

Unit Essential Question

How do body systems interact with each other to communicate and collaborate?

Introduction

After playing a game of soccer, we breathe a little bit harder, our heart beats a little bit faster, our muscles are a little bit more sore, and we may be a little bit hungrier than normal. When we do any activity, whether it's soccer, playing an instrument, or reading, the cells and tissues and organs in our body work together in what we call a body system. When we play soccer, our cells need more energy, so we need more food (sugar) and oxygen (both of which go to our mitochondria). Thus, we need to breathe more to get the oxygen and our heart needs to beat faster to get the oxygen to all the cells. In the end, we use more food to make energy, so we will be hungrier. All the parts of our body work together to allow us to play soccer or do any activity. The body systems work together so that we can do the many things we need to do to survive.

Objectives

Students will be able to

Content

- Diagram the human body as a system of multiple interacting subsystems.

Science and Engineering Practices

- Explain why exercise affects body systems.

Equity and Groupwork

- Share their expertise about a body system with others.

Language

- Summarize information from short readings.

Assessment

1. Have students independently complete the Learning Task 3 section of the Individual Project Organizer as homework or in class, depending on students' needs and/or class scheduling.
2. Collect Individual Project Organizers and assess them using these criteria:
 - "Carrying Out Investigations" row of the Science and Engineering Practices Rubric
 - "Developing and Using Models" row of the Science and Engineering Practices Rubric
 - "Engaging in Arguments from Evidence" row of the Science and Engineering Practices Rubric
3. Return the Individual Project Organizers, and give students time to make revisions. ELLs may need additional time.

Academic Vocabulary

- artery
- body system
- circulatory system
- digestive system
- large intestine
- nervous system
- respiratory system
- small intestine
- vein

Language of Instruction

- rate



LANGUAGE SUPPORT STRATEGIES

Add the new vocabulary terms to the poster currently displayed in the classroom.

Timing

This task can be completed in 5 class periods (based on 45-minute periods).

- Part I • Effects of Exercise on the Body (1 class period)
- Part II • Body Systems Parts and Functions (1.5 class periods)
- Part III • Collaboration of Body Systems Poster (1.5 class periods)
- Part IV • Connect to the Culminating Project and Assessment (1 class period)

Student Materials

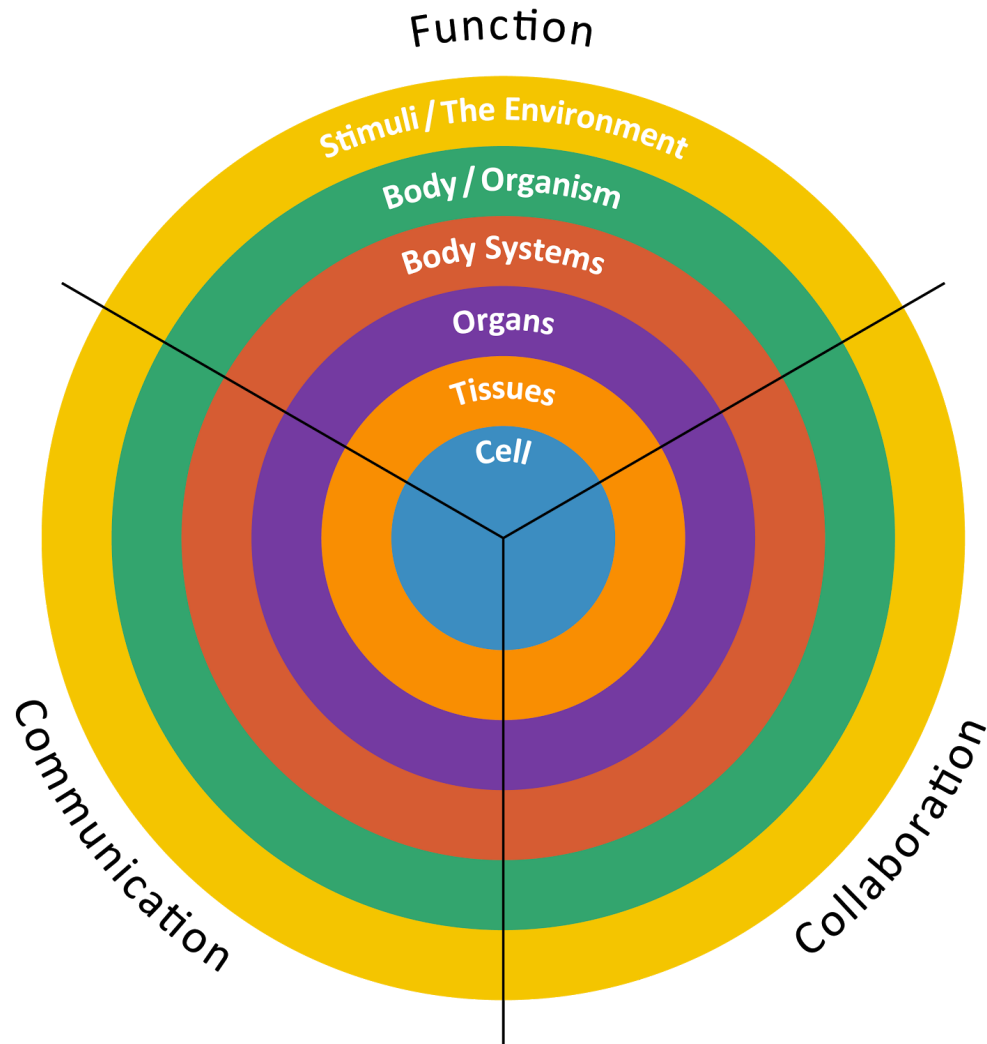
- Timer
- Body Systems Resource Cards found at the end of Task 3 (1 model card for each group, and 1 card per station)
- Poster paper
- Colored markers or pencils
- Sticky notes

Preparation of Body Systems Resource Cards

1. Print one model card of your choice (from the Body Systems Resource Cards) to model the activity.
2. Then print a complete set of cards and place one at each station.

Background Knowledge

This diagram shows the levels of organization in organisms within the context of our themes of function, communication, and collaboration.



Part I • Effects of Exercise on the Body

1. Read the questions with students. Then ask them to make predictions to the research question based on their own experience and explain why in the spaces provided in their Student Edition.
2. Ask students if they know what *rate* means.
 - Discuss the concept of *rate*.
 - Explain that rate is the number of times something happens over a period of time. $\frac{\text{beats}}{\text{minute}}$.
 - For example, heart rate is the number of beats per minute. It is sometimes written $\frac{\text{beats}}{\text{minute}}$.
 - Optional: Ask students about their favorite style of music from home, community or personally. Have them name the style and share if the beats per minute in a song are a fast, slow, or steady tempo.
3. Ask some prior knowledge questions about heart rate and breathing rate.
 - Ask students whether they know what body systems are involved in heart rate and breathing rate.
 - Ask whether they know which organs are involved in heart rate and breathing rate.
 - Ask whether they know how to monitor their heart rate and breathing rate.
4. Teach students how to find their heart rate in beats per minute.
 - Use two to three fingers but do not use the thumb. The thumb has a pulse of its own.
 - Find the radial artery in the wrist or the carotid artery in the neck.
 - The most accurate way to find heart rate is to count heart beats for 1 minute. However, 30 sec \times 2, 20 sec \times 3, 15 sec \times 4, 10 sec \times 6, or 6 sec \times 10 will also work.
5. Teach students how to find their breathing rate in breaths per minute.
 - Count your breaths.
 - The most accurate way to find breathing rate is to count breaths for 1 minute. However, 30 sec \times 2, 20 sec \times 3, 15 sec \times 4, 10 sec \times 6, or 6 sec \times 10 will also work.
6. Have each student take their resting data (heart rate and breathing rate) before they exercise. They should fill in the first row in the table to show the rates of each group member.
7. Explain how to calculate averages of heart rate and breathing rate for the group. Have students fill in the rows for “Average Group Resting Heart Rate” and “Average Group Resting Breathing Rate.”
8. Ask students to choose a type of exercise.
 - This is a good time to talk about standard factors (everyone in the group does the same thing so that the data is comparable).
 - Students can choose the exercise and the amount of time or the number of repetitions. Everyone in each group should do the same exercise for the same amount of time or number of repetitions.
 - Possible exercises include jumping jacks, squat jumps, and running line to line in a basketball court.
 - If the exercise is outside, make sure to bring out a timer, pencils, and paper to record data.



LANGUAGE SUPPORT STRATEGIES

Model the exercise (student or teacher) with proper form for safety and standardization. Explain the movement as it is performed (e.g., some ELLs will be unfamiliar with a term like “jumping jack” and will need to see it in action).

9. Have the groups perform their chosen exercise. Immediately after exercising, each student should again check their heart rate and breathing rate and record these numbers in the table.



NOTE

Students may figure out that they have to do the exercise twice to get more accurate heart and breathing rates right after exercising.

10. Ask students to return to their seats and calculate the group averages for heart rate and breathing rate.
11. Have the groups discuss the data analysis questions in the Student Edition. They should record their ideas in their science notebook.



LANGUAGE SUPPORT STRATEGIES

Offer Emerging ELLs the following sentence frames for Question 5:

- Some of the ways exercise affects my body is ____.
- My heart rate and breathing rate ____.
- I think exercise affects the heart rate and breathing rate because ____.

12. Debrief the exercise data and data analysis questions.
 - The first question can provide you with an opportunity to help students see patterns and explain the patterns they notice.
 - The second question is a “What do you think?” question, so there is no right answer. This question is designed to bring out students’ prior knowledge. In the next part, students will analyze body system parts and functions and will be asked the same question. Therefore, if students mention the circulatory and respiratory systems, do not spend a lot of time reviewing how these systems work at this point.

Part II • Body Systems Parts and Functions

1. Use the Body Systems Resource Cards to set up a jigsaw activity in which each group member will become an “expert” on one body system and then report back to the group.
2. There are five resource cards, each showing a different body system. At this point, explain to students that a body system is a group of organs that work together to perform an important function of the body. Use one resource card to model how students should conduct the activity. Then create four stations, placing one of the remaining four resource cards at each station.
 - Set up the stations so that generally there are no more than four students at a resource card station.
 - Set up the stations to accommodate the number of groups in your class. For example, if there are eight groups in a class, then have two stations for each body system and limit the number of students at each station to four.
3. Use the model resource card to show how students should gather information at their station, record the information in the Body Systems Data Table, and then share out to their group. Encourage student discussion at the resource card stations and back at the group share out. It is important to model the technique of verbally explaining the information to group members versus the technique of putting the Data Table in the middle of the table and letting the group members copy the information.
4. Have each student move to one station to gather data. Put a time limit on this portion of the task. Encourage discussion at each station.
5. Tell students to go back to their group to share their information. Encourage student discussion versus silent copying.
6. Have students discuss the “questions” in steps 3 and 4 in the Student Edition and record their answers in their science notebook.
7. Debrief the activity and the discussion questions.

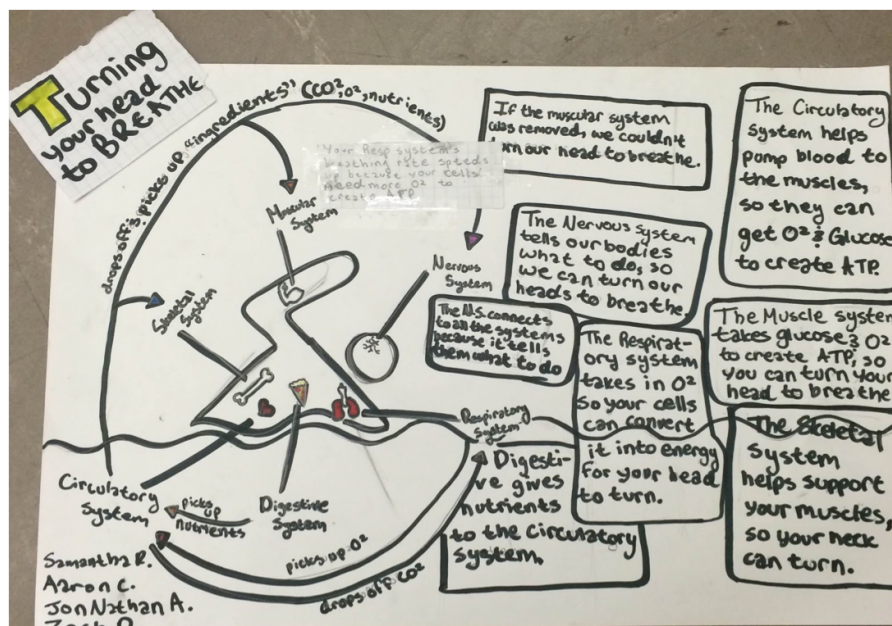
Part III • Collaboration of Body Systems Poster

1. In this part, students will apply their knowledge about body systems to an activity different from their Activity Brochure.
2. On the board, write some possible activities that students could choose from (feel free to add to this list):
 - Washing dishes
 - Bodysurfing
 - Playing a tuba in a parade
 - Cooking
 - Dancing
 - Mowing the lawn
 - Vacuuming
 - Washing a car
 - Playing soccer
 - Participating in a hot dog eating contest

Options: Students may choose the activity out of a hat or simply choose from the list recorded on the board.

3. Supply students with different colored markers or pencils. Have students create a poster representing how body systems collaborate to perform the activity that they chose. Tell students to use different colors for different systems.
4. Have students share their posters with the class using a presentation format or a gallery walk, with students providing feedback on sticky notes.

Sample poster:



Part IV • Connect to the Culminating Project and Assessment

1. Have students independently complete the Task 3 section of the Individual Project Organizer as homework or in class, depending on students' needs and/or class scheduling.
2. Collect the Individual Project Organizers and assess them using these criteria:
 - The "Carrying Out Investigations" row of the Science and Engineering Practices Rubric
 - The "Developing and Using Models" row of the Science and Engineering Practices Rubric
 - The "Engaging in Arguments from Evidence" row of the Science and Engineering Practices Rubric
 - A criterion of your choice
3. Return the Individual Project Organizer and give students time to make revisions.

Body Systems Web Resources

Body Systems

- At this site students can pick a system and click through all the organs at their own pace.
<http://www.innerbody.com/>

Digestive System

- This movie might be for a slightly younger audience, but it's kind of fun—same idea as Magic School Bus.
<http://kidshealth.org/kid/htbw/DSmovie.html>
- This is a more advanced animation, also includes interactive bit where you can click on the organs to learn more.
http://highered.mheducation.com/sites/0072495855/student_view0/chapter26/animation_organs_of_digestion.html
- Kind of fun interactive that lets kids click on each organ to learn facts about it
<http://www.childrensuniversity.manchester.ac.uk/interactives/science/bodyandmedicine/digestivesystem/>
- Another interactive where you can feed a body different foods and click through the steps of digestion
<http://kitses.com/animation/swfs/digestion.swf>

Respiratory System

- Cartoon interactive that lets you select each organ to see it in action
<http://www.e-learningforkids.org/health/lesson/respiratory-system/>
- Video of the respiratory and circulatory system
<http://schoolmediainteractive.com/view/object/clip/1D6530372B1463F3BBACEAAD4729C1EE>

Circulatory System

- Same as the silly digestive video but with circulatory system
<http://kidshealth.org/kid/htbw/CSmovie.html>
- Basic Video
<http://www.neok12.com/video/Circulatory-System/zX5d7d0e41705968036a4351.htm>
- 3D movie
<http://www.sciencekids.co.nz/videos/humanbody/circulatorysystem.html>
- Nice simple animation of blood flow
<http://www.kscience.co.uk/animations/heart.swf>
- Simple animation of heart blood flow
<http://www.pbs.org/wgbh/nova/body/map-human-heart.html>
- Map of the human heart step through
<http://www.pbs.org/wgbh/nova/body/map-human-heart.html>

Nervous System

- General overview for kids (video)
<https://www.youtube.com/watch?v=sjyl4CmBOA0>
- Video
<https://youtu.be/sjyl4CmBOA0>