



# Body Carnival

The Science and Fun of Being You

**A Special Exhibition**  
**October 8, 2011 – January 2, 2012**



**833 Las Vegas Blvd. North**  
**Las Vegas, NV 89101**

## **Educator Materials**

Call 702-382-3445  
For Field Trip Information

*Body Carnival: The Science and Fun of Being You* is an interactive exhibit developed by Catawba Science Center.

# Educator Preparation Materials for *Body Carnival*

## What's Included in This Packet?

Included in this packet is an overview of *Body Carnival: The Science and Fun of Being You*, educational goals, suggested classroom activities, a book list, and internet sites. Also included are connections to the Nevada Content Standards. We want to make it easy for you to connect the content of a visit to the Museum with your classroom goals, so if you have any questions about structuring your visit, please call the Education Department at the Museum at 702-382-3445.

## Note to Teachers and Group Leaders:

The materials in this packet are especially designed for teachers and group leaders preparing to bring young children to visit *Body Carnival: The Science and Fun of Being You* at Lied Discovery Children's Museum. The exhibit is designed for children ages 5-13, and teachers/group leaders are encouraged to customize the information provided in this packet to suit the individual needs of their students. Pertinent connections between exhibit content and Nevada Content Standards have been outlined so that the educational goals of the exhibit may be incorporated into lesson plans.

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## Exhibit Overview

### What is *Body Carnival: The Science and Fun of Being You*?

Come one, come all! Children of all ages are invited to come and explore connections between perception and the laws of physics within the human body. *Body Carnival: The Fun of Being You* is a special traveling exhibition on display at Lied Discovery Children's Museum from October 8, 2011 through January 2, 2012. This 2,000 square-foot exhibit was created by Catawba Science Center (CSC) in Hickory, North Carolina.

*Body Carnival: The Science and Fun of Being You* is an interactive, science-based exhibition enabling students to investigate concepts of force, light, and color while learning about their bodies. Activities are designed to provide safe and inviting experiences for the youngest visitors while offering challenges for older children. Teachers and group leaders are addressed specifically through text and graphics, which highlight the exhibit's educational messages.

In 18 exhibits, visitors are invited to:

- Crawl through a giant artery to see (and hear) the effects of plaque build-up on blood flow
- Test their balance as they walk through the 10-foot long Dizzy Tunnel, which simulates a rotating star field
- Put on a pair of vision-distorting goggles and discover how sight affects the ability to walk straight
- Experiment in the House of Color with different sources of light
- "Hear" through their bones and muscles while learning how these transmit sound

Exhibit experiences reinforce and augment classroom study of the Nevada Content Standards in Science, Health, Physical Education, and Math. Most closely aligned are strands of Physical Science, Growth and Development, Object Movement Skills, Locomotor and Nonlocomotor Movement Skills, Physical Fitness, and Measurement.

*Body Carnival: The Science and Fun of Being You* is an exhibition design for children between the ages of 5-13 and is intended for families, educators, schools, and community organizations that focus on childhood education and enrichment. Activities and components encourage both thoughtful and fun individual experiences as well as shared experiences between children and adults.

## Educational Goals

- To provide an experiential, hands-on learning experience for kindergarten through fifth grade children which supports Science, Health, Physical Education, and Math content standards
- To promote scientific inquiry and experimentation

- To encourage students to explore concepts of force and pressure, the properties of light and sound, mathematics concepts, and the laws of motion through physical challenges and perception altering activities
- To better understand how our bodies work and interact with the world

## **Exhibit Component Descriptions**

This exhibition features eighteen fun, interactive exhibits that allow students to explore concepts of force and pressure, properties of light and sound, mathematic concepts, laws of motion, and how our bodies work and interact with the world.

### **Entrance:**

Two columns, with a tent covering, welcomes visitors with exhibit name and description on the right column, and donors and NSF logo on the left column. “Fun House” mirrors located on the back of the columns provide an interactive element.

### **Balancing Act:**

Visitors can work at a table with four different sides to explore how the center of gravity and the base of an object affect stability. Each side has one 15” doll and a collection of metal rings. One doll has small feet, the second and third doll has larger feet, and the fourth doll has feet that you can spread apart to get a wider base. The arms on the dolls are stretched out to the sides of the dolls like a “T.” Visitors can place rings to the left and/or right of the outstretched arms to try to balance the doll.

### **Walk the Plank:**

A 12-foot long balance beam going from a 4” beam, to a 2” beam and then to a wire. There is a pirate character stanchion located at the front of the beam that has weights in a box at his feet. Visitors can try “Walking the Plank” with or without using weights from the box. The beam can be set up to be as straight 12 feet long or shaped like a Z.

### **Dizzy Tunnel:**

Visitors walk though a rotating star field and try to maintain their balance. The walk is 10 feet long and three feet wide. Ramps have been added to make this exhibit wheelchair accessible.

### **Goofy Goggles:**

Visitors put on a pair of goggles with vision-distorting lenses and attempt to follow a zigzag yellow line on the floor.

### **Wacky Wall:**

Visitors stand in front of a striped wall. They pull a rope to make the wall move side to side, at the same time, they try to stand on one foot to see if they can maintain their balance while looking at the wall move.

### **Get a Grip:**

A three-sided table, of which, two sides is equipped with hand models which demonstrate how tendons make our hands function. One hand is available to “string” your own tendons, and the

other hand comes equipped with tendons in place. The third side has three differing lengths arms, so that the visitor may experience how the length of the arm affects its leverage.

**House of Color:**

Visitors enter a small room that has a flap at the entrance to keep extraneous light out of the room. They can experiment with different sources of lights to see the effects of varying light wavelengths on the colors of various objects. There is a control panel located on a shelf right inside of the entrance. There are switches on this control panel to turn certain lights on or off. Lights available for experimentation include: white light, monochromatic light (from a sodium blub), red light, blue light, and green light.

**Pressure Vessel:**

One part of this exhibit encourages visitors to feel streams of water from 3 spouts located at different depths. The visitors are able to feel the different water pressure from the differing depths of spouts. The second part of this exhibit encourages you to take your blood pressure with your hand held at head height or at waist level to see the difference that depth of fluid makes in your own blood pressure.

**Go With the Flow:**

Two spouts offer the visitor a chance to apply their own “clogged arteries” to the spouts. The extra clogged spouts are located on a shelf at a table height for the visitor to experiment.

**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. The inside of the tunnel narrows from 3’ at the entrance to 2’ at the exit as the visitor crawls through the artery. There are 3 view ports located along the right side of the artery so that visitors can see the inside of the tunnel if they do not want to crawl through the tunnel.

**Circulation Station:**

There are three different sides to this module.

**H2O:** Visitors calculate how much water they need to drink daily. A weight scale and calculator are available for visitors to work a formula to see how much water they should drink daily depending on how much they weigh.

**Target Heart Rate:** Visitors calculate their target heart rate. A calculator and heart rate monitor are available for the visitor to work a formula that helps them find their individual target heart rate.

**The Human Yardstick:** Visitors determine the mathematical relationship between their arm span and their height. Visitors are able to get their height from a height slider located at the exhibit. They can also measure their outreached arm span fingertip to fingertip using a retractable tape.

**Clown Figures:**

There are two freestanding clown stanchions with “flat” balloons. Each clown has three balloons in their hand. Each balloon has a fact about the human body. Some of the facts are comparisons with everyday objects or activities and curious body facts.

**Feel Music:**

Visitors cover their ears and lean back against sound cushions to “hear” through their bones and muscles. Those in wheelchairs can use a portable sound cushion that is attached to the left side of the exhibit. There is a freestanding stanchion located beside the exhibit that will hold the text panel.

**Body Challenge:**

The visitor has three opportunities to compare their physical and neural activities with others.

**Hang Time:** Visitors can measure their extended and flexed arm hang times. A timing device with audible beep tells them how long their feet are off the ground. Text panels have comparisons with others of their gender and age. They will be challenged to hold their hands in different locations on the bar to determine what the easiest position to hold is.

**Think Fast:** Visitors have two 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 two different lights and choosing which button to press.

**Sit and Reach:** From a seated position visitors attempt to measure how flexible they are, with and without warming up their muscles. The slider located on the Flexibility unit has an audible click at each one-inch increment. Text panel have comparisons with others of their gender and age.

## Curriculum Links

***Body Carnival: The Science and Fun of Being You*** was developed for children ages 5-13 years old and their parents, caregivers, or teachers. The content of the exhibition supports specific portions of the Science, Health, Physical Education, and Mathematics curriculum as outlined in the Nevada State Curriculum Standards. The exhibition facilitates learning for *all* 6 grades (Kindergarten through 5<sup>th</sup> grade. *The strongest connection to the standards is for third grade.* Below is a selection, from the Nevada State Curriculum Standards, of pertinent concepts, skills, and experience in these areas for your reference in making field trip preparations to the Museum to see ***Body Carnival: The Science and Fun of Being You.***

### Kindergarten

**SCIENCE:**

*Nature of Science: Scientific Inquiry*

- N2A Students understand that science is an active process of systematically examining the natural world.

*Nature of Science: Science, Technology, and Society*

- N2B Students understand that many people contribute to the field of science.

*Physical Science: Energy*

- P2C Students know that heat, light, and sound can be produced.
- P5C Students understand that energy exists in different forms.

## **HEALTH:**

*Personal Health and Fitness*

- 1.0 Students will comprehend concepts related to health promotion/disease prevention.

## **PHYSICAL EDUCATION:**

*Locomotor and Nonlocomotor Movement Skills*

- 2.0 Students demonstrate competency in many movement forms and proficiency in a few movement forms.

*Physical Fitness*

- 4.0 Students achieve and maintain a health-enhancing level of individual fitness for an active lifestyle.

## **MATH:**

*Mathematical Connections*

- D Students will develop the ability to make mathematical connections by solving problems where there is a need to view mathematics as an integrated whole.

## **First Grade**

## **SCIENCE:**

*Nature of Science: Scientific Inquiry*

- N2A Students understand that science is an active process of systematically examining the natural world.

*Nature of Science: Science, Technology, and Society*

- N2B Students understand that many people contribute to the field of science.

*Physical Science: Energy*

- P2C Students know that heat, light, and sound can be produced.
- P5C Students understand that energy exists in different forms.

## **HEALTH:**

*Personal Health and Fitness*

- 1.0 Students will comprehend concepts related to health promotion/disease prevention.

**PHYSICAL EDUCATION:**

*Locomotor and Nonlocomotor Movement Skills*

- 2.0 Students demonstrate competency in many movement forms and proficiency in a few movement forms.

*Physical Fitness*

- 4.0 Students achieve and maintain a health-enhancing level of individual fitness for an active lifestyle.

**MATH:**

*Measurement*

- 3.0 Students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements to solve problems, communicate, reason, and make connects within and beyond the field of mathematics.

*Mathematical Connections*

- D Students will develop the ability to make mathematical connections by solving problems where there is a need to view mathematics as an integrated whole.

**Second Grade**

**SCIENCE:**

*Nature of Science: Scientific Inquiry*

- N2A Students understand that science is an active process of systematically examining the natural world.

*Nature of Science: Science, Technology, and Society*

- N2B Students understand that many people contribute to the field of science.

*Physical Science: Energy*

- P2C Students know that heat, light, and sound can be produced.
- P5C Students understand that energy exists in different forms.

**HEALTH:**

*Personal Health and Fitness*

- 1.0 Students will comprehend concepts related to health promotion/disease prevention.

**PHYSICAL EDUCATION:**

*Locomotor and Nonlocomotor Movement Skills*

- 2.0 Students demonstrate competency in many movement forms and proficiency in a few movement forms.

*Physical Fitness*

- 4.0 Students achieve and maintain a health-enhancing level of individual fitness for an active lifestyle.

**MATH:**

*Measurement*

- 3.0 Students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements to solve problems, communicate, reason, and make connects within and beyond the field of mathematics.

*Mathematical Connections*

- D Students will develop the ability to make mathematical connections by solving problems where there is a need to view mathematics as an integrated whole.

**Third Grade**

**SCIENCE:**

*Nature of Science: Scientific Inquiry*

- N5A Students understand that science involves asking and answering questions and comparing the answers to what scientists know about the world.

*Nature of Science: Science, Technology, and Society*

- N5B Students understand that many people, from all cultures and levels of ability, contribute to the fields of science and technology

*Physical Science: Energy*

- P2C Students know that heat, light, and sound can be produced.
- P5C Students understand that energy exists in different forms.

**HEALTH:**

*Growth and Development*

- 2.0 Students will demonstrate the ability to access valid health information and health promoting products and services.

**PHYSICAL EDUCATION:**

*Locomotor and Nonlocomotor Movement Skills*

- 2.0 Students demonstrate competency in many movement forms and proficiency in a few movement forms.

*Physical Fitness*

- 4.0 Students achieve and maintain a health-enhancing level of individual fitness for an active lifestyle.

**MATH:**

*Measurement*

- 3.0 Students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements to solve problems, communicate, reason, and make connects within and beyond the field of mathematics.

*Mathematical Connections*

- D Students will develop the ability to make mathematical connections by solving problems where there is a need to view mathematics as an integrated whole.

## Fourth Grade

### SCIENCE:

*Nature of Science: Scientific Inquiry*

- N5A Students understand that science involves asking and answering questions and comparing the answers to what scientists know about the world.

*Nature of Science: Science, Technology, and Society*

- N5B Students understand that many people, from all cultures and levels of ability, contribute to the fields of science and technology.

### HEALTH:

*Personal Health and Fitness*

- 1.0 Students will comprehend concepts related to health promotion/disease prevention.

*Growth and Development*

- 2.0 Students will demonstrate the ability to access valid health information and health promoting products and services.

### PHYSICAL EDUCATION:

*Locomotor and Nonlocomotor Movement Skills*

- 2.0 Students demonstrate competency in many movement forms and proficiency in a few movement forms.

*Physical Fitness*

- 4.0 Students achieve and maintain a health-enhancing level of individual fitness for an active lifestyle.

### MATH:

*Measurement*

- 3.0 Students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements to solve problems, communicate, reason, and make connects within and beyond the field of mathematics.

*Mathematical Connections*

- D Students will develop the ability to make mathematical connections by solving problems where there is a need to view mathematics as an integrated whole.

## Fifth Grade

### **SCIENCE:**

#### *Nature of Science: Scientific Inquiry*

- N5A Students understand that science involves asking and answering questions and comparing the answers to what scientists know about the world.

#### *Nature of Science: Science, Technology, and Society*

- N5B Students understand that many people, from all cultures and levels of ability, contribute to the fields of science and technology.

### **HEALTH:**

#### *Growth and Development*

- 2.0 Students will demonstrate the ability to access valid health information and health promoting products and services.

### **PHYSICAL EDUCATION:**

#### *Locomotor and Nonlocomotor Movement Skills*

- 2.0 Students demonstrate competency in many movement forms and proficiency in a few movement forms.

#### *Physical Fitness*

- 4.0 Students achieve and maintain a health-enhancing level of individual fitness for an active lifestyle.

### **MATH:**

#### *Measurement*

- 3.0 Students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements to solve problems, communicate, reason, and make connects within and beyond the field of mathematics.

#### *Mathematical Connections*

- D Students will develop the ability to make mathematical connections by solving problems where there is a need to view mathematics as an integrated whole.

## **Suggested Pre-Visit Activities**

These pre-visit activities are designed to introduce the concepts that students will encounter in the *Body Carnival: The Science and Fun of Being You* exhibition. The concepts of reaction time, center of mass, gravity, blood flow, forces, and vectors will be introduced through these activities. The more familiar students are with these concepts, the more substantial their educational experience in the exhibition will be.

## 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.

**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. Center of gravity is important for stability and balance.

**Related Exhibits:** Balancing Act, Walk the Plank

**Time:** 20 minutes

**Safety Issues:** Participants may fall down if they do not have good balance

**Materials:** chair (one that is fairly easy to lift)

### **Procedures:**

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?

**Extensions:** Keep a running poll on success rate of males vs. females on procedure # 4. Show your results in a bar graph.

## 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.

**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!

**Related Exhibits:** Body Challenge: Think Fast!

**Time:** 5 minutes

**Safety Issues:** None

**Materials:** stopwatch, calculator

**Procedures:**

1. Have participants form a chain holding each other's hands. Count the number of participants.
2. Tell the participants 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 participants.  $\text{Reaction time} = \frac{\text{total time}}{\text{number of visitors in chain}}$ .

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

**Extensions:** Vary the number of people in the chain. Compare reaction times of different groups. Create a reaction time challenge!

### **Go With the Flow**

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

**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 a little darker than the one held up because more blood flowed to it in the sixty seconds.

**Related Exhibits:** Pressure Vessel, Go With the Flow

**Time:** 5 minutes

**Safety Issues:** None

**Materials:** None

**Procedures:**

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?

### **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.

**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.

**Related Exhibits:** Body Challenge: Hang Time

**Time:** 5 minutes

**Safety Issues:** Remind participants 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:** long strong rope

**Procedures**

1. Ask as many students 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? (Note to Teacher/Group Leader – You may want to draw an illustration of the forces to clarify this point.)

### **Suggested During-Visit Activity**

This scavenger hunt was designed to help structure your visit to the *Body Carnival: The Science and Fun of Being You* exhibition. Though this activity would be most appropriate for grades 3-5, you may modify it to fit your specific classroom needs.

# **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?**

## Suggested Post-Visit Activities

These post-visit activities are designed to reinforce and extend students' understandings of the physical science concepts encountered in the *Body Carnival: The Science and Fun of Being You* exhibition. The concepts of balancing, reaction time, mixtures and solutions, and physiology will be reinforced and extended through these activities. Teachers/Group Leaders should adapt activities and discussions to their individual classes. Additional books, websites, activities and lesson plans for K-5 may be found in the Resource section of this Educator Materials guide.

### 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.

**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).

**Related Exhibits:** Body Challenge: Think Fast!  
**Time:** 10 minutes  
**Safety Issues:** None  
**Materials:** deck of cards, stopwatch, paper, pencil

#### **Procedures:**

1. Instruct the participants to turn each card face up in a pile as fast as they can. Use the stopwatch to record their reaction time. Participant records their time on paper.
2. Gather the cards in a pile face down and reshuffle. This time the participant 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.

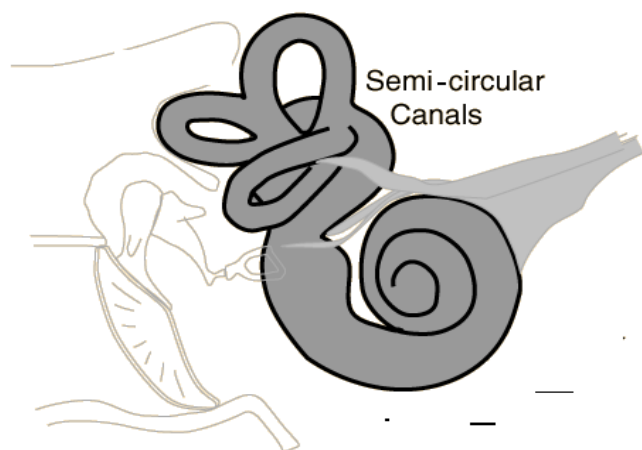
**Follow-up:** Which task were you able to complete the fastest? Why? Can you improve over time; i.e. train your brain to go faster?

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

## On the Level

**Objective/Summary:** Participants 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 and the movement of the liquid sends nerve impulses to the brain. These messages enable one to sense the angle and direction of movement.

**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>)



**Related Exhibits:** Dizzy Tunnel; Wacky Wall  
**Time:** 5 minutes  
**Safety Issues:** Minimal  
**Materials:** carpenter's level, ear model (can be a picture), glitter in a bottle of water

### **Procedures:**

1. Participants stand with feet shoulder width apart.
2. Ask participant 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.

**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!

### **Toss the Duck**

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

**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.

**Related Exhibits:** Get a Grip; Body Challenge: Hang Time

**Time:** 5 minutes

**Safety Issues:** Minimal

**Materials:** triangular block for fulcrum, meter stick, beanbag, heavy book

#### **Procedures:**

1. Tell participants 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 participants 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?

## Edible “Blood”

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

**Science Content/Background:** Blood is a viscous fluid - thicker and more adhesive than water. Blood flows approximately 4 ½ to 5 ½ 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.

**Related Exhibits:** Tunnel of Blood

**Time:** 10 min

**Safety issues:** None

**Materials:** measuring cup, blender, corn syrup, candy red hots, white jelly beans, candy sprinkles, mixing bowl, large spoon, small drinking cups (i.e. Dixie cups)

### **Procedures:**

1. Assist participants in measuring out the ingredients in the following proportions: corn syrup 55%, red hots 44%, white jellybeans 0.5%, and sprinkles .05%. 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, and 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 0.5%?

**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.

## Body Math

**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.

**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.

**Time:** 5 to 20 minutes (if graphing results)

**Safety Issues:** None

**Materials:** 10 or more tape measures, paper, pencils

**Procedures:**

1. Estimate the length between your wrist and elbow. Estimate the length of your foot. Use the tape measure to check your estimations. What do you notice? 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. What do you notice about those two numbers? (Twice around your wrist is 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.

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

## 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.

**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.

**Time:** 20 minutes

**Safety Issues:** None, unless students are helping to cut bottles

**Materials:** One 20-ounce soda bottle cut in half per student, vinyl tubing (about 60 cm long), masking or other sturdy tape, scissors

**Procedures:**

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.

**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 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.

## **Additional Resources**

### **Related Non-Fiction Books for Children**

De le Bedoyere, C. *Human Body* (2009)

Gardner, R. *Easy Genius Science Projects with the Human Body: Great Experiments and Ideas* (2009)

Green, D. *Human Body* (2011)

Katz Cooper, S. *Human Body Systems: Maintaining the Body’s Functions*

Parker, S. *Human Body* (2008)

Reilly, K. *The Human Body: 25 Fantastic Projects Illuminate How the Body Works* (2008)

Simon, S. *The Human Body* (2008)

Smith, M. *Human Body* (2008)

Stradling, J. *The Wonders Inside the Human Body* (2009)

Taylor, B. *The Best Book of the Human Body* (2008)

Walker, R. *3-D Human Body* (2011)

Walker, R. *Dr. Frankenstein’s Human Body Book: The Monstrous Truth About How Your Body Works* (2008)

Walker, R. Eyewitness Human Body (2009)

Somervill, B. The Human Body (2008)

Walker, R. Human Body (2010)

Walker, R. Human Body Q&A (2010)

### **Related Websites to Extend Learning**

- [http://kidshealth.org/kid/body/ear\\_noSW\\_p5.html](http://kidshealth.org/kid/body/ear_noSW_p5.html)
- <http://hyperphysics.phy-astr.gsu.edu/hbase/sound/eari.html>
- [http://www.grc.nasa.gov/WWW/K-12/Summer\\_Training/KaeAvenueES/lever.html](http://www.grc.nasa.gov/WWW/K-12/Summer_Training/KaeAvenueES/lever.html)