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.

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 btw. vertebrae & btw. 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
  - minor damage can have real repair
  - 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 (CaPO₄ & CaCO₃)
- 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

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**Muscle Tissue**

- Specialize for contraction along a longitudinal axis

Very different from ordinary cells:
- cytoplasm → sarcoplasm in muscles
- cell membrane → sarcolemma in muscles

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**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

...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. Neuroglea cells (several types of supporting cells)

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