Body Carnival

The Science and Fun of Being You

Programs and Activities

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Body Carnival is a colorful 1500 sq. ft. traveling exhibit. Yellow, red, and bright blue modules engage visitors in a fun exploration of the science of their bodies – "The Science and Fun of Being You."

Components list:

1. Entrance: Two tented columns welcome visitors with exhibit name, description, donors; "Fun house" mirrors provide interactive element.
2. Balancing Act: Visitors can work at a table with 4 sided signage describing activities to explore center of gravity utilizing people figures and metal rings
3. Walk the Plank: A balance beam going from thick to thin; pirate character stanchion has weights in box at his feet. Visitors can explore effects on their center of gravity.
4. Dizzy Tunnel: 10'x10' tunnel for visitors to walk through a rotating star field and try to maintain their balance. Ramps will be available to be added by those museums who desire to make this exhibit wheelchair accessible.
5. Goofy Goggles: Visitors attempt to follow a zig-zag yellow line on the floor wearing goggles with vision - distorting lenses
6. Dizzy Wall: Visitors stand on a footprint and try to maintain their balance standing on one leg; they pull a rope to make the wall move side to side.
7. Get a Grip: A 3-sided table equipped with hand models which demonstrate how tendons, pulleys, and levers make our hands function.
8. House of Color: Visitors experiment with different sources of lights to see the effects of varying light wavelengths on the colors of various objects.
9. Go With The Flow: Streams of water from 3 spouts can be adjusted by applying pressure from your hand or applying spouts with different amounts of blockage.
10. Pressure Vessel: You can take your blood pressure with your hand held high or at waist level to see the difference that height makes in pressure.
11. Tunnel of Blood: Visitors crawl through a giant coronary artery with realistically sculpted walls simulating the build-up of arterial plaque. Visitors see and hear the effects of blood flow as it is decreased by plaque build up
12. Calculation Station:
    a. H_2O: Visitors calculate how much water they need to drink daily
    b. Target Heart Rate: Visitors calculate their target heart rate for aerobic exercise.
    c. The Human Yardstick: Visitors determine the mathematical relationship between their arm span and their height
13. Feel Music: Visitors cover their ears and lean back against sound cushions to "hear" through their bones and muscles. Those in wheelchairs can hug a portable sound cushion.
14. Body Challenge: Visitors will have 3 opportunities to compare their physical and neural activities with others.

a. Hang Time: Visitors can measure the amount of time they can hang with their arms extended. Sound and a timing device will tell them how long their feet are off the ground.
b. Think Fast: Visitors will have 2 opportunities to test their neural reaction time. One is a simple one light reaction time. The second is a more complex task of reacting to 2 different lights and choosing which button to press.
c. Sit and Reach: From a seated position visitors will attempt to measure how flexible they are, with and without warming up their muscles. Flexibility is as important as strength in keeping yourself fit and safe from trauma.

15. Clown figures will each have 3 double-sided balloons which have 12 interesting facts about the body. Some are comparisons with everyday objects or activities and curious body facts.

Body Carnival
Glossary

Artery	A blood vessel which carries blood away from the heart. Arteries oxygen-rich blood to all parts of the body. Coronary arteries supp oxygen to the heart muscle itself.
Base of Support	The area supporting a person or object. The larger the base of sup the more stable the object.
Bionic	Referring to mechanical replacement parts for living organisms.
Center of Gravity	The point around which the weight of an object is distributed. The of gravity must be over the base of support in order for a person o object to be in balance.
Cholesterol	A lipid (fat) produced by the body and found in certain foods. If someone's body produces too much cholesterol or if the diet is to in this substance, it can lead to heart and artery disease.
Evaporation	The process of changing from a liquid to a gas. Sweat evaporates the body in order to cool the body.
Frequency	The number of waves that pass a given point in a period of time. S and light are measured in wavelengths or frequency.
Lever	A bar or rod that tilts on a point called a fulcrum. Crowbars or see are examples. The human body also has levers in the form of joint systems.
Neurons	Nerve cells. Messages in the body are sent from neuron to neuror
Plaque	Deposits on body surfaces. Dental plaque is the accumulation of bacteria and sugar that sticks to the teeth. Plaque in the arteries r the deposits of fat on the artery walls.
Pressure	The measure of a force applied to an area. Blood pressure measu force of blood in arteries and veins.
Proprioceptors	Nerve endings that are sensitive to changes in muscles or tendons send messages to your brain to help you know where your body is space.
Prosthesis	A man-made substitute for a missing or diseased part of the body, as a leg, hand, or eye.

Pulley	**A chain, belt or rope wrapped around a wheel to do work. Tendons body are the "rope" connecting muscles to bones and joints in orc move the body.**
Reaction Time	**The time it takes the body to respond to a stimulus.**
Respiration	**The act of inhaling air containing oxygen and exhaling carbon diox and water vapor.**
Saturated Fats	**Fats, such as butter or lard, that are solid at room temperature. Th fats are more likely to contribute to heart disease than oils.**
Tendon	**A cordlike band of tissue that connects muscle to bone.**
Vibrations	**A back and forth movement of molecules in a medium, such as air. Vibrations produce sound.**

Connections to
Benchmarks for Science Literacy
American Association for the Advancement of Science

1. Nature of Science
   - B. Scientific Inquiry
     - K-2 People can often learn about things around them by just observing those things carefully, but sometimes they can learn more by doing something to the things and noting what happens.

2. The Nature of Mathematics
   - A. Patterns and Relationships
     - K-2 Numbers can be used to count any collection of things.
     - 3-5 Mathematical ideas can be represented concretely, graphically, and symbolically.
   - C. Mathematical Inquiry
     - K-2 Numbers and shapes can be used to tell about things.
     - 3-5 Numbers and shapes- and operations on them- help to describe and predict things about the world around us.
     - 6-8 Using mathematics to solve a problem requires choosing what mathematics to use; probably making some simplifying assumptions, estimates, or approximations; doing computations; and then checking to see whether the answer makes sense.

3. The Nature of Technology
   - A. Technology and Science
     - K-2 In technology, tools are used to observe, measure, and make things.
     - 3-5 Measuring instruments can be used to gather accurate information for making scientific comparisons of objects and events and for designing and constructing things that will work properly.
     - 6-8 Engineers, architects, and others who engage in design and technology use scientific knowledge to solve practical problems.
   - B. Design and Systems
     - 3-5 There is no perfect design. Designs that are best in one respect may be inferior in other ways. Usually some features must be sacrificed to get others. How such trade-offs are received depends upon which features are emphasized and which are down-played.
     - 6-8 All technologies have effects other than those intended by the design, some of which may have been predicted and some not. In either case, these side effects may turn out to be unacceptable to some groups of the population and therefore lead to conflict between groups.

6-8 Systems fail because they have faulty or poorly matched parts, are used in ways that exceed what was intended by the design, or were poorly designed to begin with. The most common ways to prevent failure are pre-testing parts and procedures, over-design, and redundancy.

C. Issues In Technology

K-2 People, alone or in groups, are always inventing new ways to solve problems and get work done.

3-5 Technology has been part of life on earth since the advent of the human species. The technology available to people greatly influences what their lives are like.

6-8 New technologies increase some risks and decrease others. Some of the same technologies that have improved the length and quality of life for many people have also brought new risks.

4. The Physical Setting

F. Motion

K-2 Things that make sound vibrate.

3-5 Changes in speed or direction of motion are caused by forces.

6-8 Light from the sun is made up of a mixture of many different colors of light. Other things that that give off or reflect light have a different mix of colors.

6-8 Something can be “seen” when light waves emitted or reflected by it enter the eye – just as something can be “heard” when sound waves from it enter the ear.

6-8 Vibrations in materials set up wavelike disturbances that spread away from the source. These and other waves move at different speeds in different materials.

6-8 Human eyes respond to only a narrow range of wavelengths of electromagnetic radiation – visible light. Differences of wavelength within that range are perceived as differences in color.

5. The Living Environment

E. Flow of Matter and Energy

K-2 Plants and animals both need to take in water, and animals need to take in food.

6. The Human Organism

A. Human Identity

3-5 Human beings have made tools and machines to sense and do things that they could not otherwise sense or do at all.

6-8 Human beings use technology to match or excel many of the abilities of other species. Technology has helped people with disabilities survive and lead more conventional lives.

D. Basic Functions

K-2 The brain enables human beings to think and sends messages to other body parts to help them work properly.

3-5 The brain gets signals from all parts of the body telling what is going on there. The brain also sends signals to parts of the body to influence what they do.

6-8 Interactions among the senses, nerves, and brain make possible the learning that enables human beings to cope with changes in their environment.

E. Physical Health

K-2 Eating a variety of healthful foods and getting enough exercise and rest help people to stay healthy.

8. The Designed World

F. Health Technology

3-5 There are normal ranges for body measurements that help to tell when people are well. Tools provide us clues about what is happening inside the body.

3-5 Technology has made it possible to repair and sometimes replace some body parts.

12. Habits of Mind

B. Computation and Estimation

K-2 Use whole numbers and simple, everyday fractions in ordering, counting, identifying, measuring, and describing things and experiences.

3-5 Add, subtract, multiply and divide whole numbers mentally, and with a calculator.

Amazing Body Quiz

Objective/Summary:
Visitors will compare the weight, volume and length of various human body organs.

Related Exhibits: Clown Balloons Fact Stations; Tunnel of Blood
Time: 20 minutes
Age: Grades 6-8; Families
Staff: One educator or trained volunteer
Safety Issues: None
Materials: Supplied: Labeled beanbags, plastic bottles, lengths of rope, red and blue cards, timer
Needed: Plastic bottles (liters and half-liters)

<u>Procedures</u>
Preparation:
1. Group the plastic liter or half liter bottles together as noted in procedure #3 below. Example: 2.5 liters = tape together one 2-liter bottle and one half-liter bottle. Mark the plastic liter or half-liter bottles appropriately (ex. for the 1.4 liter bottle, mark the outside of the bottle at the appropriate level).

Real Time:
1. Break the group into two teams. Each team should select a leader.
2. Place 4 beanbags with weight labels in center of a cart. Have one visitor from each of the two teams come up. Give one student the set of red weight cards, and the blue cards to the other student. They should match the cards to weight. Teammates may help. Set timer for 1 minute.

Brain – 3 pounds
Lungs – 2.3 pounds
Adult heart – 10 oz.
9 year-old heart – 3.5 oz.

3. Place the 4 sets of plastic bottles on center of cart. Follow the same procedure as before.

Stomach acid produced in one day – 2.5 liters
Lung capacity – 5 liters
Saliva produced per day – 1.4 liters (about 1 _)
Blood pumped in one minute – 4.7 liters

4. Place lengths of rope on center of the cart. Follow the same procedure as before.

Small intestine – 21 feet (average)
Large intestine – 5 feet
Esophagus – 10 inches

Follow-up:
Were you surprised by any of the answers? Why do you think the brain weighs so much more than the heart? Why do you think your body circulates so much blood? How does 21 feet of intestine fit in your body?

Science Content / Background: The lungs have a surface area of 750-800 square feet, about the size of a tennis court! The exchange of gases between the air breathed in and the circulating blood takes place through the microscopically thin lining of the alveoli and the wall of the thin capillary blood vessels. The capillaries are so fine that only one red blood cell at a time can pass through, taking less than one second to do so. Because the alveoli must be lined with a thin film of water to enable gases to dissolve, exhaled air is saturated with water vapor. During a day, the equivalent of 4 cups of water are lost from the lungs. The cloud of water droplets that condense on exhalation in cold weather is this water vapor.

The wrinkled walnut-shaped brain has a surface area of about 2.5 square feet, about the size of an opened newspaper sheet. The cerebrum is responsible for our unique intelligence and all our intellectual skill. Impulses are received from the sense organs. The cerebral cortex has a half-billion nerve cells with 620 miles of connecting fibers for every cubic half-inch.

The heart and blood vessels provide the body with a pump and a closed system of about 100,000 miles of tubing through which about 5 quarts of blood circulate continuously. Blood reaches every living tissue, bringing oxygen and nutrients and removing waste. Each normal beat expels 1/3 pint of blood. In one day, an adult heart may pump 3,500 gallons.

Extensions: Here are more body facts and sources of information. If you have visitor internet access, they could look up more info from these websites.

During one day, the heart pumps around 2000 gallons of blood. (Rand McNally Body Atlas)

During one day, the salivary glands produce about three pints of saliva. (Rand McNally)

During one day, the stomach produces 2-3 liters of stomach acid (HCl).
www.people.virginia.edu/~rjh9u/lect19.html

The stomach holds 0.08 liters when empty, but can expand to 2-4 liters when full.
www.hypertextbook.com/facts/2000/JonathanCheng.shtml

The lungs total air contact is 40 times that of the surface area of skin. (Rand McNally)

The normal lung capacity of an adult is 4-6 liters.

www.fpnotebook.com/LUN59.htm

The lungs total surface are is 750 square feet.
www.coloradohealthsite.org/cancer/lung/defs.html

The intestine's total surface area is 250 square meters.
arbl.cvmbs.colostate.edu/hbooks/pathphys/digestion/smallgut/anatomy.html

The brain's total surface area is 2.5 square feet
www.hallym.ac.kr/~neuro/kns/tutor/facts.html

The average weight of the human brain is three pounds.
www.hallym.ac.kr/~neuro/kns/tutor/facts.html

Dogs have 1 billion smell receptors, while humans have 40 million.
www.hallym.ac.kr/~neuro/kns/tutor/facts.html

The average length of the small intestine is 19.7 - 23 feet.
www231.pair.com/grpulse/bt/andism.html

The average length of the large intestine is five feet.
www231.pair.com/grpulse/bt/andila.html

Balance the Nails

Objective/Summary:
The center of mass of an object is its balance point or the point at which the entire mass of an object is concentrated. This is important in designing buildings, machines, and in sports that require balance. The following activity demonstrates how to find the center of mass of a given object.

Related Exhibits:	Balancing Act; Walk the Plank		
Time:	5 minutes		
Age:	Grades 3-12; Adults		
Staff:	One educator or trained volunteer demonstrator		
Safety Issues:	Large nails will be used (not appropriate for small children)		
Materials:	Supplied:	wooden blocks, large nails	
	Needed:	hammer	

<u>Procedures</u>
Preparation:
1. Hammer a large nail into a wooden board so that the nail is sturdy and upright.

Real Time:
1. Lay one nail down on the table. Lay the next nail perpendicular to it so that its head is over the first nail. Lay another nail in the opposite direction, also perpendicular to the first. Continue to do this until you have 8 nails as shown.
2. Lay the last nail on top of the others parallel to the first nail, but with its head at the other end. This will lock the arrangement in place.
3. Carefully lift the arrangement by holding it at the ends of the top and bottom nails. Balance it on the head of the nail in the block of wood.

Follow-up:
How do balance poles make high wire walkers more stable?

Science Content/Background: In a gravitational field, any object is most stable when its center of mass is as low as possible. The center of mass of the group of nails is below the point of support when the nails are balanced.

Extensions: Cut out an odd shaped cardboard object. Balance it on a tripod of your thumb, first and second fingers. Slowly bring your fingertips together. They will converge under the center of mass of the object.

Related Activities: Balancing Tricks

Balancing Tricks

Objective/Summary:
Through the activities below, visitors will be able to find their center of gravity and demonstrate its importance in everyday movements.

Related Exhibits:	Balancing Act; Walk the Plank	
Time:	20 minutes	
Age:	All ages	
Staff:	One educator or trained volunteer demonstrator	
Safety issues:	Visitors may fall down if they do not have good balance	
Materials:	Supplied:	Balance Board (see Extensions)
	Needed:	Chair (one that is fairly easy to lift)

<u>Procedures</u>
Preparation:
1. Set up near a wall.

Real Time:
1. Stand on your right foot while lifting your left leg. You can probably balance for a little while. Now stand against the wall with your right hip and foot next to it. Try to lift your left leg. Why can't this be done? Where is your center of gravity? The wall prevents your center of gravity from moving over your right foot so it can't be done.
2. Sit in the chair with your back straight and arms at your sides. Stand up from the chair without using your hands to push. Sit back down and have a friend place their pinky finger in the middle of your forehead so that you can't move forward. Now try to stand up again. It can't be done! The "pinky of power" does not allow you to move over your center of gravity to stand up.
3. Stand on your toes. You can probably balance for a little while. Now, place the tips of your toes against the wall and try it again. The wall keeps your center of gravity from moving over your toes.
4. Move three shoe lengths away from the wall. Place a chair between you and the wall. Bend over so that your head is in contact with the wall and the chair is beneath you. Now, pick up the chair and stand up straight without moving your feet. Most of the time this is not possible for males because their center of gravity is higher than for females.

Follow-up:
Can you tell where your center of gravity is from these activities? Were any of the activities more difficult than others?

Science Content/Background: The center of gravity is an imaginary point around which the body's weight is evenly distributed. The point varies from person to person depending on height, width, and distribution of body weight. In general, the point is located in the lower torso, slightly below the waist and in the pelvic region. Center of gravity is important for stability and balance.

Extensions: Keep a running poll on success rate of males vs. females on procedure # 4. Visitors can use the balance board (provided) to explore their center of gravity.

Related Activities: Balance the Nails

Build-It-Yourself Lungs

Objective/Summary:
Visitors build their own lung function model in this make-it and take-it showing how the movement of the diaphragm causes the lungs to fill with air, due to changes in air pressure.

Related Exhibits:	Pressure Vessel
Time:	20 minutes
Age:	Grades 6 – 8; Families
Staffing:	One educator or trained volunteer demonstrator
Safety Issues:	Scissors – don't run with them! ☺
Materials:	Supplied: Lung function model Needed: Illustration showing location of diaphragm & lungs, small plastic soda/water bottles (16 ounces or smaller), large & small balloons, rubber bands, scissors. * Each visitor will need their own soda bottles and balloons, or you could let them work in pairs.

<u>Procedures</u>
Real Time:
1. Show visitors how the lung function model works. Now they can make their own version!
2. Cut soda bottles about six inches below the top.
3. Poke a balloon into the top of the bottle, with opening stretched over mouth of bottle.
4. Make a sheet of rubber by cutting the neck off a large balloon.
5. Stretch the sheet over the open bottom of the bottle; secure with a rubber band.
6. Pull down the stretched rubber – the small balloon will inflate as air rushes in from the outside.

Follow-up:
What would happen if there was a hole in the diaphragm?

Science Content/ Background: Air tends to move from spaces with higher pressure into spaces with lower pressure. When we inhale, the diaphragm moves down and air moves into our lungs; when the diaphragm moves back up, air is forced out as we exhale.

Extensions: This can also be done as a 5-minute demo with the lung function model provided, without the build-it-yourself aspect.

Related Activities: Under Pressure

Chain of Reaction

Objective/Summary:
In this activity you'll measure the reaction time of a group of ten to twenty people to find out the average reaction time of each individual in the group.

Related Exhibits:	Body Challenge: Think Fast!
Time:	5 minutes
Age:	Grades K - 8; Adults
Staff:	One educator or trained volunteer demonstrator
Safety Issues:	None
Materials:	Supplied: stopwatch, calculator

<u>Procedures</u>
Real Time:
1. Have visitors form a chain holding each other's hands. Count the number of visitors.
2. Tell the visitor at one end of the chain to squeeze the hand of the person next to them. When that person feels the squeeze, they squeeze their other hand and pass the squeeze along the line. The last person to receive the squeeze yells "stop". Time how long this process takes using the stopwatch.
3. Repeat 3 times.
4. Calculate the average reaction time per visitor. Reaction time= total time/ number of visitors in chain.

Follow-up:
What factors could affect your reaction time?

Science Content/Background: Reaction time is the time interval required to respond to seeing or hearing something. An average person's reaction time is about 0.2 to 0.3 seconds. That's about the same amount of time that it takes an automobile traveling at 60 mph to move 26 feet! (0.3 seconds) Our reaction time is a result of a sequence of events. When the person next to you squeezes your hand, the sensory nerves in your hand send a message to your brain. Your brain reacts and then sends a motor message back to your other hand to squeeze. Both electrical transmission (along the nerves) and slower chemical transmission (between the synapses- tiny gaps between the end of one nerve cell and the beginning of the next) are in action and the whole process can be over in 0.2 seconds!

Extensions: Vary the number of people in the chain. Compare reaction times of morning visitors and afternoon visitors. Create a reaction time challenge board listing the top times for the day/hour/year along with the name of the group ie. Newbridge Middle School ; Average reaction time per student = 0.24 seconds!

Related Activities: Quick Draw

Chicken Foot

Objective/Summary:
Visitors will observe how bones are moved by the pulling action of muscles and tendons.

Related Exhibits:	Get a Grip	
Time:	20 minutes	
Age:	Grades 6 – 8; Families	
Staff:	One educator or trained volunteer demonstrator	
Safety Issues:	Wear gloves and eye protection. Wash hands thoroughly after activity.	
Materials:	Supplied:	dissecting tools, dissecting pan, gloves
	Needed:	chicken foot

<u>Procedures</u>
Preparation:
1. Obtain a chicken foot from a butcher.

Real Time:
1. Carefully remove the skin from the end of the chicken foot where it has been removed from the leg, and expose the tendons.
2. Pull on the tendons one at a time and observe how each one moves a bone.

Follow-up:
How do the muscles work together to move a bone?

Science Content/Background: Skeletal muscles move bones by contracting and pulling on the bones. Muscles are attached to bones by tendons. When the muscle is contracted, it becomes shorter and pulls on the tendons that then pull on the bones. Sometimes, groups of muscles work together to pull on a bone. Because muscles can only pull on bones, they have to work in pairs. One muscle or muscle group will pull a bone in one direction, while another muscle or muscle group pulls the bone in the opposite direction. Muscles hooked to the tendons that curl the chicken foot are called flexors, and the muscles hooked to the tendons that straighten out the chicken foot are called extensors.

All three classes of levers are represented in the body by different parts of the skeleton. Bending the forearm is an example of a class three lever, the skull moving on top of the vertebral column is a class one lever, and the ankle joint when you stand up on your toes is a class two lever.

Extensions: Build models showing the three classes of levers. Label the joints on a picture of a skeleton as class 1, 2, or 3 levers.

Related activities: Toss the Duck

Edible "Blood"

courtesy of Amy L. Miller, University of Arizona

Objective/Summary:
This activity introduces visitors to the composition of blood.

Related Exhibits:	Tunnel of Blood
Time:	10 min
Age:	Grades 3 – 8; Families
Staff:	One floor staff or educator
Safety issues:	None
Materials:	Supplied: measuring cup, blender Needed: corn syrup, candy red hots, white jelly beans, candy sprinkles, mixing bowl, large spoon, small drinking cups (ie. Dixie cups)

Procedures
Real Time:
1. Assist visitors in measuring out the ingredients in the following proportions: corn syrup 55%, red hots 44%, white jellybeans _%, and sprinkles _%. Corn syrup represents plasma, the red hots represent the red blood cells (erythrocytes), the white jellybeans are used for the white blood cells (leukocytes), and the sprinkles are platelets (thrombocytes).
2. Mix all the ingredients in one container. Pour out into small cups for those who would like to eat it.
3. You can also pour ingredients into blender, mix it, then serve.

Follow-up:
Notice how the red and white blood cells and platelets are suspended in the plasma. What do you think is the purpose of the plasma? When would the white blood cells be more than _%?

Science Content/Background: Blood is a viscous fluid - thicker and more adhesive than water. Blood flows approximately 4 _ to 5 _ times slower than water. The adhesiveness or "stickiness" can be felt by touching it. It makes up about 8% of your total body weight. Plasma is a liquid made of 92% water and 8% dissolved substances such as proteins, hormones, electrolytes and enzymes. It is responsible for regulating blood volume and viscosity. Red blood cells transport oxygen and carbon dioxide through the blood vessels to all parts of the body. White blood cells combat inflammation and infection. Platelets are involved in blood clotting.

Extensions: Density column- objects made of various substances such as wood, rock, plastic, cork, rubber, etc. are dropped into a column of solutions of varying density. For example, corn syrup, water, soap solution, rubbing alcohol, vegetable oil. The density of the objects can be determined by where they come to rest in the column of solutions.

Go With the Flow

Objective/Summary:
Visitor will experience the effects of gravity on blood flow.

Related Exhibits: Pressure Vessel; Go With The Flow
Time: 5 minutes
Age: Grade 2 and up
Staff: One educator or trained volunteer demonstrator
Safety Issues: None
Materials: None

Procedures

Real Time:

1. Hold one hand high above your head, leaving the other one hanging down by your side.
2. Count to sixty or use a timer and hold for one minute.
3. Hold hands side by side at waist height and notice the difference.

Follow-up:
Are your hands the same color? Why or why not?

Science Content/Background: The heart must circulate blood throughout the body often against gravity. The heart must work much harder to get the blood up to the hand held high while gravity helps get blood to the other hand at your side. The lower hand should be darker than the one held up because more blood flowed to it in the sixty seconds.

Related Activities: Under Pressure

Music in My Head

Objective/Summary:
Visitors will experience sound vibrations through their bones using rubber bands.

Related Exhibits:	Feel Music	
Time:	5 minutes	
Age:	Grades K-8, Families	
Staff:	Trained volunteer or educator	
Safety issues:	None	
Materials:	Needed:	Rubber bands of varying sizes, trash can

<u>Procedures</u>
Real Time:
1. Choose a rubber band and stretch it around your thumb and forefinger.
2. Pluck it to make it vibrate and produce a sound.
3. Now hold it in between your teeth and stretch it away from your mouth. Pluck it again and notice the difference.

Follow-up:
Which sound appears louder?

Science Content/Background: Solids, liquids, and gases all conduct sound but at different speeds. Sound waves travel faster through solids and liquids than through air. Gases, solids, and liquids are all made up of tiny molecules that transmit sound. When an object vibrates, it causes sound to travel through the surrounding molecules. The sound travels as a series of waves, moving away from the vibrating object. The vibrations of the rubber band go to your teeth, then to the jawbone and bones of your skull. The sound travels to your inner ear and seems very loud.

Extensions: Use various sizes of rubber bands to make different sounds. With a tuning fork and glass of water, you can demonstrate sound waves traveling through water. Fill a glass with water almost to the brim. Hit the tuning fork on a carpeted surface or the bottom of your shoe, and then slowly dip the fork into the water. Be prepared to get wet!

Related Activities: Tooth Tunes, Spoon Bells

On The Level

Objective/Summary:
Visitors explore and experience the sense of balance using a carpenter's level, a diagram or model of the ear showing semi-circular canals, a bottle of water, and a few simple body movements. They learn that the semicircular canals in the middle ear contain liquid, the movement of which sends nerve impulses to the brain. These messages enable one to sense the angle and direction of movement.

Related Exhibits:	Dizzy Tunnel; Wacky Wall	
Time:	5 minutes	
Age:	All ages	
Staffing:	One educator or trained volunteer	
Safety Issues:	Minimal	
Materials:	Supplied:	carpenter's level, ear model, glitter
	Needed:	bottle of water

Web Sites:
http://kidshealth.org/kid/body/ear_noSW_p5.html
http://hyperphysics.phy-astr.gsu.edu/hbase/sound/eari.html

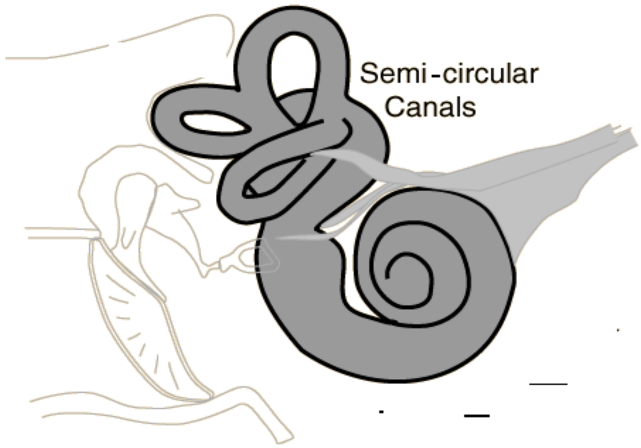
Procedures

Preparation:
1. Add glitter to bottle of water leaving some air space and secure top.

Real Time:
1. Visitors stand with feet shoulder width apart.
2. Ask visitor to lean to one side slightly.
3. Ask: "How do your feet feel? Is one working harder than the other?"
4. Have them lean the other way and notice how the feet adapt.
5. Ask: "How do your feet know to do that?"

Follow-up:
Your brain told your feet what to do – but how did your brain know? Your EARS told your brain you were leaning! Ears do more than hear - they help you balance, too. In the inner ear, there are three small loops called *semi-circular canals* (SHOW EAR MODEL). They are filled with liquid and have thousands of microscopic hairs (cilia). When you move your head, the liquid in the semi-circular canals moves too. Just like the liquid moves in this carpenter's level (SHOW LEVEL). The liquid moves those tiny hairs, which send a nerve message to your brain about the position of your head. In less than a second, your brain figures out where your head is and which muscles to send messages to so you can keep your balance.

Science Content/Background: Carpenters' levels work because water seeks its own level, and because a gas suspended in a liquid will rise to the highest possible point. The movement of liquid within the semicircular canals is transmitted via the cilia cells to the brain. The canals are situated along three axes to measure movement in three planes. (See http://hyperphysics.phy-astr.gsu.edu/hbase/sound/eari.html)



Extensions: Do you ever feel dizzy? Sometimes the liquid in your semi-circular canals keeps moving after you've stopped moving. Ask a participant to hold the water bottle filled with glitter. Have them swish the water in the bottle around a little bit, then hold the bottle still. Notice how the water keeps swishing around, even after the bottle is still? That's what happens in your semi-circular canals when you spin around really fast or take a cool ride at the carnival. When you stop spinning or step off the ride, the fluid is still moving and the hairs are still sending messages about the position of your head. But you're looking straight ahead and your eyes are telling your brain that you're standing still! That's why you might feel dizzy - your brain is confused about the position of your head. Once the fluid stops moving, your brain gets the right message, and you feel better!

Related Activities: Balancing Tricks

Prizmatic!

Objective/Summary:
Visitors will learn that white light is really all the colors of the rainbow. They will observe that when visible light is refracted or bent into its various wavelengths; red, orange, yellow, green, blue, indigo, and violet are seen.

Related Exhibits:		House of Colors
Time:		20 minutes
Age:		Grades K – 5; Families
Staff:		One educator or trained volunteer
Safety Issues:		None
Materials:	Supplied:	Radiometer, prisms, flashlight, prism glasses, eye model
	Needed:	white wall or board

<u>Procedures:</u>
Preparation:
1. Gather materials and go to an area where the lights can be dimmed if possible.

Real Time:
1. Ask visitors, "What part of our bodies help us see?" "What else do we need in order to see?" Turn out the lights, if possible, to make this point.
2. "What is light?" It's energy! Demonstrate this by having a volunteer shine the flashlight at the radiometer and watch it spin.
3. "So light is energy that travels in waves to our eyes and enables us to see, but how does the light get in our eyes?" They can look in each other's eyes and pass around the eye model to find the pupil. Describe how it gets bigger or smaller depending on the amount of light available.
3. Shine a flashlight on a white surface and ask what color it is. Then ask if they believe that the "white" light is really red, blue, green, etc. Shine the flashlight through the various prisms to prove this is true. They can observe the direction of the flashlight and the direction in which the colors appear on the white wall to demonstrate how the light is bent (refracted) by the prism into the various wavelengths.
4. Pass out prism glasses and ask visitors to put them on and look at a light. What do they see? Are the colors always in the same order – just as in a rainbow?
5. Tell them the acronym "ROY G. BIV" to remember the order of wavelengths or colors.

Science Content/Background: Visible light is part of the electromagnetic spectrum, which also includes x-rays, microwaves, radio waves, etc., which we cannot see. The length of the various waves that make up "white" light determines the colors of visible light. The prisms and prism glasses bend or refract the white light into its various wavelengths producing the colors of the rainbow.

Extensions: To demonstrate the difference between light and pigment, visitors may use markers to combine colors on paper. Mixing colors will eventually produce black. Using theater light filters or gels and a light source, you can mix colors of light to show that they will produce white light again.

Related Activities: none

Quick Draw

Objective/Summary: In this activity visitors will compare their reaction times while sorting a deck of cards in different ways. The more processing the brain has to do, the longer the reaction time.

Related Exhibits:	Body Challenge: Think Fast !	
Time:	10 minutes	
Age:	Grades 3 - 8; Families	
Staff:	One educator or trained volunteer demonstrator	
Safety Issues:	None	
Materials:	Supplied:	deck of cards, stopwatch
	Needed:	paper, pencil

<u>Procedures</u>

Preparation:

1. Shuffle the cards and lay them face down in a stack.

Real Time:

1. Instruct the visitor to turn each card face up in a pile as fast as they can. Use the stopwatch to record their reaction time. Visitor records their time on paper.
2. Gather the cards in a pile face down and reshuffle. This time the visitor should sort out the black and red cards into two separate piles as fast as they can. Record their time.
3. Reshuffle. Now, record the time it takes for them to sort out the cards by suit.

Follow-up:

Which task were you able to complete the fastest? Why? Can you improve over time; ie. train your brain to go faster?

Science Content/Background: Reaction time is the time interval required to respond to seeing or hearing something. An average person's reaction time to a single stimulus is about 0.2 to 0.3 seconds. That's about the same amount of time that it takes an automobile traveling at 60 mph to move 26 feet! (0.3 seconds) Our reaction time is a result of a sequence of events. When you see the card in front of you, the visual message travels along the optic nerve to your brain. Your brain must then decide which pile to put it in and reacts by sending a motor message back to your hand to move the card. Both electrical transmission (along the nerves) and slower chemical transmission (between the synapses- tiny gaps between the end of one nerve cell and the beginning of the next) are in action and the whole process can be over in 0.2 seconds! The more decisions you have to make about which pile to put the card in, the longer it will take (more processing).

Extensions: Have visitors repeat the activity to see if they improve their record.

Related Activities: Chain of Reaction

Spoon Bells

Objective/Summary:
Visitors will observe how sound travels through matter.

Related Exhibits: Feel Music
Time: 5 minutes
Age: All ages, Families
Staff: 1 trained volunteer or educator
Safety Issues: Remind visitors that it is usually not a good idea to place objects in their ears. Don't tap the spoon too hard while the visitor has their fingers in their ears.
Materials: Needed: string, spoon

Procedures
Preparation:
1. Tie a two-foot piece of string to the handle of a spoon, making sure the two ends of the string are equal in length.

Real Time:
1. Have a visitor wrap one end of the string around the tip of his right index finger and the other end around the left.
2. Ask the visitor to place his fingertips in his ears and lean over so the spoon can dangle from the string.
3. Tap the spoon gently with another object so you can hear it ring. The visitor should hear a sound like a tolling bell.

Follow-up:
Why does the sound appear different than tapping on a spoon without the strings in your ears?

Science Content/Background: Vibrating objects produce sound. Sound travels in waves that need matter to travel through. Because the molecules of a solid are closer together than the molecules of a liquid or gas, sounds travel farther and faster through solids.

Extensions: Try tying other objects to the string. Vary the length, thickness, and material of the string.

Related Activities: Tooth Tunes, Music in My Head

Techno Hand

Objective/Summary:
Some exciting developments in human bionics have come about through science and technology. Prosthetic hands with artificial skin are amazingly lifelike. There are limitations, however, in comparison with the actual human hand. This activity explores some of those limitations, reinforcing the wonder of the human body.

Related Exhibit:	Get a Grip	
Time:	5 minutes	
Age:	Grades K – 5	
Staff:	One educator or trained volunteer	
Safety issues:	None	
Materials:	Supplied:	2 oven mitts, 30 clothespins
	Needed:	a variety of small objects to manipulate; ice cubes

Procedures
Preparation:
1. Gather materials.

Real Time:
1. Talk about what it would be like to lose a hand, foot or even an arm or leg. Do they know anyone who has? How can amputees button clothes, use the computer, or perform other activities?
2. Ask students to use clothespins rather than their hands to do a variety of fine motor activities such as picking up coins, tying a shoelace or buttoning a button. How difficult was it? This would be similar to the dexterity one would have with a prosthetic hand that provides opposable thumb movement.
3. Try to trace a toothpick while wearing oven mitts. Try dialing a phone number. Difficult right? This also demonstrates the lack of dexterity one has without complete use of a healthy hand.
4. You can also use the mitts to demonstrate lack of sensation. Have a student wearing the mitt close his eyes. Now gently touch his hand. Do the same to another student not wearing a mitt. Which one feels the touch? Put an ice cube on each student's hand. Which one feels the cold?

Follow up:
Although nothing is as good as your real hand, doctors can attach artificial replacements, called <u>prostheses</u>, for some body parts. In addition to replacing some lost function, prostheses can result in cosmetic improvements for the patient and build self-confidence.

Science Content/Background: Some prostheses are called static prostheses – such as an artificial arm that ends in a pair of hooks rather than a hand. The patient can manipulate the hooks to grasp objects. Dynamic prostheses use sophisticated electronics. Sensors detect muscle electricity in the arm and transmit the signal to the artificial hand, powered by batteries, which then opens and closes.

Extensions: Students can research new developments in the field of human bionics. They could also design their own replacement body parts. What would their ideal prosthesis look like? How would it work? What could it do?

Related Activities: none

Tooth Tunes

Objective/Summary:
Visitor bites a stick that is connected to a radio. Vibrations from the stick travel through the teeth and bones in the visitor's head directly to the eardrum, bypassing the outer ear. Visitor hears sound "inside their head".

Related Exhibits:	Feel Music	
Time:	Demo - 5 minutes; Building device - 20 minutes	
Age:	Demo – K +; Building device – 6th +, Families	
Staff:	Demo – 1 floor staff; Building device – 1 educator	
Safety Issues:	For sanitary reasons, use a new piece of drinking straw to cover the stick before each person uses it.	
Materials:	Supplied:	transistor radio with earphone jack tooth tunes* kit repair kit (electrical tape, ring magnets, wire)
	Needed:	paper-wrapped plastic drinking straws

*Additional Tooth Toons kits available from Science Kit and Boreal Laboratories catalog (800-828-7777)

<u>Procedures</u>
Preparation:
1. Follow instructions in tooth tunes kit to put device together.
2. Cut straws into 2" long pieces to cover tip of tooth tunes stick. Keep trashcan handy for used straws and straw paper.
3. Set tuner on radio before plugging in wire. After plugging in, turn volume all the way up.

Real Time:
1. Give visitors a piece of straw to cover the end of the stick.
2. Instruct them to bite down on the stick, place their fingers in their ears, and bend over to hold the end of the stick over the ring magnet that is on the table. The sound will be faint but clear, so it is best to do this in a relatively quite area. If the visitor can't hear the sound check the following:
   - make sure volume is turned up and the tuner is adjusted
   - check for a break in the wiring

Follow-up:
How is the sound getting to your ears?

Optional Activity – Let the visitor build a Tooth Tunes device and then use it as above.

Science Content/Background: Sound is produced by vibrating objects and travels in waves. Sound waves require matter as a medium to travel through. Sound waves can travel through your body to get to your middle ear, bypassing your outer ear.

Extensions: Use the tuning fork set (provided) to demonstrate that sound produces vibrations. Strike the tuning fork and slowly dip it into a glass of water. Visitors will get a splash! You could also discuss the structure of function of the ear using the ear model provided. Other ideas: discuss how different animals sense vibrations; how electricity and magnetism are related; how the other human senses work.

Related Activities: Spoon Bells

Toss The Duck

Overview/Summary:
Visitors experiment with levers to find the optimum fulcrum point to toss a beanbag duck (or anything else, for that matter) the maximum distance. Then visitors try using their levers to lift a heavy object, and notice the difference made by moving the fulcrum point.

Related Exhibits:	Get a Grip; Body Challenge: Hang Time		
Time:	5 minutes		
Age:	K – 8, Families		
Staff:	One person: educator or volunteer		
Safety Issues:	Minimal		
Materials:	Supplied:	triangular block for fulcrum	
	Needed:	meter stick, beanbag, heavy book	

<u>Procedures</u>
Preparation:
1. You'll need to do this activity on a flat surface (table or cart) with plenty of room for the duck to fly!

Real Time:
1. Tell visitors we're going to look at two different tasks to perform with levers – tossing an object and lifting a load.
2. Place meter stick on the fulcrum; place the beanbag at one end. Have visitors try tossing the beanbag into the air to determine the best placement for the fulcrum.
3. Then place the heavy book at one end of the stick and try to lift it. Experiment with various placements of the fulcrum.

Follow-up:
What was the best placement for tossing an object? At what placement of the fulcrum is the book easier to lift?

Science Content/Background: In its simplest form, a lever is a stick that is free to pivot or move back and forth at a certain point. Levers are probably the most common simple machine because just about anything that has a handle on it has a lever attached. The point on which the lever moves is called the fulcrum. By changing the position of the fulcrum, you can gain extra power with less effort. The closer the fulcrum is to an object to be lifted, the greater the power. When tossing an object, the distance of the object from the fulcrum should be greater. Visitors will experience this through experimentation; little explanation should be necessary.

Website for more info:
http://www.grc.nasa.gov/WWW/K-12/Summer_Training/KaeAvenueES/lever.html

Tug of War

Overview/Summary:
A force is a vector – it has an amount (pounds) and a direction. The following activity demonstrates that the direction as well as the amount of force is important.

Related Exhibits:	Body Challenge: Hang Time
Time:	5 minutes
Age:	Grades 6 – 8, Families
Staff:	One educator or trained volunteer
Safety Issues:	Remind visitors that they are not trying to pull each other down in this tug of war. They are just trying to apply a consistent horizontal force. Encourage care and cooperation to avoid rope burns, and instruct them not to wrap the rope around their hands.
Materials:	Supplied: long, strong rope Needed: pad or white board for illustrations

Procedures
Preparation:
1. None, other than getting the rope and easel. You will need a long, cleared space for this activity.

Real Time:
1. Ask as many students/visitors who wish to participate in a tug of war. Save one person (the smallest) for the middle.
2. Tell the people on each end to pull the rope with a strong, steady force. Their goal is not to pull the other team down, but to simply keep the rope horizontal.
3. The person in the middle tries to push the rope downward. Will he/she succeed?

Follow-up:
Who was exerting the most pounds of force, the people at the ends or the person in the middle? Were the people at the ends of the rope pulling in the right direction to oppose the force of the middle student? (You may want to draw an illustration of the forces to clarify thi point.)

Science Content/Background: The student in the middle is easily able to push the rope down. The other students are pulling in the horizontal direction, opposing each other, but no one is opposing the force of the student in the middle. This is similar to hanging from a bar with your arms spread apart as opposed to straight above your shoulders.

Under Pressure

Objective/Summary:
Students will observe the difference in flow of water from lower to higher pressure.

Related Exhibits: Pressure Vessel; Go With the Flow
Time: 5 minutes
Age: All ages; Families
Staff: One educator or trained volunteer demonstrator
Safety Issues: Punching holes in the can should be done by demonstrator
Materials: Supplied: nail for punching holes, blood pressure wrist cuff
Needed: metal cans (coffee cans or soup cans), masking tape, water,
small bucket

<u>Procedures</u>
Preparation:
1. Punch 3 holes horizontally at the bottom of a metal can _" apart. Label this can "A".
2. Punch 3 holes diagonally along the side of another can and label this can "B".

Real Time:
1. Cover the horizontal holes in can A with masking tape.
2. Cover the 3 holes punched diagonally in can B with masking tape.
3. Fill with both cans with water. Hold them over the bucket.
4. Audience predicts what will happen when you remove the tape from both cans.

Follow up:
What is the difference in water flow from can A and B? Were any of the streams of water longer than the others? Why or why not?

Science Content/Background: The water at the top of the can is under less pressure than the water at the bottom of the can. The deeper you go in the can, the greater the water pressure. Therefore, the water flowing out of the hole at the bottom of can "B" will be pushed out at a greater distance because it is under more pressure. Blood pressure works in a similar way. Blood pressure is the amount of force on the walls of the vessels and arteries by the blood. The heart has to pump the blood through the vessels and arteries to the brain against gravity and back to the lungs from the feet against gravity. The body does this by increasing blood pressure to force the blood up to the brain and to the lungs from the feet. The cardiovascular system regulates this pressure depending on posture and body motion.

Extensions: Using the blood pressure wrist cuff provided, you can allow visitors to take their own blood pressure. Blood pressure is measured using a sphygmomanometer. It has an inflatable cuff attached to a mercury-tube pressure gauge. The cuff is placed around the arm and inflated until blood flow is blocked. Blood pressure is determined by the level of mercury (Hg) in the pressure gauge. A reading such as 120/80 means that the force with which the blood is pushing against arterial walls during ventricular contraction is 120 mm Hg and the force of blood during ventricular relaxation is 80 mm Hg.

Related Activities: Go With the Flow

Body Math
Measurements and Ratios

Objective/Summary:
Students can take and compare measurements of different parts of their bodies and make some interesting comparisons. The comparisons represent averages in the general population of body proportions.

Time:	5 to 20 minutes (if graphing results)
Age:	Grades 3 - 5
Safety Issues:	None
Materials:	10 or more tape measures; paper and pencils

<u>Procedures</u>
Preparation:
1. Gather tape measures. Provide paper and pencils.
2. Prepare a chart for graphing results (optional).

Real Time:
1. Estimate the length between your wrist and elbow. Do you think it is the same as the length of your foot? Use the tape measure to check. For most people the measurements will be the same or close. What is the ratio of your measurements?
2. Measure the circumference of your head. Measure your height. What is the ratio of your head circumference to your height? Will this value be different depending on your age? (The value is largest for young children, decreases during puberty, and reaches a constant value after people reach their maximum height.)
3. Measure the circumference of your neck. Divide by 2. Now, measure your wrist. Is twice around your wrist about the same as once around your neck?

Follow up:
Have students graph the results of their class/group to provide an illustration of averages and variations.

Science Content/Background:
Body proportions are important in drawing, painting, and building models of people and animals. Architects, scientists and others use proportions to make scale models to represent much larger objects.

Extensions:
Students could build a scale model of themselves or some simple object.

Body Math
Measurements and Ratios

Objective/Summary:
Students can take and compare measurements of different parts of their bodies and make some interesting comparisons. The comparisons represent averages in the general population of body proportions.

Time: 20 minutes
Age: Grades 6 - 8
Safety Issues: None
Materials: 10 or more tape measures; paper and pencils

Procedures
Preparation:
1. Gather tape measures. Provide paper and pencils.
2. Prepare a sample chart for graphing results.

Real Time:
1. Estimate the length between your wrist and elbow. Do you think it is the same as the length of your foot? Use the tape measure to check. For most people the measurements will be the same or close. What is the ratio of your measurements?
2. Measure the circumference of your head. Measure your height. What is the ratio of your head circumference to your height? Will this value be different depending on your age? (The value is largest for young children, decreases during puberty, and reaches a constant value after people reach their maximum height.)
3. Measure the circumference of your neck. Divide by 2. Now, measure your wrist. Is twice around your wrist about the same as once around your neck?

Follow up:
Have students graph the results of their class/group to provide an illustration of averages and variations.

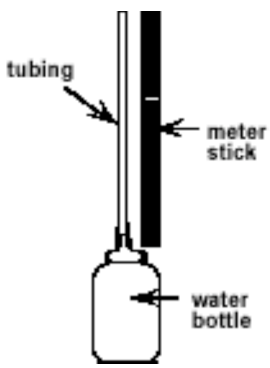
Science Content/Background:
Body proportions are important in drawing, painting, and building models of people and animals. Architects, scientists and others use proportions to make scale models to represent much larger objects.

Extensions:
Students could build a scale model of themselves or some simple object. Students could take measurements of their family members and bring the results into class to make age comparisons.

Heart Model

Objective/Summary: Students will analyze the amount of pressure required to raise the level of a fluid in a model that replicates the way the heart pumps blood up to the brain.

Time: 50 minutes
Age: Grades 6-8
Safety Issues: None
Materials: Per group (2-3) :
- Red food coloring
- Water
- Meter stick
- Squeeze water bottle (300-400 ml)
- Thin plastic tubing that forms a leak-proof seal around the top of the bottle (1 meter long)
- String (15-20 cm long)
- 100 ml graduated cylinder



<u>Procedures</u>
Preparation:
1. Introduce the concept of the cardiovascular system by having students find and count their pulses, either on the wrist or at the neck. Ask "What causes a pulse?" (expansion and contraction of arteries caused by the pumping action of the heart) Have students clench their fists. The human heart is about the size of the person's fist.
2. Introduce the concept of blood pressure by asking students how blood gets to the head. Use an analogy such as pumping oil out of a well to get students to think about how the heart helps defy gravity by pumping blood uphill. Discuss the relationship between water pressure and flow. (Less pressure, less flow)

Real Time:
1. Fill the squeeze bottle with water and add red food coloring. Attach a meter-long piece of clear tubing to the top of the bottle. Secure it so that no water can leak from the point where it connects. The water bottle in this experiment represents the heart and the tubing represents an artery that carries blood to the head.
2. Using the string, tie the meter stick to the tubing so that the 0 mm line is at the base of the tube where it connects to the bottle.

3. One student should hold the bottle and tube without applying any "squeeze pressure" to the bottle. Another student then applies pressure to the "heart" by using 1 finger to push on the bottle. Record how high the fluid reached on the meter stick on your paper.
4. Repeat step #3 but increase pressure by using 2 fingers. Record your height measurement. Continue to increase pressure and record results using 3,4 fingers, one hand, and finally, 2 hands to squeeze.

Follow up:
1. Make a graph showing your results. What conclusions can be drawn about the relationship of pressure to water level?
2. What effects do you think gravity has on blood pressure?

Science Content/Background: Any fluid driven by a pump and flowing in a circuit of closed channels operates under pressure. Blood pressure is the force exerted by the blood on the walls of the blood vessels and arteries. The cardiovascular system ensures that all parts of the body receive an adequate supply of blood regardless of posture or body motion. Every blood vessel in the circulatory system has its own blood pressure, which changes depending on your posture, level of activity and diet.

Blood pressure and flow are directly influenced by gravity. When you are standing, gravity tends to pull the blood downward to the lower body. Blood pressure keeps the blood from pooling in the lower body. Gravity also makes it more difficult for blood to flow upward and return to the heart and lungs. Our bodies have evolved to deal with this by using our leg muscles as pumps to help return the blood to the heart.

Extensions:
Blood pressure is measured using a sphygmomanometer. It has an inflatable cuff attached to a mercury-tube pressure gauge. The cuff is placed around the arm and inflated until blood flow is blocked. Blood pressure is determined by the level of mercury (Hg) in the pressure gauge. A reading such as 120/80 means that the force with which the blood is pushing against arterial walls during ventricular contraction is 120 mm Hg and the force of blood during ventricular relaxation is 80 mm Hg.

6-Pack Glasses

Objective/Summary:
Students use plastic 6-pack rings and colored cellophane to make colored glasses. The cellophane filters out some colors and lets other colors go through.

Time:	20 minutes
Age:	K - 2
Safety Issues:	Either precut the 6-pack holders and lighting gels or have adults help children cut them.
Materials:	Plastic 6-pack holders (can be obtained from a cola bottler) Scotch tape Lighting gels of various colors (available from theatrical supply companies such as www.dudleytheatrical.com) Scissors Single hole puncher Pipe cleaners

Procedures

Preparation:
1. Cut the 6-pack holders into three pieces, so that each piece has two holes in it. These will be the rims of the colored glasses.
2. Lay the rims on a piece of lighting gel and trace around them. Cut out the piece of gel you just traced around.
3. Punch one hole in each side of the glasses to attach the earpieces.

Real Time:
1. Instruct students to tape one piece of gel to each rim of the glasses.
2. Attach pipe cleaners through each hole at the end of the rims to make earpieces.
3. Hook the pipe cleaners over your ears and try them on.
4. Look at the objects in the room or outside the window.

Follow-up:
How have colors of objects in the room changed?

Science Content/Background: Light is electromagnetic energy that we can see. There are seven colors in the visible spectrum: red, orange, yellow, green, blue, indigo, and violet. White light is light that has all these colors. White objects reflect all these colors to your eye. A black object absorbs all the colors and does not reflect light to your eye. A red object reflects red light to your eye, but absorbs all the other colors. Grass looks green because it absorbs all the light except green light. The green light gets reflected to your eyes so you see green grass. Color filters absorb some colors of light and let other colors go through them. A blue filter lets blue light pass through but absorbs the rest of the colors.

Extensions: Try putting a different color in each lens.

Stethoscopes

Objective/Summary:
Stethoscopes are used to hear sounds generated from within the body. They are used to listen to the heart, lungs, and intestinal tract. They are also used for measuring blood pressure. Using a stethoscope is an age-old art in medicine and is a useful, non-invasive diagnostic tool. Students will construct a stethoscope and compare it to an actual one. They will listen to body and other sounds and learn about sound transmission.

Time:	20 minutes
Age:	Grades K - 2
Safety Issues:	None, unless students are helping to cut bottles
Materials:	One 20-ounce soda bottle cut in half per student, vinyl tubing (@ 60 cm long), masking or other sturdy tape, scissors

<u>Procedures</u>

Preparation:
1. Gather materials.
2. Cut the soda bottles in advance if you want to save time, or at least make a small slit with a sharp knife to get the students started. Cut about one-fourth of the way up from the bottom and parallel to the top of the bottle.

Real Time:
1. Give each student a soda bottle and a length of tubing.
2. If you have not pre-cut the bottles, ask students to start at the slit and cut off the bottom portion of the bottle so that it makes a funnel shape.
3. Place a piece of vinyl tubing into the mouth of the bottle and secure it with tape.
4. Hold the end of the tubing to your ear and hold your homemade stethoscope against various objects in the room – clock, window, your friend's tummy!
5. Listen to your heart with your stethoscope. Move it around until you get the best sound.
6. Place your stethoscope on each side of your breast bone, just below your collar bones. Take several deep breaths and listen to the air rushing in and out of your lungs.

Follow-up:
Does your stethoscope help you to hear sounds better? Why? How do you think your heartbeat will change if you jog in place for a minute? Try it.

Science Content/Background: Sound is a form of energy that causes molecules of a medium to vibrate back and forth. The stethoscope transmits the vibrations from your heart, or whatever you're listening to, to your ears. The "lub-dub" sound you hear when you listen to your heart is the sound of valves closing in the one-way pumping system that is your heart.

Extensions: You can extend this program in a variety of ways. Add a diagram of the heart and discuss how the one-way pump works. You can also discuss how sound waves travel through a variety of mediums. Since the molecules of a solid are closer together than those of a gas, vibrations are more easily passed from one molecule to another. Students can test this out in different ways, such as by listening to the vibrations of a tuning fork travel through air and then placing it on their head and listening to the vibrations travel through their bone.

Stethoscopes

Objective/Summary:
Stethoscopes are used to hear sounds generated from within the body. They are used to listen to the heart, lungs, and intestinal tract. They are also used for measuring blood pressure. Using a stethoscope is an age-old art in medicine and is a useful, non-invasive diagnostic tool. Students will construct a stethoscope and compare it to an actual one. They will listen to body and other sounds and learn about sound transmission.

Time:	30 minutes
Age:	Grades 3 - 5
Safety Issues:	Supervise cutting of bottles
Materials:	One 20-ounce soda bottle per student, vinyl tubing (@ 60 cm long), masking or other sturdy tape, scissors, one real stethoscope with both diaphragm and bell

Procedures

Preparation:
1. Gather materials.
2. Cut the soda bottles in advance if you want to save time, or at least make a small slit with a sharp knife to get the students started. Cut about one-fourth of the way up from the bottom and parallel to the top of the bottle.

Real Time:
1. Give each student a soda bottle and a length of tubing.
2. If you have not pre-cut the bottles, ask students to start at the slit and cut off the bottom portion of the bottle so that it makes a funnel shape.
3. Place a piece of vinyl tubing into the mouth of the bottle and secure it with tape.
4. Hold the end of the tubing to your ear and hold your homemade stethoscope against various objects in the room – clock, window, your friend's tummy!
5. Listen to your heart with your stethoscope. Move it around until you get the best sound.
6. Place your stethoscope on each side of your breast bone, just below your collar bones. Take several deep breaths and listen to the air rushing in and out of your lungs.
7. Compare your homemade stethoscope to the real one. (See the list below for an explanation of the parts of a stethoscope.)

Follow-up:
Does your stethoscope help you to hear sounds better? Why? How do you think your heartbeat will change if you jog in place for a minute? Try it.

Science Content/Background: Sound is a form of energy that causes molecules of a medium to vibrate back and forth. The stethoscope transmits the vibrations from your heart, or whatever you're listening to, to your ears. The "lub-dub" sound you hear when you listen to your heart is the sound of valves closing in the one-way pumping system that is your heart.

Extensions: You can extend this program in a variety of ways. Add a diagram of the heart and discuss how the one-way pump works. You can also discuss how sound waves travel through a variety of mediums. Since the molecules of a solid are closer together than those of a gas, vibrations are more easily passed from one molecule to another. Students can test this out in different ways, such as by listening to the vibrations of a tuning fork travel through air and then placing it on their head and listening to the vibrations travel through their bone.

Basic Parts of a Stethoscope

Bell

The bell of the stethoscope is the cup shaped part at the end of the tubing, usually opposite to the diaphragm. Not all stethoscopes have a bell. The bell is used to listen to low pitch sounds.

Diaphragm

The diaphragm of the stethoscope is the flat part at the end of the tubing, with the thin plastic "drum-like" covering. The diaphragm is used to listen to high pitch sounds. Some stethoscopes have a diaphragm but no bell.

Tubing

The stethoscope tubing transmits sound from the bell or diaphragm to the earpieces. Some stethoscopes have single tubes, some have double tubes. Double tubes are more sensitive, but may rub against one another causing "squeaks" to be heard.

Earpieces

Earpieces fit into the ears. They should angle slightly forward for the best fit. Earpieces made of soft rubber are more comfortable and may prevent outside sounds from interfering with your listening.

Brainstorms

- In the programming buckets you will find harpo horns and red & white striped vests. These can be worn and used by the floor staff or educators during demos, family nights, openings, etc. Great Fun!

- You can put together several demos from this toolkit to develop a class. For example, for our K – 2 class, we focused on light and how the eye works. We used the Prizmatic activity to discuss the nature of light then had students make the 6-pack glasses to take back to school. Our 6 – 8 class was set up as a game show, using the Amazing Body Quiz as our content.

- The scavenger hunts in this toolkit can be used to focus school groups or large groups.

Include your brainstorming ideas here for the next museum:

Body Carnival

Exhibits and Programs Evaluation

Please make a copy of this form. Return your evaluation to:

The Health Adventure
P.O. Box 180
Asheville, NC 28802

- Were there exhibits that you didn't like, and what did you not like about them?

- Which exhibits were the favorites of your visitors? Why?

- What did you think about the signs and other written information given? [e.g. too much; too little; interesting and at the right level; boring; too technical; etc.] Give some examples.

- Which activities from the toolkit did you use?

- Which aspects of the activities were most helpful/revealing/clarifying for your visitors?

- What types of programming did you do with the activities?

THANKS!

SCHOOL PROGRAM EVALUATION

Date _________ Museum Educator _________________________

Program Title ____

School _______________________ Your name ____________________________

How would you rate the program content? ___ excellent ___ good ____ acceptable

How would you rate the teaching materials? ___ excellent ___ good ___ acceptable

Rate your students' interest level during the program: ___ high ___ average ___ low

How well did the program meet your expectations? _______________________________

Rate the effectiveness of our museum instructor: ___very effective ____ effective ___ ineffective

How can we better coordinate our programs with your classroom content?

____

Please comment on the time your group spent exploring the entire museum:

____

Are there any additional programs you would like to see the museum offer?

____

Any other thoughts or comments you'd like to share?

____

What field trips does your group take each year?

____

Body Carnival
Scavenger Hunt
Grades 3 - 5

1. Where in your body would you find an artery like the one in the exhibit?

2. Is it easier to balance with your feet wide apart or close together?

3. What percent of your body is water?

4. Can sound waves travel through your body?

5. In the "Pressure Vessel" exhibit, which water stream was hardest to stop?

6. Which was easier to lift, the short arm or the long arm?

7. Name a part of your body that acts as a lever.

8. The reason you feel dizzy in the tunnel is that your brain is getting different messages from what two parts of your body?

Body Carnival

Scavenger Hunt

Grades 6 - 8

1. What happens to blood pressure as an artery narrows?

2. What must happen in order for an object to remain in balance?

3. How many glasses of water do <u>you</u> need each day? Show your calculation here:

4. Which conducts sound better, solids or gases such as air?

5. What was your reaction time? Was it faster or slower when you had to make a choice?

6. Why is your brain confused in the Dizzy Tunnel?

7. What is the relationship between fluid depth and pressure?

8. Name a part of your body that acts like a pulley system.