Skills: Math, Science, Health, Language Arts, Music

Objective: Students will measure their heart rates at rest and after physical activity.

Background

The heart is a muscle about the size of your fist. It is a pump that delivers oxygen, through the blood, to the tissues. It beats, without stopping, for an entire lifetime. In an adult, each heartbeat pumps about 55-80 milliliters (ml) (1/3 cup) of blood. The average child’s heart pumps around 25-85 ml per beat. The average adult heart pumps about 6,000-7,500 liters (1,500-2,000 gallons) of blood each day day, although that amounts to only about 5 quarts continuously circulated.

During each heartbeat, the muscles of the heart contract, causing a wave of pressure which forces blood through the arteries. This wave of pressure is known as a pulse. There is one pulsation for each heartbeat. The pulse can be felt at various points on the body where the arteries are just under the skin—the temples, neck, crook of the elbow, wrist, groin, back of the knee, and the inside back of the ankle. The normal pulse rate varies with age.

The best place to feel your blood pulse is at the carotid artery and the radial artery. To find the carotid artery, place your index and middle finger just below the angle of the jaw. To find the radial artery, place your finger on your thumb, slide it up, just above your wrist and gently press.

When you are at rest, about 5 liters of blood per minute flow through your heart. When you exercise, your body needs more oxygen, causing about 20 liters of blood per minute flow through the heart. The heart can beat up to 200 times per minute with extreme exercise. The brain sends nerve signals to the heart to control the rate. The body also produces chemical hormones, such as adrenaline, which can change the heart rate. When we are excited, scared, or anxious, our heart gets a signal to beat faster. During a fever, the heart beats faster to bring more blood to the surface of the body to release heat and cool the body. The heart rate increases during and after a meal to send more blood to the digestive system.

A trained athlete's heart can pump more blood with each beat so his or her heart rate is slower. Likewise, an athlete's recovery time is shorter.

There are two ways the heart can meet the body's need for oxygen during exercise. It can beat faster or it can beat harder, moving more blood per pump. But it can only beat harder if it has been strengthened through regular exercise.

Doctors use an instrument called a “stethoscope” to listen more closely to

http://www.agclassroom.org/ok
your heart. The stethoscope was invented in 1816 when a young French physician named Rene Theophile Hyacinthe Laennec was examining a young female patient. Laennec was embarrassed to place his ear to her chest, which was a method used by physicians at that time. He remembered a trick he learned as a child, that sound travels through solids, so he rolled up 24 sheets of paper, placed one end to his ear and the other end to the woman’s chest. He was delighted to discover that the sounds were not only conveyed through the paper, but they were also louder and clearer.

Laennec preferred to have his instrument simply called "Le Cylindre," as he thought naming such a fundamental instrument was unnecessary. He disliked all the names it was being given by his colleagues and decided that if it should be called anything, it should be "stethoscope," from the Greek words for “I see” (scope) and “the chest” (steth).

Laennec then took his idea further. He set up a small shop in his home, with a wood-turning lathe and many different materials. He created a stethoscope from a turned piece of wood that was hollow in the center. It was made of two pieces. One end had a hole to place against the ear, and the other was hollowed out into a cone. There was a third piece that fit into this cone which had a hollow brass cylinder placed inside it. This piece was placed in the stethoscope to listen to the heart, and removed to examine the lungs.

**Language Arts**

1. Read and discuss background.
2. Brainstorm all the ways we use the word “heart” (heart-throb, heart-break, heartless, heart-to-heart, heartsick, heart-rending, take to heart, know by heart, hearty, heartfelt). Discuss the meanings of all these expressions.

**Health**

1. Help students locate their pulse points on their wrists and their necks, using the information found in the background.
2. Hand out the cardboard tubes, and have students pair up and listen for their partners’ heartbeats.
   — Place the tube over the partner’s heart.
   — Count the number of beats per 30 seconds.
   — Double this number to find out how many times each minute the person’s heart beats.
   — Have one partner run in place for one minute, then listen again.
   — Students will write down what they hear and calculate the new beats per minute.
   — Subtract the first number from the second number to determine how many more beats per minute the heart beats after exercise.
   — Have the partners switch and repeat the process.
   — Have students try a variety of activities—walking all the way around the playground or around the school, walking or running different dis-

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**Materials**

1. cardboard tube from a paper towel roll per every 2 students
2. 1 stopwatch per every two students.
科学/数学

1. 为了获得最准确的计数，你应该在完整的60秒内测量脉搏。然而，脉搏可以被取自60秒的因数——30，15，12，10，6秒等。让学生找到脉搏点并为不同的60秒因数计数脉搏。
   ——选择一个60的因数。
   ——数出在那个时间周期内的脉搏数。
   ——将数出的脉搏数乘以对应的因数，得到一分钟内脉搏的近似数，例如，数出的脉搏数在15秒内，数出4倍。
(15x4=60，一分钟有60秒。
2. 制作学生的心率列表。心率相同还是不同？
3. 找到所有学生的平均心率？(将所有心率加总除以学生总数)
4. 让学生收集不同成年人的心率，并在图表上列出。计算平均心率。这与学生的平均心率有何不同？
5. 尝试使用纸板听诊器来听其他声音——通过墙壁，等等。

社会研究

1. 让学生研究听诊器和其它医学发明的演变。

音乐
1. Have students find their pulses at the carotid or radial artery and tap their heartbeats in 2/4, 3/4, 4/4 and dotted rhythm (quarter note equals one pulse).

2. Have students sing simple songs (“Twinkle, Twinkle, Little Star,” “Mary Had a Little Lamb”) to the pulse of their own hearts.

**Online Resource**

“Habits of the Heart,” Science Museum of Minnesota,
http://www.smm.org/heart/

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**Vocabulary (Cont.)**

**oxygen**—a colorless tasteless odorless gaseous element that constitutes 21 percent of the atmosphere and is found in water, in most rocks and minerals, and in numerous organic compounds, and that is essential for animal and plant respiration.

**pulse**—a regular throbbing caused in the arteries by the contractions of the heart.

**radial**—relating to, placed like, or moving along a bodily radius (as the bone of the forearm)

**stethoscope**—a medical instrument used for listening to sounds produced in the body and especially those of the heart and lungs.