Skeletal System

I. Functions

1. support
2. protection
3. levers –
4. mineral storage
5. hemopoiesis by red bone marrow

blood *make*

II. Anatomy of a long bone

A. **Know Fig. 6.2** – all terms & word roots

diaphysis	compact bone	red marrow	periosteum
epiphysis	spongy bone	yellow marrow	endosteum
epiphyseal line	marrow (medullary)cavity	articular cartilage	nutrient foramen
			nutrient artery

B. Blood and nerve supply

1. nutrient artery (via nutrient foramen) →
2. epiphyseal & periosteal arteries provide alternate sources
3. veins accompany arteries
4. nerves accompany vessels =
   - most sensory are in the periosteum

III. Histology of bone

A. Components

1. Cells (Fig. 6.4)

- ♦ osteogenic cells

  ↓ mitosis

- ♦ osteoblasts

  ↓ mature

- ♦ osteocytes

osteoclasts

↳ "break"

2. matrix
   - 25% H_2O
   - 25% collagen fibers
   - 50% mineral salts
     - calcium phosphate
     - $CaCO_3$, Mg, Fl, SO_4

⇒ Calcification –

⇒ Matrix is not solid

B. Compact (dense) bone tissue

- location –

  –

- structural unit is the **osteon**
- **Know Fig. 6.5** (Note legends for c & d reversed)

osteon (haversian system)	concentric lamellae	lacunae
central (haversian) canal	circumferential lamellae	canaliculi
perforating (Volkmann) canals	interstitial lamellae (ADD)	

C. Spongy (cancellous) bone tissue

- location –

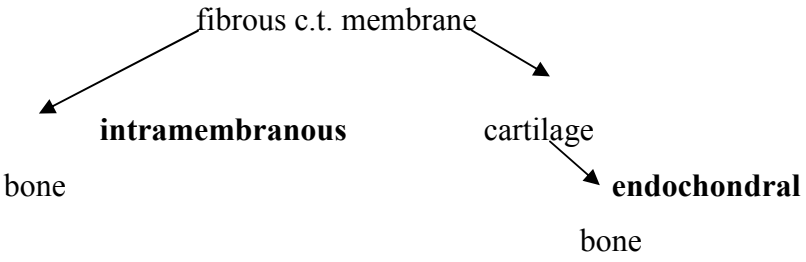
  -

- structural units are flat **trabeculae** and pointed **spicules**
  "little beams" ↵
- only site of red marrow in adults

IV. Bone formation: ossification

A. Overview

1. two pathways, both start with



2. both form spongy bone which is then remodeled to compact bone

B. Intramembranous ossification (Fig. 6.8)

- flat bones of the skull and mandible

1. fibrous membrane with <u>mesenchymal</u> <u>cells</u>

-sketch- fetal c.t ↵

mesenchymal cells cluster

↓

become osteogenic cells

↓

become osteoblasts → deposit matrix

↓

2. -sketch**:** result in center of ossification

more fiber, mineral deposition

↓

central osteoblasts mature → osteocytes

↓

peripheral osteoblasts remain active

3. -sketch:

result is multiple trabeculae separated by miniature marrow cavities filled with <u>red marrow & many blood vessels</u>

↓

original fibrous membrane has been converted into a <u>periosteum</u>

4. Peripheral bone is remodeled into compact bone, creating "sandwich".

C. Endochondral ossification (Fig. 6.10) **Know Handout**

- most bones are formed this way

1. mesenchymal cells become **chondroblasts**, which form a cartilage model of the bone.

   **Ossification will occur simultaneously →

   →

Steps 2-5 on Handout

V. Bone growth

A. In length: interstitial growth (Fig. 6.11 & 6.12)

1. occurs at metaphysis → transition between epiphyseal plate/cartilage & diaphyseal bone

-sketch → 5 zones

2. mechanism

   - division and enlargement in middle two zones pushes epiphysis away from diaphysis
   -
   -

3. growth is controlled by hormones, but stops when cartilage is replaced by bone:

B. In diameter: <u>appositional growth</u>

1. occurs under <u>peri</u>osteum

-

2. osteo<u>clasts</u> lining the <u>endo</u>steum resorb bone from the <u>inside</u>,

VI. Remodeling

– osteoblast/ osteoclast balance continually altered

- rapidly adjusts plasma levels of Ca^{++} and $PO_4^{—}$
- allows response to applied stresses (Rule #1? = Wolff's Law)

-

VII. Aging and Osteoporosis *(="porous bone")*

A. Loss of Ca^{++} and minerals

↓ bone mass (density) →

-

-

PREVENTION → Diet and Exercise

B. Decreased rate of protein synthesis

↓ collagen →