SUGGESTED ACTIVITIES

(Human Body)

From *Invitations to Science Inquiry 2nd Edition* by Tik L. Liem:

Activity	Page Number	Concept
How fast can you react?	448	Using senses
How fast does your heart beat?	450	Circulatory System
How do we breathe?	453	Respiratory system
Drinking while sitting on your head	458	Body systems working together

From *NSF/IERI Science IDEAS Project*:

Activity Page Number Concept

Activity	Page Number	Concept
Human Body Systems	105 (w/156) - Big Book of Science 2004 by Dinah Zike	Classification and function of body systems

From *Harcourt Science* Teacher's Ed. Unit A: (For ALL grade levels)

Activity	Page Number	Concept
Fur helps animals	A40-41 (3rd)	Model use and mammalian characteristic
Breathing rates	A94-95 (4th)	Respiratory & circulatory system working together
Muscle model	A109 (4th)	Muscular & skeletal system working together
How muscles cause movement	A22-23 (5th)	Muscular system (and measurement)

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HOW FAST CAN YOU REACT?

A. Question: *Do you have good reflexes?*

B. Materials Needed:

- A meter stick

C: Procedure:

1. Place your hand over the edge of a table and leave about a 3 cm opening between the thumb and forefingers. As in the diagram, your wrist should be touching the table and your fingers should not.
2. Let your partner hold the meter stick vertically from the top end of the stick. The stick should be placed between the 3 cm gap of your thumb and forefingers.
3. Read off and record the spot where your thumb is on the meter stick before the tester drops the stick (It may be easiest to start at an even number- for example 10 or 20 cm).
4. Let the tester drop the stick. The moment that you see the stick drop, try to catch it immediately. Record where your thumb stopped when you regrasped the stick. Calculate the difference between the starting point and ending point. Record this distance.
5. Try testing the other stimuli. Hearing: close your eyes and have the tester say "Now" exactly at the moment that he/she drops the stick. Touch: close your eyes and let the tester touch your other hand at exactly the moment that he/she lets go of the stick.

D: Anticipated Results:

The students will be able to see how fast their reflexes respond. The length of time or cm it takes for them to regrasp the stick will vary from student to student.

E: Thought Questions for Class Discussion:

1. How do girls compare to boys in reaction time?
2. In doing the above comparison, what variables have to be controlled?
3. How do the different stimuli compare in your reaction time?
4. What is the actual falling time for the distance in the drop?
5. What are all the variables involved in this experiment?

F: Explanation:

There are two types of variables in this experiment, the manipulated variable and the responding variable. The manipulated variable is the stimulus, sensed either through vision, hearing, or touch. The responding variable is the falling time or distance on the meter stick.

The free fall distance can be calculated by: $\mathbf{d = \frac{1}{2} gt^2}$ where t = the square root of (2d/g) and where g = the gravity acceleration.

All other variables such as, distance between fingers, the place where the tester holds the stick, catching with two fingers vs. with the whole hand, the accuracy of saying "now" and simultaneously letting go of the stick have to be held constant.

HOW FAST DOES YOUR HEART BEAT?

A. Question: *Can we determine our pulse in the classroom? Does it ever change?*

B. Materials Needed:

- Low step stools
- A stop watch or a watch with a second hand

C: Procedure:

1. Let students work in pairs: one acting as the tester and the other as the subject. Instruct the tester to count the number of heartbeats of the subject by placing his/her fingers on the subject's wrist, and counting the number of pulses that occur within 10 seconds. Once the number is observed and recorded it should be multiplied by 6.
2. After this is completed, allow the subject to step up and down on a stool 10 times. Immediately after the 10^{th} step, the tester should retake the subject's pulse for a 10 second period. Once again multiply this number by 6 and record the data.
3. Give the subject time to recuperate breath if needed (perhaps wait 3 minutes). Then have him/her do 20 stool climbs. Immediately retake the pulse as before. Record data.
4. Repeat step 3, but with 30 steps this time.
5. After all data has been recorded, the tester and subject should switch roles.

D: Anticipated Results:

It is expected to see an increase in pulse rate as intensity of exercise increases.

E: Thought Questions for Class Discussion:

1. What was the normal resting pulse (before the steps up and down the stool) ?
2. What was the pulse after 10, 20, and 30 steps up and down the stool?
3. What made the heart beat faster after exercise?
4. What did the muscles need to do all that work?

F: Explanation:

The pulse or heartbeat is caused by the blood pressure impact on the arteries as the heart muscles contract. It can be felt by placing a finger on the radial artery on the wrist. By doing vigorous exercise, like the steps up and down the stool, the leg muscles need more oxygen and thus more blood to carry this oxygen. Thus the heart automatically speeds up to pump more blood to the working muscles, from around 72 beats per minute to more than 120. However, within three minutes this sped up pulse should return to the normal 72. By increasing the number of steps on the stool, an increase in the subject's pulse should be observed. Some deviations from the expected pulse rates may be normal for certain individuals.

HOW DO WE BREATHE?

A. Question: *What happens when we breathe?*

B. Materials Needed:

- A large bottle or jar with a rather narrow neck
- A one-hole stopper (able to fit snugly in the bottle neck)
- A y-glass tube (or straight tube)
- Two small balloons & two rubber bands
- One large balloon (or beach ball balloon)

C: Procedure:

1. Cut the bottom of a large bottle out. If the bottle/jar is glass, this can be done by covering it with a cm thick layer of hot oil, and touching the outside of the jar with an ice cube exactly at the surface of the oil (the jar will crack and the bottom will drop out). Smooth the edge by filing or firing. An adult should assist with this part of the experiment.
2. Tie the two small balloons to the two ends of the Y-tube using the rubber bands. Hold the long end of the Y-tube through the bottle neck and insert the one-hole stopper over the Y-tube and in the bottle neck. Refer to diagram.
3. Cut the large balloon/ beach ball in half, stretch it over the open end of the bottle and tie or tape it around airtight (it represents a diaphragm).
4. Pull the center of the diaphragm up and down and observe the balloons expand and collapse.

D: Anticipated Results:

As you pull the beach ball down you should see the balloons inside the bottle expand.

E: Thought Questions for Class Discussion:

1. What does the Y-tube represent in this demonstration?
2. What do the small balloons and the stretched rubber sheet represent?
3. What made the small balloons expand?
4. What stage of the breathing could the expanded state of the balloons be compared with?
5. How different would it be to compare the glass jar with our chest cavity? How are they the same?

F: Explanation:

The Y-tube in our demonstration represents the bronchial tube; the small balloons represent the lungs; the rubber sheet represents the diaphragm; and the jar represents the chest cavity. The chest cavity can be expanded or contracted due to flexible rib joints. This is not the case with the glass jar. This is one difference between our model and the actual human physiology. By pulling the rubber sheet down, the pressure inside the jar decreases, and therefore the air is sucked from the outside into the small balloons. This mimics the process of inhaling.

TRY DRINKING WHILE STANDING ON YOUR HEAD

A. Question: *Is it possible to drink something while upside down?*

B. Materials Needed:

- A glass of drinking water or juice
- A bent drinking straw or flexible tube

C: Procedure:

1. Try to stand on your head against the wall. If this is not possible, bend from your waist down until your head touches the floor.
2. Have your partner bring you a glass of water with the drinking straw inserted. Your partner should help place the straw in your mouth.
3. Suck through the straw while your body (or upper body) is upside down. Drink as much as desired.

D: Anticipated Results:

Students will see that it is possible to drink fluids while upside down.

E: Thought Questions for Class Discussion:

1. Is gravity needed to make fluids come down the esophagus?
2. Can we drink water while we stand on our head?
3. How does food go down the esophagus into the stomach?
4. Is the esophagus like a glass or rubber tube going in the stomach?
5. Why did the fluid not flow out of the mouth when drinking upside down?
6. What is the muscle action called, which pushes food into the stomach?

F: Explanation:

After food is swallowed, it enters the esophagus. Here it is pushed along by muscle action, which is called peristalsis. This movement of the food is carried out by involuntary muscles. There are two layers of muscles: the inner layer forms a series of circles around the tube, and the outer layer is longitudinal. When the inner layer contracts, the tube becomes smaller at that point. When they relax the longitudinal muscles contract. This alternate contraction and relaxation of the two sets of muscles push the food along the tube in peristaltic waves. This is the reason why food, whether it is in solid or liquid form, may be swallowed with the body positioned in any direction. Gravity has little or no influence on this.