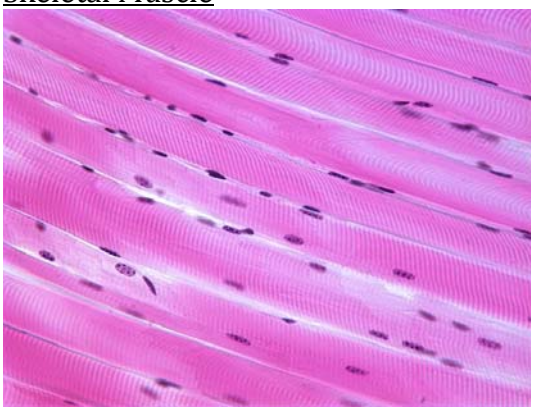
Histology of Muscle and Bone

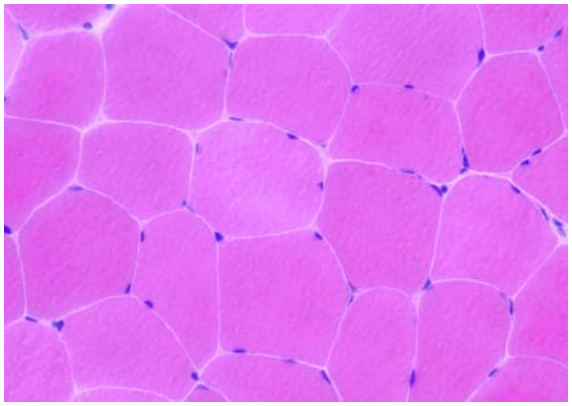
Muscle

Type	Skeletal	Cardiac	Smooth
Nucleus	multinucleated; on cell periphery	one nucleus; centrally located	one nucleus; centrally located
Cell Appearance	striated	striated	non-striated
Special Feature		intercalated discs*, cell branching	can tonically contract
Control	voluntary & involuntary	involuntary	involuntary
Function	movement, heat generation, posture & support	pump blood through heart & body	movement of food, blood vessels, "goose bumps"
Location	attached to bones	heart	walls of internal organs, skin

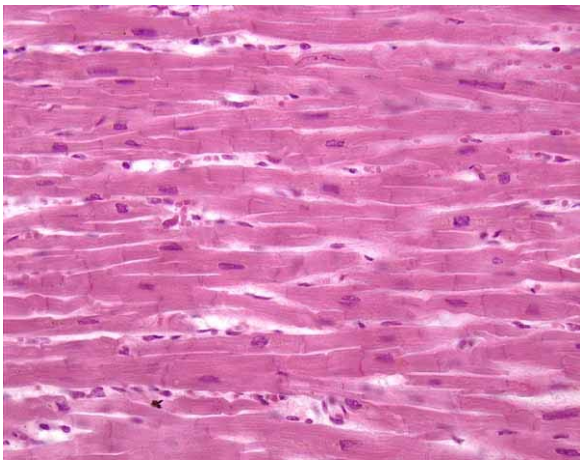
*intercalated discs: specialized cell junctions (esp. gap junctions) that allow cardiac muscle cells to contract at the same time

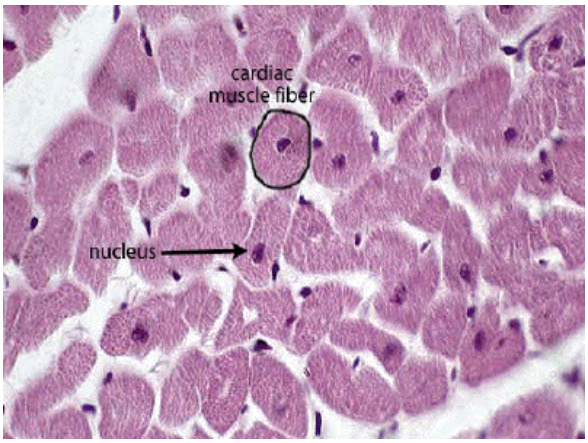
Skeletal Muscle



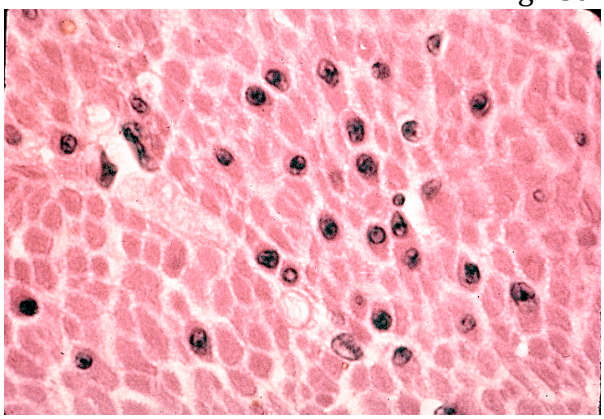


Cardiac Muscle



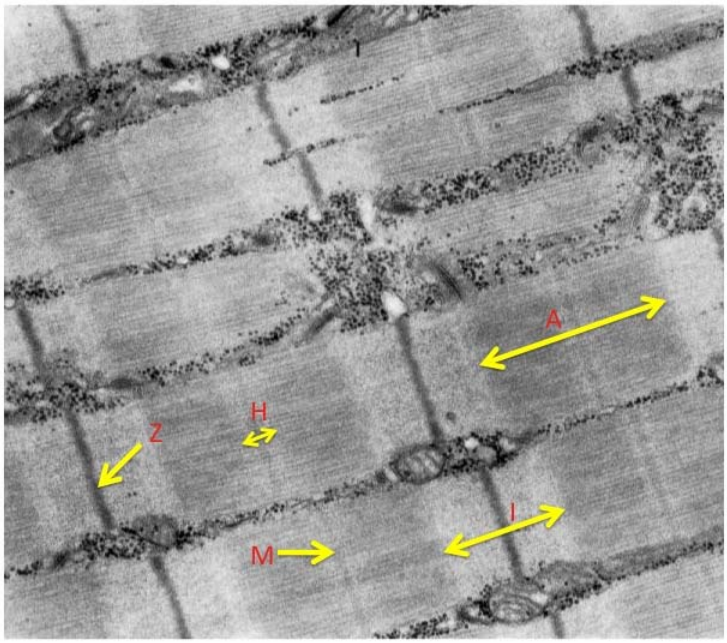


Smooth Muscle



Sarcomere

- Microscopic regions of muscles that give striated appearance
- Chain of proteins that act like a spring and shorten during contraction
- Contain two types of myofilaments:
    - Thick aka myosin
    - Thin aka actin



Z – Z disc: borders of sarcomere

A – A band: thick & thin filaments

I – I band: thin filaments
- bisected by Z disc

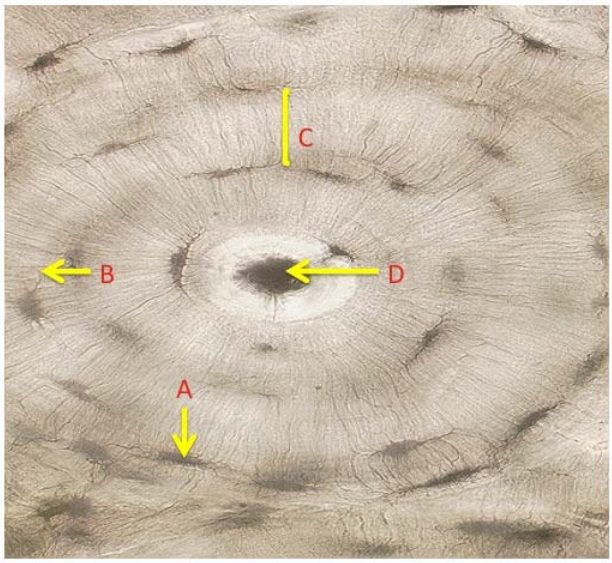
H – H zone : thick filaments

M – M disc: bisect H zone

Bones

- Functions:
    - Attachment sites for muscles
    - Protection of internal organs
    - Calcium storage

- Three types of cells are found in bones:
  - Osteoblasts:
    - Immature bone cells that secrete o**ST**eoid
      - Gives bone **ST**rength
      - Compared to **H**ydroxyapatite that gives bone **H**ardness
    - Develop into osteocytes
  - Osetocytes:
    - Mature bone cells
    - Function to maintain bone
  - Osteoclasts
    - Resorption of bone
    - Releases calcium stored in bones back into blood
- Two types of bone:
  - Compact
    - Made up of osteons



A – osteocyte
- sits in hollowed out space called LACUNAE

B – cell process of osteocyte
- sits in hollowed out space called CANALICULI

C – concentric lamellae

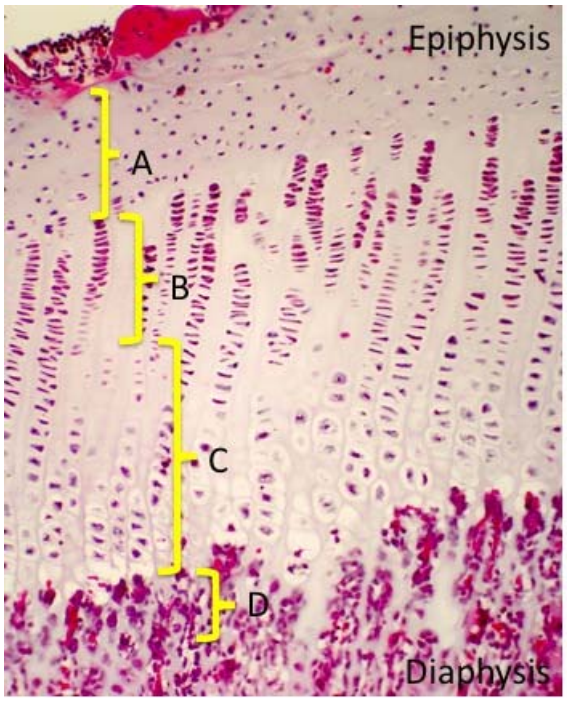
D – central canal (aka Havarsian Canal)
- contains veins, arteries, & nerves

    - Nutrients diffuse from vessels in central canal to osteocytes by way of the cell processes
    - Central canals are connected by perforating canals (aka Volkmann's canal)
    - External layer

- Spongy bone
  - Lack osteons, but are composed of trabeculae
  - Support beams of bone
  - Internal to compact bone

<u>Bone Growth</u>

- Endochondrial Ossification
  - The calcification of cartilage
  - Chondrocytes: cartilage cells
- Length
  - Occurs at epiphyseal plates aka growth plates
  - Involves hyaline cartilage



A – zone of resting cartilage: randomly arranged chondrocytes

B - zone of proliferation: chondrocytes line up in rows

C – zone of maturation & hypertrophy: chondrocytes enlarge and mature

D – zone of calcification: death of chondrocytes

Epiphysis is the **E**nd of a bone

Diaphysis is the shaft of a bone

- Width
  - Occurs by adding osteon to osteon