Long Bone Anatomy: Extremity Bones

Long Bone Regions:

1. **Epiphysis (Head):** *Epi* = “above”; *physis* = “growth”
   - **Epiphysis Composition:**
     a. Spongy Bone:
     b. Compact Bone:

2. **Diaphysis:** *Dia* = “through”
   - **Shaft Composition:**
     * Compact bone tube
     * Central space:
     * Contents:
   - **Function:**

3. **Metaphysis:** “*Union*”
   - **Location:** Between
   - **Site of bone growth:**
   - **Composition:**
     * Juvenile:
     - **Hyaline cartilage:**
       - **Clinical Importance:** Epiphyseal Fractures
Osteogenesis: “*Bone Formation*

- **Bone Formation:**
  - Carefully regulated by:
    - **Begins:**
    - **Ends:**
  - Results from replacing connective tissue with bone:
    - 
    - 

**2 Forms of Ossification:**

1. **Intramembranous (IM) Ossification** “*Dermal Ossification*”

   - **Location:** Embryonic or Fibrous CT
     - **Mesenchymal cells:** Differentiate into:
     - **Osteoblasts** secrete:
       - Site:
       - Form:
       - Mature: into:
     - Bone growth is:
       - Projections of matrix:
       - Spicules unite to form:
   - **Resulting structure:**

   - **3 primary STIMULI:**
     - **Fetal Hormones**
     - **Chronic Mechanical Stress**
     - **Connective Tissue Injury**

   - **Sites of Intramembranous ossification**
     - **Skeleton:** Skull, Mandible, Clavicles, Patella
     - **Stress:** Dermal Bones:
       - Contusion, damaged fibers
     - **Injury:**
     - **Clinical Importance:** Myositis Ossificans

2. **Endochondral Ossification:** endo = “within” ; Chondral = “cartilage”

   - **Location:** Within:
     - Cartilage provides framework:
     - Result:
       - “Shaft – Diaphysis”

   - **Steps of Endochondral Ossification:**
a. Cartilage:
b. **Cartilage plate** grows (*Hypertrophy*):
   - Centrally located:
     ⇒ Cause:
c. **Perichondrium**: Mesenchymal cells differentiate into:
   ⇒ Result:
d. **Chondrocyte death**: Allows **blood vessels** to:
e. **Osteoblasts**: Migrate in with vessels into:
f. **Osteoblasts**: Secrete:
   - ♦
   - ♦ Ossification begins in diaphysis & moves toward:
g. **Remodeling occurs**
   - ♦ **Osteoclasts**:
     ⇒ Result:
h. **Epiphysis enlarges**:
   - ♦ Central:
     - ♦ Periosteal osteoblasts migrate into:
     - ♦ Convert epiphysis into bone:
i. **Epiphyseal Cartilage**: Separates:
   ⇒
   - ♦ Location:
   - ♦ Significance:

**Metaphysis Activity**: “Bone Elongation”

**Steps of Bone Elongation**:

1. **Epiphyseal Plate**:
   a. Epiphyseal side -
      ⇒ Chondrocytes: Interstitial Growth
   b. Diaphyseal side -
      ♦
      ➔ Ossified by:

2. **Bone Lengthening**:
   a. **Growth**:
      - ♦ **Chondrocyte activity equals**: 
b. **Cessation of Bone elongation:**

- **Osteoblast** activity *slightly faster* than:
  - Orchestrated by:

  ⇨ **Puberty**: Sex hormones stimulate BOTH:
  - ✓ Result:

  ⇨ **End Result**: Complete ossification of:
  - ✓ Remnant:

---

**Study Questions**

1. Describe the structure of long bones – where do you find compact and spongy bone? Describe the structural regions of the: Epiphysis, diaphysis, & metaphysis. In which region does: bone lengthening occur, blood cell formation occur, red bone marrow reside, and yellow bone marrow reside?
2. What is contained within the marrow (medullary) cavity? What is the function of yellow bone marrow?
3. Define Osteogenesis. What are the 2 forms of Ossification?
4. Describe the process of intramembranous ossification. Provide examples of bones resulting from intramembranous ossification. What are some of the stimuli for intramembranous ossification?
5. Describe why intramembranous ossification results in the production of spongy bone (rather than compact bone)? Which type of bone do you think would best resist fracture under: 1) longitudinal stress 2) compressional stress?
6. Describe the steps involved in endochondral ossification. Why does this result in compact bone formation?
7. People who are often on their feet all day tend to develop bone spurs (projections of bone growth) within the connective tissue of the foot. What type of ossification results in the formation of bone spurs? Explain
8. Athletes (esp. football and soccer players) often acquire contusion injuries. Many times they develop small plates of bone within the muscle at the site of injury. What type of ossification results in this type of bone growth? Describe the steps resulting in this bone growth. What might you do for the athlete to help prevent bone formation?
9. Using x-ray technology, how could one determine a juvenile long bone from an adult long bone? Explain
10. What is the relationship between osteoblast activity and chondrocyte activity in long bone growth?
11. What events happen at puberty resulting in the characteristic growth spurt and formation of the epiphyseal plate?
12. When you are done growing, does bone continue to change in adulthood? If so, how?
13. How does the slow growth of cartilage result in dwarfism?