

LAB-AIDS #8 HUMAN SENSES (PHYSIOLOGY) EXPERIMENT KIT
Student Worksheet and Guide
PART I

For hundreds of years, men have been curious about the ways in which living creatures perceive the world around them. Of special interest have been the senses: touch, taste, smell, sight, and hearing. Investigators had learned as early as the 17th Century that the human eye is a form of camera and the ear perceives sound by detecting the vibrations of sound waves in the air. Skin was known to be able to respond to pressure.

In the following exercises, you will map your body for sensory perception – smell, touch, pain, heat, cold, pressure, visual perception, blindspot determination, and reflex actions.

I. CHEMICAL SENSES

A. TASTE

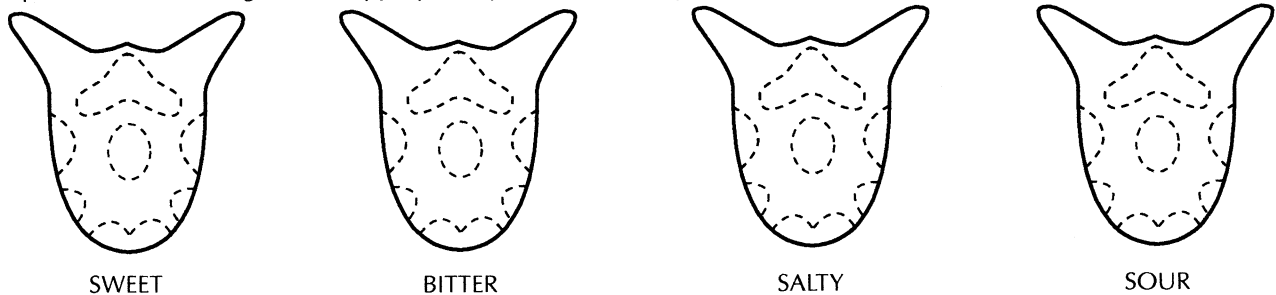
A partner will be required for this exercise. Necessary materials for this exercise:

- | | | |
|-----------------------------------|--|-----------------------------|
| Each partner should have: | 4 three-inch cotton-tipped applicators | |
| | 1 plastic taste solution dish | |
| | 1 taste map | |
| To be shared by the class: | 2 bottles of bitter solution | 2 bottles of sour solution |
| | 2 bottles of salty solution | 2 bottles of sweet solution |

Before proceeding with this exercise, remove gum or other food material from your mouth and rinse your mouth with water.

Procedure:

1. Pour a small amount of one of the taste solutions into the taste dish so there is enough to cover the bottom.
2. Dip a clean cotton-tipped applicator into the liquid. Drain the excess solution from the applicator by pressing it against the side of the dish.
3. Touch the applicator to the tongue of your partner in the regions outlined on the taste map. Tell your partner to place a plus (+) sign on the corresponding area of his taste map if he can sense the taste. If he cannot sense the taste, have him place a minus (-) sign in the appropriate place on the map.



Indicate in each outlined area the presence (+) or absence (-) of that specific taste. Compare results.

4. After the four areas of the tongue have been tested with one solution, snap the cotton-tipped applicator and discard it.
5. Exchange roles with your partner and repeat the test with the same solution.
6. Rinse your mouth with water. Also, rinse out the taste dish.
7. Repeat the procedure with each of the other three taste solutions.

B. Smell:

Necessary materials: Each student will need a plastic inhaler.

To be shared by the class: 2 vials of perfume, 2 vials oil of cloves, 2 vials oil of peppermint

Before proceeding with this activity, check to see that the spouts of the perfume vials are open or have been punctured.

Procedure:

1. Place the plastic inhaler over the spout of the perfume vial.
2. Insert the end of the inhaler into the lower posterior part of the nostril (Fig. 1) while the other nostril is held closed.
3. Slowly, inhale through the nose and attempt to determine the odor.

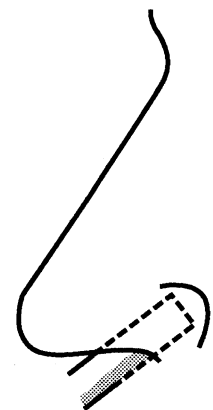


Fig. 1

Student's Name _____ Date _____

4. Record the results: _____

5. Repeat the process, placing the end of the tube in the *upper anterior* part of the nostril (Fig. 2).
6. Record the results _____

7. Which region gives the most distinct olfactory sensation?

8. Where do you think the olfactory area is located? _____

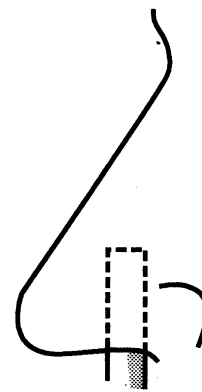


Fig. 2

9. Close one nostril and with the other, smell the oil of cloves by holding the vial about 1.5 cm from the nose. Exhale through the mouth and inhale through the nose. Make sure to keep one nostril closed.

10. Record the time it takes until the smell of cloves is no longer detected. (This is called *olfactory fatigue* or *olfactory exhaustion*.) Also, determine the time necessary for recovery. Repeat this procedure three to five times and calculate the average time for olfactory exhaustion and recovery.

Olfactory Fatigue Times: _____
Average: _____

Olfactory Recovery Times: _____
Average: _____

11. Repeat the process with the oil of peppermint and record your results.

Olfactory Fatigue Times: _____
Average: _____

Olfactory Recovery Times: _____
Average: _____

Was there any significant difference in the average times? _____

12. Fatigue the olfactory mechanism with oil of cloves and *then* smell the oil of peppermint?

13. Explain the results: _____

OPTIONAL ACTIVITY:

Necessary materials (not provided in this kit).
pieces of fresh apple and fresh raw potato, cut in small pieces - all the same size
forceps for each team of two students

Have your partner sit down, Tell him to close his eyes, hold his nose and put out his tongue. Take a piece of either the apple or potato with the forceps and gently place it on his tongue. Have him try to identify by taste alone, the material you placed on his tongue. Repeat several times and record the results.

Mark (+) if correctly identified, and (-) if incorrectly identified.

Taste trials: _____

Exchange roles with
your partner: _____

After comparing your results with those of your partner, what conclusion can you make concerning the correlation of taste with smell? _____

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PART II

2. SKIN SENSES

A. Touch: A partner will be required for this exercise.

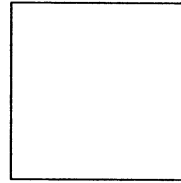
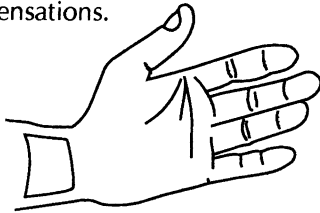
Each student should have: 1 bristle
 2 straight pins
 1 metal probe

Each team should have: 1 styrofoam pin holder
 absorbent cotton (not in kit)
 container of warm water

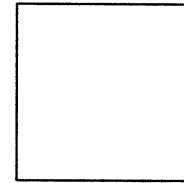
Procedure:

1. With a ball point or felt pen, mark off a 4 cm square on the inside surface of your wrist near the palm (Fig. 3).
2. Tell your partner to rest his hand on a table, palm side up, and close his eyes.
3. Explore the marked off area with the tip of a bristle using just enough pressure to bend the bristle. Always apply the same amount of pressure.
4. When your partner indicates he feels the bristle, record on this worksheet the locations corresponding to the points at which he feels sensations.
5. Exchange roles.

Fig. 3



TOUCH



PAIN

B. Pain Sensation:

Procedure:

1. Apply a piece of absorbent cotton soaked with warm water to the same marked off area of your partner's arm for five minutes. This will soften the skin. Repeat procedure as often as necessary during this exercise to keep skin soft.
2. Have your partner close his eyes. Place the point of a straight pin on the surface of the skin within the marked boundaries. **DO NOT PUNCTURE THE SKIN.** Press enough to produce a sensation of pain. Explore the area in a systematic manner.
3. Record the locations that give your partner a pain sensation.
4. Exchange roles.
5. How does the number of touch points compare with the number of pain points?

C. Heat and Cold Sensation:

Procedure:

1. On the back of your wrist draw another 4 cm square.
2. Place a metal probe in ice water for about one minute. Dry it quickly.
3. Have your partner close his eyes.
4. With the end of the probe, explore the area marked off for places cold can be felt. **REMEMBER TO KEEP PROBE COOL.**
5. Mark the location **on the wrist** with a X.
6. Immerse the probe in hot water so it gives a sensation of warmth. **DO NOT ALLOW THE PROBE TO BECOME TOO HOT.**
7. Proceed as before, locating the position of the places where warmth can be felt.
8. Determine the frequency of each sensation. Warm receptors _____/cm² Cold receptors _____/cm²
 Do you think the same receptors sense heat and cold? _____
9. Reverse roles with your partner and proceed as above.

Optional: Compare both frequency and proximity of these sensations on different parts of the body.

D. Two-point Threshold: Two-point threshold is the smallest separation at which two stimuli are perceived as distinct. It is also the ability to distinguish two small objects (in this exercise the objects will be blunt pin points) from each other, when they touch the skin at nearby points. The smaller the space between two distinct stimulation points the more sensitive the area is to touch and in particular to feeling textures.

Procedure:

1. Blunt the tips of two straight pins by tapping the points on a hard surface such as a coin.
2. Mount the pins in the styrofoam pin holder as shown in Fig. 4.
3. Tell your partner to close his eyes.
4. Touch various points in a region of your partner's skin **VERY LIGHTLY** with one or both of the blunted pin points. Adjust the separation of the pins so that all double stimuli are reported as two and single stimuli as one. Have your partner report as to whether he feels two objects or one.
5. Gradually lessen the separation space of the pins until only about 8 in 10 reports are correct. When this happens, the separation of the points in mm is the two-point threshold for that area.
6. Determine and record the two-point thresholds for the upper arm, back of hand, palm of hand, fingertips, lips and nape of neck. Calculate the number of receptors per cm² in each area tested and record in tabular form.

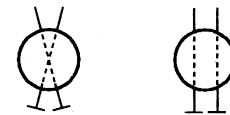



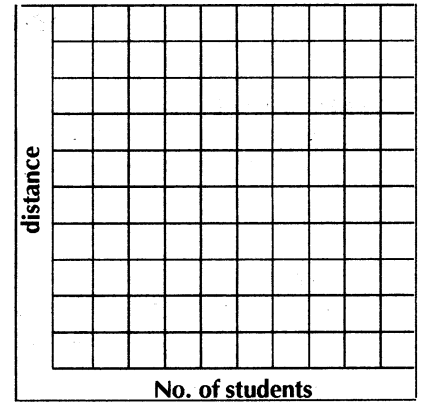
Fig. 4

Area	Two-point threshold	Receptors/cm ²
Upper arm		
Forearm		
Back of hand		
Palm of hand		
Fingertips		
Lips		
Nape of neck		

3. VISUAL SENSES

A partner will be required for most of the following exercises.
Each student should have:

- 1 blind spot determiner 
- 1 straight pin
- several sheets of loose leaf paper



A. Blind Spot Detection

Procedure:

1. Hold the blind spot determiner (dot on the right of the cross) about 20 inches from your face in front of your right eye.
2. Close your left eye. You should be able to see both the cross and the dot.
3. With your left eye closed and right eye focused on the cross, **slowly** bring the determiner closer to your face.
4. At a certain distance the circle will disappear from your field of vision. Have your partner measure the distance from the point at which the circle disappears to your eye.
5. Compare the distances obtained by other students by constructing a graph. Plot the distance on the X-axis and the number of students on the Y-axis.

B. Dominant Eye Determination: Most individuals do not make equal use of both eyes. They depend more heavily on one eye – the dominant eye.

Procedure:

1. Roll a sheet of loose leaf paper into a tube with a 4 cm diameter.
 2. Hold the tube at arm's length. Look through it with both eyes at some object across the room.
 3. With the tube held steady, close one eye then the other. Which eye sees the object through the tube? _____
- This is your dominant eye. Is it on the same side as your dominant hand? _____

C. Visual Accommodations: Proper focusing on objects of varying distances requires the eye to accommodate by adjusting both the lens shape and the size of the opening. In the following exercises you will observe some conditions under which these automatic accommodations take place.

Near Point of Vision: The distance from the eye to the nearest object that can be focused clearly is called the "near point of vision."

Procedure:

1. Place one hand over an eye and focus the other eye on a straight pin held at arm's length.
2. Gradually bring the pin closer to your eye, focusing continually until the pin begins to blur.
3. Have your partner measure the distance from the eye to the pin at the point of blurring. This is your near point of vision.
4. Repeat the process with the other eye and compare the two. Right eye: _____ Left eye: _____

Afterimage:

Procedure:

1. Look at a bright light for 20 seconds. DO NOT LOOK AT THE SUN.
2. Now look at the wall or ceiling. Describe what you see. _____
3. Repeat the process and have your partner time the length of the period that the after image stays with you. After image time: _____

Pupil Reactions:

Procedure:

1. Have your partner observe the pupils of your eyes in this exercise and record the results.
2. Allow a strong light from a window or lamp to fall on your eyes. DO NOT LOOK AT THE SUN.
3. Now look at a dark surface away from the light. What happens to the pupils of the eyes? _____
4. With your partner observing your pupils, place your hand over one eye for a minute. When you remove your hand what happens to your pupils? _____
5. Cover one eye and have your partner observe what happens to the pupil. _____
6. With one eye, look through a pinhole in a sheet of paper at a well-illuminated surface such as a lamp. Make sure the other eye is covered by the paper.
7. Close the eye covered by the paper and note the size of the illuminated field.
8. Now open that eye and record what happened. _____

4. HUMAN REFLEXES: Certain reactions occur automatically. The impulse from stimuli travels a short circuit path which does not at first involve the brain. The following exercises involve reactions over which you normally have no control.

A partner is needed for these exercises.

Procedure:

1. Have your partner sit on a table so that his lower legs swing freely.
2. Strike a point just below the kneecap with the blunt edge of a ruler or the edge of your hand. What happens? _____
3. About how long is the reaction time between striking the knee and the muscle response? _____
4. Is it possible for your partner to prevent the muscle response? _____
5. Try to fool your partner by starting to strike the knee without actually touching it. Is there a muscle response? _____
6. Have your partner stand resting one knee on a chair. Bend the raised foot forward to stretch the large calf muscle. Tap the Achilles tendon with the edge of your hand. What happens? _____
7. Twist a small piece of clean cotton to a fine point and touch the edge of your partner's cornea. Record what happens. _____
8. Use a six-inch cotton-tipped applicator and GENTLY touch the uvula (small fleshy body projecting downward from the middle of the soft palate) in the throat of your partner. What happens? _____
9. Gently stroke the short hair on the back side of your partner's neck with your finger. Observe the size of the pupils of his eyes. Record what happens. _____