

# STUDENT GUIDE

## EVALUATE LESSON 31



### Part 1: Our Motivation

Record what we were trying to explain about the Anchor Phenomenon.

We are going to revisit our Anchor presentation to determine what new scientific information we can communicate to the audience about how milk helps with recovery from exercise, including the new information that we have figured out how milk nutrients are available to help the body recover from muscle soreness after exercise.



### Part 2: Communicating Scientific Ideas

Create a presentation with your group that communicates the answer to our Driving Question, ***How can milk help athletes recover from physical exercise?*** to an audience of your choosing. Here, you should add the new content from Module 4 to the presentation you created in Lesson 24.

Presentation Format Requirements:

- Videos cannot exceed 5 minutes.
- Written reports cannot exceed 4 pages.
- Presentation is designed for the same chosen audience and with the same format you selected in Modules 1-3.
- Prepare a script of your presentation before adding multiple media formats.

Presentation Development Steps:

- Develop a script/outline.
- Have the teacher review your script/outline.
- Develop your presentation.
  - If doing a written presentation, create the formal writing product.
  - If doing a video presentation, rehearse and record the video product.
- Receive peer feedback on your presentation.
- (Optional - can be done here or in the final Performance Task) Revise your presentation based on peer feedback.

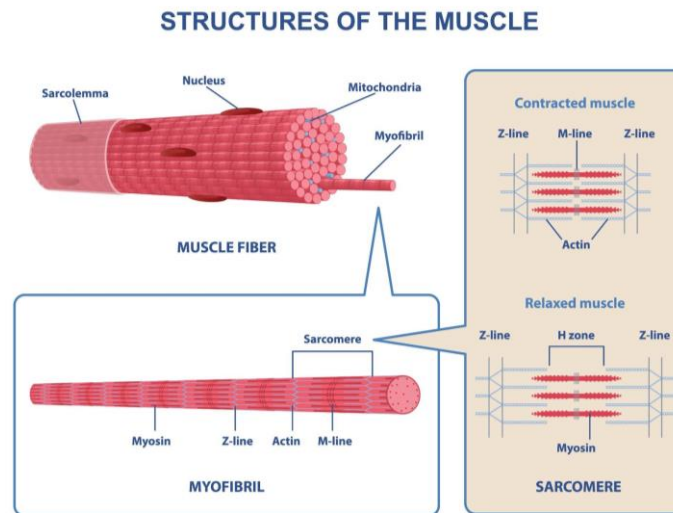


Be sure to use the Look Fors provided below to guide your presentation. Mark each Look For after you include it.

Included	Look Fors
	<p>Include multiple methods of communication, including models and evidence from the module (video plus graphics/diagrams, written report plus graphics/diagrams, or video with narration of a slideshow).</p> <ul style="list-style-type: none"> <li>You can use the class consensus model, data sets, and/or models from any other resources from the module.</li> </ul>
	<p>Clearly communicate scientific information in a way that is appropriate for your chosen audience.</p>
	<p>Describe how exercise can destabilize muscle structure and function in the body and how negative feedback mechanisms in the body and the consumption of milk can help the body return muscle structure and function to its stable state.</p>
	<p>Describe how the functions of multiple kinds of specialized cells contribute to muscle structure and function and to exercise recovery.</p>
	<p>Describe how much of the study of the human body involves tracking how various molecular factors in the body change or remain stable.</p>

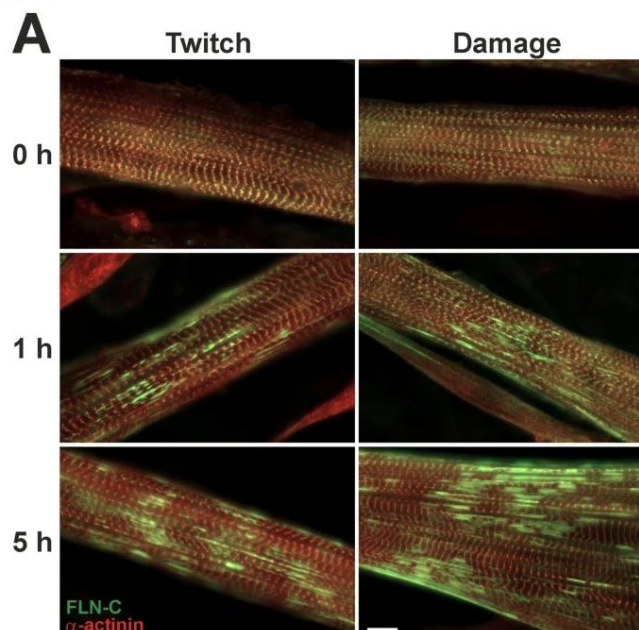
In the space below, prepare your presentation script or written report.

So, why do athletes have sore muscles after they work out, and how do the muscles repair themselves? First, you probably need to understand that the muscles are composed of cell structures called myofibers. Take a look at the myofibers on the diagram below.

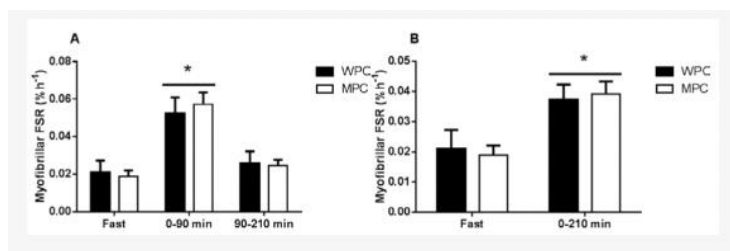


The molecular structure of the myofibers and the filaments within the myofiber help the muscle fiber function. For example, when a muscle contracts, its myofibers slide past each other in a coordinated manner; conversely, when the muscle relaxes, these myofibers slide past each other in the opposite direction. When muscles contract and relax during exercise, they undergo tiny microtears in their structure. These microtears are responsible for the feeling of muscle soreness. Take a look at this data from Lesson 26, that shows microtears in the muscle.

Figure 1



So you're probably thinking, how exactly do these tears get repaired? After exercise, the body responds to exercise-induced damage to muscle fibers by increasing a process called protein synthesis in the muscle cells. You can see this graph from Lesson 27 shows protein synthesis happening. The studies showed that drinking protein drinks (at least for healthy people) increases the rate of protein synthesis above rest. They both showed that protein synthesis remains increased for at least 210 minutes after in one and 28 hours in the other.



This process of protein synthesis is also how milk helps you recover from soreness. The microtears damage the muscle fibers, and the muscle fibers undergo protein synthesis to be repaired. Proteins in milk are broken down into amino acids during digestion, and they enter the bloodstream where they are transported to the myocytes. The myocytes use these amino acids in protein synthesis to make new muscle fibers and recover from the damage they had.

The body also increases the amount of a type of cell called a satellite cell at the site of the muscle fiber injury. This is part of stabilizing the muscle structure which will help the body recover from the damage done to the muscle cells.

So the body has a number of negative feedback responses to help it recover from the microtears in muscle fibers that happen during exercise. Basically immune cells move to the site of the muscle microtears and immune cells help clear away damaged cells and reconstruct new muscle fiber cells. Satellite cells in the muscle fibers are also activated; these cells undergo cell division to differentiate into new muscle fiber cells. Finally, the muscle cells themselves increase their rate of protein synthesis, which helps rebuild proteins in the muscle fiber cells. All of these responses help the myocytes regain a state of stability after they are damaged.

Now this is the important part for you to know, when muscles recover from exercise, they also become larger and stronger in the process. This happens through the release of several molecules called growth factors that send growth signals to the muscle cells. The process of the body increasing its strength in response to exercise is known as adaptation because the body adapts to the stress placed on it. The body also has several additional adaptations to exercise, such as increased lung capacity, cardiac output, and capillary density.

So basically, to wrap it up and make it all connect, as athletes move, their muscles contract and experience microtears. These microtears cause muscles to feel sore and we know that specialized cells, called satellite cells, go in and repair microtears. The other important part is the proteins! The proteins in milk break down into amino acids, which are crucial for repairing skeletal muscle microtears to aid in exercise recovery.



### Part 3: Sharing Presentation Drafts and Receiving Feedback on Our Presentations

As part of the process of preparing your presentation, you will work with another group to rehearse your presentations, then get feedback from your peers and give them feedback.

Pair with another group, then decide which group will rehearse first. After each group finishes their presentation, have a discussion about your observations. Use reasoning and evidence to support your ideas.

#### When the other group presents:

Respectfully provide feedback to your peers on their presentation. Use the “Peer Feedback Form” handout to document your feedback.

#### When your group presents:

Listen to the other group’s feedback on your presentation and thank them for their suggestions. Be open to receiving critiques on your presentation. Then, as a group:

- Consider each item of feedback from your peers.
- Discuss the suggestions you want to incorporate in your presentation and explain why/why not. Use reasoning and evidence as you talk through ideas.
- (Optional - can be done here or in the final Performance Task) Make any revisions to your script or written report as agreed upon through group consensus.

Use the space below to record your group’s discussion.

Suggested Improvement or Additional Science Ideas/Evidence	Reasoning for Incorporating/Not Incorporating