Heart and Lung Hands-On Activities

The Heart (modified from the Franklin Institute, (http://www.fi.edu/learn/heart/enrichment/activity_healthy-heart.htm)

The heart is a hollow muscle. It is about the size of your fist. It is located slightly to the left of the center of your chest. The two halves of the heart are separated by a membrane called the septum. This wall prevents the flow of blood between the left and right chambers. Each chamber has an upper and lower part: a ventricle (lower) and an atrium (upper).

- The right upper receives blood from the body.
- The right lower pumps blood to the lungs.
- The left upper receives blood from the lungs.
- The left lower pumps blood to the rest of the body.

The valves within the heart are one-way valves. This means that blood can flow into the heart but not back into the arteries or ventricles.

The heart pumps blood in two phases. In the systolic phase, the ventricles contract, pumping blood into the arteries. In the diastolic phase, or second phase, the ventricles relax and blood flows into them from the atria. These two phases of the heartbeat are measured when the blood pressure is taken.

The Lung (adapted from “How Things Work” website) –

Where the Air Goes

As you breathe air in through your nose or mouth, it goes into the trachea. It continues down past the larynx until it reaches the bronchi. From the bronchi, air passes into each lung. The air then follows narrower and narrower branches of the bronchi (bronchioles) until it reaches the small air sacs (alveoli).

What Happens When the Air Gets There

Within each air sac, the oxygen concentration is high, so oxygen passes or **diffuses** across the alveolar membrane into the pulmonary capillary. At the beginning of the pulmonary capillary, the hemoglobin in the red blood cells has carbon dioxide bound to it and very little oxygen. The oxygen binds to hemoglobin and the carbon dioxide is released. The concentration of carbon dioxide is high in the pulmonary capillary, so carbon dioxide leaves the blood and passes into the air sac. The carbon dioxide then leaves the air sacs when you exhale and the oxygen-enriched blood returns to the heart.

Thus, the purpose of breathing is to keep the oxygen concentration high (and the carbon dioxide concentration low in the air sacs) so this gas exchange can occur and the blood can be enriched with oxygen and taken around the body.

Station 1: Build a lung model (each student makes a lung model to take home)

Activity 1: Build the lung model

Supplies:
Top ½ of a 2-L bottle (students bring in this)
Balloons
Latex sheets
Rubber bands
Construction paper
Tape

1. Stretch the latex sheet over the bottom of the soda bottle opening and tape securely.
2. Attach a balloon to the top part of the bottle, and push it through the opening. Secure the balloon with a rubber band.
3. Fold a strip of construction paper in half, and tape it to the latex sheet at the bottom to make a handle.
4. Now slowly pull the construction tab down (inhaling) and slowly push it up (exhaling). You are modeling contracting the diaphragm. What happens to the balloon?

Discuss hiccups: Hiccups are thought to be caused when the diaphragm starts contracting and relaxing in a jerky way (spasms).

What do you try to get rid of hiccups?
Compare answers.

Activity 2: Hand Exercise (taken from Bill Nye the Science Guy: Heart)

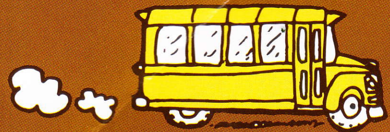
Supplies:
Student

1. Instruct the students to put one arm up in the air and to keep the other hand down low.
2. Wait one minute.
3. Have the students compare the color of their two hands—one should be pale and the other reddish.

Have the students discuss why they think this happened.

Discuss what other times could they end up with very little blood in one part of the body?

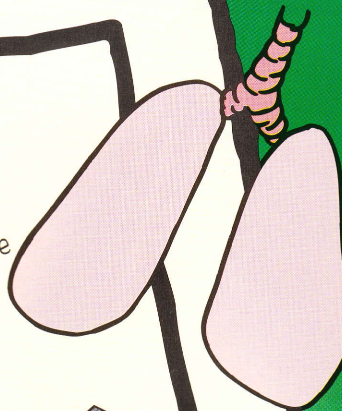
Arnold's Experiment



Your muscles need lots of energy and this energy comes from the food we eat, the water we drink, and the air we breathe. Air flows into your body through your nose and mouth and then travels through the larynx into the trachea and then into the bronchi to the lungs. This is called the respiratory system.

Your lungs are found in the chest cavity where they are surrounded by the ribs for protection. Below the lungs is a thin muscle called the diaphragm. When the diaphragm contracts, the chest cavity enlarges, the lungs get bigger and air flows in. Let's make a lung model so that you can see how this works.

Don't forget to add this system to your poster!



Question: What would happen if the diaphragm has a hole?

Hint: Remember that the lungs inflate when the diaphragm contracts.

Hypothesis:

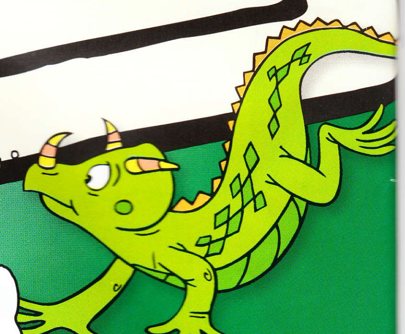
Let's test your hypothesis.

Materials Needed: 2-liter soda bottle, balloon, piece of latex, 2 elastic bands, and strip of construction paper

Methods: Have an adult cut the two liter soda bottle in half. You will need the top half of the bottle. Stretch the piece of latex tight over the bottom of the half bottle. Make sure that the latex is tight and secure it with a rubber band (tape can also be used). Attach the balloon to the top of the bottle and push the balloon into the bottle. Secure this balloon with a rubber band. Fold the strip of construction paper in half and tape it to the middle of the piece of latex. Now slowly pull the construction tap down (inhaling) and slowly push it up (exhaling).

Results:

Conclusion:



It is thought that hiccups are caused when the diaphragm starts contracting and relaxing in a jerky way (spasms)!

Station 2: Stethoscopes and Exploring Vessel Physics

Activity 1: Observations with the school stethoscopes:

Supplies:

School stethoscope
Stop watch or watch with a seconds hand
Disinfectant wipes

1. Have students create table below in their notebooks
2. Make guesstimates for the table below
3. Listen to your heart, count beats in 15 seconds, fill in table
4. Listen to your lungs, count breaths in 15 seconds, fill in table
5. Complete the table below

	Heart Beats	Breaths
Guesstimate the number of beats or breaths/minute:		
How many in 15 seconds?		
How many in 60 seconds (multiply by 4)		
Group Average (write down everyone's data, add up, divide by the number in your group: Example: 70+71+72= 71/beats per minute (in a group of 3 people)	_______	_______

Clean lab stethoscope ear pieces with disinfectant wipes

Activity 2: Exploring Vessel Physics (adapted from MNS, Dallas handout)

Supplies:

Two clean drinking straws
Waterproof clay/playdough
Paperclip
Bottom half of two clear plastic soda containers
Paper towels/sponges

To Do:

With this exercise, the student will learn how changes in the diameter of a vessel can affect the flow of moving blood. Vessels that become obstructed or constricted offer more resistance to the movement of fluid. In this activity, you'll explore models that represent normal and constricted blood vessels. You'll also observe how a build-up of pressure may affect a weakened vessel wall.

1. Fill the containers 2/3 full of water.
2. Insert a clean straw into the container. Blow a steady air stream that produces a continual stream of bubbles. Describe the blowing effort needed to produce this steady, but **non-violent** stream of bubbles and have your partner describe the bubble flow.
3. Completely pack the end of a second dry straw with a bean-sized lump of clay.
4. Unbend a paperclip and use it to poke a small hole through the clay plug.
5. Insert this straw into the second container. Blow into both straws with an equal amount of effort at the same time. How does the effort on the blocked straw compare to the unobstructed straw? Does the appearance of the bubble stream differ? Write down your observations.
6. Switch roles with your partner. Make sure to use two new straws when you repeat the above steps.

Station 3: Exercise in the Hall
Stop watch or watch with a seconds hand (for timing)
2 adult supervisors/hall monitors

Activity 1: Resting v. Exercising Pulse

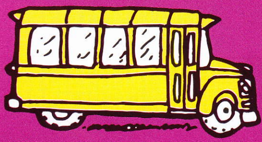
Step 1: Make tables in lab notebook and practice finding his/her pulse at the wrist.

	Heart Beats/15 seconds
Resting Pulse (Pulse 1)	
Do 10 Jumping Jacks & 10 Pushups and run in place 1 minute	
Check Pulse (Pulse 2)	
Do 10 Jumping Jacks & 10 Pushups and run in place 1 minute	
Check Pulse (Pulse 3)	
Rest quietly on the floor for 5 minutes, fill in tables	
Check Pulse (Pulse 4)	

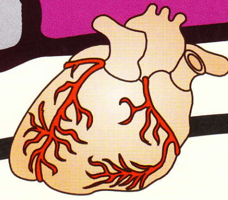
	Heart Beats/15 seconds at the start of the record keeping (resting pulse)	Pulse after 2 Rounds of Exercise (Pulse 3)
Person 1		
Person 2		
Person 3		
Person 4		
Person 5		
Person 6		
Total:		
Average: (divide total by the number of people in the group)		

Step 2: Take resting pulse (Pulse 1)
Step 3: Exercise
Step 4: Take pulse again (Pulse 2)
Step 5: Exercise
Step 6: Take pulse again (Pulse 3)
Step 7: Rest quietly for 5 minutes
Fill in notebook tables—how does your personal data fit into the group's data?
Step 8: Take pulse again (Pulse 4)

At home: ask your parents to do this and compare their resting pulse and their pulse after exercise with yours.



Wanda's Experiment



Question:

What do you think will happen to your heart rate if you exercise?

Hint: Remember that your muscles will need a lot more oxygen during exercise!

Hypothesis:

Let's test your hypothesis.

Materials Needed: stop watch

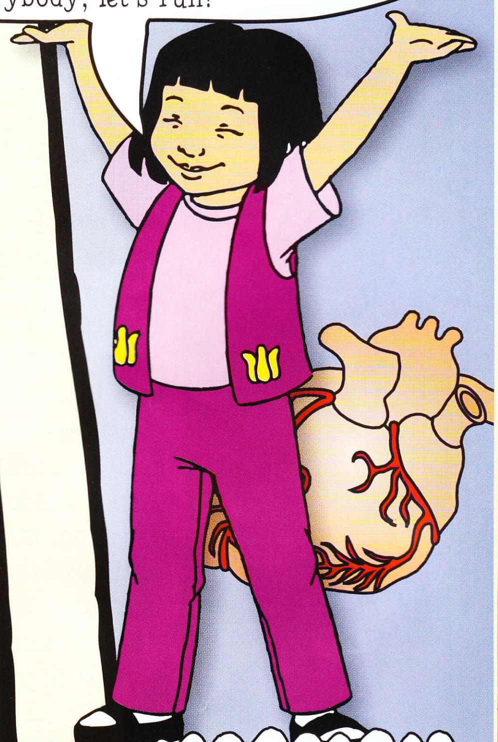
Methods: Place your index and middle finger of your right hand over the artery of your left wrist. Count how many beats you feel in one minute. Now run in place for 1 minute and determine what your heart rate is. Repeat this experiment with friends and family.

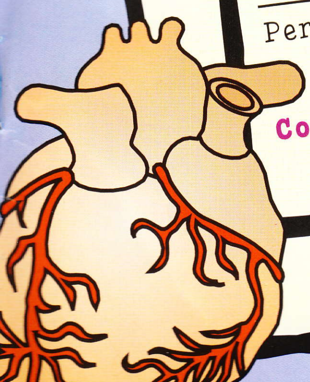
Results:

Name	Resting heart rate	Heart rate after exercising
Young Scientist		
Person 1		
Person 2		

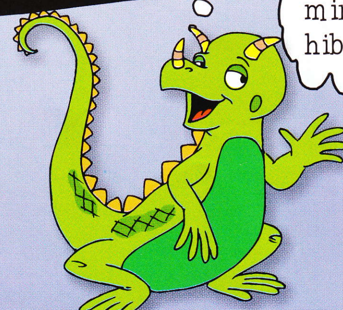
Conclusion:

Your heart rate is the number of times your heart beats in one minute. On average, an adult has a resting heart rate of 72 beats per minute whereas a child between the ages of 5 and 10 has an average resting heart rate of 82. As you get older, your heart becomes stronger and more efficient and the heart rate goes down. In fact, the more you exercise, the stronger the heart muscle becomes, and the lower the resting heart rate. Runners often have a resting heart rate of 55 beats per minute. So c'mon everybody, let's run!





The heart rate of some hibernating animals can drop below 10 beats per minute during their hibernating phase.



Station 4: Examine Models and Posters; Watch animations; Hand Exercises

Supplies:
Watch with a seconds hand
Laptop computer loaded with animations and the Bill Nye the Science Guy Heart
Heart model
Lung model
Body maps

Activity 1: Observations

Models and Pictures:
Models of normal and diseased hearts
Take apart and put back the heart model
Examine photos of diseased lungs

Animations:
Explore how blood circulates through the heart and lungs
Look at diseased/malfunction heart valves

Activity 2: **Hand exercise #1**
Instruct students to lay their hand (palm side up) on their desk and have students count how many times they can open and close their hand for one minute. Their hands should start getting tired after about 45 seconds. Don't stop!

Have students record how many times they opened and closed their hand.

Ask students what is their hand doing? (opening and closing).

What part of the body might your hand represent?

Recommended Websites:

Franklin Institute: http://www.fi.edu/learn/heart/index.html

Cool Science for Curious Kids http://www.hhmi.org/coolscience
Great animation on blood flow to lungs and back to the heart at:
http://www.hhmi.org/biointeractive/cardiovascular/animations.html

American Heart Association:
http://www.medmovie.com/mmdatabase/MediaPlayer.aspx?ClientID=69
Library of animations on the heart: blood flow, dilated cardiomyopathy, coronary artery disease, heart valve disease

How Stuff Works: http://health.howstuffworks.com/heart.htm
(includes an 'ok' animation of blood flow)