THE TOUR OF BONE

Academic Success Center
Introduction

• The skeletal system is formed by bones and cartilages.
• Bone tissue is a complex and dynamic living tissue. It continually engages in a process of remodeling – building new bone tissue and breaking down old one
• The various components of bones are going to help us understand how bones are form, how they age, and how exercise affects the density and strength of bones.
Topics of Discussion

• Male vs. Female
• Functions of the Skeletal System
• Anatomy of the Bone
• Bone Formation
• Bone Growth
• Relation between exercising, aging and bone tissue
• Divisions of the Skeletal System
• Types of Bones
• Joint Classification
• Applications to Health
First things first, male or female?

- The difference between male and female skeletons is evident in their pelvises.
- Can you tell which one is which?
• The male pelvis is too large to allow for a baby to squeeze through
• The female pelvis in contrast became specialized for birth, allowing an offspring’s head to fit “comfortably” through
Functions of the skeletal system

- Protection. Against injury of internal organs
- Assistance in movement with muscles.
- Mineral storage and release. Calcium and phosphorus for strength of bone
- Blood cell production. Red bone marrow produces red blood cells
- Triglyceride storage. Energy. In adipose tissue of yellow bone marrow
Parts of Long Bone

- **Diaphysis**: Bone’s shaft or body
- **Epiphyses**: Distal and proximal ends of the bone
- **Metaphyses**: Where diaphysis joins epiphyses
- **Articular cartilage**: Cartilage covering epiphysis
- **Periosteum**: Surrounds the bone surface
- **Medullary cavity**: Space within the diaphysis that contains yellow marrow
- **Endosteum**: Membrane that lines medullary or marrow cavity
Bone Formation

- Ossification (osteogenesis): Process by which bone forms.
- Two methods of bone formation
  1. Intramembranous ossification. Bone forms directly within mesenchyme arranged in sheet-like layers that resemble membranes. The flat bones of the skull and mandible are formed in this way.
  2. Endochondral ossification. Bone forms within hyaline cartilage that develops from mesenchyme. This process is observed in long bones.
Bone Growth

• Growth in length
  The activity of the epiphyseal plate is the only way that the diaphysis can increase in length. As bone grows, chondrocytes proliferate on the epiphyseal side of the plate. New chondrocytes cover old ones, which are destroyed by calcification, and the cartilage is replace by bone.

• Growth in thickness
  Bone can grow in thickness only by appositional growth. At the bone surface, osteoblasts secrete collagen fibers. They are surrounded by matrix and develop into osteocytes. This process forms bone ridges that fuse and form an endosteum-lined tunnel. New concentric lamellae forms a new osteon.
Exercise, aging and bone tissue

- Bone tissue, under mechanical stress, adapts by becoming stronger through increased deposition of minerals, production of collagen, and calcitonin. Without stress bone becomes weak and loss minerals and decreased number of collagen fibers.

- There are two types of effects of aging on bone tissue: loss of bone mass and brittleness. The first one, is a result of demineralization with the loss of calcium and other minerals from bone. The second one is due to decrease rate of protein synthesis. These factors will increase the susceptibility to fracture, deformity, pain, stiffness, loss of height, and loss of teeth.
# AXIAL SKELETON

<table>
<thead>
<tr>
<th>Structure</th>
<th>Number of bones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skull</td>
<td></td>
</tr>
<tr>
<td><em>Cranium</em></td>
<td>8</td>
</tr>
<tr>
<td><em>Face</em></td>
<td>14</td>
</tr>
<tr>
<td>Hyoid</td>
<td>1</td>
</tr>
<tr>
<td>Auditory ossicles</td>
<td>6</td>
</tr>
<tr>
<td>Vertebral column</td>
<td>26</td>
</tr>
<tr>
<td>Thorax</td>
<td></td>
</tr>
<tr>
<td><em>Sternum</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Ribs</em></td>
<td>24</td>
</tr>
<tr>
<td><strong>Subtotal:</strong></td>
<td><strong>80</strong></td>
</tr>
</tbody>
</table>
# APPENDICULAR SKELETON

1. Pectoral (shoulder) girdle
   - **Clavicle**: 2
   - **Scapula**: 2

2. Upper limbs
   - **Humerus**: 2
   - **Ulna**: 2
   - **Radius**: 2
   - **Carpals**: 16
   - **Metacarpals**: 10
   - **Phalanges**: 28
2. Pelvic (hip) girdle

*hip, pelvic, or coxal bone* 2

**Lower limbs**

*Femur* 2
*Patella* 2
*Fibula* 2
*Tibia* 2
*Tarsals* 14
*Metatarsals* 10
*Phalanges* 28

Subtotal = 126
TOTAL  = 206
TYPES OF BONES

Based on their shapes:
1. Long bone (humerus)
2. Flat bone (sternum, cranial)
3. Short bone (trapezoid, wrist bone)
4. Irregular bone (vertebra)
5. Sesamoid bone (patella)
JOINTS

• Bones are too rigid to bend without being damaged. Flexible connective tissue form joints that hold bones together and permit some degree of movement.

• A joint, also known as articulation or arthrosis, is a point of contact between two bones, between bone and cartilage, or between bone and teeth.
JOINT CLASSIFICATION

• Fibrous joints: Bones held together by collagen fibers. There is no synovial cavity.
• Cartilaginous joints: Bones are held together by cartilage and there is no synovial cavity.
• Synovial joints: The bones have a synovial cavity and are united by an articular capsule and accessory ligaments.
• Fibrous joints include:
  * sutures (cranial)
  * syndesmoses (ulna-radius)
  * gomphoses (teeth)

• Cartilaginous joints:
  * synchondroses (epiphysial plate)
  * symphyses (pubic symphysis)
• Types of Synovial Joints:
  
  * Planar Joints (cuneiforms)
  * Hinge Joints (elbow)
  * Pivot Joints (radius-ulna)
  * Condyloid Joints (radius-carpals)
  * Saddle Joints (thumb)
  * Ball-and-Socket Joints (shoulder)
Applications to Health

• Rheumatoid Arthritis (RA)
  Is an autoimmune disease in which the immune system of the body attacks its own cartilage and joint linings. Its characterized by inflammation of the joint, which causes swelling, pain, and loss of function.

• Osteoarthritis (OA)
  Is a degenerative joint disorder in which joint cartilage is gradually lost. It results from combination of aging, irritation of the joints, and wear and abrasion.
• **Gouty Arthritis**
  Uric acid is a waste product produced during the metabolism of nucleic acid subunits. A person who suffers from this disease either produces excessive amounts of uric acid or is not able to excrete as much as normal.

• **Ankylosing Spondylitis**
  Is an inflammatory disease that affects joints between vertebrae and between sacrum and hip bone. It is common in males from 20 to 40 and is characterized by pain and stiffness in hips.
THE END