

Topic: Heart Rate and Body Movement

Teacher Information

Time Allowance

50 min.

Background

The heart is the pump that moves blood through the body. The tightening and relaxing of the heart muscle is called a heartbeat. The heart pumps red blood cells out one valve. They circulate throughout the body and return to the heart through another valve. Red blood cells may make that round-trip journey through the body more than a thousand times a day every day.

The flow of blood in the body is directly influenced by gravity. When standing, gravity helps to pull the blood downward to the lower part of the body. As a person moves, muscles in the legs help send the blood back up to the heart and lungs. Without gravity, blood tends to collect around the heart and in the upper part of the body.

Materials

Stopwatch or Watch/Clock with second hand

Paper

Pen or Pencil

Carpet square, small pillow or access to carpeted area where students can do a headstand

Preparation

1. Talk about the heart's function and why it cannot stop and rest like other muscles.
2. Go over the background information on the student sheets. Relate the heart beat to how much blood is being moved through the body.
3. Divide the class into groups of 3 and explain the procedure. Allow the students time to learn how to take someone else's pulse.
4. Pass out materials.
5. If necessary explain what a hypothesis is and why scientists use them.
6. After completing the lab clean up and discuss the results.
7. Discuss whether the results supported or disproved the students' hypotheses.
Tell them scientist often make educated predictions that turn out to be wrong.

Extensions:

- Collect individual data and make a class chart that averages the data for each of the four body positions/movement.
- Lesson 3 from this article is a related activity that discusses the heart's reaction to microgravity by inverting the student's body (they lay down so their head is below their feet).

Heart Rate and Body Movement

Student Worksheet

Read the following:

Your heart is the pump that moves blood through your body. The tightening and relaxing of the heart muscle is called a heartbeat. The heart pumps red blood cells out one valve. They circulate throughout the body and return to the heart through another valve. Red blood cells may make that round-trip journey through your body more than a thousand times a day every day of your life!



The flow of blood in the body is directly influenced by gravity. When you're standing, gravity helps to pull the blood downward to the lower part of the body. As you move, muscles in your legs help send the blood back up to the heart and lungs. Without gravity, blood tends to collect around the heart and in the upper part of the body.

The amount of blood pushed through the heart by each heartbeat is called the stroke volume. Although stroke volume increases with activity, it usually remains relatively stable. For this experiment, we'll assume stroke volume is constant at about 75 milliliters per beat.

Cardiac output is the amount of blood pumped by the heart in a unit of time. Different conditions affect cardiac output on Earth and in space. Since cardiac output changes it is called a variable.

$$\text{Cardiac Output} = \text{stroke volume} \times \text{heart rate}$$

(ml/min) (ml/beat) (beats/min)

On Earth, do you think changes in body position or increases in movement can affect cardiac output?

Develop a one-sentence hypothesis that answers the following question:

Do you think changes in body position or increases in movement can affect cardiac output?

Heart Rate and Body Movement

Procedure

Record the name of all members of the team here: _____.

Repeat the following procedures for each member of your team.

1. Ask your partner to sit in a chair for 2 minutes.
2. Using your index and middle finger, find your partner's pulse by applying light pressure to the wrist to measure heartbeat. Ask your teacher for help if you cannot find the pulse.
3. For 30 seconds, count the number of heartbeats you feel and record the number in the chart below.
4. Multiply the number by two to calculate the pulse rate for a minute. Record the number in the chart below.
5. Ask your partner to stand for 1 minute, then remain standing as you take their pulse again, for 30 seconds.
6. Multiply this number by 2, and record the result in the chart below.
7. Ask your partner to sit for 2 minutes as their pulse returns to a sitting rate.
8. Your partner should now do a headstand against the wall (with teacher holding their legs for support) for 30 seconds, then remain in a this while you count the number of heartbeats. Record the number in the chart below.
9. Ask your partner to return to a sitting position and remain seated for 2 minutes.
10. Next your partner should jog in place for 30 seconds then remain standing for an additional 30 seconds while you take their pulse. Multiply this number by 2, and record the result in the chart below.
11. Calculate the averages for each position.

Name	Sitting	Standing	Inverted	Jogging
Average				

Heart Rate and Body Movement

Worksheet (Math Extension)

Complete the following calculations:

How many times does your heart beat:

In an hour?

beats per minute X 60 minutes = beats per hour

In a day?

beats per hour X 24 hours = beats per day

In an average month (30 days)?

In an average year (365 days)?

Bonus

How many times has your heart beat since you were born?

How many times do you expect your heart to beat in your lifetime (average age of death is about 76.7 years)?