# **STUDENT GUIDE** EXPLAIN LESSON 29



#### Part 1: Our Motivation

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Record what we are now trying to explain about the module phenomenon.

We have figured out that there are a lot of changes that happen to the body to help it recover from muscle soreness after exercise, so we will try to explain how this process happens.

### Part 2: Developing an Explanation of Recovery from Muscle Soreness

Using all the evidence gathered throughout this module, construct an explanation of the Module Question, *How does milk help in muscle recovery from soreness induced by intense exercise*? In your explanation, be sure to describe:

- The role of muscle cells in muscle movement and what happens to muscles and muscle cells when they get sore from exercise.
- How a feedback response involving organs, specialized cells, and signals helps muscles recover from soreness after exercise.
- How protein in milk can help in the process of recovery from soreness after exercise.
- Cite at least two pieces of evidence from data sets and/or the Science Theater model used in this module.

When someone does intense exercise, muscles get sore due to microtears occurring in the muscle. This happens when a muscle lifts a weight, for example. The muscle fibers contract after they get a signal from the nervous system and the brain. The muscle fibers experience small tears in them called microtears, which make the muscle fibers damaged. We saw evidence of this when we saw in the research study by R M Crameri 2007 that under a microscope, the muscle fibers looked highly structured and organized before exercise, then, after exercise, their structure was really changed and distorted.

The body has a number of feedback responses it takes to help the body recover from the microtears in muscle fibers and to make the soreness go away. Immune cells move through the bloodstream to the site of the muscle microtears. Immune cells help clear away damaged cells and reconstruct new muscle fiber cells. Satellite cells in the muscle fibers are also activated; these cells move into the area of the damaged muscle cells and undergo cell division to differentiate into new muscle fiber cells. We have evidence of this from the research study Masschelein 2020 where scientists observed that the green-stained satellite cells would move into the area with the damaged muscle cells. Finally, the muscle cells themselves increase their rate of protein synthesis, which uses the amino acids in the bloodstream (from the digestion of proteins in milk) to help rebuild muscle

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proteins such as the actin and myosin proteins in the muscle fiber cells. We saw that in the Cameron J, 2015 study the amount of muscle protein synthesis went from 0.02 %/hr to above 0.05%/hr after drinking a protein recovery drink after exercise.

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### Part 3: Revising the Effects of Exercise and Recovery Models

We will update the class Effects of Exercise and Recovery Models. List 2-3 additions you would make to the class model in the space below. These may be:

- Organs and their function
- Specialized cells and their function
- Signals or molecules and where they move
- Add the immune cells and how they move to the muscle cells to help remove damaged cells.
- · Add the satellite cells and how they move to the damaged muscle cells to help replace them.
- Add the myofibers and how they experience microtears during exercise, which leads to soreness.

## Part 4: Asking New Questions

Record any new questions that you have that might help you:

- Find additional information about why our muscles get sore after exercise and how dairy can help them recover.
- "Fill in a gap" in your explanation or our class consensus explanation.
- Settle an area of disagreement that we've identified in our explanations.
- We are still curious how some people "build" muscle from exercising.
- Why are proteins important to muscle growth?
- How do we get stronger from exercise rather than just build the muscle cells back as they were before?