STATION 1: The Effect of Exercise on Homeostasis

Purpose:
To discover the effect of various levels of exercise on specific body parameters.

Materials:
Stopwatch, jump rope

Introduction:
Exercise causes many homeostatic factors to kick in, in an effort to maintain internal homeostasis. How exercise affects some of these homeostatic factors can be determined by measuring and observing certain parameters such as:
- change in skin color on arms/hands and face
- perspiration level
- heart rate
- breathing rate

At this station, one member of your lab group will exercise for 10 minutes by skipping in place over a 10 minute interval of time. The parameters listed above will be recorded at rest, after 2 minutes, 2 more minutes, 3 more minutes and 3 more minutes, and 2 minutes after exercise has stopped. The subject should stop just long enough for the needed measurements to be taken. Record all data in the table provided. In addition, your report must include a graph for the parameters of heart rate and breathing rate versus the duration of exercise.

Procedure:
1. Each group will obtain a stopwatch and jump rope.
2. Record the resting observations and values of your subject for each of the four parameters.
   i. Record normal skin color of hands and face (i.e. pale, pink, red, etc.)
   ii. Record normal perspiration level (i.e. none, mild, medium, high, etc.)
   iii. Determine the heart rate from the wrist by counting the number of beats in one minute.
   iv. Determine the breathing rate by counting the number of breaths taken in one minute.
3. Have your subject begin to skip in place. Please note your subject should be sure to exercise at a level they can maintain for the entire 10 minutes.
4. Take your subjects parameter readings using the same techniques described above at the 2 minute mark, after 2 more minutes of exercise, after 3 more minutes, and once more after 3 minutes of exercise. Be sure to take final readings 2 minutes after your subject has stopped exercising.
5. Record all of your parameter readings in the table provided.
STATION 2: Detecting Temperature Changes

Purpose:
To discover the effect of different temperatures on skin receptors.

Materials:
3 large beakers, warm water, cold water, room-temperature water

Introduction:
Rather than detecting specific temperatures as does a thermostat, hot and cold skin receptors are adapted to signal changes in environmental temperatures.

Procedure:
1. Have one member of your group place their right-hand in the cold water beaker and their left-hand in the warm water beaker. The subject should allow his or her hands to adjust to the temperatures for about two minutes.
2. The subject should then transfer both hands to the beaker containing room-temperature water and submerge them at the same time into the beaker. Record your observations.
HOMEOSTASIS LAB

STATION 3: Reflex Arcs – Knee-Jerk & Achilles

**Purpose:**
To examine the functioning of reflex arcs.

**Materials:**
Rubber reflex hammer

**Introduction:**
Reflex arcs make up the neural circuit that travels through the spinal cord, providing a framework for reflex actions. Simple physical tests are used by physicians to check reflexes.

**PART 1 - KNEE-JERK REFLEX:**
**Procedure:**
1. Have one member of your group sit on a chair with his or her legs crossed. The subject’s upper leg should remain relaxed.
2. Locate the position of the kneecap and find the large tendon below the midline of the kneecap. Using the rubber reflex hammer, gently strike the tendon below the kneecap. Record your observations.
3. Ask the subject to clench a book with both hands, and then strike the tendon once again. Record your observations.

**PART 2 - ACHILLES REFLEX:**
**Procedure:**
1. Have your subject remove a shoe. Ask your subject to kneel on a chair so that his or her feet hang over the edge of the chair. Push the toes toward the legs of the chair and then lightly tap the Achilles tendon with the reflex hammer. Record your observations.
HOMEOSTASIS LAB

STATION 4: Reflex Arc – Papillary Reflex

**Purpose:**
To examine the functioning of reflex arcs.

**Materials:**
Light source (window)

**Introduction:**
Reflex arcs make up the neural circuit that travels through the spinal cord, providing a framework for reflex actions. Simple physical tests are used by physicians to check reflexes.

**Procedure:**
1. Have the subject close one eye for one minute. Ask him or her to open the closed eye. Compare the size of the pupils. Record your observations.
2. Face a light source (the window) and ask the subject to close one eye for three minutes. After three minutes, tell the subject to look out the window with both eyes open, allowing light to enter the eyes. Record your observations.
STATION 1: The Effect of Exercise on Homeostasis

Observations:

<table>
<thead>
<tr>
<th></th>
<th>Skin Color</th>
<th>Perspiration</th>
<th>Heart Rate (beats/min)</th>
<th>Breathing Rate (breaths/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>REST</td>
<td>Arms/hands:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Face:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 min of exercise</td>
<td>Arms/hands:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Face:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 more min of exercise</td>
<td>Arms/hands:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Face:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 more min of exercise</td>
<td>Arms/hands:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Face:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 more min of exercise</td>
<td>Arms/hands:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Face:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 min after exercise</td>
<td>Arms/hands:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Face:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analysis:
1. Plot your measured data for heart rate and breathing rate versus the duration of exercise (i.e. rest, 2, 4, 7, 10, 12 min) on one graph, using two separate lines. Be sure to include all an appropriate title, legend, and to label the axes.
2. Answer the **discussion questions**.

**Discussion Questions:**
1. What are the changes you observed in body color and perspiration level in response to the exercise? How do these changes contribute to the maintenance of homeostasis?
2. Why do you think a change in body temperature occurs? What mechanisms does your body use to maintain its homeostatic temperature?
3. Why does an increase in heart rate and breathing rate accompany exercise?
4. By studying your parameter measurements after exercise has stopped, what conclusions can you make about your body’s ability to maintain homeostasis?
HOMEOSTASIS LAB

STATION 2: Detecting Temperature Changes

Discussion Questions:
1. Describe what happened when you placed both hands in the room-temperature beaker. Explain why you think these results were obtained.
2. Explain why you might feel a chill when you step out of a warm shower, even though room-temperature is comfortable under normal circumstances.
3. Provide a logical explanation for the following observations: When a frog is placed in a beaker of water above 40°C, the frog will leap out immediately. However, when the frog is placed in room-temperature water and the temperature is slowly elevated, the frog will remain in the beaker.

STATION 3: Reflex Arcs – Knee Jerk & Achilles

Discussion Questions:
1. Describe the movement of the leg observed in Step 2 of the procedure.
2. Compare the movement of the leg while the subject is clenching the book (Step 3) with the movement in Step 2. How does the knee-jerk reflex change when the subject is clenching a book? What do you think this is?
3. Describe the movement of the foot in the Achilles Reflex experiment.
4. Explain why the knee-jerk and Achilles reflexes are important in walking.
5. How might the knee-jerk reflex help people maintain their balance if they slipped or were pushed from behind.
6. A person touches a hot stove, withdraws his or her hand, and then yells. Why does the yelling occur after the hand is withdrawn? Does the person become aware of the pain before the hand is withdrawn?

STATION 4: Reflex Arc – Papillary Reflex

Discussion Questions:
1. Which pupil is larger in Step 1 of the procedure?
2. Describe the changes you observe in the pupil of each eye in Step 2 of the procedure.
3. What is the effect of light on the pupils of the eyes?
4. Why is the papillary reflex beneficial to you?