Lab Unit 1

Histology of Bone Tissue

Compact Bone

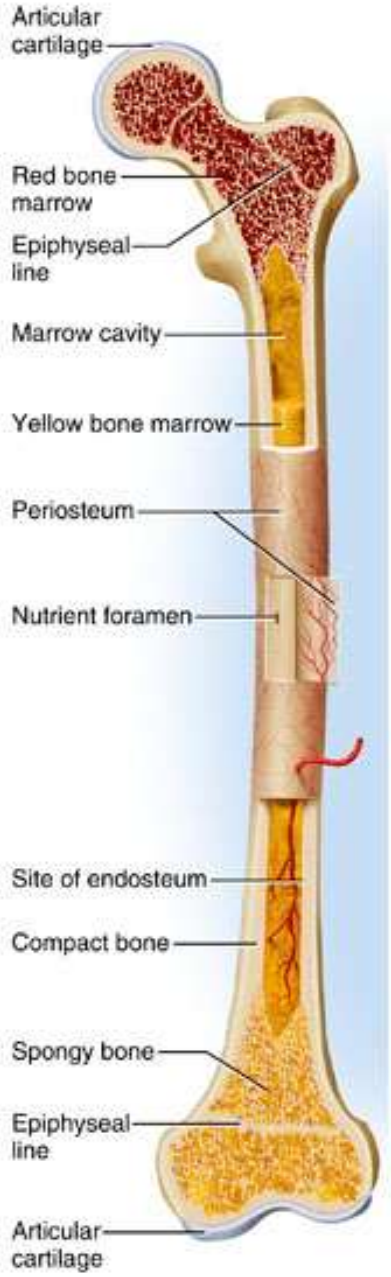
Spongy Bone Structure

Long Bone Structure

Osteocyte VS Osteoblast VS Osteoclast

General Features of Bones

- Shaft (diaphysis) = cylinder of compact bone /// marrow cavity (medullary cavity) lined with endosteum (osteogenic cells and reticular connective tissue)
- Enlarged ends (epiphyses) /// spongy bone covered by compact bone /// enlarged to strengthen joint and attach ligaments
- Joint surface covered with articular cartilage (hyaline).
- Shaft covered with periosteum // outer fibrous layer of collagen // inner osteogenic layer of bone forming cell
- Endosteum membrane lining central canals and perforating canals
- Epiphyseal plate (growth plate)



(a) Living

Structure of a Long Bone

- Compact and spongy bone
- Marrow cavity
- Articular cartilage
- Periosteum

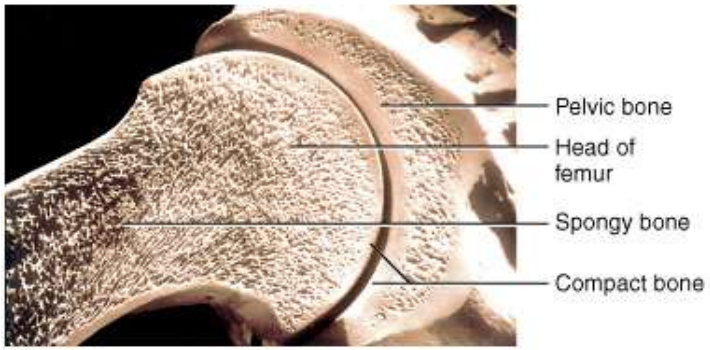
Compact Bone

- Osteon = basic structural unit /// cylinders formed from layers (lamellae) of matrix around central canal (osteonic canal) /// collagen fibers alternate between right- and left-handed helices from lamella to lamella

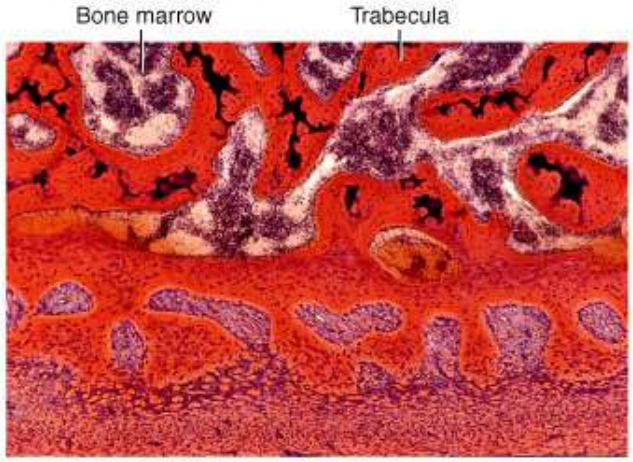
- Osteocytes within compact bone connected to each other and their blood supply by tiny cell processes in canaliculi

- Perforating canals or Volkmann canals /// vascular canals perpendicularly joining central canals

Histology of Compact Bone



(a)



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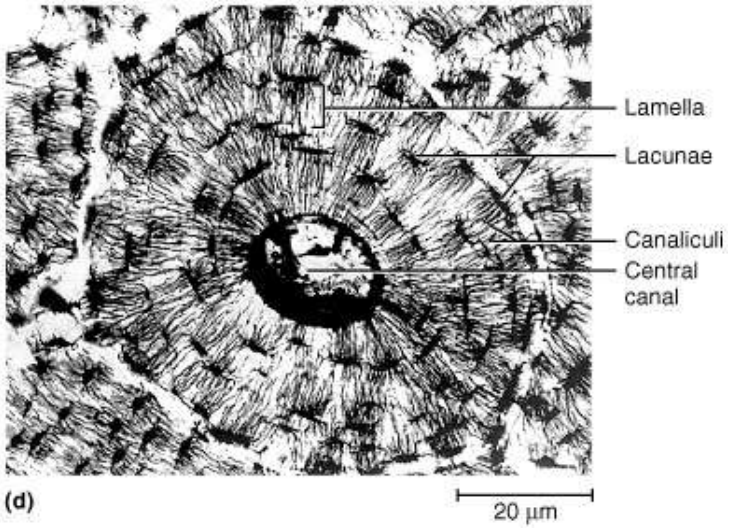
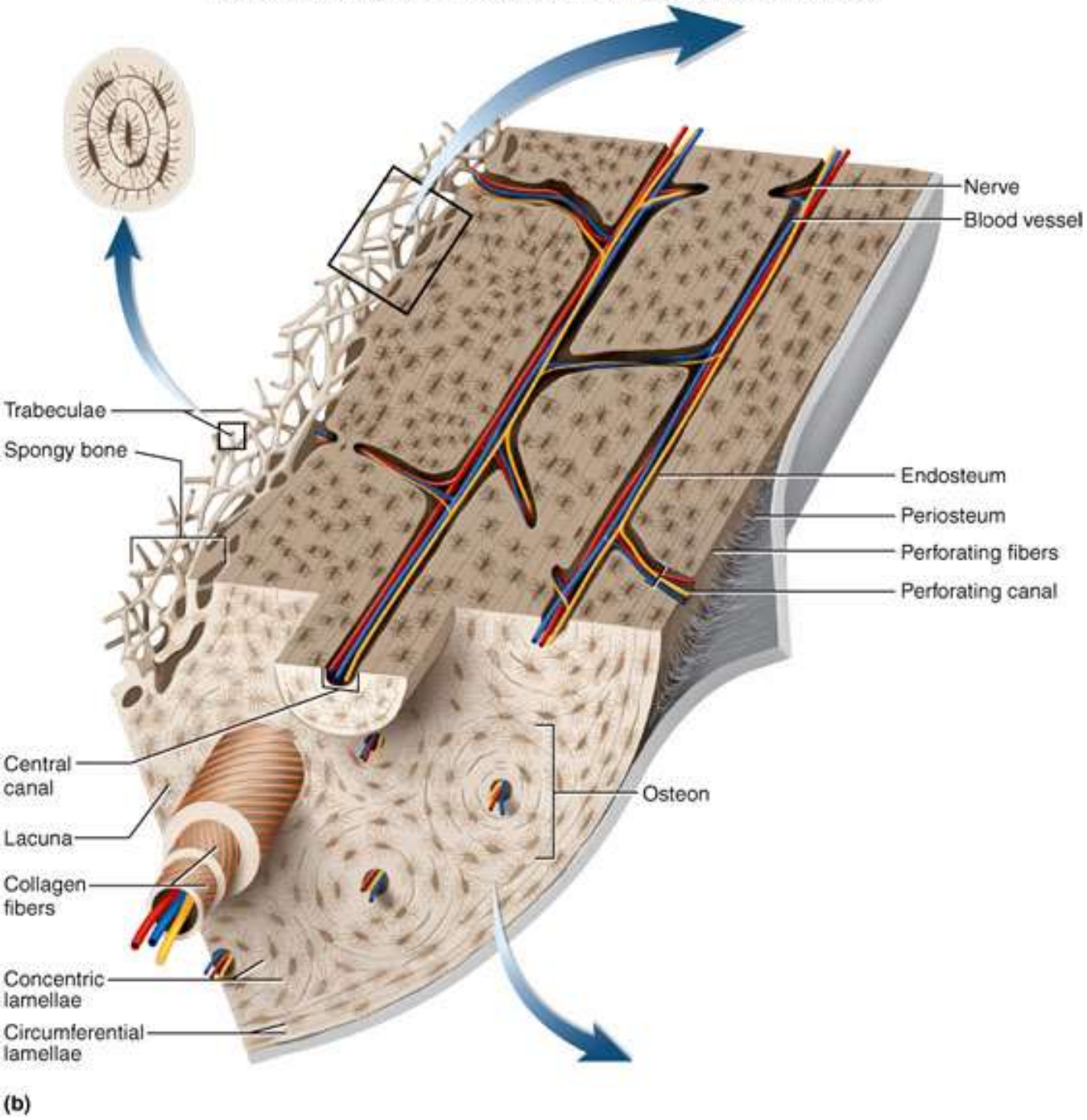
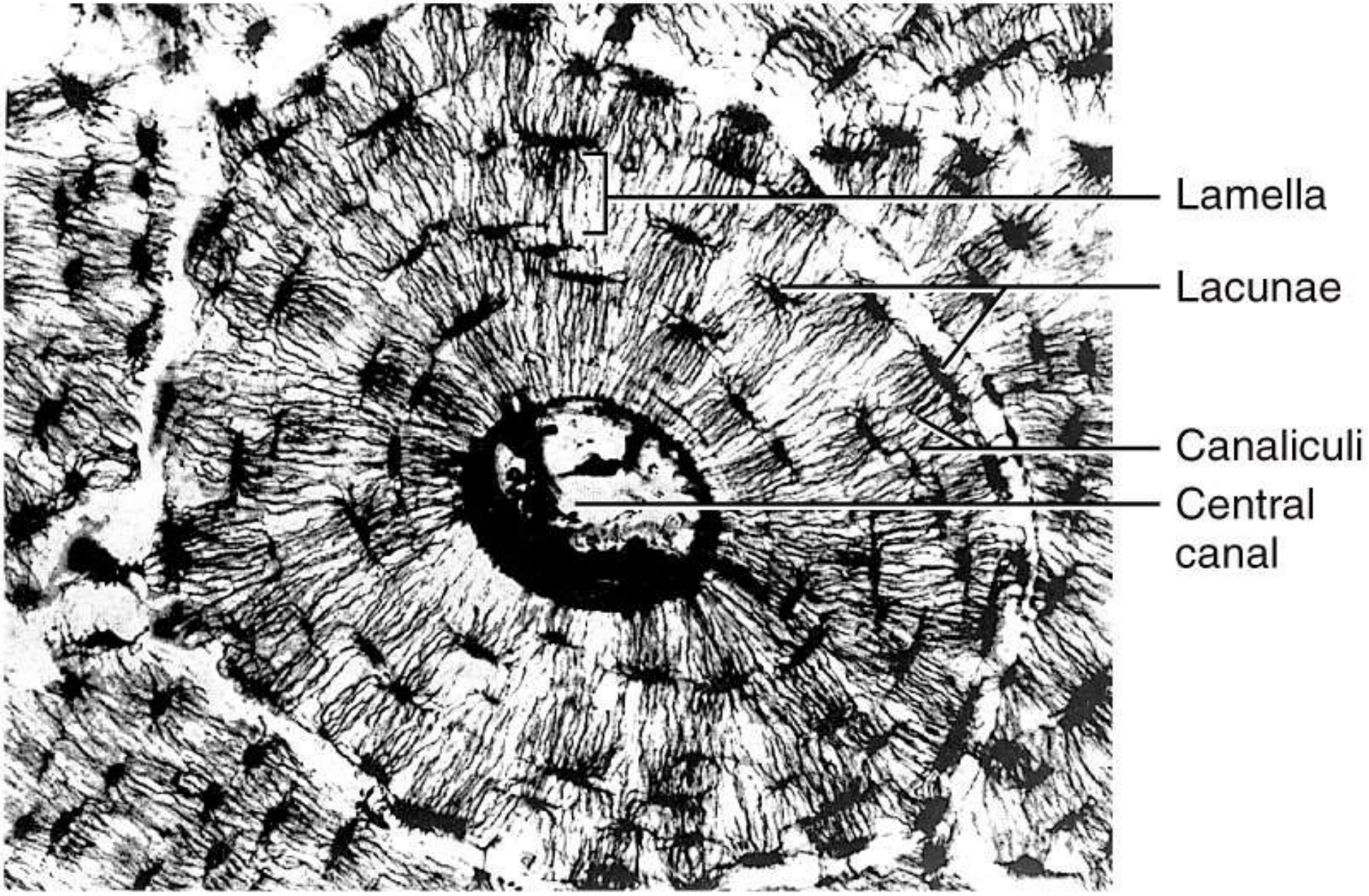


(d)

Blood Vessels of Bone



- circumferential lamellae
- interstitial lamellae



(d)

Spongy Bone

- Spongelike appearance formed by plates of bone called trabeculae /// spaces filled with red bone marrow

- Trabeculae have few osteons or central canals // no osteocyte is far from blood of bone marrow

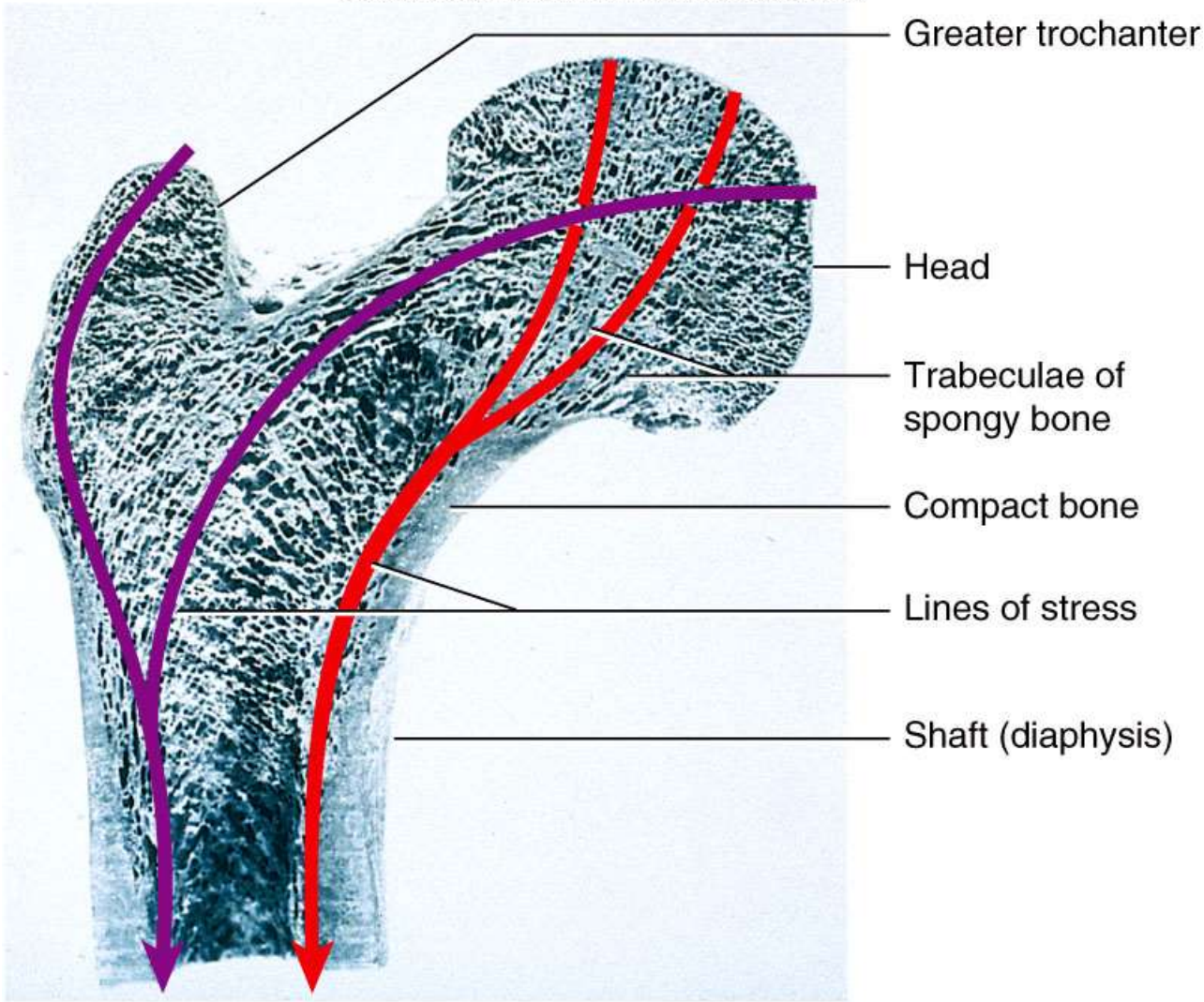
- Provides strength with little weight /// trabeculae develop along bone's lines of stress

Spinal Osteoporosis

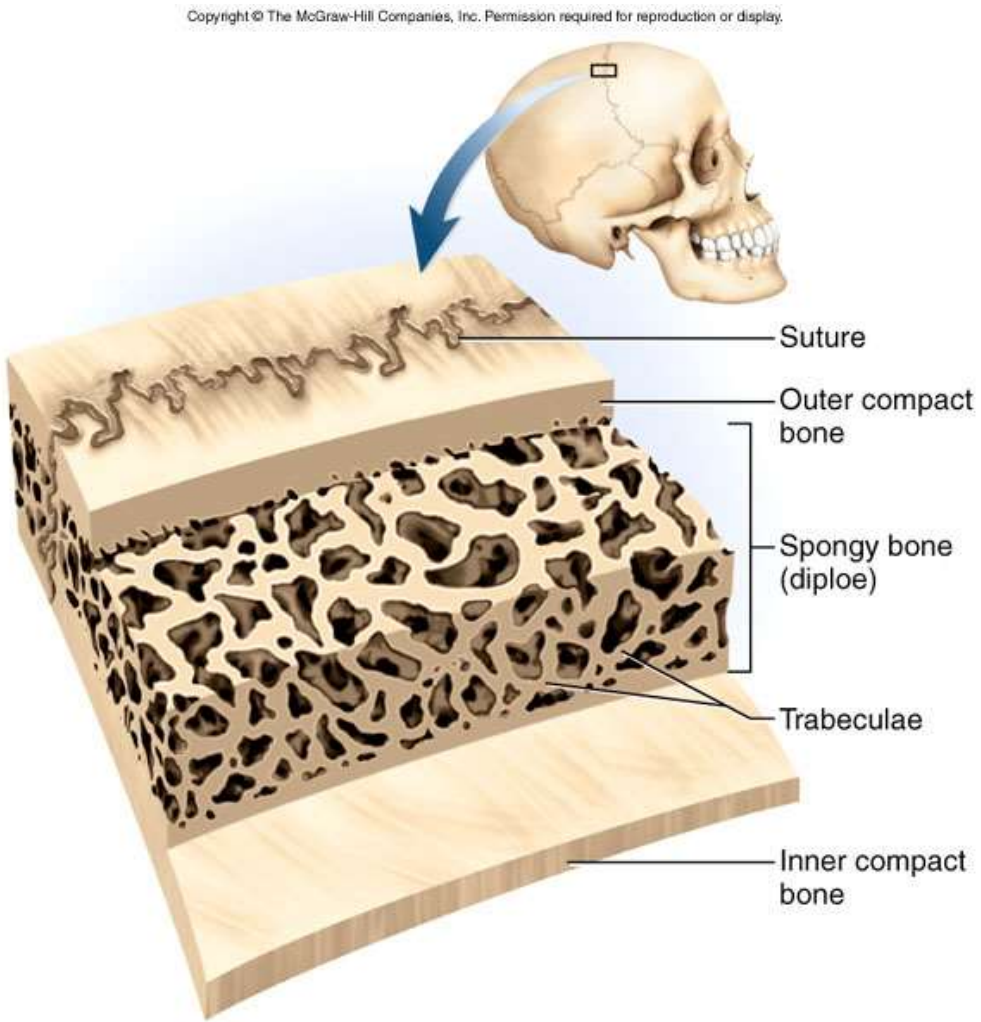
(a)

(b)

Spongy Bone Structure and Stress

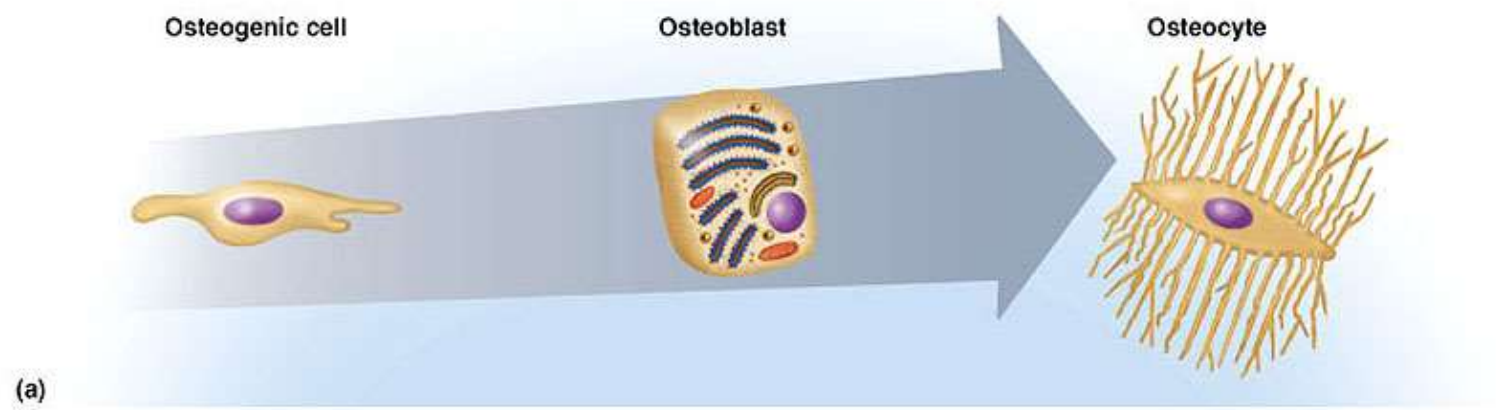


Structure of a Flat Bone



- External and internal surfaces composed of compact bone
- Middle layer is spongy bone and bone marrow
- Skull fracture may leave inner layer of compact bone unharmed

Cells of Osseous Tissue (1)

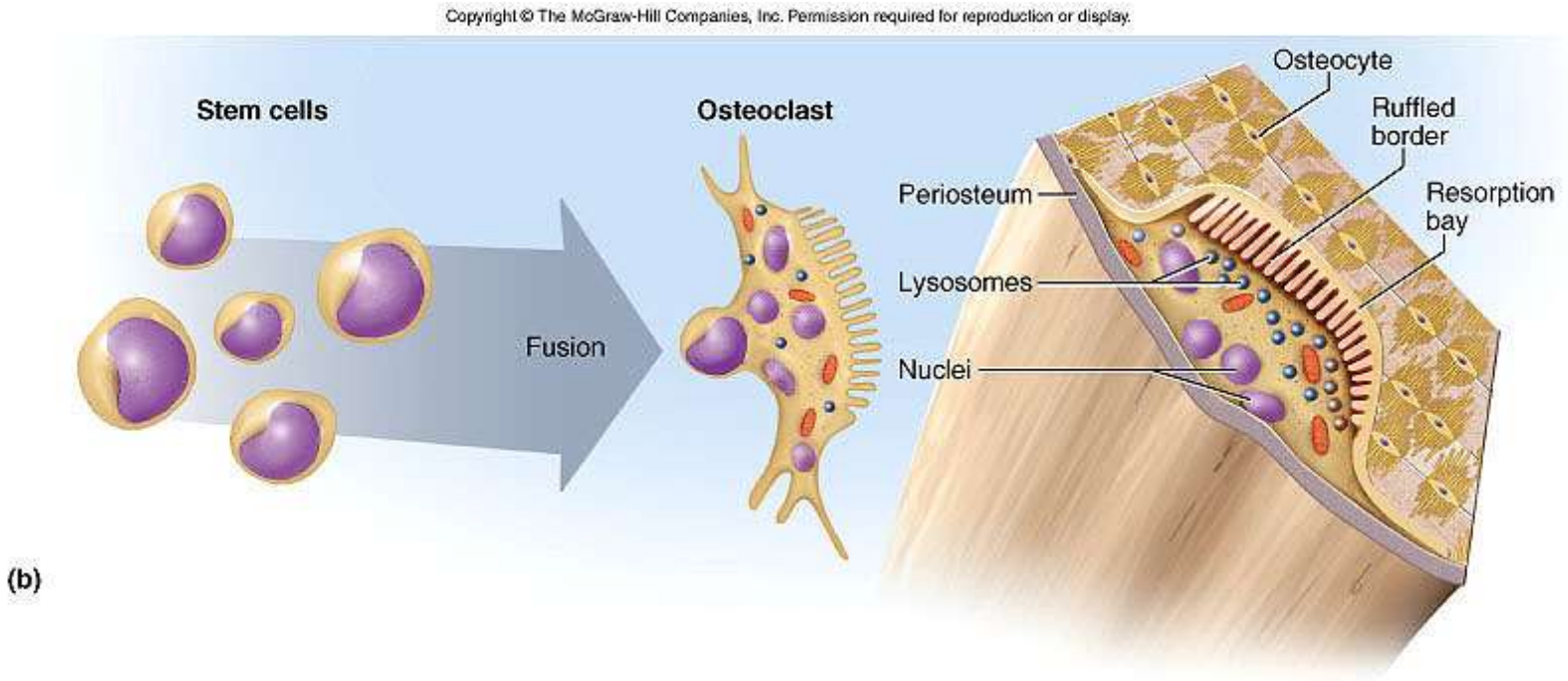


- Osteogenic cells in endosteum, periosteum or central canals give rise to new osteoblasts /// arise from embryonic fibroblasts /// multiply continuously

- Osteoblasts mineralize organic matter of matrix

- Osteocytes are osteoblasts trapped in the matrix they formed /// cells in lacunae connected by gap junctions inside canaliculi

Cells of Osseous Tissue (2)

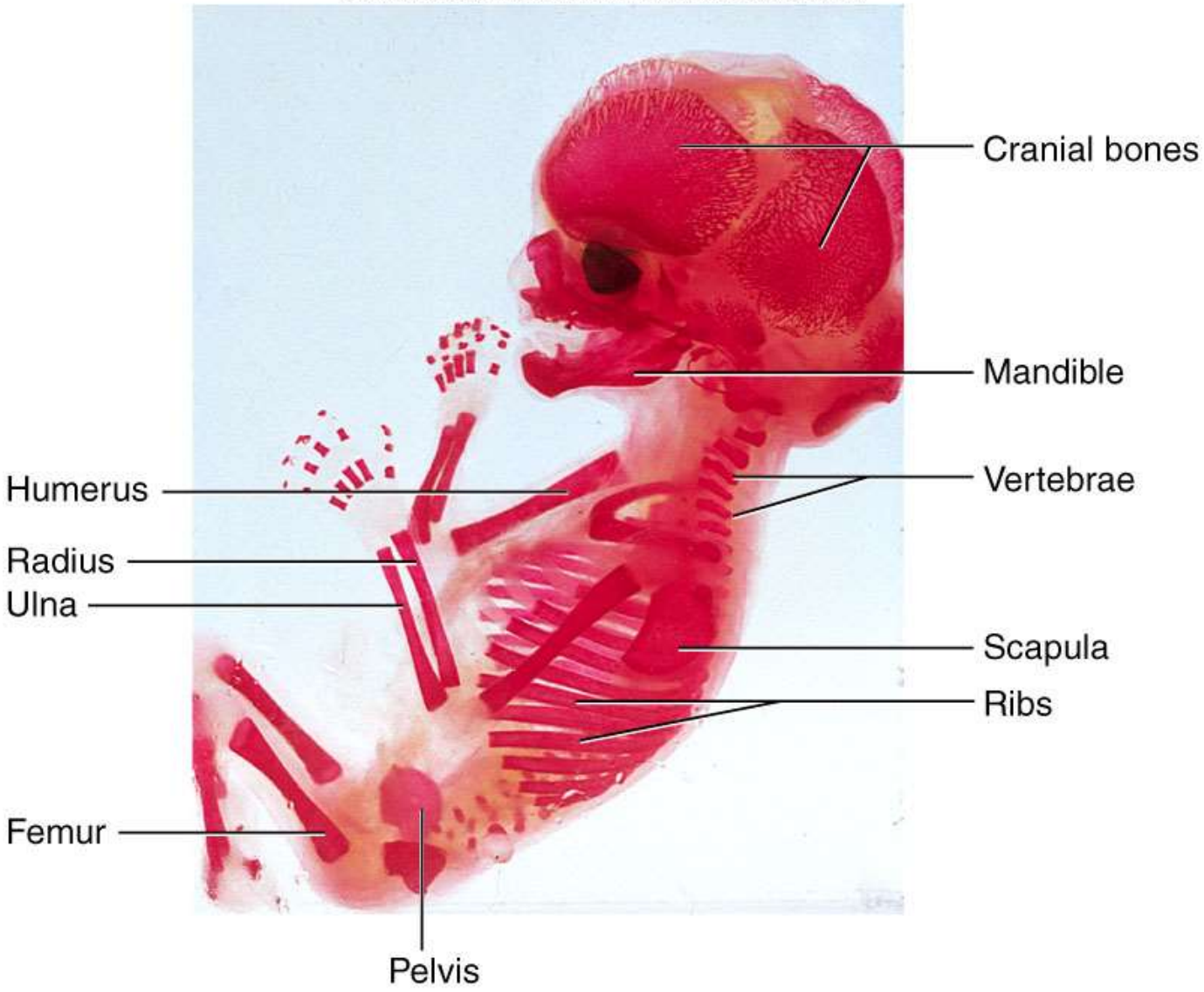


- Osteoclasts develop in bone marrow by fusion of 3-50 stem cells
- Reside in pits that they ate into the bone

Matrix of Osseous Tissue

- Dry weight = 1/3 organic and 2/3 inorganic matter
- Organic matter /// collagen, glycosaminoglycans, proteoglycans and glycoproteins
- Inorganic matter
  - 85% hydroxyapatite
  - 10% calcium carbonate
  - other minerals (fluoride, potassium, magnesium)
- Combination provides for strength and resilience
  - composite
  - minerals resist compression; collagen resists tension
  - bone adapts by varying proportions

Fetal Skeleton at 12 Weeks



Bone Marrow

- In medullary cavity (long bone) and among trabeculae (spongy bone)
- Red marrow like thick blood
  - reticular fibers and immature cells
  - Hemopoietic (produces blood cells)
  - in vertebrae, ribs, sternum, pelvic girdle and proximal heads of femur and humerus in adults
- Yellow marrow /// fatty marrow of long bones in adults
- Gelatinous marrow of old age // yellow marrow replaced with reddish jelly