Human Anatomy & Physiology: Skeletal System

Background Material

The primary system of support is the skeleton. The skeletal system contains the bones, ligaments, joints, and cartilage of the body. Your bones provide a living framework that is perfectly designed to support and protect your body. Yet in spite of their amazing design, bones have no ability to move by themselves. Movement is the job of the muscles, which have the special ability to shorten themselves to produce motion.

Each of the 206 bones of your body is organized around a complex framework that can be seen only with the microscope. In the first portion of the lab, we will study the microscopic structure within compact bone, the type of bone that comprises the shaft of each of your long bones.

Obtain a permanent slide of ground bone and observe it under low power with a reduced light adjustment. Refer to this figure on bone tissue.

The tissue has been stained to emphasize the structural details. Scan your slide until you find an area that looks like the figure. Begin your observation by finding the haversian canals. They should appear as large, clear areas that are somewhat round in shape. Around each haversian canal, you will see a distinct circular area. Each of these areas is called a haversian system. Each haversian system appears to consist of concentric rings like the growth rings of a tree. The ringlike appearance is a result of the circular arrangement of the osteocytes (bone cells). Each osteocyte appears as a tiny, flattened speck with hairlike projections extending outward from it. The osteocytes are separated from each other by the matrix. The matrix also fills the spaces between the haversian systems.

Materials

Part 1: microscope; preserved slide of human dry ground bone; human skeleton; colored pencils
Part 2: 6 jars with lids; isopropyl alcohol; bleach; dilute hydrochloric acid (HCl); vinegar; water; lab apron; gloves; goggles; 6 chicken bones; forceps; marker; masking tape paper towels
Label the bones numbered on the skeleton. Find each bone on the human skeleton model.

On the skeleton color in each of the following:  
in red – a fused joint  
in blue – a freely moveable joint  
in orange – a slightly moveable joint  
in yellow – a ligament  
in green – a tendon (need to draw a muscle)
Fill in the missing information on the “Joints of the Human Body” chart below.

<table>
<thead>
<tr>
<th>Joints of the Human Body</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
</tr>
</tbody>
</table>
| Freely movable | Ball and socket | free movement in all directions | 1.  
2. |
| | | flexion and extension on one plane | 1. Elbow (humerus, ulna)  
2. |
| Pivot | rotation | 1. Atlas and axis  
2. |
| Freely movable | Gliding | | 1. Thumb  
2. Wrist |
| Slightly movable | Cartilaginous | Bending, twisting, and slight compression | 1. |
| Immovable (fused) | Suture | | 1. |

**Procedures Part 1 - Microscope**

1. Observe and draw the preserved slide of human dry ground bone.  
2. Label a central (haversian) canal, an osteocyte, and matrix.

**Drawing Part 1**

Human Ground Bone (Slide # _____)
Background Part 2 – Experiment: Analysis of a Bone

Bones are composed of a variety of substances. Calcium compounds are found in the hard, outer layer of bones. Calcium provides for the toughness and strength of bones. Bone cells remove calcium phosphate and calcium carbonate from the blood to form bone in a process called ossification.

Problem Part 2 – Experiment: Analysis of a Bone

To determine how removing or leaching calcium from a bone affects the bone structure

CAUTION: Keep hands away from face when doing this activity.

Procedures Part 2 – Experiment: Analysis of a Bone

1. **CAUTION: Put on goggles, gloves, and lab apron before you begin this activity.** Using the masking tape and marker, label each jar with a different liquid, as shown in the figure. The sixth jar should be labeled “Control.”

2. Test the strength of each chicken bone by twisting and bending it. Be careful not to snap the bone. Record your results in the data table. Write “no” if the bone does not bend or twist and “yes” if it does.

3. Place one bone in each jar.

4. Fill each jar with the liquid shown on the label. Each bone should be covered by liquid. **CAUTION:** Hydrochloric acid may be corrosive to your skin, eyes, mucous membranes, and clothes. Never inhale fumes from hydrochloric acid or bleach. Be especially careful when pouring the hydrochloric acid and the bleach. If a spill occurs, flush the area immediately with large quantities of water. Wipe up any spills and pick up dropped objects to prevent slips and falls.

5. After five days, remove the bones from the liquids with the forceps. Rinse each bone with water. Then blot dry with paper towels. **CAUTION:** Wipe up any spills and pick up dropped objects to prevent slips and falls.

6. Retest each bone for strength by twisting and bending. Record your results in the data table. **CAUTION:** Wash hands thoroughly when finished.
### Data Chart for Part 2 — Experiment: Analysis of a Bone

<table>
<thead>
<tr>
<th>Liquid</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isopropyl alcohol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bleach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vinegar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrochloric Acid</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Analysis and Conclusions for Part 2 — Experiment: Analysis of a Bone

1. Was there any evidence that calcium was removed from any of the bones? If so, what was it?

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2. From which liquids was the calcium removed?

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________________________________________________________________________________________________

3. What do the liquids that remove calcium have in common?

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________________________________________________________________________________________________

4. What is osteoporosis? How can it be prevented?

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