

Biology 125- Human Physiology  
Laboratory 6/7- Sensory Physiology

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**I. Purpose**

The purpose of this lab is to complete a series of tasks designed to assess the capabilities of your sensory systems. To investigate basic principles of human sensory physiology, the cutaneous, olfactory, auditory, proprioceptive, and visual systems will be explored.

**II. Procedure**

6/7-A: Tests of Cutaneous Sensation

A-1: Two-point Discrimination: The ability to distinguish two distinct points on the skin surface will be recorded.

1. With your partner's eyes closed, apply two caliper pinpoints as closely together as possible on your partner's skin on the palm of his/her hand.
2. Remove the pins and move them 1 millimeter apart. Reapply the caliper points to your partner's skin. Repeat this procedure until your partner can discriminate two distinct points.
3. Record this distance between pins at which your partner can discriminate two separate caliper points.
4. Compare results obtained from the following areas:
  - a. palm of hand
  - b. back of hand
  - c. fingertip
  - d. outer edge of the lips
  - e. back of neck
5. Have your partner repeat this experiment on your skin. 6. Interpret the results you have obtained.

A-2: Accommodation of Thermoreceptors: Accommodation, or sensory adaptation, occurs when receptors generate fewer impulses during constant stimulation. Accommodation of cutaneous thermoreceptors will be recorded.

1. Place your left fingers in 15°C water and your right fingers in warm water (37°C) and record the sensation of each. Keep hands immersed for 2 minutes.
2. After two minutes, describe the sensation in each hand.

3. Remove hands and promptly place them both in 25°C water. Describe the immediate sensation in each hand.

#### 6/7-B: Olfactory adaptation

The adaptation of olfactory chemoreceptors will be timed.

1. Block your left nostril. Uncork and hold the bottle of camphor oil under your nose until you can no longer detect the camphor. Do not consciously sniff the contents of the vial! Record the adaptation time.
2. Remove the camphor and place the bottles of cloves, then peppermint oil under your nose. Distinguish the smells of cloves and peppermint oil.
3. Uncork and hold the bottle of camphor under your nose again until the smell is no longer recognized. Record this second adaptation time.
4. Unblock your left nostril to determine if the camphor is detected.
5. Interpret these results.

#### 6/7-C: Auditory measurements

Sound is measured in terms of amplitude (decibels–dB) and frequency (Hertz–Hz). Tuning fork tests and an audiometer will be used to evaluate auditory function.

##### C-1: Tuning fork tests

These tests utilize the principle of bone conduction to directly vibrate the cochlear hair cells. They should be done in a quiet room for the most reliable results.

##### **Rinne's Test** (checks for middle ear damage)

1. Plug your left ear with cotton or hold your hand over it and test the right ear.
2. Hold the handle of a vibrating tuning fork to the right mastoid process.
3. When the sound disappears, move the fork near the external auditory canal.
4. Reappearance of the sound indicates middle ear damage.
5. Repeat the test with your left ear.
6. Record the results for each ear.

##### C-2: Audiometry

An audiometer measures hearing acuity by presenting pure tones to the subject's ear through a set of color-coded earphones (red = right ear, blue = left ear). The intensity required to first perceive the signal is recorded for each ear at a number of frequencies. The presentation of signals should be randomized. The results are plotted on an audiogram to determine individual hearing acuity compared to normal values.

1. In a quiet room, the instructor will demonstrate the proper method of operating the audiometer.
2. Audiometry tests will be conducted in pairs. Each student will take his/her partner's audiogram.
3. Record your results on the worksheet on page 44.
4. Analyze the audiograms in the following way:
  - a. Average the values obtained for each ear for the frequencies of 500 Hz, 1000 Hz, and 2000 Hz.
  - b. Subtract 26 dB from each average.
  - c. If the difference is greater than 26, multiply this number by 1.5%. This equals the percent impairment of each ear.

#### 6/7-D: Equilibrium-Demonstration of Nystagmus

Nystagmus, the slow drift of the eyes in one direction followed by a rapid movement back to the opposite direction, is a reflex that allows moving targets to be tracked. Nystagmus is under the control of the semicircular canals. When the semicircular canals are rotated in one direction, the cupula of the crista ampullaris is deflected in the opposite direction by the inertia of the endolymph and the eyes slowly drift in the direction opposite the movement, then, suddenly snap towards this direction. Nystagmus following body rotation will be demonstrated.

1. A student volunteer will be seated on a swivel stool with his/her head bent 30° forward.
2. The instructor will spin the student rapidly to the right for 10 turns.
3. The instructor will suddenly stop turning the student and have the student look straight ahead.
4. Observe and note the subsequent movement of the student's eyes.
5. Explain these eye movements in terms of direction of endolymph movement.
6. These procedures will be repeated with a second student spun to the left.

#### 6/7-E: Visual Measurements

The sense of sight is the most important of the senses. As such, a number of standardized tests have been developed to evaluate visual functions.

#### E-1: Demonstration of the Blind Spot

1. Cover your left eye and focus the right eye on the center of the cross below.
2. Slowly bring the page closer to your eye until the spot disappears.



3. Have your partner measure this distance from your eye to the page.
4. The image of the spot is now superimposed on the optic nerve. Explain the lack of vision at this point.

### E-2: The Snellen Test

The ability to discriminate fine detail is known as visual acuity. The Snellen test uses a standardized eye chart to evaluate visual acuity. You will be using one of several versions of this eye chart in the form of the wall chart in the laboratory.

1. Stand 20 feet away from the Snellen chart. Cover your left eye.
2. Attempt to read the line designated "20".
3. If you cannot read line 20, attempt line 30, 40, 50, 70, 100 or 200 until a line is legible. Perform these attempts with your left eye, covering your right eye.
4. The Snellen chart is analyzed in the following way:  
Visual acuity = Distance you read the letters  
Lowest line read clearly at 20 feet

Examples:

Nearsightedness (myopia) = 20/30

Normal = 20/20

Farsightedness (hyperopia) = 30/20

### E-3: Astigmatism

An abnormal curvature of the cornea may produce a blurred image on the retina known as an astigmatism.

1. Stand approximately 8–10 inches away from the radial astigmatism eye chart so that it fills your field of vision. Cover your left eye.
2. Focus on the lines in the vertical plane with your right eye.
3. If a blur appears in the lateral lines or the lines converge into one, you have an astigmatism in this plane of your eye.
4. Record the results of this test and repeat with the left eye.

### E-5: Perimetry

The arrangement of rods and cones in the retina is not at random. Using objects of different colors, you will map the locations of the cones in your retina for one eye.

1. Seat yourself before the perimeter board with your right eye at the edge of the semicircle. Cover your left eye. Stare at the center line.

2. Your lab partner will introduce several different colored blocks into your field of vision. Identify these blocks by color. Do not take your eye from the center of the chart or uncover your left eye.
3. Your partner will record the degree at which the colors were discriminated on the perimetry scoresheet on page 47.
4. Repeat these procedures for each block for both the horizontal and vertical perimetry charts. Record the data and connect the same-colored dots to form an outline of cone placement of your right eye on your data sheet.
5. Explain these results in regards to cone placement in your retina.

### **III. Result**

#### 6/7-A: Tests of Cutaneous Sensation

##### A-1: Two-point Discrimination:

- a. Palm of hand 11 ml
- b. Back of hand 27 ml
- c. fingertip 4 ml
- d. outer edge of the lips 7ml
- e. back of neck 13 ml

##### A-2: Accommodation of Thermoreceptors:

- After two minutes, my left hand felt like it was hurting, sending shooting pain up my left arm to my elbow. My right hand felt warm, I could feel the water warm between my fingers with no pain or numbness.
- After removing my hands and promptly placing them both in 25°C water I felt not much, a little warming, but my hand was extremely numb. My right hand which was in the warm water was instantly cold.

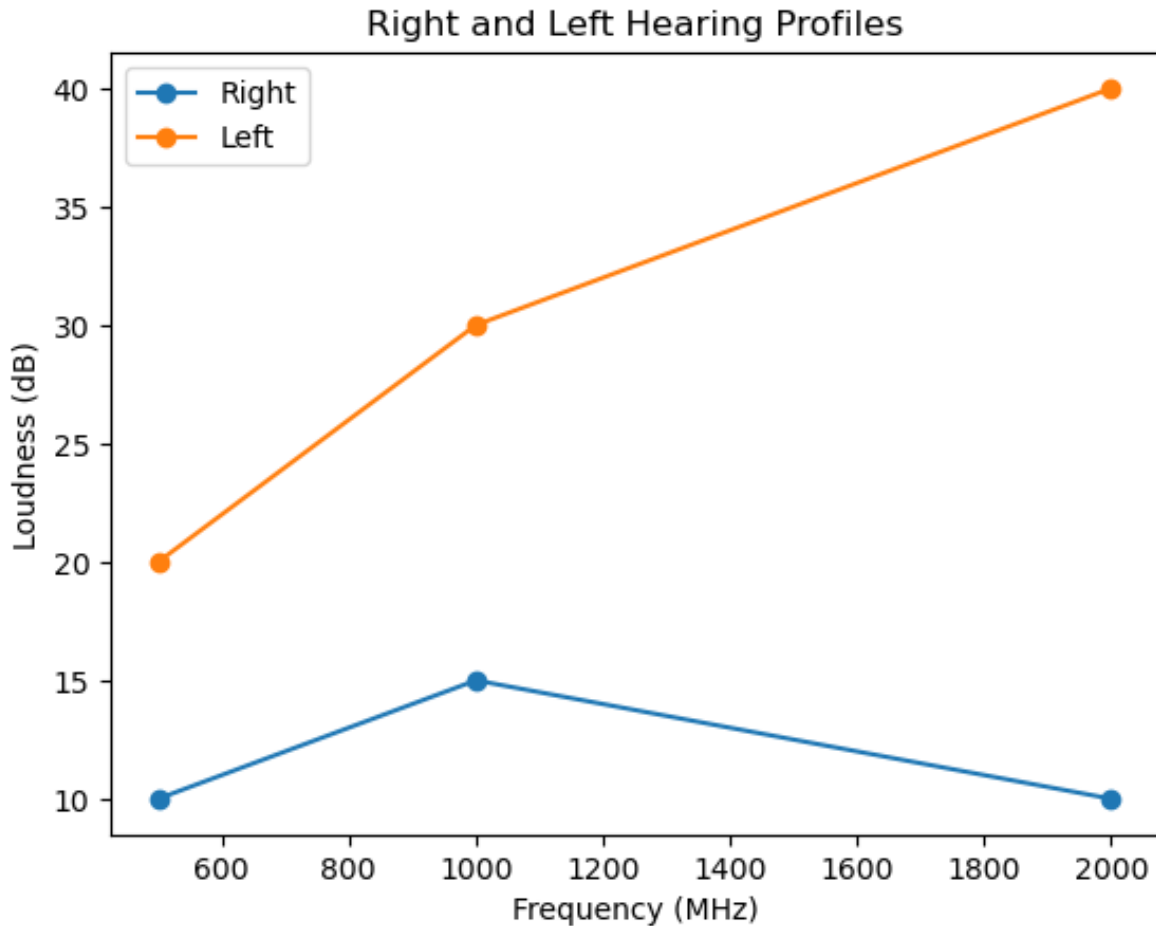
#### 6/7-B: Olfactory adaptation

- After uncorking the camphor oil, it took 1.25 seconds for it to no longer be detected.
- After placing the bottle of cloves and peppermint oil under my nose. It took 31 seconds for the camphor oil to no longer be recognized.

##### C-1: Tuning fork tests

- According to “Rinne’s Test”, no damage present to the left or right ear.

## C-2: Audiometry



## 6/7-D: Equilibrium-Demonstration of Nystagmus

- The students were spinning, then stopped, and asked to look straight ahead. The students' eyes were rapidly going back and forth, even after they were stopped from spinning.

## E-1: Demonstration of the Blind Spot

- While covering my left eye and staring at the center of the cross, the dot disappeared from view 14 inches away from my eyes.

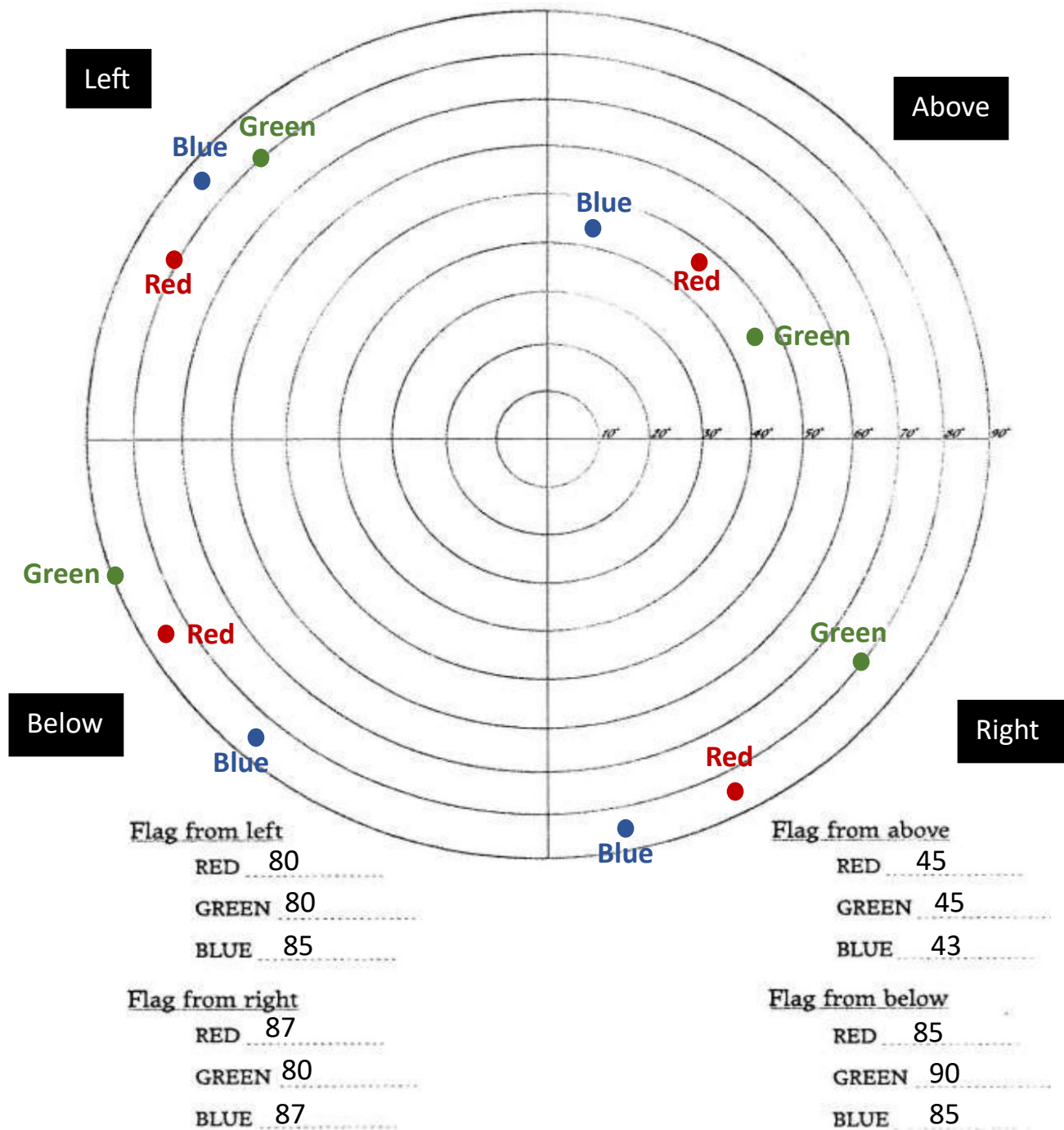
## E-2: The Snellen Test

- Completed "Snellen Test" on myself with no partner. My results concluded that with my contacts:
  - Right Eye: 20/20 vision (normal)
  - Left Eye: 20/20 vision (normal)

### E-3: Astigmatism

- Completed “Astigmatism Test” on myself with no partner. My results concluded that with my contacts:
  - Right Eye: No astigmatism present.
  - Left Eye: No astigmatism present.

### E-5: Perimetry Mapping



#### **IV. Discussion**

Completing these experiments was interesting to see how results vary by user error and how each individual is different due to sensory stimuli. Each individual has different reaction times to sensory stimuli. I would like to complete a few of these experiments without my contacts and see how my results differ from when I have my contacts in.

#### **V. Conclusion**

I concluded that depending on the person being tested each result will vary for each person because everyone has a different stimuli sensitivity.