SENSES AND PERCEPTION

INTRODUCTION

The human must be aware of and adjust to environmental demands. Our ***senses*** provide information about the physical environment. Our ***perception***, developed the experiences of trial and error, evaluates sensory information, allowing us to make the appropriate adjustment to the environment. Working together, these two processes have contributed to the success of the human species.

Human senses result from specialized receptors located in various parts of the body. These *receptors* are activated by only one kind of *stimulus* (sound, touch, light, chemicals, etc.). The information from one receptor is kept separate from that sent by another sense organ. In the brain, particular areas are specialized for processing and interpreting the information pertaining to each sense.

Today's lab is designed to demonstrate some of the sensory and perceptual mechanisms of your nervous system.

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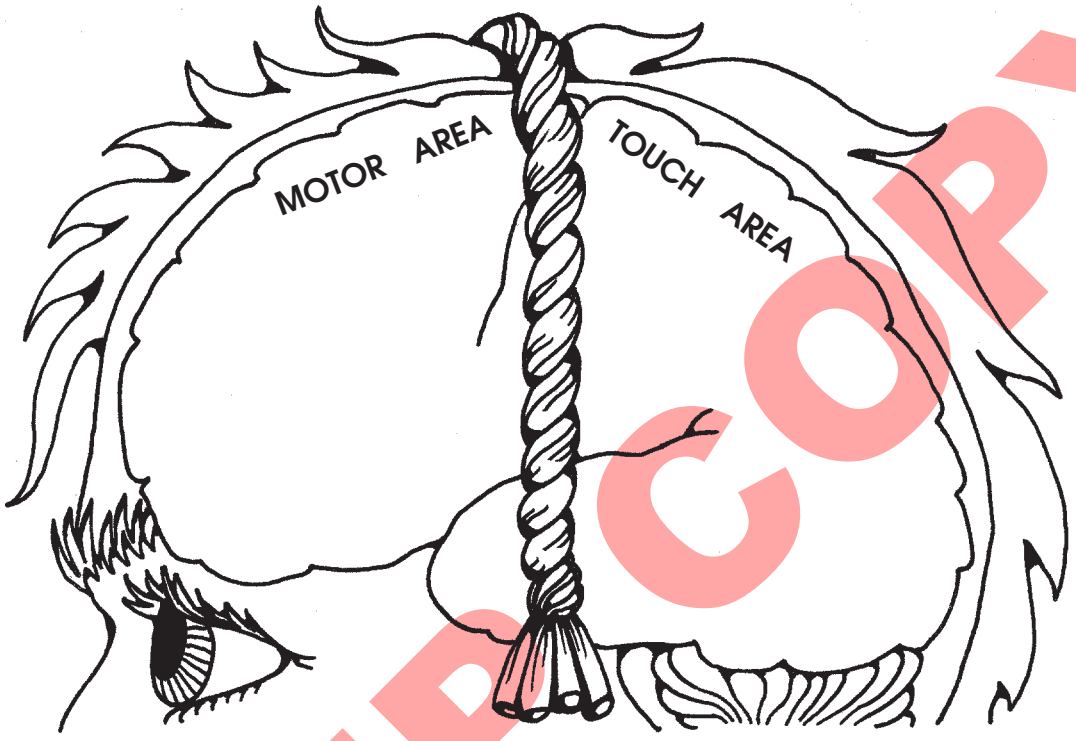
ACTIVITY #1

"TOUCH"

A string-line that loops over on the top of your head from ear to ear approximately separates the ***motor area*** of the brain (which controls movement) from the ***touch area*** of the brain (which interprets touch signals). The touch area is behind this line and the motor area is in front of it.



You will determine the density of touch receptors in several areas of your body. Using that information, you can test the idea that *areas of greater sensitivity contain more touch receptors.*

GO GET

1. A horse hair.

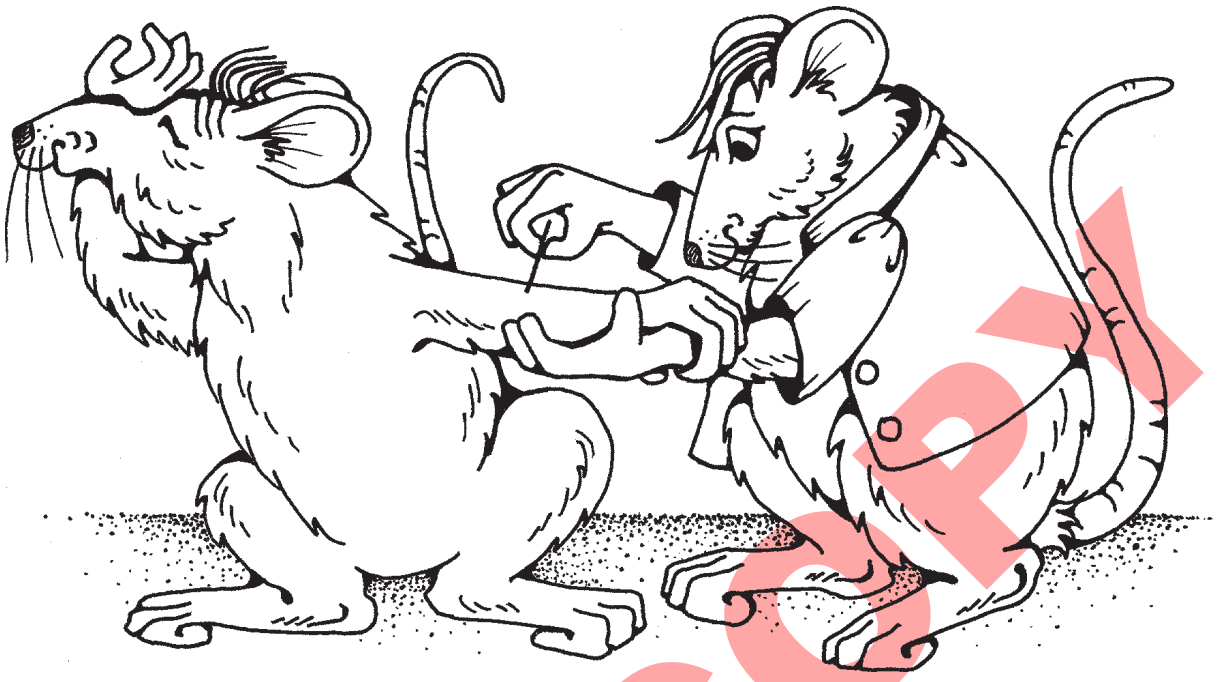
2. A metric ruler.

3. A compass.

NOW

1. Be sure to perform all the tests on each person in your lab group.

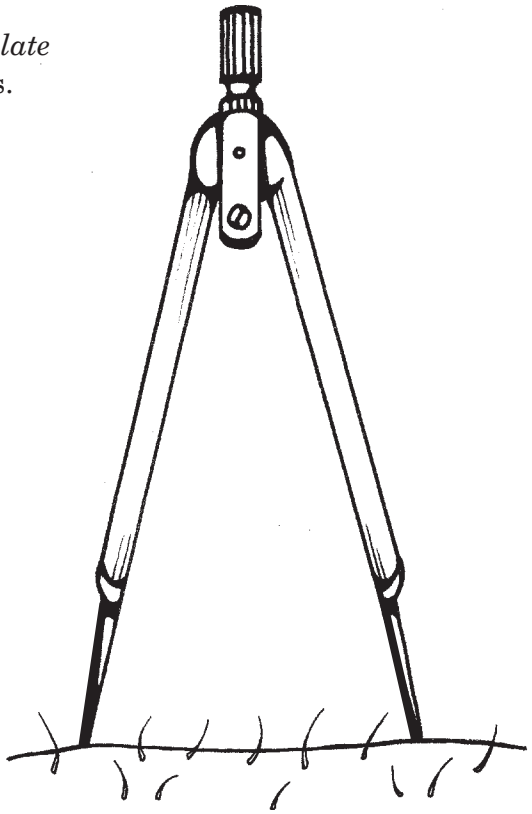
2. Mark off a 1 cm x 1 cm square on your fingertip, back, and another area of your body that you would like to test. You might choose an area that itches often or feels strange when touched.



3. Close your eyes while your lab partner lightly touches you 25 times with the horse hair. The touching should be done in a grid-like pattern that covers all of the square you have marked.

4. Each time you feel the touch of the horse hair, say so. Record the number of positive responses in the Touch Experiment Table on the next page.

5. Next, use the points of a compass to *lightly stimulate* the subject's skin in the area of the marked boxes. The compass points must be blunt and not poke through the skin. (File the points if necessary.) Start with the points close together, then increase their distance apart until the subject definitely feels *two distinct points*. Be sure that the two points are applied simultaneously each time, and retest to see if there is error due to imagination.



6. Measure the distance between the two compass points when the subject clearly perceives two points. This is called ***two-point discrimination***. Record the results for each area of the body that you mapped for touch receptor density. Include the results from everyone in your lab group.

TOUCH EXPERIMENT TABLE

Part of the Body	# of Positive Responses During 25 Touches in 1 cm^2	Two-Point Discrimination (in cm)
Fingertip		
Back		
(Other) _____		

? QUESTION

1. Which test area had the greatest density of touch receptors?

2. Which test area had the best two-point discrimination? Explain.

3. How is *two-point discrimination* related to *density* of touch receptors?

4. When you have an itch somewhere on your back, why does it take so much scratching before you finally find it?

ACTIVITY #2

"TEMPERATURE SENSATION"

During this Activity you will determine whether your body detects the *actual* temperature of the environment or only the *change* in environmental temperature.

GO GET

1. A large beaker of cold water (10 °C).

2. A large beaker of hot water (50 °C).

3. A large beaker of 30 °C water.

NOW

1. If the water beakers are already set up at the demonstration table, then check and adjust the temperatures using water from the hot plate or ice cubes in order to maintain the three temperature conditions listed above.

2. Place the index finger of one hand into the cold water, and the index finger of the other hand into the hot water for 15 seconds.

3. After 15 seconds, quickly place both fingers into the 30 °C water. Record the sensations.

Cold-water Finger = _____.

Hot-water Finger = _____.

? QUESTION

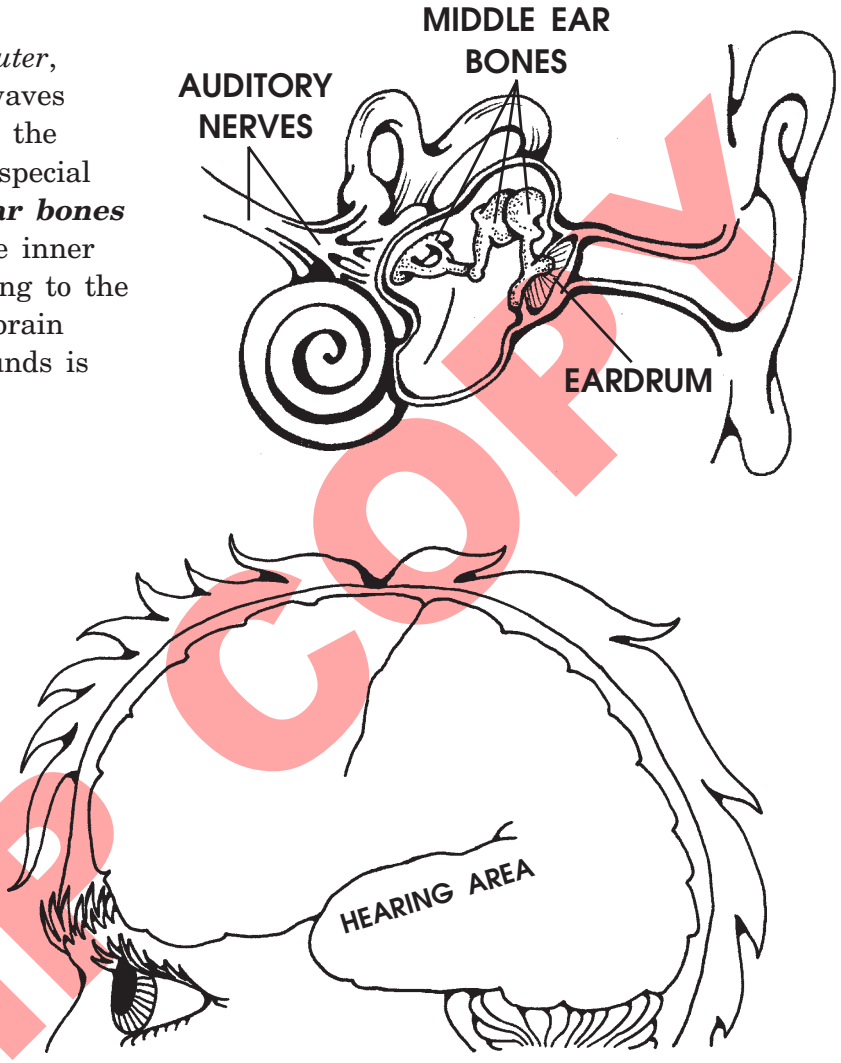
What seems to be the most important factor related to your perception of skin temperature? (circle your choice)

actual temperature or *change* in temperature

ACTIVITY #3

"HEARING"

The ear is divided into three parts: *outer*, *middle*, and *inner* ear. When sound waves enter the ear, the ***eardrum*** (between the outer and middle ear) is shaken and special small bones vibrate. These ***middle ear bones*** transmit the sound vibrations into the inner ear where the ***auditory nerves*** leading to the brain are activated. The area of the brain that is specialized for interpreting sounds is next to the ears.

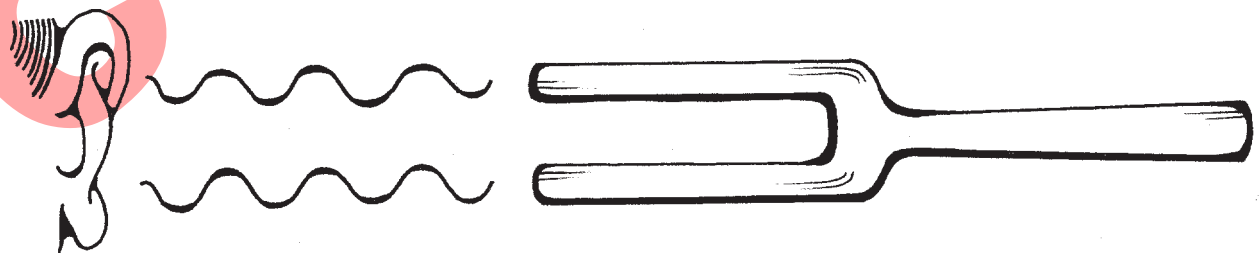


GO GET

1. Some cotton for ear plugs.
2. A set of tuning forks.
3. A meter stick.

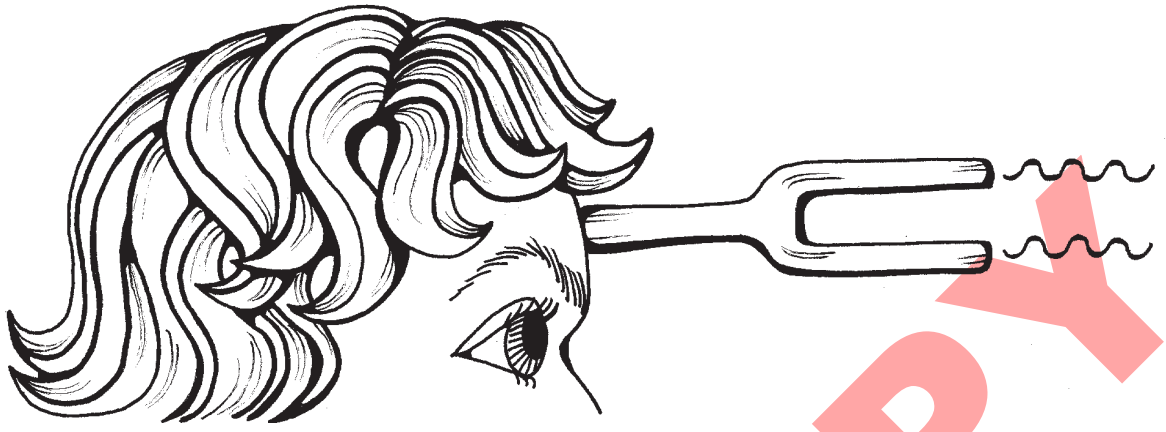
NOW

1. Do this test in a quiet room. Have the subject close one ear with cotton and close his eyes. Strike the tuning fork against the table and hold it in line with the open ear. Move the tuning fork away from the ear until the subject just loses the ability to hear it. Measure the distance. Repeat the test again to validate your first measurement. Record the hearing distance for the other ear. *Be sure to strike the tuning fork with equal force each time you do the test.*



2. Repeat the test with each of the six tuning forks of different tones to determine if you have hearing loss in any of the six ranges. If one of your ears has a hearing loss at a particular tone range, then do the next test.

3. This next test should not be performed in a quiet room. Place the handle of a vibrating tuning fork on the midline of the subject's forehead.



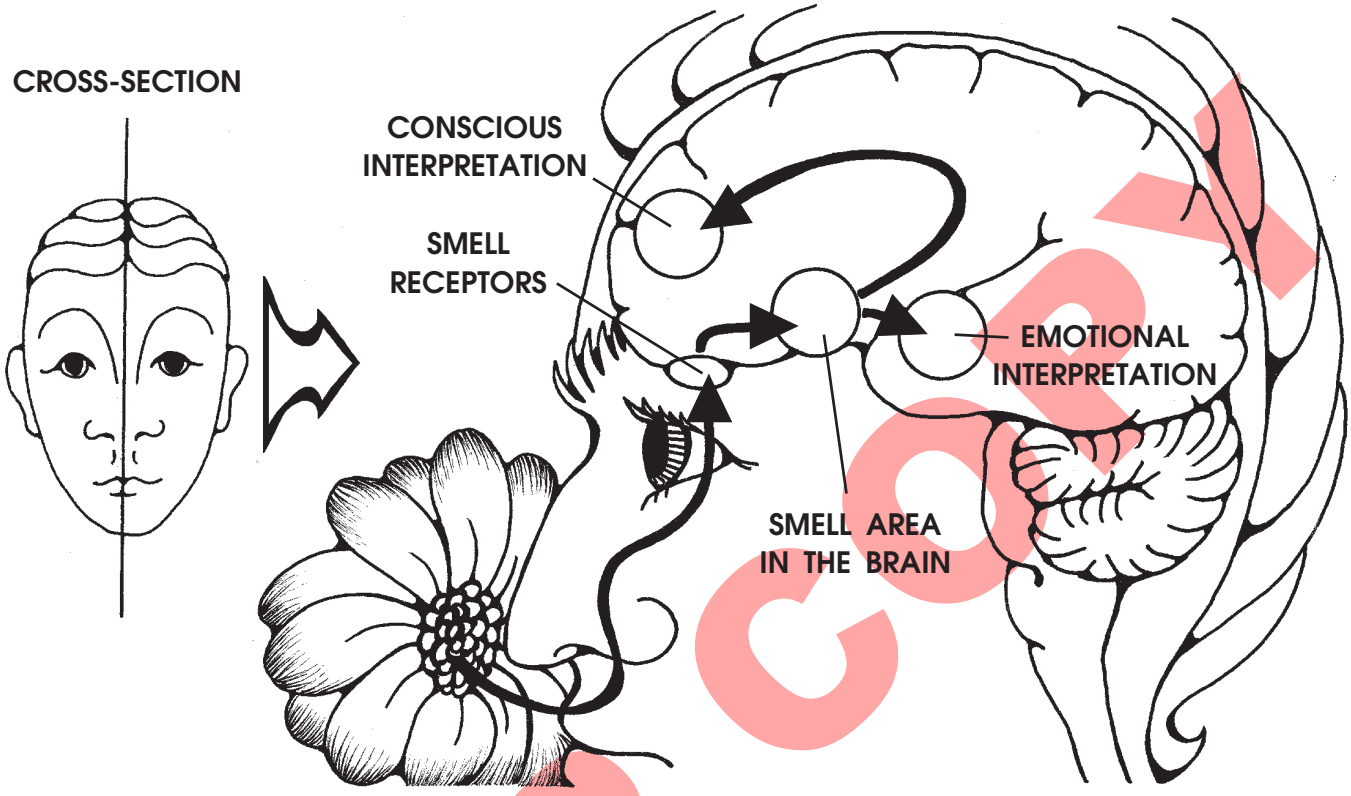
A person with normal hearing will localize the sound as if it were coming from the midline. If one ear has defective middle-ear function (ear bones), then the sound will be heard much better in the defective ear than when the tuning fork is not in contact with the forehead. If there is an affliction of the auditory nerve in the ear, then touching the tuning fork to the forehead won't improve hearing in the defective ear.

RESULTS OF HEARING TESTS

Sound Frequency (cycles per second)	Farthest Distance sound heard from Left Ear	Farthest Distance sound heard from Right Ear
128 cps fork		
256 cps fork		
512 cps fork		
1024 cps fork		
2048 cps fork		
4096 cps fork		

ACTIVITY #4

"SMELL"



Recent studies show that smell is much more important in human behavior than was previously thought. Some researchers suggest that the evolutionary specialization of the mammal forebrain began with the sense of smell. The exact role of smell in our lives is not understood. This sense seems to be more closely linked to emotional memories than to the conscious activities of our brains. As you experiment with the various odors in the exercise below, describe the type of *emotional reaction* you have to each.

GO GET

A smell kit.

NOW

1. Close your eyes. Have your lab partner pass an open odor vial about 3" under your nose for a couple of seconds. Repeat the test if necessary.

2. *First*, determine if you can smell the odor. *Second*, determine if you can correctly identify the smell. *Third*, describe any special memories associated with the smell.

3. Record the results of your test in the Odor Recognition Table.

ODOR RECOGNITION TABLE

Vial Number	Detects Smell	Identifies Smell	Memories Associated with the Smell
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Totals			

? QUESTION

1. How many of the smells were associated with emotional memories?

2. List three examples of how specific smells might be used to sell you a product.

   a.

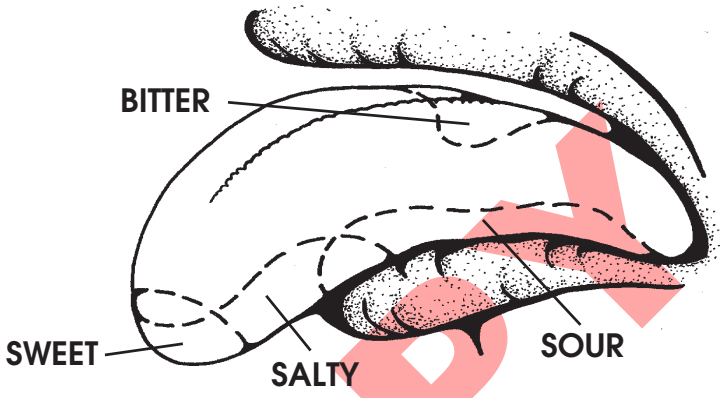
   b.

   c.

ACTIVITY #5

"TASTE"

The tongue has at least four different taste receptors (***salty***, ***sweet***, ***bitter***, and ***sour***). However, the taste of many chemicals is also influenced by your interpretation of their *smell*. In this Activity, you will examine different aspects of your ability to taste.



GENETICALLY DETERMINED TASTE

Your ability to taste certain chemicals is not influenced by previous eating habits, but is determined by whether or not you have inherited the *gene* controlling the taste response to that particular substance. This is an important lesson to remember when certain foods don't taste bitter to you, but other people complain about them (especially your children). They may have the gene to taste it, and you don't!

GO GET

The special taste papers for PTC and thiourea.

NOW

1. Take one taste paper, and touch it to your tongue. You will immediately know if you are a taster!

2. Do the same test with the other taste paper.

3. *Put the used taste papers in the trash.*

? QUESTION

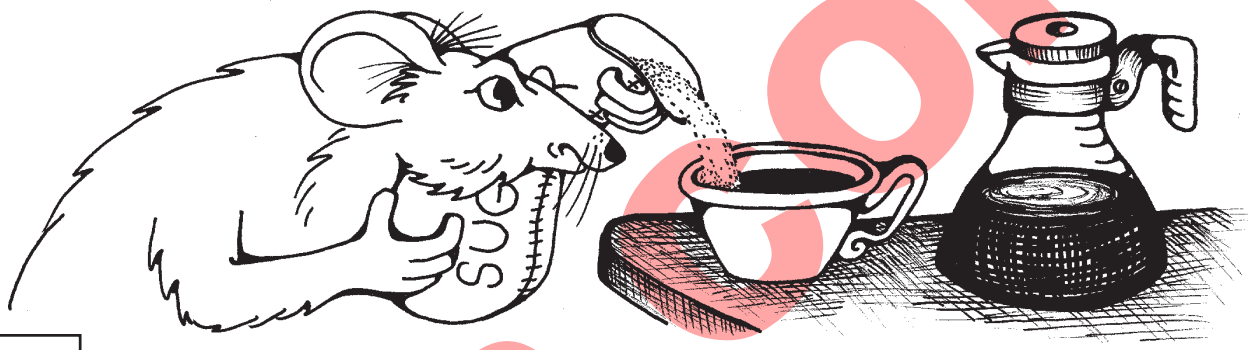
1. Are you a taster for thiourea?

2. Are you a taster for PTC?

3. If you are a non-taster and you want to be a high-class chef, what might you do to compensate for this genetic limitation?

SUGAR TASTE THRESHOLD

This experiment should give you insight about why some people prefer more sugar in their foods.



NOW

1. Go to the demonstration table and determine your sugar taste threshold.

2. Dip a strip of tasting paper into each solution, and record whether or not you can detect a sweet taste. *Discard the used taste papers.*

3. After testing all of the solutions, go to the front desk for the key to the sugar concentration of each solution.

4. Record your results in the summary chart on the front chalkboard.

? QUESTION

1. What was the lowest threshold for tasting sugar?

2. What was the highest threshold?

3. Do the people with a high taste threshold also like to add more sugar to their food? (Perhaps you could determine this by asking your classmates how much sugar they add to their coffee.) Your lab may have a setup for making a "food coloring" tongue print to count the number of taste buds in different people.

ACTIVITY #6

"VISION"

Human beings are primarily visual animals. This is the dominant sense you use to relate to the environment. Furthermore, most human behavior has been shown to be strongly influenced by visual perception. There is a lot of scientific literature on visual perception and we encourage you to investigate this information when you have time to do so. What you don't know can be used against you!

PREFERRED EYE

This Activity is designed to reveal which one of your eyes is used for certain visual functions. Your *preferred eye* is the one your brain chooses to use when both eyes can see the same object.

NOW

1. Pick an object that's about 30 feet away. Make a circle with your thumb and first finger of both hands.

2. Straighten and raise your arms from your waist to a position where the circle surrounds the object. Keep your head and feet positioned straight ahead.

3. Without further movement, close one eye. Then open the closed eye, and close your other eye.

4. Which eye has the *same view* as the view with *both eyes* open? This is your preferred eye. ***Hint:*** When you close your preferred eye, the distant object will move out of the circle formed by your hands.

? QUESTION

1. Which eye is your preferred eye?

2. If you are left-eyed, what problem will you have in shooting a rifle?

3. Why should you use your preferred eye when looking through a monocular microscope?

EYE WITH BEST VISION

Use the classroom eye chart to determine which of your eyes has the best vision (without glasses).

? QUESTION

1. Which of your eyes has the best vision?

2. Talk with other lab students, and discover whether the eye with the best vision is always the same one as the preferred eye. Results: _____

EYE WITH BEST DEPTH PERCEPTION

There are fairly simple ways of determining which of your eyes has the best depth perception. If this equipment is available, then determine the depth perception for each of your eyes. If this equipment is unavailable, then refer to the information chart to answer the questions below.

INFORMATION

Vision Tests	13 Left-Handed People	11 Right-Handed People
Eye with Best Depth Perception	9 left eye 3 right eye 1 same in both eyes	2 left eye 8 right eye 1 same in both eyes
Preferred Eye	7 left eye 6 right eye	5 left eye 6 right eye
Eye with Best Vision	1 left eye 1 right eye 11 same in both eyes	2 left eye 1 right eye 8 same in both eyes

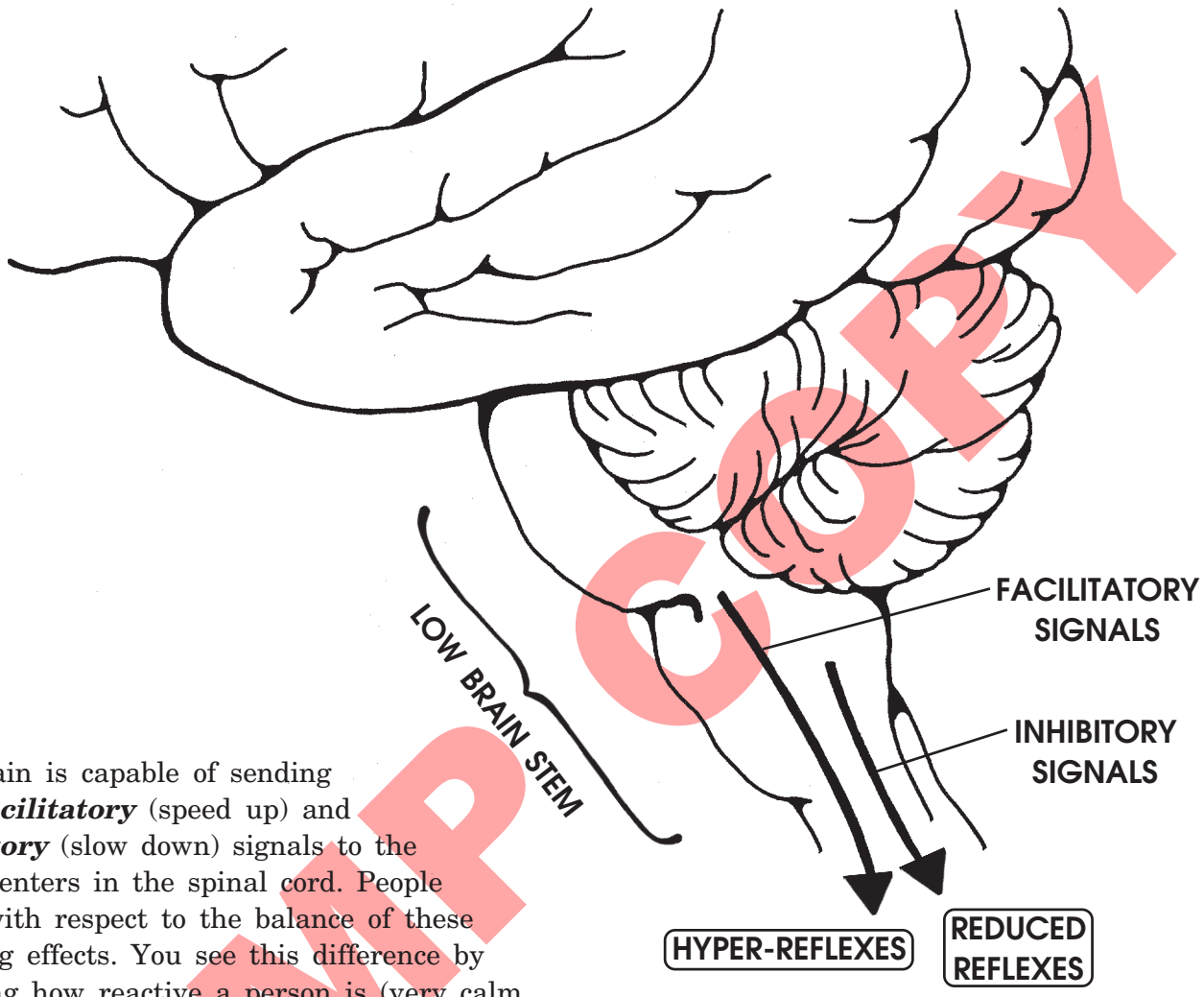
? QUESTION

The eye with best *depth perception* is most closely associated with . . . (circle your choice)

Preferred Eye or Preferred Hand or Eye with Best Vision

ACTIVITY #7

"REFLEXES"



The brain is capable of sending both ***facilitatory*** (speed up) and ***inhibitory*** (slow down) signals to the reflex centers in the spinal cord. People differ with respect to the balance of these opposing effects. You see this difference by watching how reactive a person is (very calm vs. quick reacting).

A reading reflex test can be used to determine which reflex type you are. *Concentrating on reading should reduce the effect your brain normally has on your reflex centers.* If reading reduces your reflex response, then normally your brain must be stimulating reflexes (you are a quick-reacting person). If reading increases your reflex response, then your brain normally inhibits reflexes (calm reacting). Your brain's reflex emphasis can change. No person is 100% one type or the other all of the time.

GO GET

1. A patellar hammer.

2. A meter stick.

NOW

1. Before beginning the test, ask your lab partner to evaluate whether you are the calm or quick-reacting type.

Lab Partner's Opinion: _____

Your Opinion: _____

2. Sit on a table so that your legs hang freely over the edge. Have your lab partner hit the patellar ligament (just below the knee) with the reflex hammer. *Don't hit too hard.* This may take some practice. Measure the amount of leg movement several times in order to get an average estimate of the reflex intensity.

Normal Reflex: _____

3. Next, read from a textbook while your lab partner measures the amount of reflex leg movement. Is the reflex more intense or less intense during the reading conditions?

? QUESTION

1. Under normal circumstances, does your brain activate or inhibit spinal reflexes?

2. So, which reflex type are you?

3. Does this agree with how you evaluated yourself before the test?

4. Compare your conclusions with those of other students in the class. What did you discover?