

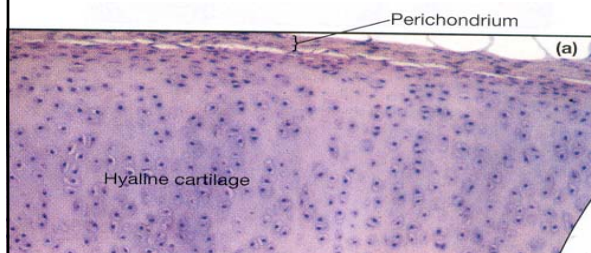
# Supporting Connective Tissue

## Cartilage

- Firm gel
- Chondrocytes are the only cells found in the cartilage matrix
- Chondrocytes live in small chambers called lacunae (plural, lacuna singular)
- Avascular so all nutrient and waste transfer must occur by diffusion through the matrix.
  - produce antiangiogenesis factor, discourages growth of vessels.
- Extremely slow to heal
- Cartilage is surrounded by a perichondrium

## Perichondrium

- Outer fibrous region of dense irregular CT for mechanical support and protection.
- Inner cellular layer important in growth & maintenance of cartilage.



## 3 Main Cartilage Types

### 1. Hyaline Cartilage

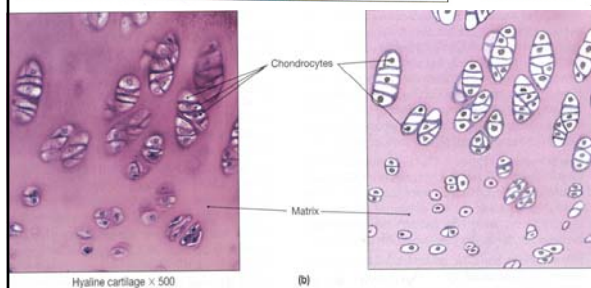
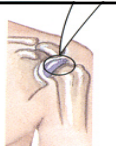
- Most common type
- Matrix contains closely packed collagen fibers
- Tough but somewhat flexible
  - i.e.- nasal cartilage, articular cartilage, connection of ribs to sternum, tracheal rings.

## HYALINE CARTILAGE

Example: shoulder joint

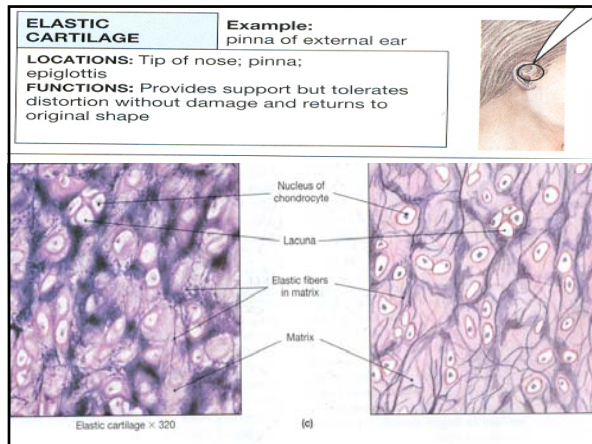
**LOCATIONS:** Between tips of ribs and bones of sternum; covering bone surfaces at synovial joints; supporting larynx (voicebox), trachea, and bronchi; forming part of nasal septum

**FUNCTIONS:** Provides stiff but somewhat flexible support; reduces friction between bony surfaces



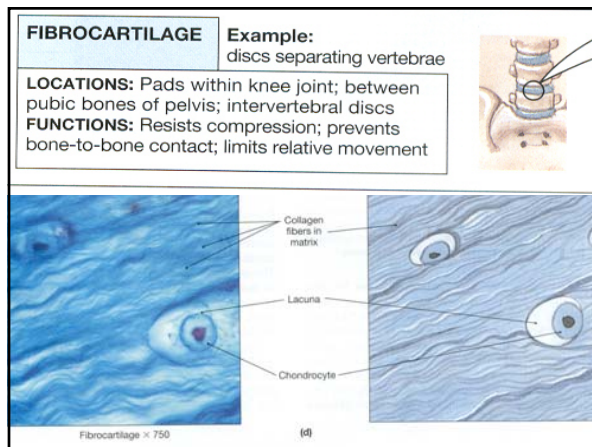
### 2. Elastic Cartilage

- Numerous elastic fibers make it flexible & resilient
  - i.e.- outer flap of ear, epiglottis, larynx



**3. Fibrocartilage**

- Little ground substance
- Matrix dominated by collagen
- Fibers densely interwoven, so this is very durable tissue.
- Absorb shock and prevent bone to bone contact  
 i.e.- pads btn. vertebrae & btn. bones of the pelvis



**Cartilage Growth**

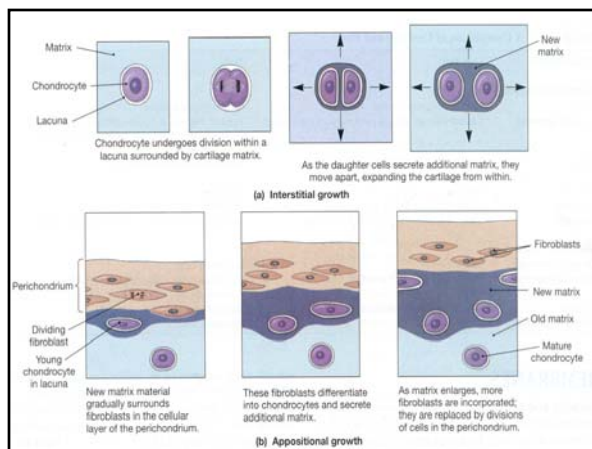
- Grow by 2 mechanisms

**1. Interstitial growth**

- chondrocytes divide
- daughter cells produce new matrix
- cartilage grows from within

**2. Appositional**

- new layers of cartilage added to the surface
- cells on inner layer of perichondrium undergo repeated cycles of division



- \***Embryonic:** interstitial growth most important
- \***Early development → adolescence:** appositional growth most important.
- \*Normally no cartilage growth in adults

**Adult onset of appositional growth may occur under unusual circumstances like:**

- after cartilage damage
  - a. minor damage can have real repair
  - b. major damage, cartilage replaced w/a dense fibrous patch
- under excessive stimulation by pituitary growth hormone

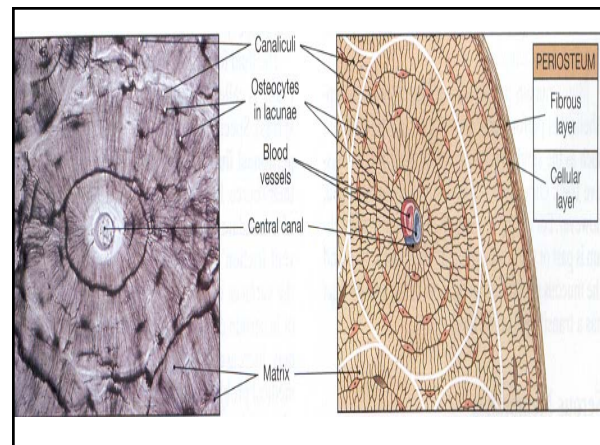
**Bone**

- Volume of ground substance in bone is small (1/2 bone matrix is collagen fibers) the rest is calcium salts ( $\text{CaPO}_4$  &  $\text{CaCO}_3$ )
- Salts are arranged around the fibers giving a strong but somewhat flexible structure
- In most things bone can compete w/ steel reinforced concrete

•Lacunae in the matrix contain the bone cells (osteocytes)

•Lacunae typically organize around blood vessels

•Osteocytes communicate with blood vessels and each other through a set of thin cytoplasmic extensions which run through passageways in the matrix called canaliculi.



•Except in joints (where bones are covered by hyaline cartilage) bones are sheathed by a periosteum.

**Outer fibrous layer-** aids in adhesion

**Inner cellular layer-** functions in appositional bone growth

**Bones**

- \* get thick w/ exercise
- \* get thin w/ inactivity

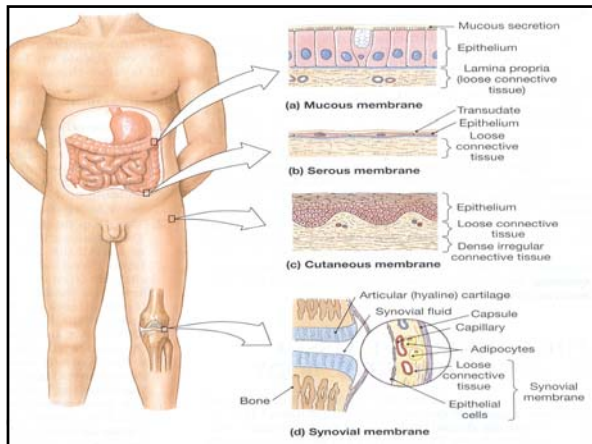
**Membranes**

**Mucous membranes:** coated with secretions of mucous glands. Line the digestive, respiratory urinary, and reproductive tract.

**Serous membranes:** line the ventral body cavities (the peritoneal, pleural, and pericardial cavities).

**Cutaneous Membranes:** or skin, covers the outer surface of the body.

**Synovial membranes:** line joint cavities and produce the fluid within the joints.



### Connective Tissue Framework of The Body

- (1) Provide strength & stability
- (2) Maintain the relative position of internal organs
- (3) Provide a route for the distribution of blood vessels, lymphatics, and nerves.

**Fascia:** CT layer and wrapping that support and surround organs

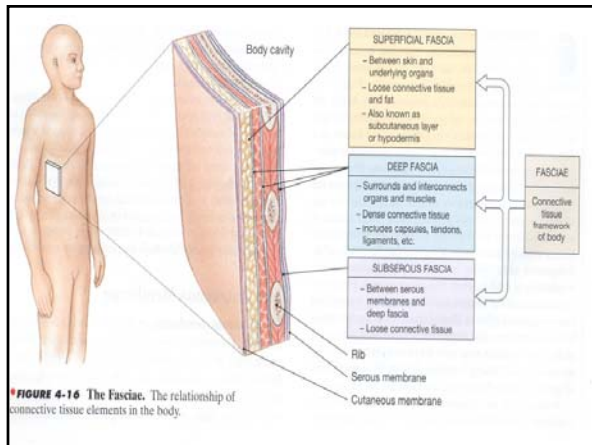


FIGURE 4-16 The Fasciae. The relationship of connective tissue elements in the body.

### Muscle Tissue

- Specialize for contraction along a longitudinal axis

Very different from ordinary cells:

- cytoplasm → sarcoplasm in muscles
- cell membrane → sarcolemma in muscles

### 3 Types found in the body

- 1) skeletal muscle
- 2) cardiac muscle
- 3) smooth muscle

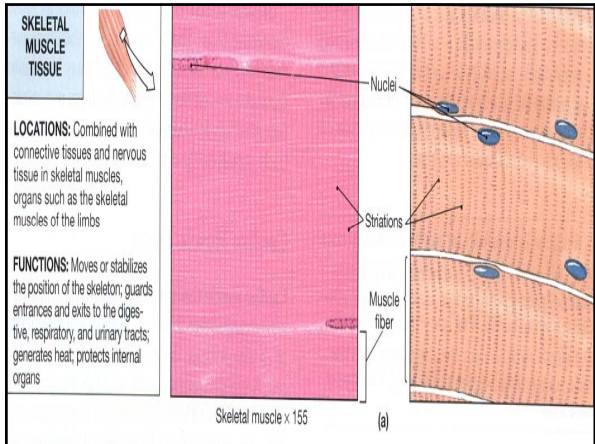
### Skeletal Muscle

- Contains very large (up to 1 ft. long) muscle cells
- Because they are long and thin they are usually called muscle fibers
- These muscle fibers are multinucleated (several hundred / cell)
- Incapable of regeneration, but new fibers can grow from satellite stem cells in the muscle tissue, so skeletal muscle tissue can at least partially repair itself after an injury.



- Because of internal structure these cells appear striated
- They do not contract unless stimulated by nervous tissue . Since these nerves are controlled contraction of skeletal muscle is voluntary.

.....often referred to as striated voluntary muscle

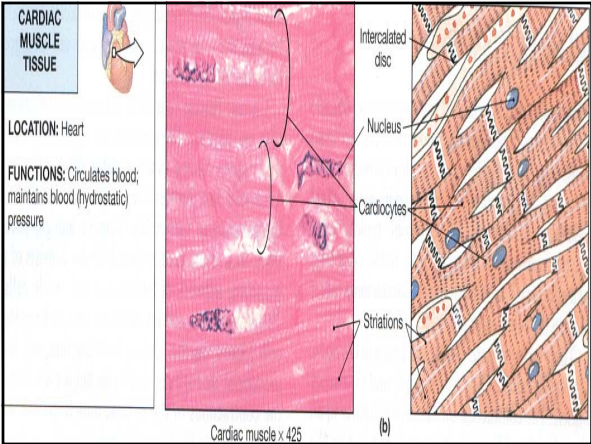


**Cardiac Muscle Tissue**

- Located only in the heart
- Heart muscles cells are called cardiocytes or cardiac monocytes
- Usually has one centrally placed nucleus, but may have as many as 5
- Smaller than skeletal muscle cells
- Striations similar to skeletal muscle
- Form extensive connections w/ each other

- Form special connections called intercalated discs (allow ion flow while simultaneously making a strong junction)
- Cardiocytes are incapable of dividing, and because they lack satellite stem cells, they are also incapable of regeneration
- Specialized cardiocytes (called pacemaker cells) establish the intrinsic heart rate
- The nervous system can alter the rate of pacemaker activity but not voluntary control

.....often referred to as striated involuntary muscle

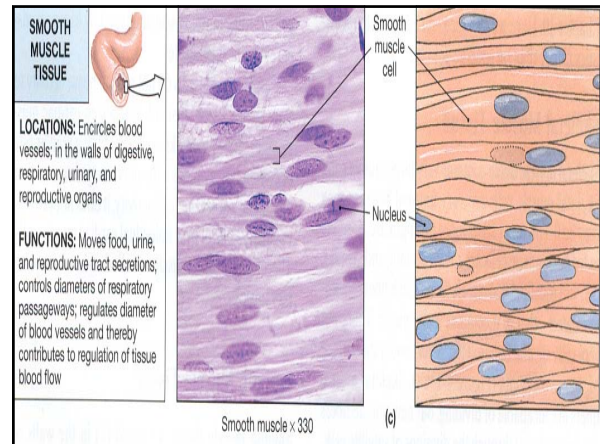


**Smooth Muscle Tissue**

-located in

- 1) walls of blood vessels
- 2) around hollow organs (like urinary bladder)
- 3) in layers around the respiratory, circulatory, digestive, & reproductive tract

- Small spindle shaped cell with tapering ends and a single oval nucleus
  - They can divide and regenerate after injuries
  - No striations
  - Contraction can be affected by nervous system, but not voluntarily controlled
- ...often referred to as non-striated involuntary muscle



### Neural Tissue

- aka nervous tissue
  - Specialized for conduction of electrical signals. 98% of neural tissue concentrated in the brain & spinal cord
- 2 Basic Types of Cells**
1. Neurons (basic nerve cell)
  2. Neuroglia cells (several types of supporting cells)

### Neurons

- longest cells in body (some reach 1m in length)
- unable to divide / limited regeneration capabilities

