



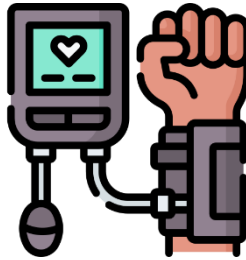
Anatomy and Physiology



Why study Anatomy and Physiology?

Anatomy and Physiology provides insight into how **YOUR** body works! This class answers questions such as:

- What is blood pressure, and why do they always take it when I go to the doctor?



- What is a fever?



- Why does my stomach growl when I am hungry?



Basic Anatomy Definitions

Anatomy: The study of structures in the body

Physiology: The study of body function

Homeostasis: The body's internal and external interactions and how they work to maintain equilibrium

Metabolism: All chemical reactions in the body

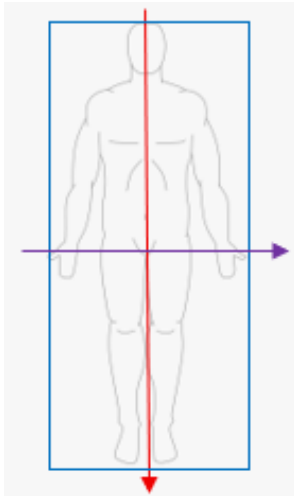
Anabolism: Chemical reactions that build

Catabolism: Chemical reactions that break down

Basic Organization (Simple to

Complex: Cell -> Tissue -> Organ -> Organ System -> Organism

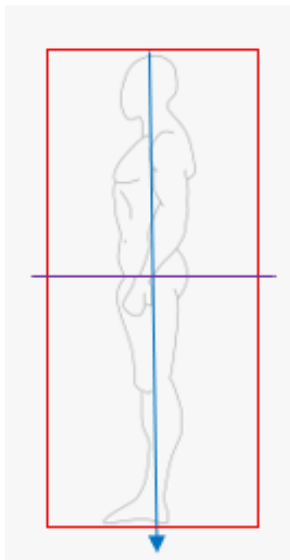
Body Planes



Frontal/Coronal

Transverse

[Mid]Sagittal



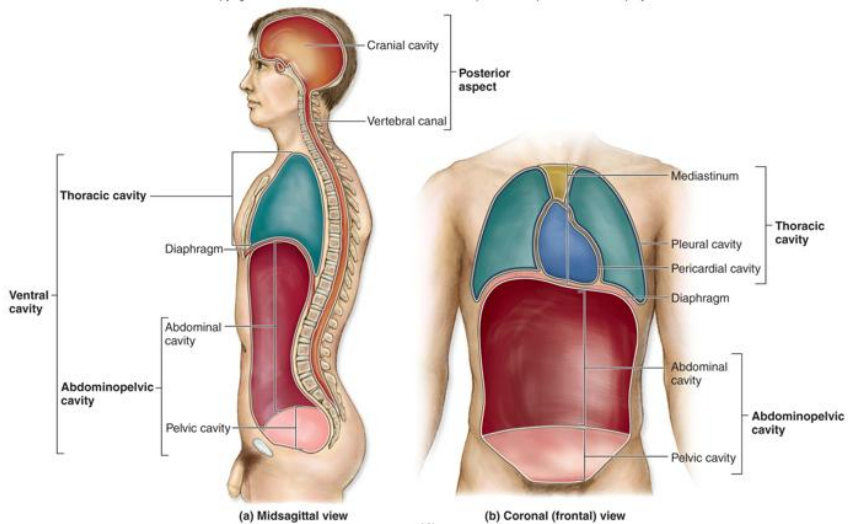
***The sagittal plane
is considered
midsagittal ONLY at
the body's midline***

Frontal/Coronal

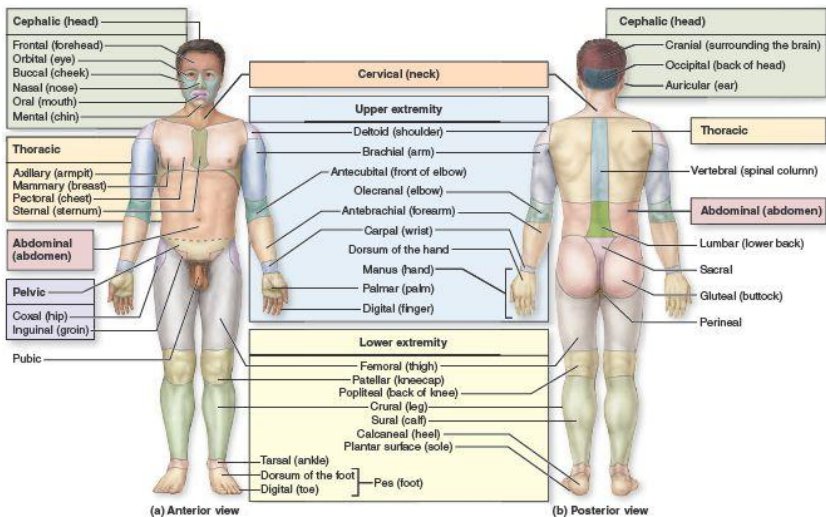
Transverse

[Mid]Sagittal

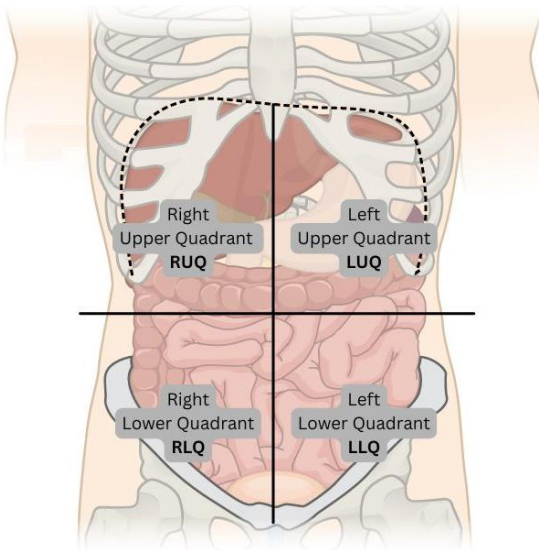
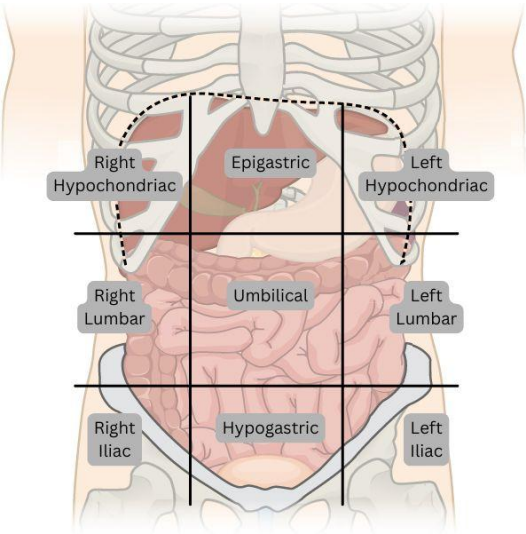
Body Cavities



Body Regions

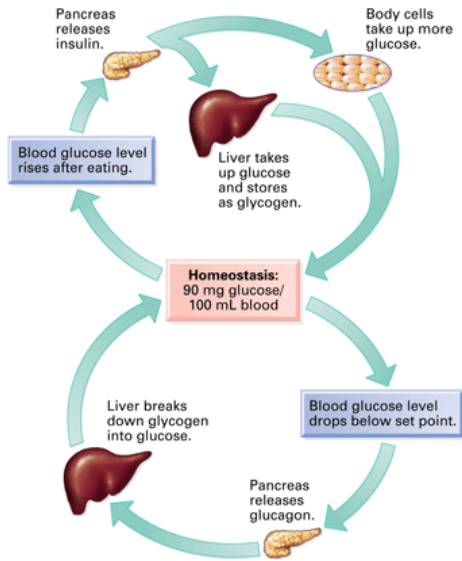


Abdominal Regions

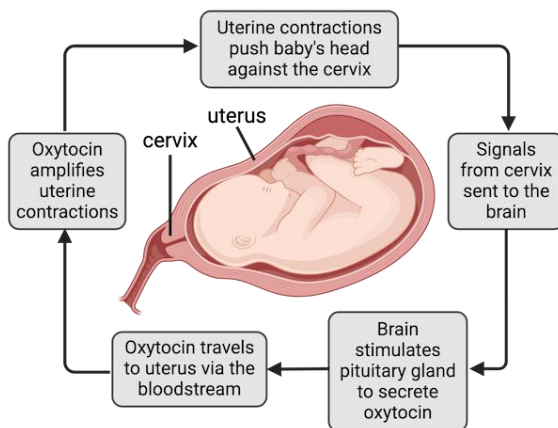


Feedback Loops

Negative:



Positive:



Redox Reaction Mnemonic

Oxidation

Is

Loss of Electrons

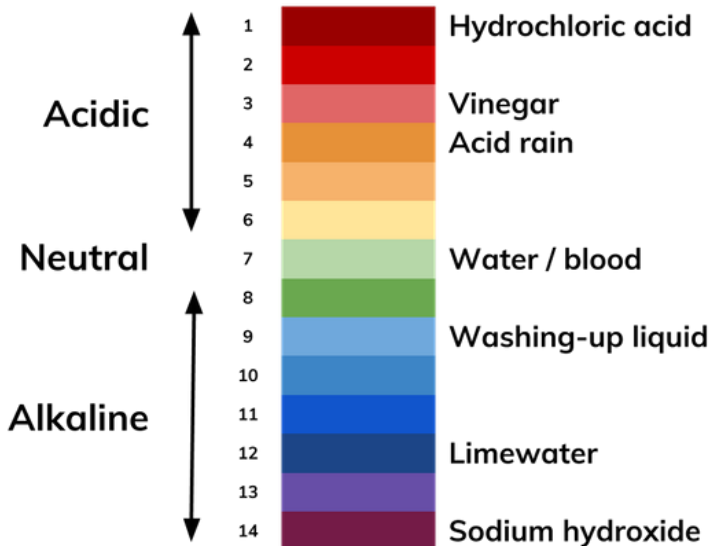
Reduction

Is

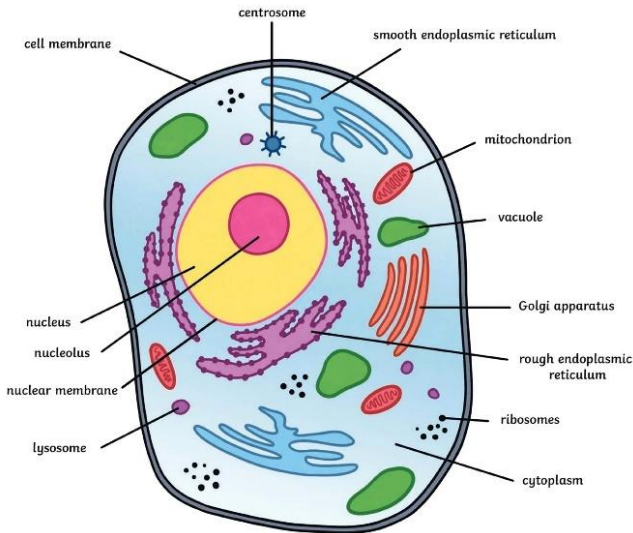
Gain of Electrons



pH Scale



Anatomy of an Animal Cell



Rough ER: Protein synthesis;
modify/stores proteins

Smooth ER: Synthesize/store lipids;
metabolizes carbs; detox

Golgi Apparatus: Modify, packages, and
sorts molecules from ER

Lysosome: Digest molecules of cell

Mitochondria: Breaks down fuel
molecules for ATP synthesis

Ribosome: Synthesizes proteins during
translation

Cytoskeleton: Intracellular support;
organizes organelles

Tissue Definitions

Histology: Study of tissues

Types of Tissue (4): Epithelial, connective, muscular, and nervous

Epithelial Cells: Body surfaces; little/no extracellular matrix; cavities/most glands

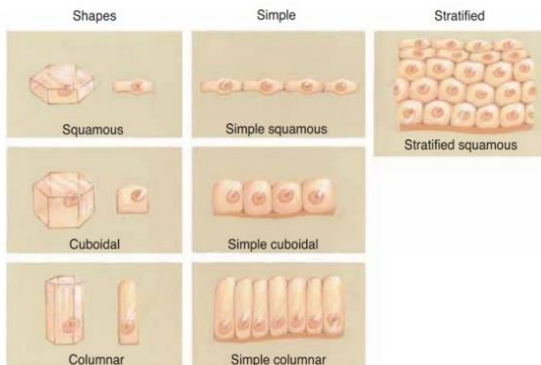
Endocrine: Releases hormones into blood; ductless

Exocrine: Releases substances onto epithelial surface; has ducts

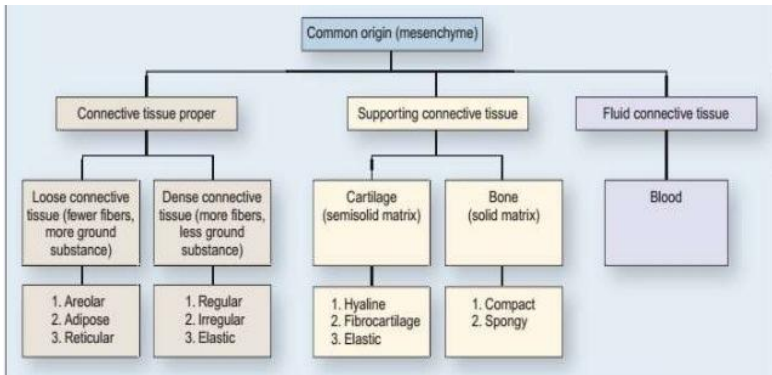
Connective Tissue: Most diverse, abundant, and widely distributed type of tissue; Physical protection, support/structure

Mesenchyme: Embryonic tissue which contains stem cells for ALL connective tissues

Necrosis: Death of cells



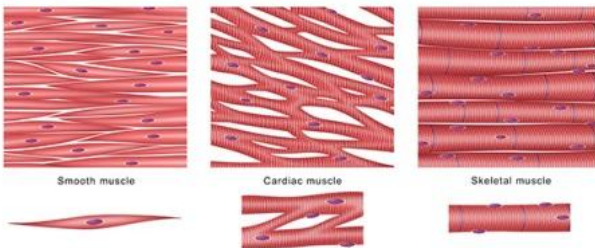
Connective Tissue



Other Tissue Types

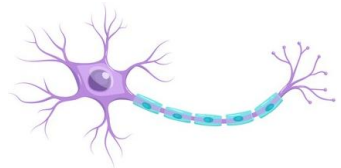
Muscle Tissue

- Skeletal
- Cardiac
- Smooth

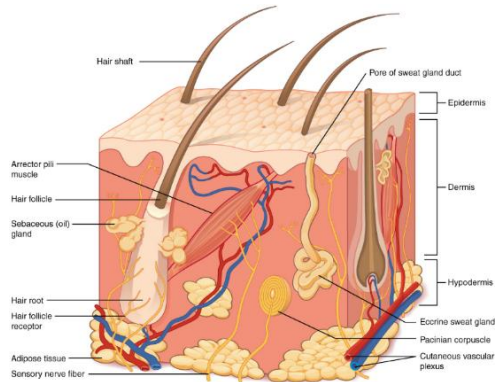


Nervous Tissue

- Neurons
- Glial (supporting) cells



Integumentary System



Integument: External tissues that protect internal structures; 7%-8% body

Layers of the Epidermis

Superficial to Deep

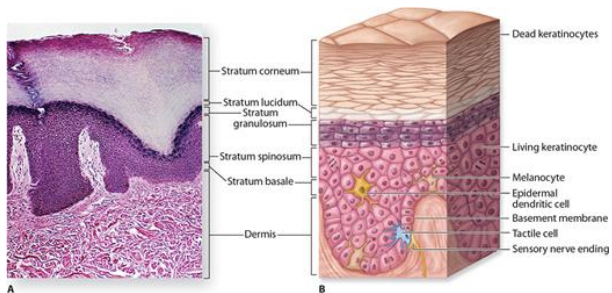
Stratum **Corneum**

Stratum **Lucidum**

Stratum **Granulosum**

Stratum **Spinosum**

Stratum **Basale**

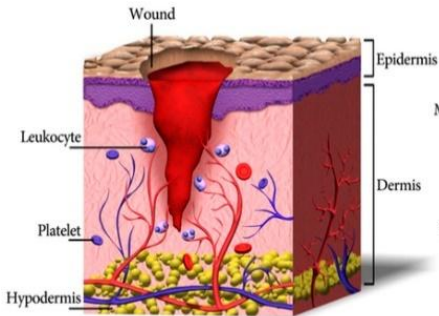


Source: Rose L. Hammen: Text and Atlas of Wound Diagnosis and Treatment, 2e

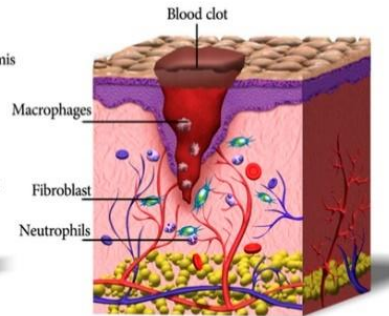
Come Let's Get Sun Burnt

Wound Healing

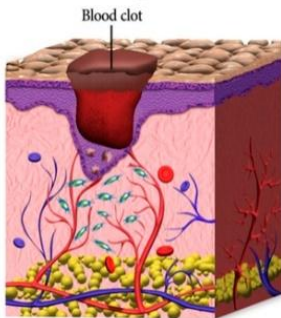
1. Hemostasis phase



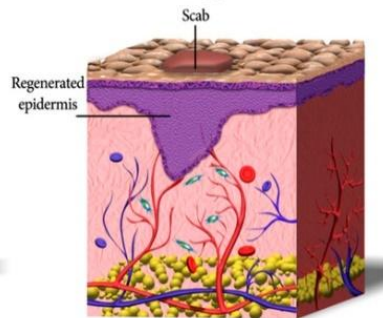
2. Inflammatory phase



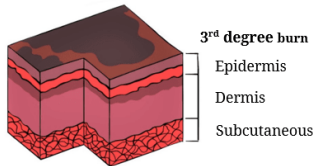
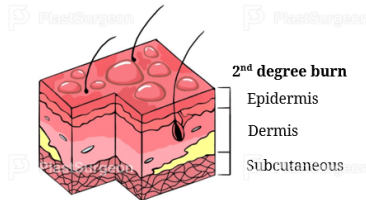
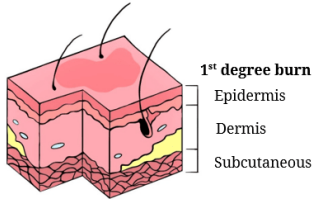
3. Proliferation phase



4. Remodelling phase

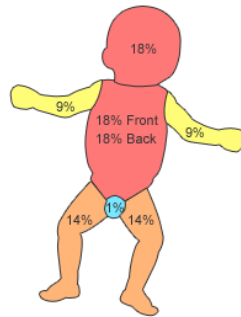
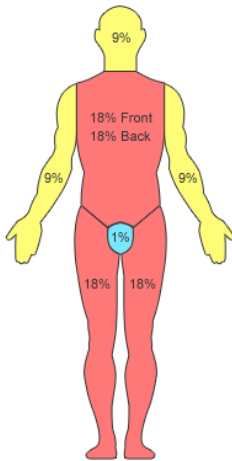


Burn Degrees



The Rule of Nines

Determines surface area (%) of a burn



Skeletal System

Skeleton: Supportive framework within the body that provides structure and protects organs

Axial: Skull, sternum, ribcage, vertebral column

Appendicular: Shoulder and pelvic girdles; arm and leg bones

Types of bone

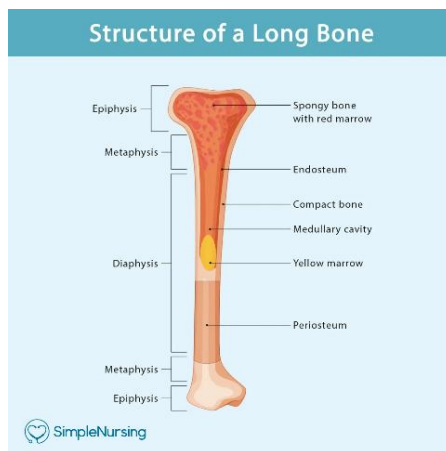
- Compact (also known as cortical or dense)
- Spongy (also known as cancellous or trabecular)



Bone Marrow

Red Bone Marrow: Hemopoietic (forms blood cells)

Yellow Bone Marrow: Adipocytes; degenerated red bone marrow



Other Components

Cartilage: Semirigid connective tissue

- Mature = Avascular

Two major types of cartilage

- Hyaline cartilage (**MOST ABUNDANT**)
- Fibrocartilage

Ligament: Bone to bone



Think BBL

Tendon: Muscle to bone

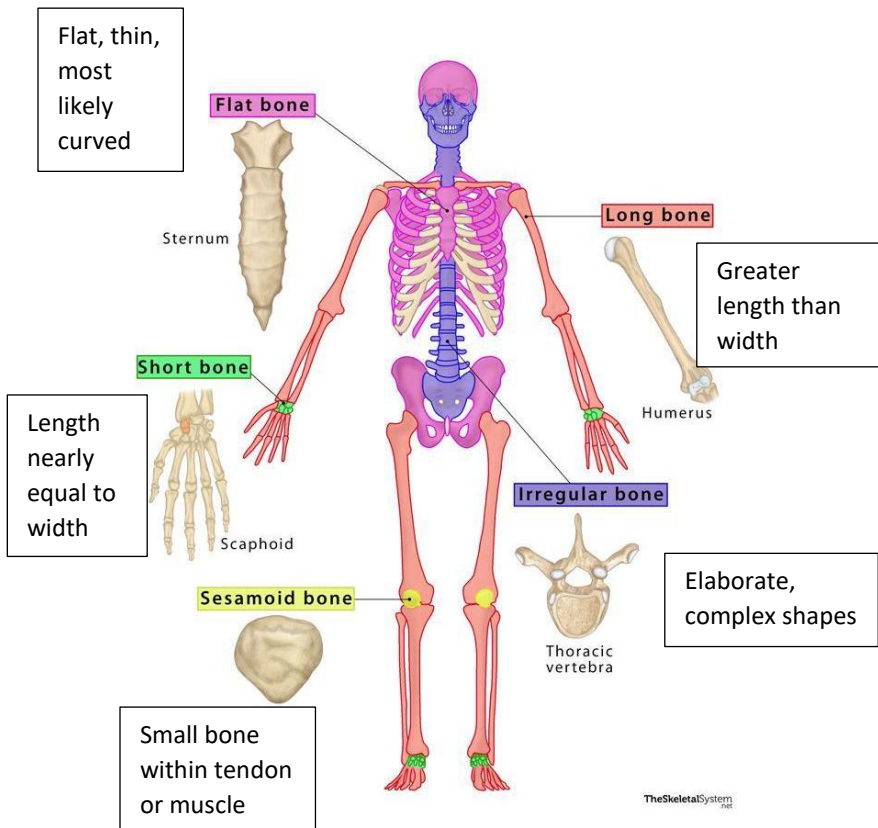


Think MTB

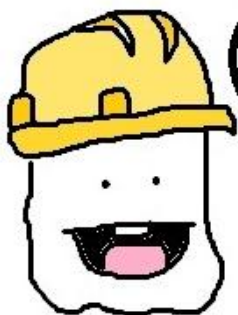
Bone Functions

- Support
- Protection
- Storage of minerals
- Hemopoiesis
- Movement
- Energy

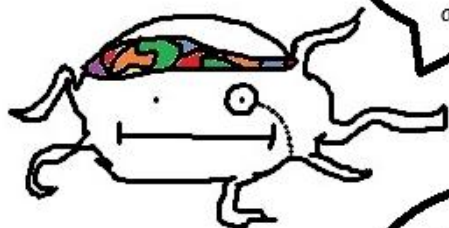
Bone Types



Bone Cell Cartoon



Hello, I am an osteoBLAST! I BUILD and mineralize bone tissue



Hi. I am an osteocyte. I maintain the bone matrix. I am mature.



I am osteoCLAST. I CRASH the bone tissue for CALCIUM during bone resorption

Articulation Vocabulary

Articulations (also known as joints): Where bones rub against each other

Joint Types (Structural)

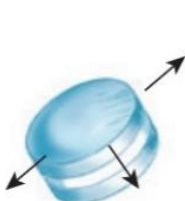
- Fibrous joint
- Cartilaginous joint
- Synovial joint

Joint Types (Movement)

Synarthrosis: Immovable

Amphiarthrosis: Slightly moveable

Diarthrosis: Freely movable



Gliding joint



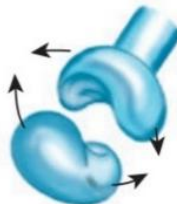
Hinge joint



Pivot joint



Ellipsoidal joint



Saddle joint



Ball-and-socket joint

Joint Movements

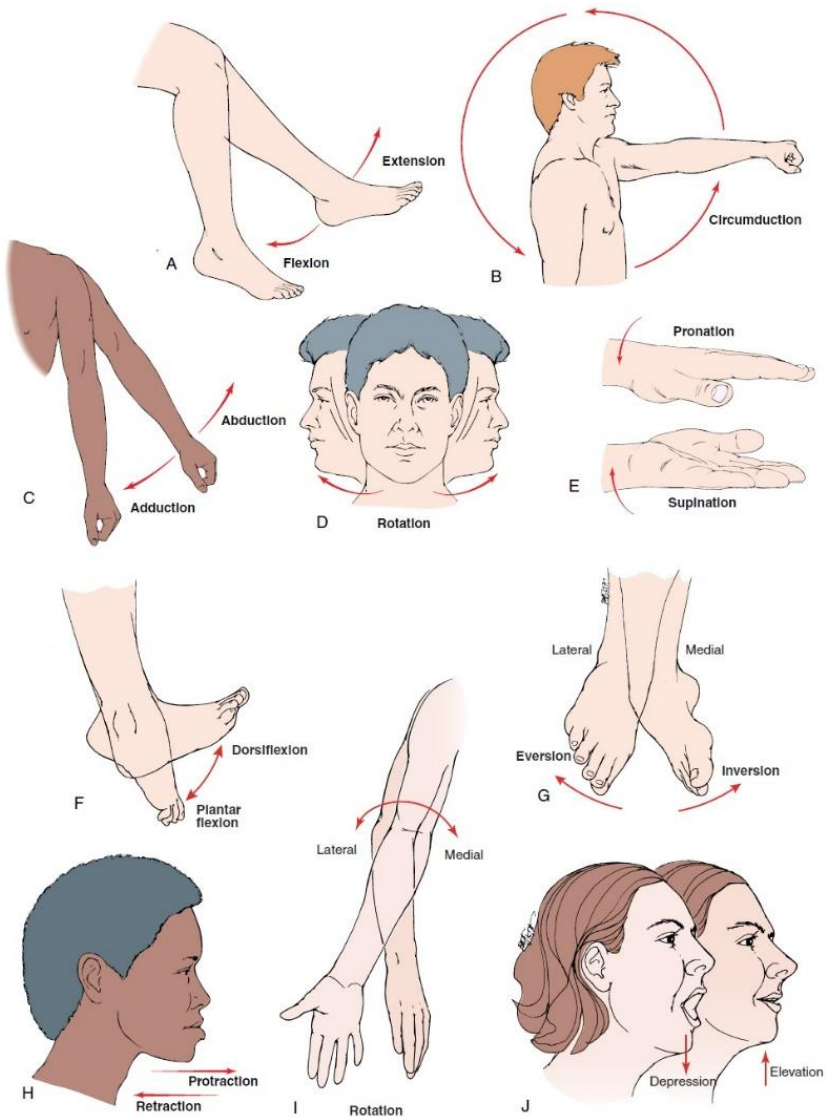


FIGURE 3.33. Joint Movements. A, Flexion and Extension; B, Circumduction; C, Abduction and Adduction; D, Medial and Lateral Rotation; E, Pronation and Supination; F, Dorsiflexion and Plantar Flexion; G, Inversion and Eversion; H, Protraction and Retraction

Muscular System Definitions

Muscle: Specialized tissue that contracts and relaxes to create movement and force

Connective Tissue Associated with the Muscular System:

- **Tendon:**
- **Aponeurosis:**

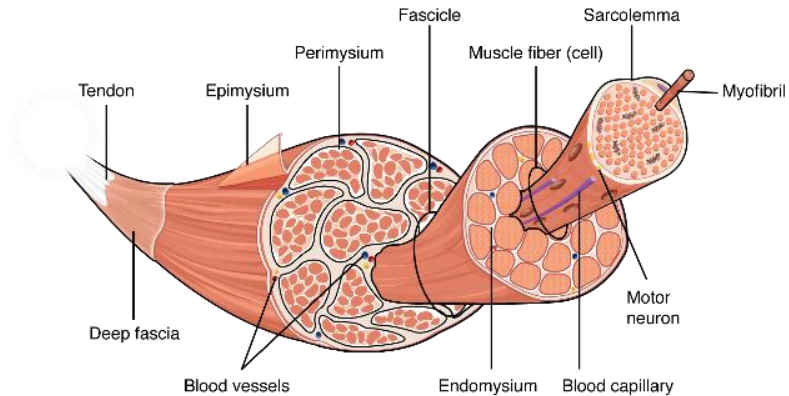
Organization (Biggest to Smallest):

Muscle -> Fascicle -> Muscle Fiber ->

Myofibril -> Sarcomere -> Myofilament

Superficial to Deep

Epimysium-> Perimysium -> Endomysium



Muscle Types

Skeletal: Voluntary muscle attached to bones

- Multinucleate
- Striated

Cardiac: Involuntary muscle found within the walls of the heart; contract via autorhythmic pacemaker cells

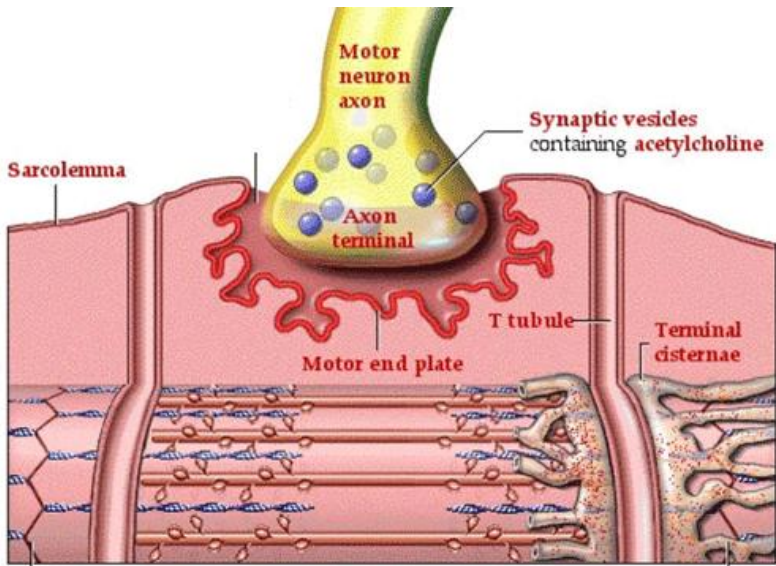
- Uninucleate (sometimes binucleated); many mitochondria
- Striated
- Branched
- **INTERCALATED DISCS**

Smooth: Involuntary muscle found within organs and passageways

- Uninucleate
- Unstriated
- Spindle-shaped



The Neuromuscular Junction



Sarcolemma: Plasma membrane

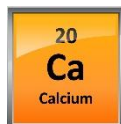
Acetylcholine: Neurotransmitter responsible for muscle cell contraction

Triad: Two terminal cisternae and one T-tubule; forms the sarcoplasmic reticulum

T-Tubule: Allows the electrical pulse to travel down to the sarcomere

Think: T-Tubule = Tunnel

Terminal Cisternae: Calcium Reservoir



Think: Cisternae = Calcium

Sliding Filament Model

Sarcomere: Functional unit of muscle
composed of myofilaments; in between Z-discs

Myofilaments:

- **Thick**

- **Myosin**

- Two heads
 - Actin and ATP binding site

- **Thin**

- **Troponin**

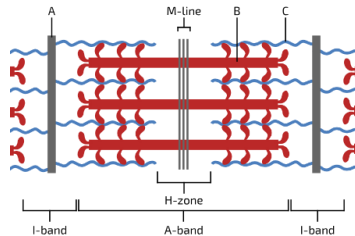
- Ca^{2+} binding site
found on
tropomyosin sheath

- **Tropomyosin**

- Holds and covers
actin

- **Actin**

- Myosin binding site



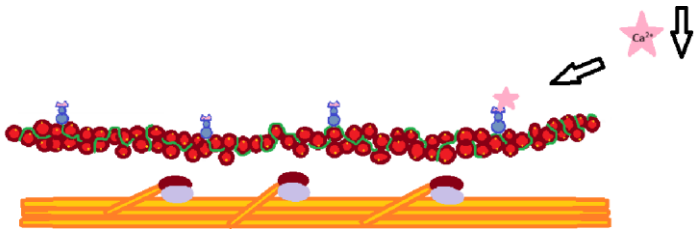
ATP (Adenosine Triphosphate):

Energy used to move myosin medially,
across the thin filament

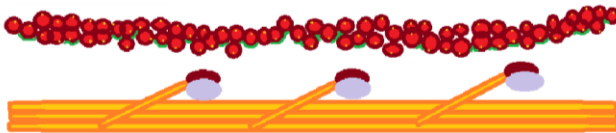
Sliding Filament Model Cartoon

1. Calcium comes through the T-tubule and binds to Troponin

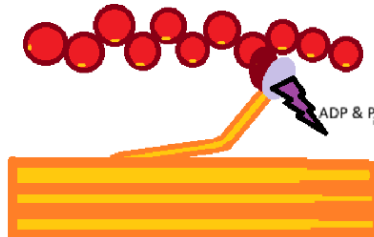
- Ca^{2+} releases when the resting membrane potential of the motor end plate goes from -90mV to -60mV



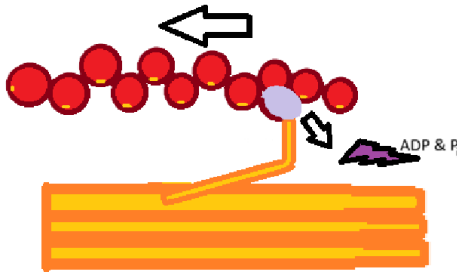
2. Troponin pulls back the tropomyosin sheath, revealing the actin



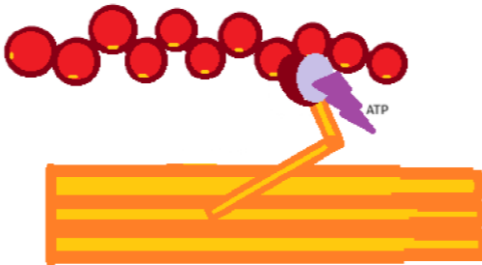
3. The *crossbridge* between the myosin and actin connects via ADP and P_i



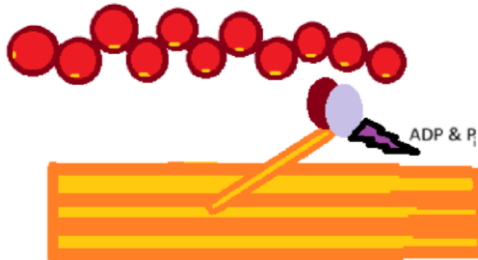
4. The myosin head performs a *power stroke* and pulls the thin filament, medially



5. ATP binds to the myosin head



6. Using energy from the catabolized ATP, the myosin head retracts to its original position



Nervous System Definitions

General Organization:

Central Nervous System

Peripheral Nervous System

Afferent (Sensory): Receives information and takes it to the CNS

Efferent (Motor): From CNS to an effector

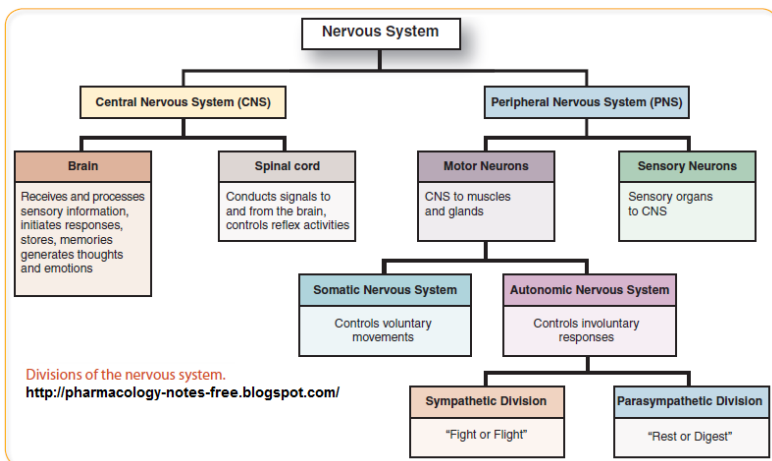
Nerves: Parallel bundle of axons in peripheral nervous system

Neurons: Transmit electrical signals

Connective Tissue Covering Nerves

Superficial to Deep

Epineurium -> Perineurium -> Endoneurium



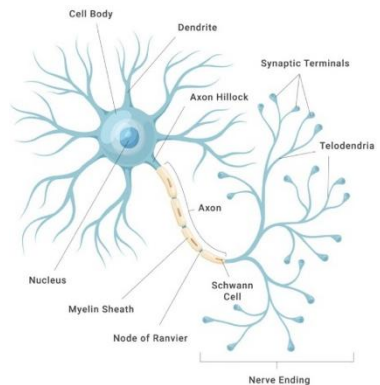
Neuron Structure

Dendrites: Receives electrical input and moves it towards the cell body

Cell Body (Soma): Composed of the nucleus and cytoplasm

Axon: Attaches to soma via *axon hillock*; conducts signals further down

- **Telodendrion:**
Branched terminals of the axon; ends at the synaptic knobs
- **Cytoskeleton:** Composed of intermediate filaments which bundle into neurofilaments
- **Myelin Sheath (Schwann cell):**
Insulates the axon; allows for saltatory conduction



Brain Characteristics

Regions: Cerebrum, diencephalon, brainstem, cerebellum

Gyrus: Raised portions of the brain

Sulcus: Depressions within the brain

Grey Matter: Unmyelinated

White Matter: Myelinated

Meninges: Protective layers around CNS

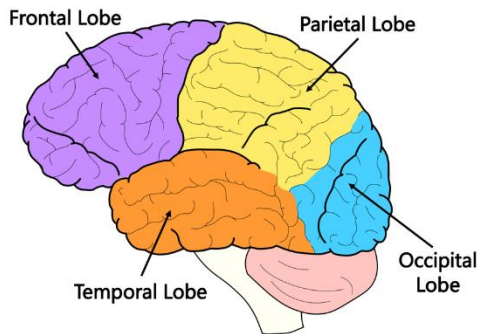
Lobes: Frontal, Temporal, Parietal, Occipital, Insula**

Limbic System: Emotions

Diencephalon: Relays information

Brainstem: Breathing and heart rate

Cerebellum: Balance (vestibular sense)



** - The insula is a region deep within the brain (some textbooks classify it as a lobe)

Cranial Nerves Mnemonics

Old (Olfactory)

Orange (Optic)

Ogres (Oculomotor)

Totally (Trochlear)

Try (Trigeminal)

And (Abducens)

Fight (Facial)

Vicious (Vestibulocochlear)

Gremlins, (Glossopharyngeal)

Victory (Vagus)

Ain't

(Accessory)

Here

(Hypoglossal)

