Bones, Muscles & Movement

July 2020
About Me

• Youth leader and leadership advisor
• Lifelong sports fan
• Worked for the British Olympic and Paralympic Teams
• Master’s degree in Sport Psychology
• Bachelor’s degree in Sport & Exercise Science from Loughborough University
• Gym fanatic
• Pathfinder to Guide level – attended Oshkosh Camporee in 2009
Let’s get started!
Worksheets at the ready...

Bones, Muscles & Movement Pathfinder Honour

Participant Worksheet

Honour Requirements (available here)

1. What's the difference between exoskeletons and endoskeletons? Which type of skeleton do humans have?
2. List three functions of the skeletal system
3. Is bone a living tissue? Explain why or why not.
4. Describe the structure and development of bone.
5. Identify the following bones of the skeletal system: Carpals, clavicle (collarbone), cranium, femur, fibula, humerus, mandible, maxillary bones, metacarpals, metatarsals, patella, pelvis, phalanges, radius, ribs, scapula (shoulder blade), coccyx (tailbone), sternum (breastbone), tarsals, tibia, ulna, and vertebrae.
6. What is a joint?
7. List the three types of joints found between bones.
8. Name and describe six types of freely moveable joints. Be able to locate an example of each of these in your body.
9. Be creative and construct a model of one of the six freely moveable joints. Describe how bones heal and how doctors can help this process.
10. What is another name for a broken bone? List 3 types of breaks that can occur in bones. Describe how bones heal and how doctors can help this process.
11. What is osteoporosis? Who can get it? List at least 5 health habits that deal with maintaining healthy bones and muscles.
12. What is the function of the muscular system?
13. Name and describe three types of muscle tissue. Give one example of each.
14. Be able to identify the following muscles on your body: Masseter, Trapezius, Deltoid, Pectoralis, Biceps, Abdominal, Quadriceps, Triceps, Latissimus dorsi, Gluteus maximus, Hamstrings, Gastrocnemius, and Soleus.
15. Describe the process that causes a muscle to contract.
16. Describe the difference between voluntary and involuntary muscles.
17. Using your model in #9, show how muscles, bones, and joints work together to produce movement.
18. Find 3 texts in the Bible that mention bones and/or muscles. Tell about each one in your own words.
1. What's the difference between exoskeletons and endoskeletons? Which type of skeleton do humans have?
An exoskeleton is a hard shell on the outside of a creature (such as an insect or a lobster). An endoskeleton is the system of bones on the inside of a creature (such as a human, dog, cat or a bird).
2. List three functions of the skeletal system
3. Is bone a living tissue? Explain why/why not
Bone is a living tissue

- Bones produce blood cells
- Bones heal after being broken
- Bone cells continually regenerate themselves

DID YOU KNOW...

The collagen in bone constantly replenishes itself. So about every 7 years, you have a new skeleton.
4. Describe the structure and development of bone
Fun Fact!

- Babies have 300 bones when they are born.
- Adults have 206 bones.
- The number of our bones actually decreases as we mature!
Bone Structure

- Bone is hard, but lightweight
- Bone is primarily formed of calcium phosphate
- It has high compression strength
- It has poor tensile strength (the resistance of a material to breaking under tension)
- Bone is somewhat elastic due to its collagen
- The density of bone varies at different points
There are 2 types of bone: woven or lamellar.

- Woven bone is used for growth or repair. Its fibres are aligned at random, so has low strength.
- Lamellar bone has parallel fibres and is therefore much stronger.
- Lamellar bone replaces woven bone during growth/repair processes.
Bone Development

- Most bone development occurs in the womb, but some bones do fuse after birth ("ossification").
- Bone growth starts in the cartilage.
- Long bones ossify and get longer as they grow and develop. These bones grow from their ends, known as the epiphysis.
- If a bone has a growth plate on the end of it (the "epiphyseal line"), then that signifies that the bone is still growing.
- In late teens/early twenties, a person stops growing – all of their cartilage has been replaced by bone, so no further growth in bone length is possible. However, bones can still increase in thickness. This may occur in response to increased muscle activity, such as weight training.
Bone Marrow

- Bone marrow is a spongy substance found in the center of the bones.
- Bone marrow makes blood cells.
- Each type of blood cell made by the bone marrow has an important job:
  - Red blood cells carry oxygen to tissues in the body.
  - White blood cells fight infections.
- Over time, red marrow is mostly replaced by yellow marrow in large bones. Most red marrow in adults is found in flat bones, not long bones (e.g. in the skull, ribs, vertebrae and pelvis).
5. Bone Identification
### The Bones we must Identify

<table>
<thead>
<tr>
<th>Bones (singular)</th>
<th>Bones (plural)</th>
<th>Bones (singular)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpals</td>
<td>Mandible</td>
<td>Radius</td>
</tr>
<tr>
<td>Clavicle (collar bone)</td>
<td>Maxilla</td>
<td>Ribs</td>
</tr>
<tr>
<td>Coccyx (tail bone)</td>
<td>Metacarpals</td>
<td>Scapula and Sternum</td>
</tr>
<tr>
<td>Cranium</td>
<td>Metatarsals</td>
<td>Tarsals</td>
</tr>
<tr>
<td>Femur</td>
<td>Patella</td>
<td>Tibia</td>
</tr>
<tr>
<td>Fibula</td>
<td>Pelvis</td>
<td>Ulna</td>
</tr>
<tr>
<td>Humerus</td>
<td>Phalanges</td>
<td>Vertebrae</td>
</tr>
</tbody>
</table>
Head

- Maxilla
- Mandible
Arms

- Clavicle
- Scapula
- Humerus
- Ulna
- Radius
- Carpals
- Metacarpals
- Phalanges
Upper Body

- Cranial portion
- Vomer
- Facial portion
- Mandible
- Thoracic vertebra
- Clavicle
- Sternum
- Ribs
- Vertebral column
- Coccyx
Legs

- Pelvis
- Femur
- Patella
- Tibia
- Fibula
- Tarsals (7)
- Metatarsals (5)
- Phalanges (14)
6. What is a joint?
Joints

- A joint is the place where two or more bones meet
- What examples can you think of, of joints within the body?
7. List the three types of joints found between bones

- **Fibrous** (Immoveable)
- **Cartilagenous** (Semi moveable)
- **Synovial** (freely moveable)
Fibrous  
(Immoveable)

Cartilagenous  
(Semi moveable)

Synovial  
(freely moveable)
8. The six types of synovial (freely movable) joints
6. _______ and _______ joints, (like your hip and shoulder joints) are the most mobile type of joint in the human body. They allow you to swing or rotate your arms and legs in many different directions.

5. _______ joints occur between the surfaces of two short bones that are held together by ligaments. (Some of the bones in your wrists and ankles); have limited range of motion.

4. _______ joints, such as the joint at the base of your index finger, allow bending and extending, rocking from side to side, but rotation is limited.

1. _______ joint (Like in your neck) allows you to turn your head from side to side.

2. _______ joints, like in your knee and elbow, enable movement similar to the opening and closing of a hinged door.

3. _______ joints (in your thumbs) The bones in these joints can rock back and forth and from side to side, but they have limited rotation.
9. Be creative and construct a model of one of the six freely moveable joints
10. Broken bones
Broken bones are otherwise known as fractures. There are 2 main types of fracture:

1. Open fractures
2. Closed fractures
Sub-Categories of Fractures

- Transverse
- Stress
- Oblique, Displaced
- Greenstick
- Comminuted
How do bones heal and how can doctors help?

- Living bones are in constant change. Cells die and are replaced on a regular basis. Because of this, a bone will heal all by itself if allowed to.

- Doctors can help this process in two ways:
  1. They can **set** the bone. This is done by making sure the pieces of the bone are aligned properly. In a comminuted fracture this may involve surgery
  2. They can **immobilise** the bone - that is, keeping it from moving around. This can be done by surrounding the broken limb with a cast or by embedding pins inside the body. Some bones do not need to be immobilised when broken (e.g. the nose)
11. Osteoporosis
What is osteoporosis and who can get it?

• Osteoporosis is the depletion of minerals from the bone
• Minerals in bones give them their strength, so a bone with a low bone mineral density (or BMD) is more susceptible to breakage, even when stressed only lightly
• Anyone can get osteoporosis, but it is more common in older women
• Some of the risk factors of getting osteoporosis cannot be reduced by modifying behaviour (e.g. being a woman, having dementia, having a history of weak bones/fractures and/or being of European descent), but other factors can be avoided by healthful living
List at least 5 healthy habits that deal with maintaining healthy bones and muscles

1. Avoid soft drinks
2. Avoid alcohol
3. Avoid tobacco
4. Maintain a healthy body weight. Those with abnormally low body weight are more susceptible to osteoporosis
5. Make sure your diet has plenty of calcium
6. Make sure your diet has plenty of vitamin D
7. Get plenty of exercise, especially weight-training
12. The muscular system
What is the function of the muscular system?

• The muscular system is the system in humans and in animals that facilitate motion. This motion can be either internal (a beating heart) or external (walking).
13. Types of Muscle Tissue
13. Name and describe three types of muscle tissue. Give one example of each.
14. Muscular System
# The Muscles we must Identify

<table>
<thead>
<tr>
<th>Muscles</th>
<th>Muscles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal</td>
<td>Masseter</td>
</tr>
<tr>
<td>Biceps</td>
<td>Quadriceps</td>
</tr>
<tr>
<td>Deltoid</td>
<td>Pectoralis</td>
</tr>
<tr>
<td>Gastrocnemius</td>
<td>Soleus</td>
</tr>
<tr>
<td>Gluteus maximus</td>
<td>Trapezius</td>
</tr>
<tr>
<td>Hamstrings</td>
<td>Triceps</td>
</tr>
<tr>
<td>Latissimus dorsi</td>
<td></td>
</tr>
</tbody>
</table>
The Muscular System

These are the major muscles of the body...

- Deltoids
- Pectorals
- Biceps
- Abdominals
- Quadriceps
- Trapezius
- Triceps
- Latissimus Dorsi
- Gluteals
- Hamstrings
- Gastrocnemius
15. Muscle contractions
15. Describe the process that causes a muscle to contract.
Muscle Contraction

- Watch this video after the session and make notes on your worksheet
- The process is quite complex, so take the time to watch the video several times and find any other resources that might be useful (books, articles, pictures)
- Link to video
16. Voluntary & involuntary muscles
# Voluntary v Involuntary Muscles

<table>
<thead>
<tr>
<th></th>
<th>Voluntary Muscles</th>
<th>Involuntary Muscles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anatomy</strong></td>
<td>Attached to the skeletal frame</td>
<td>Most are organs</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>Generally under the control of the person to whom they belong</td>
<td>Controlled by the autonomic system without the conscious control of the individual</td>
</tr>
<tr>
<td><strong>Examples</strong></td>
<td>Arms, Legs</td>
<td>Heart, Digestive system</td>
</tr>
</tbody>
</table>
17. Using your model from #9, show how muscles, bones, and joints work together to produce movement.
18. Find 3 texts in the Bible that mention bones and/or muscles. Tell about each one in your own words.
Questions