# TESTING THE SENSES

## PURPOSE

Your senses are your connection to your environment. They are the detectors that tell you "what's out there." All animals, even the most simple, have some sensory structures. The purpose of this set of activities is to test the human sense organs to determine how they operate, and to develop an understanding of the types of information they provide.

Can your senses be fooled?

## ADVANCE PREPARATION

1. Review your text and your class notes for the anatomy and function of the various sense organs.

2. Read Appendix B on Lab Safety for details on handling body fluids.

## PREAMBLE

Because of the subjective nature of human body sensations, there is difficulty in providing objective tests of sensory functions. Therefore, you must work with a partner who will test you and record your observations and comments. You, of course, will serve as your partner's tester in turn.

Because we do not have a complete set of materials for everyone, the following tests are done in any order. Do them as the materials become available.

## *I MAPPING THE TONGUE*

### MATERIALS

- 4 taste test solutions
- 4 Q-tips
- disposal receptacle

### METHOD AND RESULTS


***Dispose of your own used Q-tips.*** ***NEVER*** leave them for someone else to clear away. ***NEVER*** handle anyone else's Q-tips.

1. Sit facing your partner.
2. Your partner arranges the bottles of test solutions so that the labels are hidden from you.
3. Your partner dips a clean Q-tip into one of the test solutions and hands it to you.
4. You then apply it to your tongue in the following order — front, side, back — at one second intervals. Hold the tongue still for a few seconds more to notice which region is sensitive to the solution.
5. You discard the Q-tip in the labelled receptacle.
6. Record your observations.
7. Repeat with fresh Q-tips and the remaining three solutions.
8. ***Under no circumstances dip a used Q-tip into a solution.***
9. Switch places with your partner and repeat the above procedures.

| | Student #1 | | | Student #2 | | |
|---|---|---|---|---|---|---|
| | Front | Side | Back | Front | Side | Back |
| Sweet | | | | | | |
| Sour | | | | | | |
| Bitter | | | | | | |
| Salt | | | | | | |

10. Draw a "map" of ***your*** tongue's taste sensitivity areas.

## *II HABITUATION TO ODOUR*

### MATERIALS

- 2 vials labelled "A" and "B"

### METHOD AND RESULTS

1. Quickly sniff the contents of Vial A. Replace the cap. Then quickly sniff the contents of Vial B. Replace the cap.

2. Describe the odours from the two vials. Are they similar?

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3. Return to Vial A. Hold the open vial about 2 – 3 cm below your nose for two minutes while you inhale and exhale normally. Replace the cap.

4. Return to Vial B. Sniff the contents quickly. Does Vial B still smell similar to Vial A? Describe the odours of both vials as they seem to you now.

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5. Provide an example of habituation to odour that you might encounter in everyday life.

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## *III TOUCH SENSITIVITY OF SKIN*

### MATERIALS

- a pair of fine pointed scissors
- a small metric ruler

### METHOD AND RESULTS

1. Sit with eyes closed and forearm uncovered.
2. Your partner touches the skin gently with either one or two scissor points. The scissors should rest for a few seconds on the skin. The scissors are spread wide apart prior to touching for the first tests and are gradually narrowed for subsequent tests. The method will be demonstrated by the instructor.
3. The subject reports whether one or two points were felt.
4. The tester records the distance at which the subject can no longer distinguish between one or two points.
5. The areas to be tested are the front of the forearm, the back of the hand, and the tip of the index finger.

6. Which area is the most touch sensitive?

7. In which area are the nerves closest together?

## *IV SOUND LOCALIZATION*

### MATERIALS

- tuning fork
- rubber hammer

### METHOD AND RESULTS

1. Sit with your eyes closed. Your partner stands behind you. Your partner holds the tuning fork in one of several positions about 10 - 15 cm from your head and then strikes the fork with the hammer.

2. Report the apparent location of the sound.

3. Positions to be tested are: behind the head, above the head, in front of the head, to the right side of the head, and to the left side of the head. The order should be varied and some positions should be repeated more than once. (If the lab is too noisy to hear the fork, ask the instructor to suggest a quiet place.)

4. Explain why (relative to the location of the ears on your head) some positions were incorrectly identified.

| | Student #1 | | Student #2 | |
|---|---|---|---|---|
| | Correct | Incorrect | Correct | Incorrect |
| Back | | | | |
| Above | | | | |
| Front | | | | |
| Right | | | | |
| Left | | | | |

## *V MAINTENANCE OF POSTURE*

### MATERIALS

- none

### METHOD AND RESULTS

1. Stand firmly with feet about 30 cm apart and arms extended to the side. Do you sway? Is this position easy to maintain?

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2. Now stand on one foot with arms extended. Do you sway? Is this position easy to maintain?

   _____

3. Now stand on both feet (30 cm apart) but with eyes closed and arms extended. Do you sway? Is this position easy to maintain?

   _____

4. Now stand on one foot, eyes closed, with arms extended. Do you sway? Is this position easy to maintain?

   _____

5. List the sense organs that are used to maintain posture. Which one seems most crucial?

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_____

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## *VI SUPERIMPOSITION*

### MATERIALS

- cardboard tube about 4 cm wide × 30 cm long

### METHOD AND RESULTS

1. With one hand, hold the tube directly in front of one eye. Be sure that the tube points straight ahead and at a well-lighted area.

2. Hold the other hand directly alongside the tube. Keep both eyes open. Record what you see.

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3. Consider the manner in which the right brain and left brain share visual information during the formation of one image. How might the optic chiasma and corpus callosum play a role in this image formation process?

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## *VII PUPILLARY REFLEXES*

### MATERIALS

- small flashlight
- 5" × 8" card (12.5 cm × 20 cm)

### METHOD AND RESULTS

1. Working in a dim corner of the room, hold the flashlight in front of your partner's face about 60 cm away.

2. Turn the flashlight on and quickly note the reactions of your partner's pupils. Turn the flashlight off.

3. Have your partner now hold the card vertically beside the nose in such a way that light shining in one eye will not shine in the other (at a slight angle, tucked into the notch at the bridge of the nose). Position the flashlight so that it will shine in one eye only.

4. Now turn the flashlight on while watching the reaction of the shaded eye. Turn the light off and record the changes of the pupil of the unlit eye.

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5. What role do the optic chiasma and corpus callosum play in communicating information from one eye to the other?

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   _____

## *VIII LENS FLEXIBILITY*

### MATERIALS

- pencil
- 30 cm ruler

### METHOD AND RESULTS

1. The subject covers one eye and holds a pencil vertically at arm's length. While focussing on the pencil tip, bring the pencil slowly toward the face. Stop at the position where a sharp focus can barely be maintained.

2. The tester measures the distance from the pencil to the eye.

3. Now, repeat for the other eye.

4. Repeat without glasses if you wear them.

5. Record your results and compare them to the chart below. How "old" are your eyes? "Young eyes" have flexible lenses, which can "bulge more" to focus light rays from objects close to the eye.

| cm | 9 | 10 | 13 | 18 | 50 | 83 |
|---|---|---|---|---|---|---|
| "age" | 10 | 20 | 30 | 40 | 50 | 60 |

## *IX COLOUR PERCEPTION*

### MATERIALS

- Kubara Box

### METHOD AND RESULTS

1. Work in a dim corner of the room.
2. Raise the plastic screen of the Kubara Box so that you see the ends of three metal tubes. Each of these tubes is fitted with a different coloured filter.
3. Turn on the lamp in the box, using the pull-chain at the side.
4. What three colours do you see with the screen raised?

   _____

   _____

5. Lower the screen.
6. What additional colours do you now see where the three original colours overlap?

   _____

   _____

7. In our retinas, we have receptors for red, blue, and green, yet we see more than just these three colours. Diagram the paths of light in the box.

8. Now, explain the difference between colour reception and colour perception.

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9. Correlate your findings with a chart of the visible light spectrum provided.

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10. ***Turn the Kubara box off when you are finished!***

## *X. PERCEPTION OF TEMPERATURE*

### MATERIALS

- large beakers
- thermometers
- ice cubes
- a timer

### METHOD AND RESULTS

1. Work beside a sink.

2. Fill one beaker with warm tap water (about 45°).
   Fill the second with tepid water (about 25°).
   Fill the third with cold water and float 1–2 ice cubes in it (about 10°).

3. Immerse one finger of one hand in the warm water and one finger of the other hand in the cold water. Keep your fingers in the water for 30 seconds.

4. Now place both fingers in the tepid water.

5. Record the temperature sensations "felt" in each finger.

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6. Explain your observations for Steps 3 and 5 in terms of **HEAT FLOW** and **ADAPTATION** of the hot and cold temperature sensors to a constant stimulus.

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## *XI AFTERIMAGES*

### MATERIALS

- a set of testing cards, black with various coloured patches
- a piece of white cardboard

### METHOD AND RESULTS

1. Work in a well-lit part of the room.

2. Place one of the testing cards flat on the table.

3. Choose a corner of one of the coloured patches and stare at it for 30 seconds (count "1 second, 2 second....."). Try not to move the eyes (concentrate on the corner).

4. Now place the white cardboard on top of the testing card.

5. What is the colour of the image that you see on the white cardboard?

_____

6. Repeat for the other testing cards in the set.

| Colours of patches | Afterimages |
|---|---|
| | |
| | |
| | |
| | |
| | |

6. Are these negative or positive afterimages?

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7. Consider the effects of prolonged exposure to a particular colour of light on cone elements in the retina and provide an explanation for the above answer.

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## *XII MULLER-LYER ILLUSION*

### MATERIALS

- a diagram of the illusion
- a ruler

## METHOD AND RESULTS

1. Draw a diagram of the Muller-Lyer illusion. Be very careful that the vertical lines are exactly the same length.

2. Do the actual dimensions coincide with your perception of the dimensions? Measure them again to ensure that they are the same length.

3. Explain why the illusion "works" in terms of distance habit and the prevalence of corners in our environment.

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## *XIII BLIND SPOT*

## MATERIALS

- card with symbols (a cross and a dot)
- ruler

## METHOD AND RESULTS

1. With the left hand, hold the card out in front of your face with the symbols lined up with your eyes.

2. Cover your right eye with your right hand and look at the right-hand symbol on the card with your left eye.

3. Bring the card toward your face in a straight-line path until the left-hand symbol on the card disappears. Have your partner measure the distance between the card and your eye.

4. Reverse the procedure for the other eye.

5. Are the blind spots in the same place in both eyes?

_____

6. Did you know that you have a blind spot? Why do you have a blind spot?

_____

_____

7. Is a blind spot in your eye a problem if you have normal binocular vision? If you have vision in only one eye?

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## *XIV BONE CONDUCTION*

### MATERIALS

- tuning fork
- rubber hammer

### METHOD AND RESULTS

1. Have your partner strike the tuning fork and place the end of the handle on the top of your head. Can you hear the sound produced by the fork equally well in both ears?

   _____

2. Plug one ear with your finger. Where do you hear the sound now?

   _____

3. Plug both ears. What do you hear now?

   _____

4. How does external noise affect this test?

   _____

   _____

5. Have your partner hold the handle of the vibrating fork against your mastoid process (the rounded bulge behind the ear). As soon as the sound stops, advise your partner who will then move the fork so that the prongs are in front of the ear canal. What do you hear? Which is better, bone or ear conduction?

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   _____

## *XV TASTABILITY OF SOLIDS*

### MATERIALS

- piece of coarsely crushed sugar cube
- tissues such as Kleenex or Kim-wipes

### METHOD AND RESULTS

***Dispose of your own used tissues.*** ***NEVER*** leave them for someone else to clear away. ***NEVER*** handle anyone else's tissues.


1. Dry your tongue with the tissue, then hold your mouth open so that your tongue remains dry.
2. Discard this tissue in the labelled discard receptacle.
3. Place a piece of sugar cube on your tongue.
4. Can you taste the sugar?

   _____

5. Wait for a few moments. Do you eventually taste it? How did the sugar change while you waited?

   _____

   _____

## *XVI PROPRIOCEPTIVE RESPONSES*

### MATERIALS

- none

### METHOD AND RESULTS

1. With your eyes closed, stretch one arm out to the side. Now move this arm and try to touch the tip of your nose with your index finger. Repeat using different speeds. Describe your success. How does the speed of movement affect your success rate?

   _____

   _____

2. With your eyes closed, stretch both arms out to the side. Now move your arms to bring the tips of the index fingers and the thumbs of each hand together. Repeat using different speeds. Describe your success. How does the speed of movement affect your success rate?

   _____

   _____