Bone Growth and Articulation Notes

MMHS Science
Bone Formation

- Known as “Ossification” or “Osteogenesis” (=bone creation).

Two Types of Embryonic Ossification:

1. Intramembranous Ossification
2. Endochondral Ossification
Intramembranous Ossification

LOCATION: Occurs in flat bones like ribs and the plates of the skull. (=Epiphysis Formation)

1. Begins with the formation of connective tissue “sheets” in late embryonic development.
2. These sheets are highly vascularized and form osteoblasts on the interior.
3. The osteoblasts turn into osteocytes, thus forming the spongy bone.
4. The remaining CT “sheets” are layed down to form the Periosteum.
5. The newer osteoblasts accumulate on the edge of the spongy bone and then create the compact bone.
Order of Bone Formation

“CT” Sheets → Spongy Bone → Periosteum → Compact Bone
Intramembranous Growth

- Osteoblasts
- Osteocytes
- Calcified cartilage
Endochondral Ossification

**Location:** Long, short & Irregular Bones (=Diaphysis Formation)

1. Chondrocytes swell up and begin to die.
2. Periosteum forms along the outside of the cartilage.
3. Osteoblasts invade the P.O.C (Primary Ossification Center) in the diaphysis turning into osteocytes.
4. Next, chondrocytes die in the epiphyses, osteoblasts invade the S.O.C (Secondary Ossification Center) turning into osteocytes.
5. The P.O.C and S.O.C never merge and are left with cartilage inbetween the 2 regions.
6. This remaining cartilage becomes the Epiphyseal Plate or “Growth Plate” where new cells are layed down.
Endochondral Growth

Cartilaginous model

Developing periosteum

Compact bone developing

Secondary ossification center

Compact bone

Calcified cartilage

Primary ossification center

Blood vessel

Secondary ossification center

Medullary cavity

Remnant of epiphyseal plate

Spongy bone

Marrow

Spongy bone

Articular cartilage
Bone Growth

- Two Types
  1. Length-Wise (=Oppositional Growth)
  2. Diameter/Width (=Appositional Growth)
1. Chondrocytes in the epiphyseal plate divide (via Mitosis).
2. They are replaced by bone on the diaphysis side of the plate.
3. When growth stops, cartilage in the epiphyseal plate is replaced by bone (osteocytes).
4. Osteocytes then lay down the calcified matrix (=calcification).
Appositional Growth

1. Bone around medullary cavity is destroyed.
2. More yellow marrow moves into the void and fills the space.
3. The periosteum adds new bone to the outside.
Appositional Growth
Articulations (=Joints)

- 4 Main Categories of Joints
  1. Immovable
  2. Fibrous
  3. Cartilaginous
  4. Synovial
1. Immovable Joints

- No movement
- **Example:** The plates of the skull that form the cranial sutures.
2. Fibrous Joints

- Slight movement in the joint.
- Dense connective tissue holds bones together.
- Forms Interosseus membrane.
- **Example:** Ulna/Radius
  
  Tibia/Fibula
Fibrous Joint

- Fibula
- Tibia
- Interosseous membrane
- Anterior tibiofibular ligament
- Syndesmoses between tibia and fibula
3. Cartilaginous Joint

- Formed by Hyaline or Fibrocartilage.

Examples: Intervertebral disks (Vertebra), Costal Cartilage (Ribs), Symphysis Pubis (Pubic Bone)
3. Cartilaginous Joints
4. Synovial Joints

- The most “movable” joints in the body.
- Membrane secretes synovial fluid in the joint.
- Fluid used for lubrication.
- Fluid is produced by the bursa sack.
- Bone ends have articular (hyaline) cartilage.
Synovial Joints

- Bone
- Synovial membrane
- Synovial fluid
- Articular cartilage
- Ligament forming fibrous capsule
## Types of Synovial Joints

<table>
<thead>
<tr>
<th>Type of Synovial Joint</th>
<th>Location Found in Body</th>
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<tbody>
<tr>
<td>1. Ball and Socket</td>
<td>Hip; Shoulder</td>
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<tr>
<td>2. Condylloid</td>
<td>Phallanges (fingers/toes)</td>
</tr>
<tr>
<td>3. Hinge</td>
<td>Knee; Elbow</td>
</tr>
<tr>
<td>4. Pivot</td>
<td>Radius/Ulna</td>
</tr>
<tr>
<td>5. Saddle</td>
<td>Artic. b/w Thumb + Metacarpal.</td>
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<tr>
<td>6. Gliding</td>
<td>Wrist or ankle</td>
</tr>
</tbody>
</table>
Which Joint Type?

ANS = Hinge
Which Joint Type?

ANS = Saddle
Which Joint Type?

ANS = Hinge
Which Joint Type?

ANS = Ball and Socket
Which Joint Type?

ANS = Gliding
Which Joint Type?

ANS = Gliding
Bone Terminology

1. Bumps on Bones
2. Depressions on Bone
3. Holes in Bones
1. Bumps on Bones

- **Process** = projections
- **Condyle** = rounded smooth projections
- **Epicondyle** = above a condyle.
- **Spine** = thorn-like, elevated projection.
- **Tubercle** = knob-like process
- **Tuberosity** = large, rough tubercle.
- **Trochanter** = large, rough tuberosity.
2. Depressions on Bones

- **Facet** = flat area that articulates (on vertebrae)
- **Fossa** = shallow indentation (scapula)
3. Holes in Bones

- Foramen = holes for blood vessels, nerves, and ligaments.
- Meatus = bony tube (opening for ear)
- Sinus Cavity = space filled with air
Sinus

Meatus