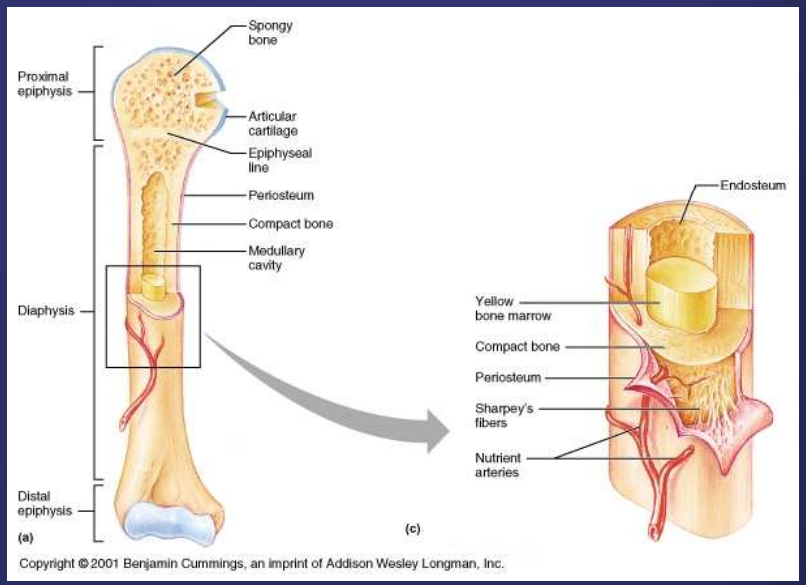
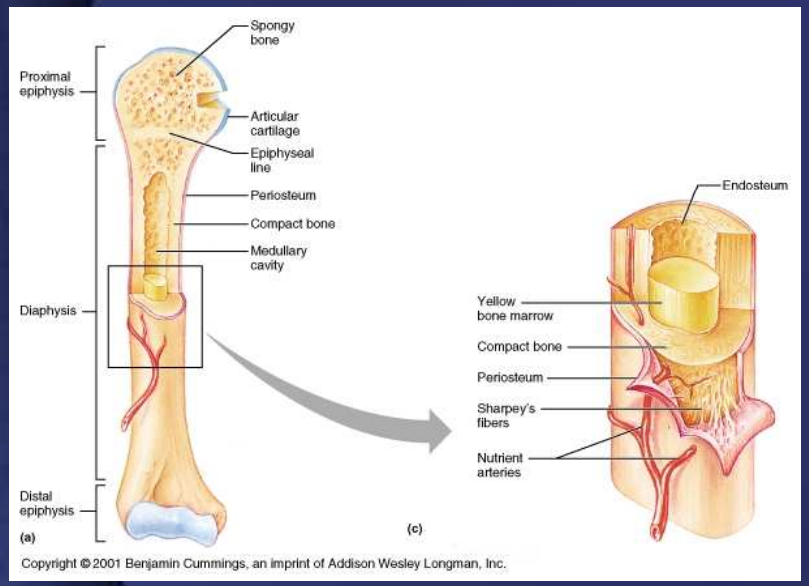
Bone Structure

I. Membranes of bone

- A. Periosteum-outer surface of bone. Ends are covered with hyaline cartilage.
- Inner layer is made of mostly osteoblasts – bone forming cells. Also contain osteoclasts – bone destroying cells





- B. Endosteum – lines the cavities of bone Contains osteoblasts and osteoclasts.
- Osteogenic = bone cell
- Hematopoietic = blood cell

II. Marrow

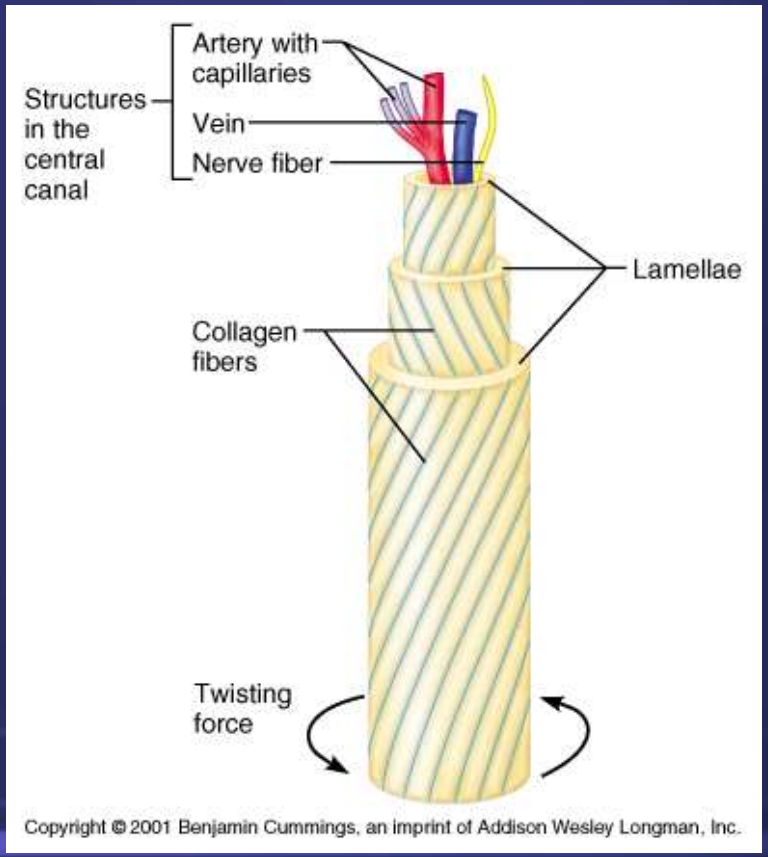
- **A. Red Bone Marrow** found in spongy cavities of newborns, in adults – in long bones, the head of femur, humerus, ribs vertebrae, sternum & pelvis
- Forms red & white cells, platlets (clotting)

B. Yellow Bone Marrow

- Connective tissue with fat cells.
- Shafts of long bones in marrow cavity

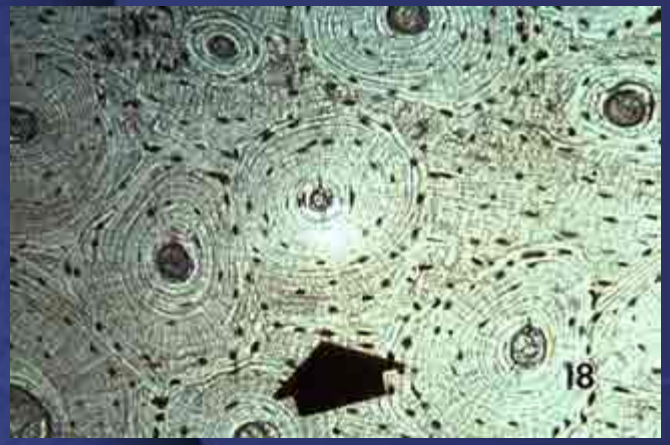
III. Haversian System

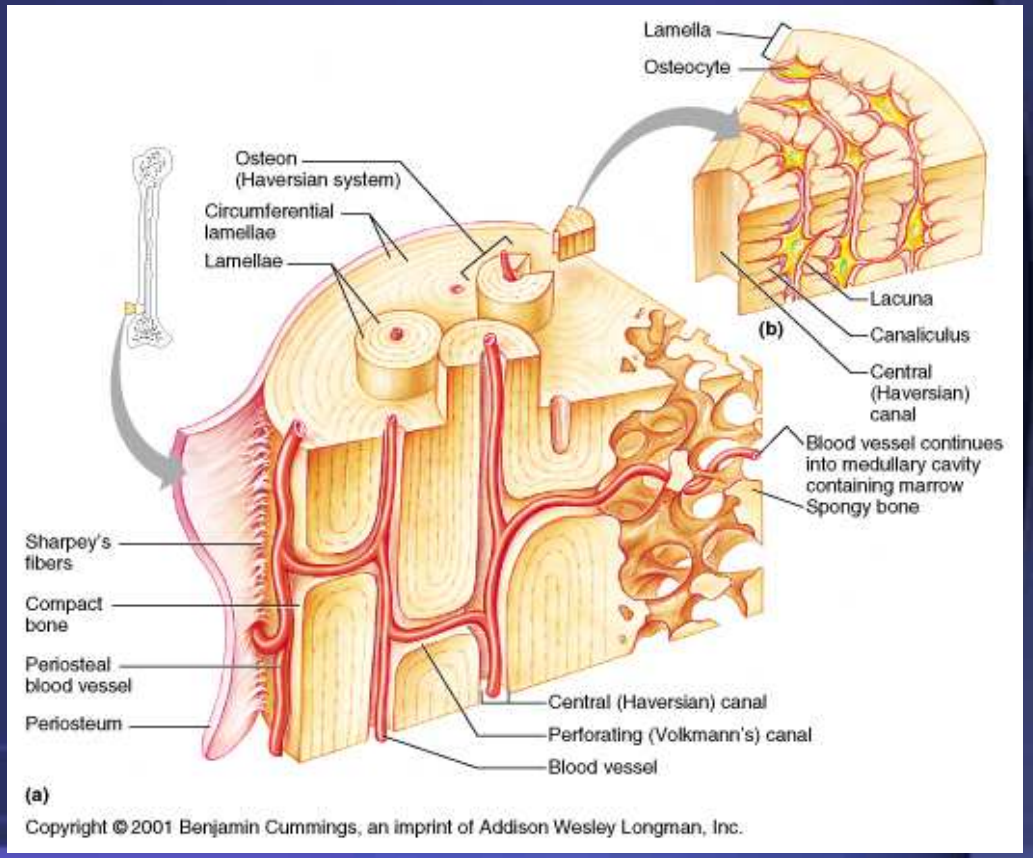
- Structure of compact bone
- Bring O_2, food, removes waste



Haversian System cont.

- Rings of bone tissue with blood vessels and nerves in the center





End day 1

Bone formation & Growth

OSSIFICATION OR HARDENING INTO BONE

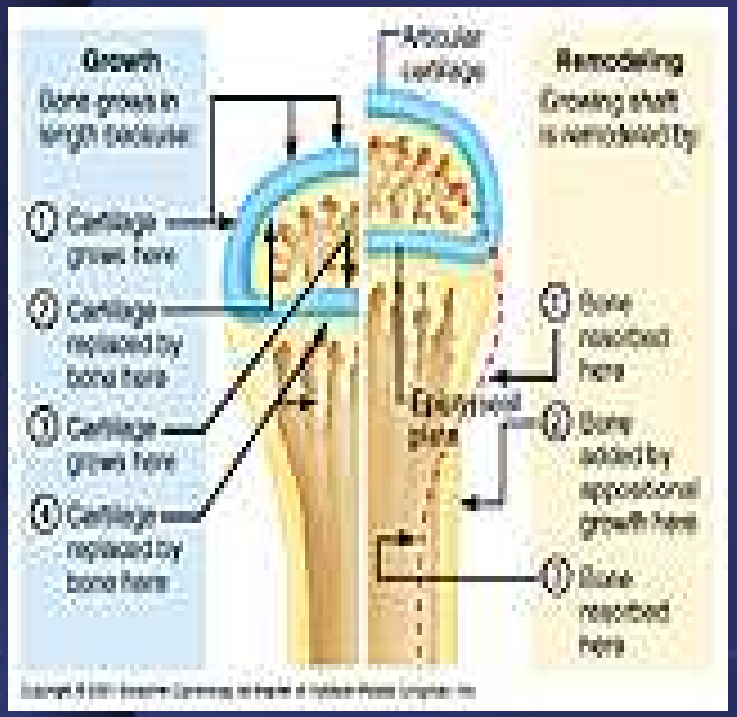
- 1. Intramembranous Ossification (membrane Bone)
- Dense connective membranous tissue is replaced by deposits of salts to form bone
- Membrane becomes→ periosteum→ spongy bone→ compact bone
- Cranium forms completely by this method
- Flat bones form this way.

2. Endochondral Ossification

- Most bones form this way
- 3mos. Of pregnancy (cartilage skeleton)
- 3mos. → 9 most ossification growth
- Birth → 15 years old (female)→ 18
- 16 years old (male) → 15,16→ 21
- bone maturation (so regular, that age can be determined from x-ray exam) (autopsy)

- Does cartilage turn into bone?
  - NO!!!!!!
- Cartilage represents the environment in which the bone develops

Growth in length



- occurs at the growth or epiphyseal plate
- → bone growth- continuous remodeling
- → becomes spongy bone and cavity

Bone Disorders

Vitamin D deficiency

- Rickets (children), osteomalacia (adults)
- Lack of calcium in bones (soft bones) children can develop bowed legs.
- Ultraviolet light causes chemical in skin to change it to vit. D. This enables Ca^{+} to be absorbed.

Growth Hormone Deficiency
(somatotropin)

- Secreted by the pituitary gland
- Stimulate increase in cartilage cells
- Inadequate amounts = short bones
- Excessive amounts = long bones

Vitamin C deficiency

- Vit. C required for making protein of connective tissue.
- Deficiency causes weak bone matrix

Thyroxine

- Secreted by the thyroid
- Thyroxine increases the rate of replacement of cartilage by bone at growth plate.
- Too much – the epiphyseal plate closes early, resulting in stunted growth.
- A balance between growth hormone and thyroxine is important during growth.

Estrogens & Androgens – sex hormones

- Promote deposition of bone during growth
- Regulate maintenance of bone throughout life.
- Osteoporosis – Estrogen deficiency after menopause.
- loss of Ca^{+} results in weakening of bone, broken bones, loss of height, humped back. Believed that estrogen deficiency causes increased bone resorption.

Osteoporosis

Vitamin A

- Stimulates bone resorption
- Deficiency hampers the hollowing and reshaping of bone – causing a pinching of nerves in bone cavities.

Bone & Calcium homeostasis

- Maintaining bone - remodeling is controlled by Ca^{+} moving in and out of bloodstream. 2 methods: hormones & stress.
- Lack of calcium causes:

  1. myo spasms
  2. weakness of heart myo – loss of blood to body
  3. Interferes with blood clotting

- 99% of the body's calcium is in bone, 1% in blood & interstital fluid.
- Hormones control release & deposition of Ca^{+}. Low blood Ca^{+}, it is released from bone to blood.
- High blood Ca^{+}, it is deposited in bone.