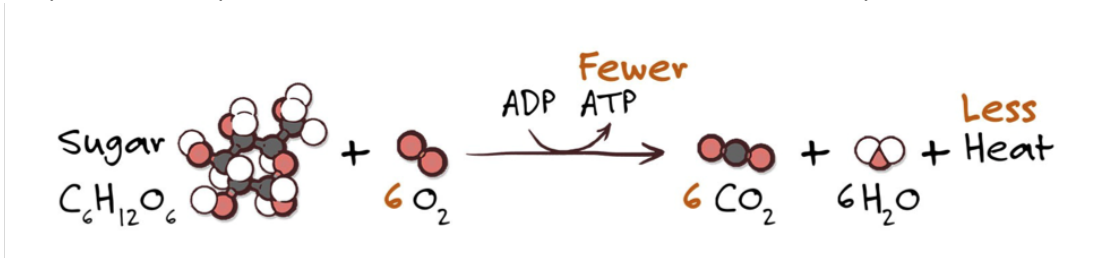
	Highland Deer Mice	Lowland Deer Mice
<b>Environment</b> (Describe characteristics of the places where each population lives.)		
<b>Energy supply</b> (What type of "metabolic fuel" do they use more or less of?)		

<b>Appearance</b> (What do they look like in the film?)		
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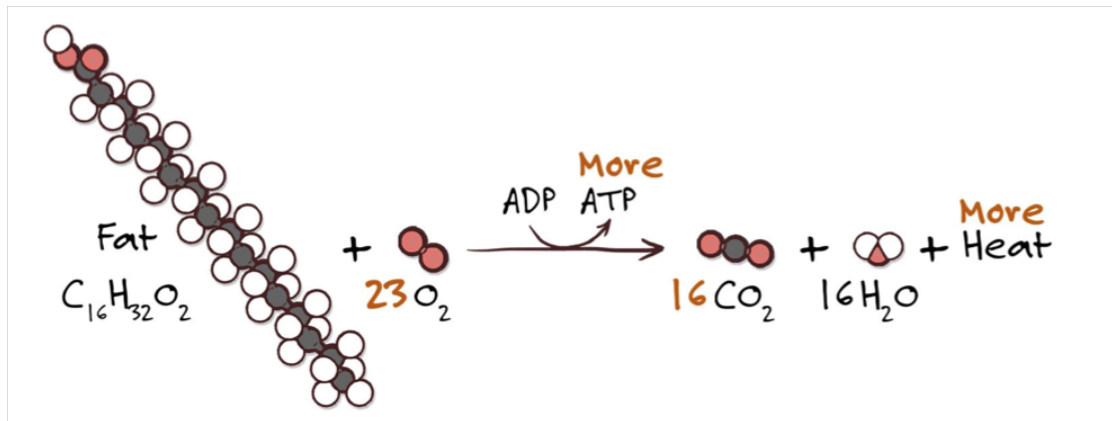
4. Identify the major differences between carbohydrates and fats by filling out the following table:

	Carbohydrates/Sugars	Fats
<b>Activities that muscles use it for</b> (Describe one or two activities in each box to the right.)		
<b>How long it takes to convert to usable energy</b> (Write either "quickly" or "longer" in each box to the right.)		
<b>How much usable energy is contained in 1 gram</b> (Write either "more" or "less" in each box to the right.)		

Figures 1 and 2 show two processes that use food molecules to produce **ATP**, a molecule that cells can use for energy. Both processes are part of **metabolism**: the chemical reactions in the body that maintain life.



**Figure 1.** The process by which sugar and oxygen are used to produce ATP.



**Figure 2.** The process by which fat and oxygen are used to produce ATP.

5. Use Figures 1 and 2 to answer the following:

a. Compare the processes in each figure by filling out the following table:

	Figure 1	Figure 2
<b>Type of food molecule used</b>		
<b>Oxygen molecules (O<sub>2</sub>) used</b> <i>(Write a specific number in each box to the right.)</i>		
<b>Usable energy (ATP) produced</b> <i>(Write either "more" or "less" in each box to the right.)</i>		
<b>Heat produced</b> <i>(Write either "more" or "less" in each box to the right.)</i>		

- b. What does a mammal's body do with the extra CO<sub>2</sub> produced by these processes? (Think about what happens to the CO<sub>2</sub> produced by your own body.)
  
- c. Evaluate this statement: "Burning carbohydrates requires a lot more oxygen than burning fats." Based on the figures, explain why this statement may or may not be true.
  
- d. Which product(s) of the process in Figures 1 and 2 do you think highland deer mice need to survive in their high-elevation environment? Explain your reasoning.
  
6. If sugars can be used to produce ATP more quickly than fats can, why do the highland deer mice use more fats?
  
7. Which of the following would a ratio of CO<sub>2</sub> to O<sub>2</sub> equal to 0.83 most likely indicate about a mouse's metabolism? (You may want to refer back to the video.)
  - a. It was using mostly carbohydrates.
  - b. It was using mostly fats.
  - c. It was using a mixture of fats and carbohydrates.
  - d. It wasn't using fats or carbohydrates.