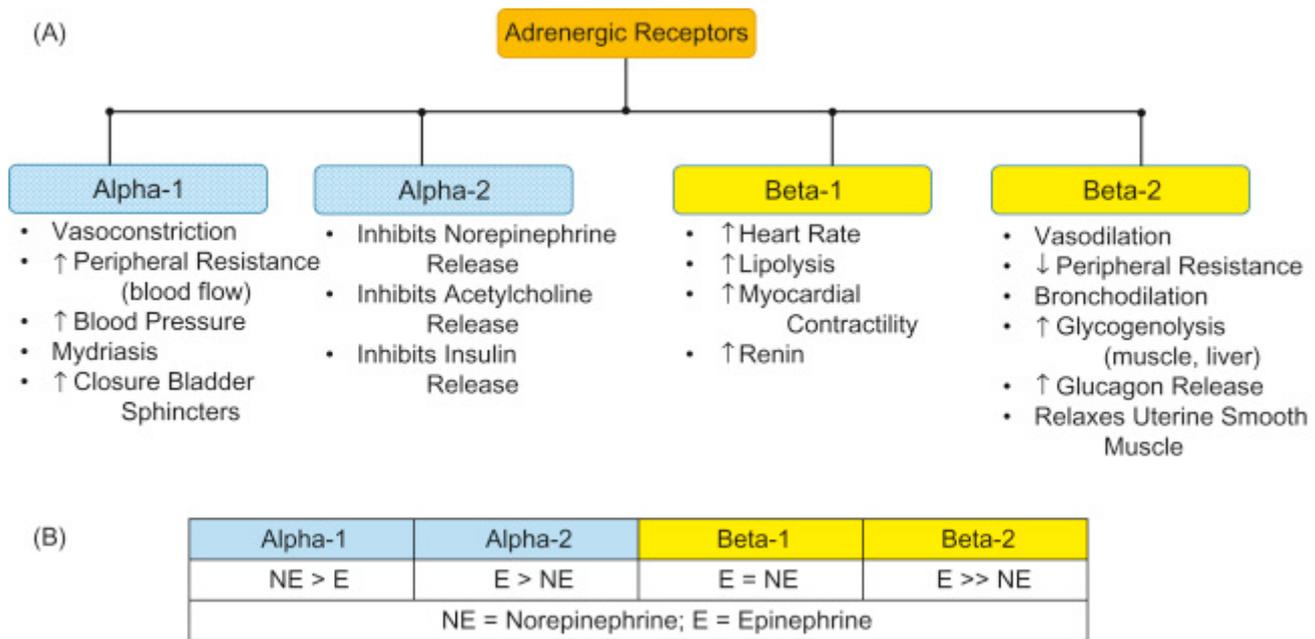
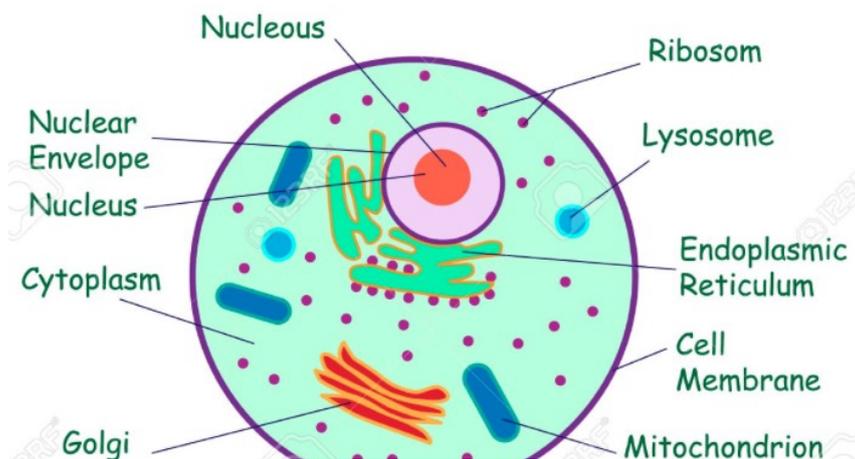


Basic cell phys



The resting potential differs according to the different types of cells:

- Skeletal muscle cells -95 mV
- Smooth muscle cells -60 mV
- Astroglia -80 to 90 mV
- Neurons -60 to 70 mV
- Cardiac myocyte -90mV
- Cardiac autorhythmic cell -60 to -70 mV



• **Nucleus**

- DNA → packaged as chromatin → chromosomes. 22 autologous pairs, 1 sex pair
- Useful DNA code = exons. Intermingled with introns
- DNA replicated by DNA polymerase
- Transcription of DNA by RNA polymerase → mRNA → translation mRNA by ribosomes → protein

• **Ribosomes**

- Either free in cytosol or bound to rough ER
 - Free in cytosol - proteins for cell
 - Bound to rough ER - proteins for export (bud off from ER → golgi bodies which package proteins for export)

• **Smooth ER**

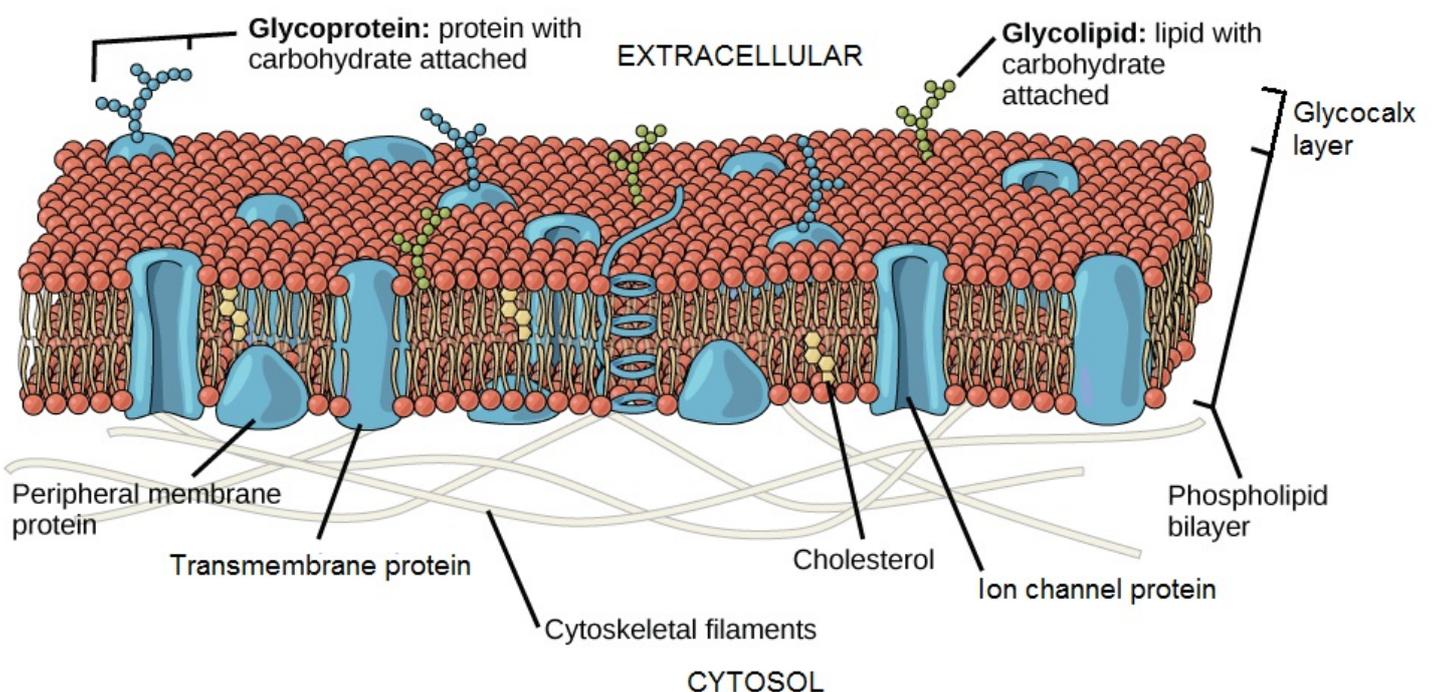
- Lipid, cholesterol and steroid synthesis site
- Drug detoxification - smooth ER in hepatocytes have a lot of p450

• **Vesicles**

- Move proteins and molecules between organelles without mixing them within the cytoplasm

• **Mitochondria**

- Inner and outer membrane
- TCA cycle and electron transport chain
 - Glycolysis occurs in cytoplasm
 - → TCA cycle role is to reduce NADH → electron transport chain → oxidised back to NAD⁺ which is coupled to synthesis of ATP
- Maternal inheritance

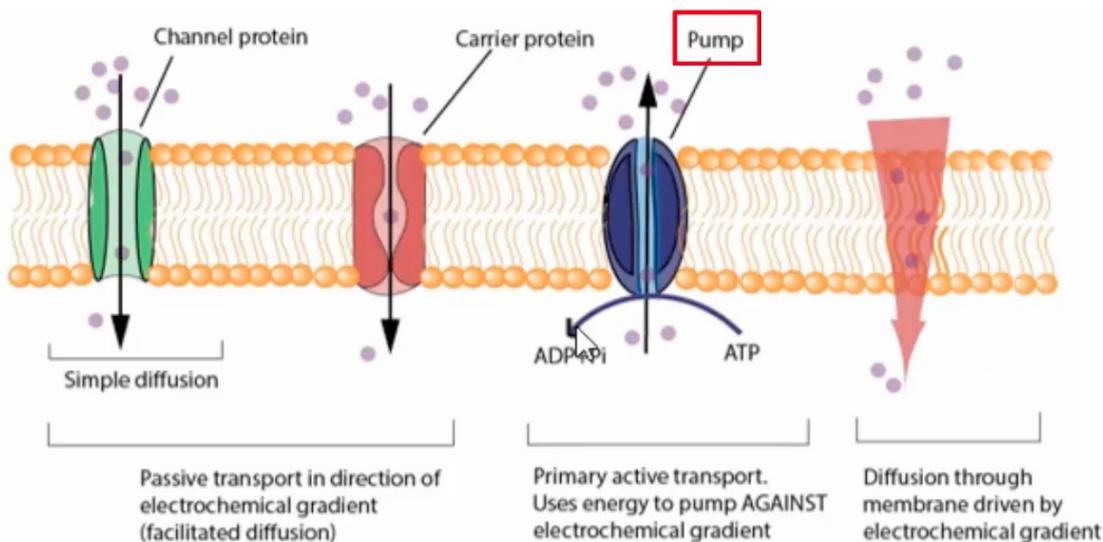


Transport across cell membranes

- Passive diffusion (nonpolar)
 - Gases: O₂, CO₂
 - Lipid soluble
 - Lipids & cholesterol
 - Steroid hormones
 - Fat soluble vitamins
- Transport protein mediated
 - Charged/polar molecules
 - Ions
 - Glucose
 - Amino acids
 - Non-steroid hormones
- Vesicular transport
 - Proteins

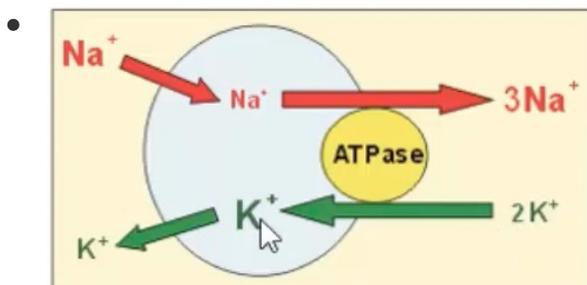
Different channels

- Passive transport channels (electrochemical gradient)
- Gated channels - pumps (*against* electrochemical gradient)
 - Ligand gated
 - Voltage gated



Na/K ATPase

- Every ATP = 3 Na out, 2 K in



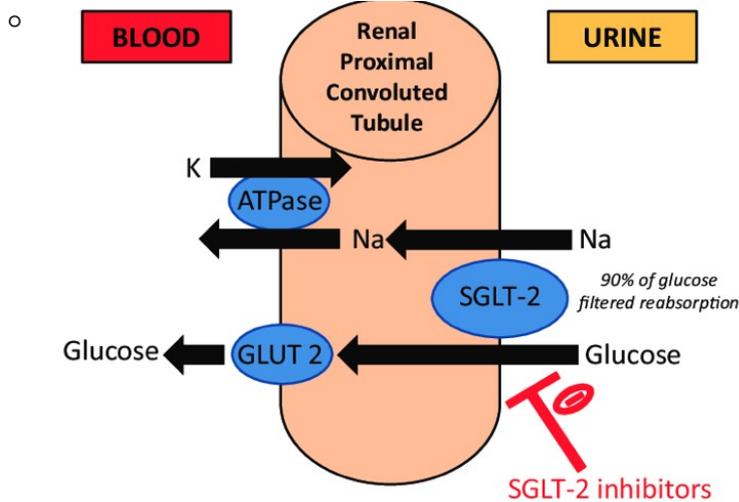
- Maintain membrane potential (-50 millivolts usually)

maintain membrane potential (50 millivolts usually)

Glucose transporters

GLUT 1 & GLUT3	GLUT4	SGLT
<ul style="list-style-type: none">carrier proteinsall body cellsfacilitated diffusionset basal level of glucose uptake into cells	<ul style="list-style-type: none">carrier proteinmuscle & adiposeInsulin sensitiveImportant in post prandial glucose uptake stimulated by insulin	<ul style="list-style-type: none">secondary active transportkidney (proximal tubule)reabsorbs glucose from renal tubule against its concentration gradient by co-transport with Na⁺Easily <u>saturable</u> kinetics hence glycosuria with raised blood sugars

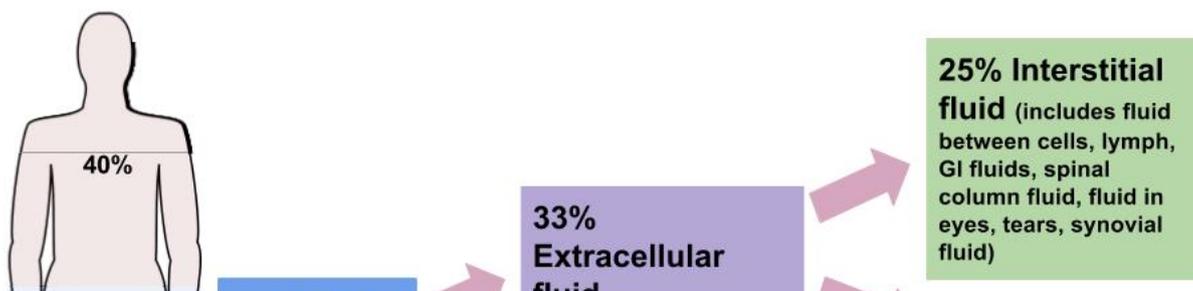
- **SGLT:**

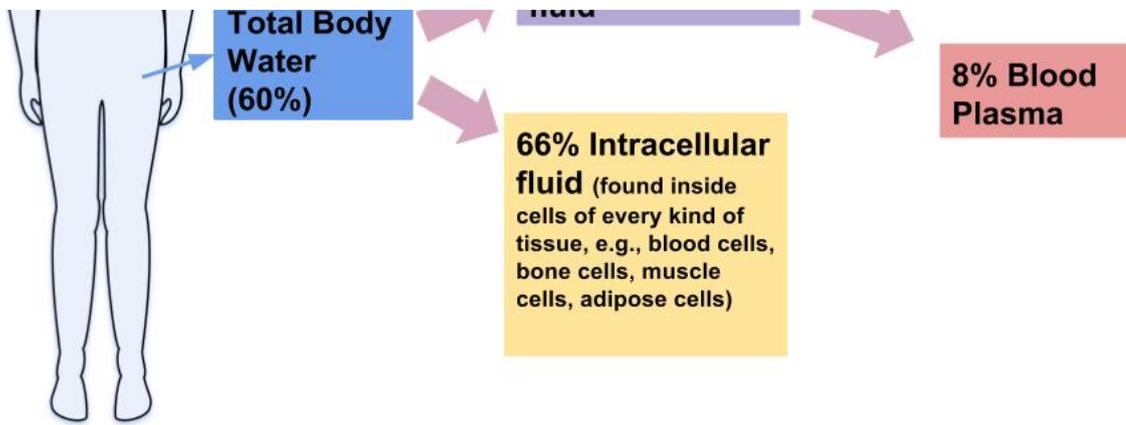


- SGLT slow and easily saturable - hence high BM = high PU output and urine sugar

Body fluid compartments

- Average 60% bw = water
 - 2/3 intracellular
 - 1/3 extracellular
 - Lymphatics
 - Vascular fluid
 - Extracellular fluid
 - → transcellular fluid (CSF, GI tract, urine etc)
 - → interstitial fluid (fluid within the interstitial of organs)





	Intracellular concentration (mM)	Extracellular concentration (mM)
Cations		
[Na ⁺]	10	145
[K ⁺]	160	4.5
[Ca ²⁺]	0.0005	2.5
[Mg ²⁺]	25	1.0
Anions		
[Cl ⁻]	5	110
[HCO ₃ ⁻]	10	25

Epithelial membranes

- Simple
 - Squamous (rapid diffusion/filtration required - endothelial, alveoli, glomerulus)
 - Cuboidal (secretory glands, renal tubules)
 - Columnar (GI, uterus)
- Stratified
 - Stratified Squamous
 - Keratinised - Skin
 - Non-keratinised - mucous membranes
 - Stratified transitional - bladder (cells that change shape with stretch)

Endothelial cells

Plasma protein \gg ECF protein = \uparrow plasma oncotic pressure (**starling forces**)

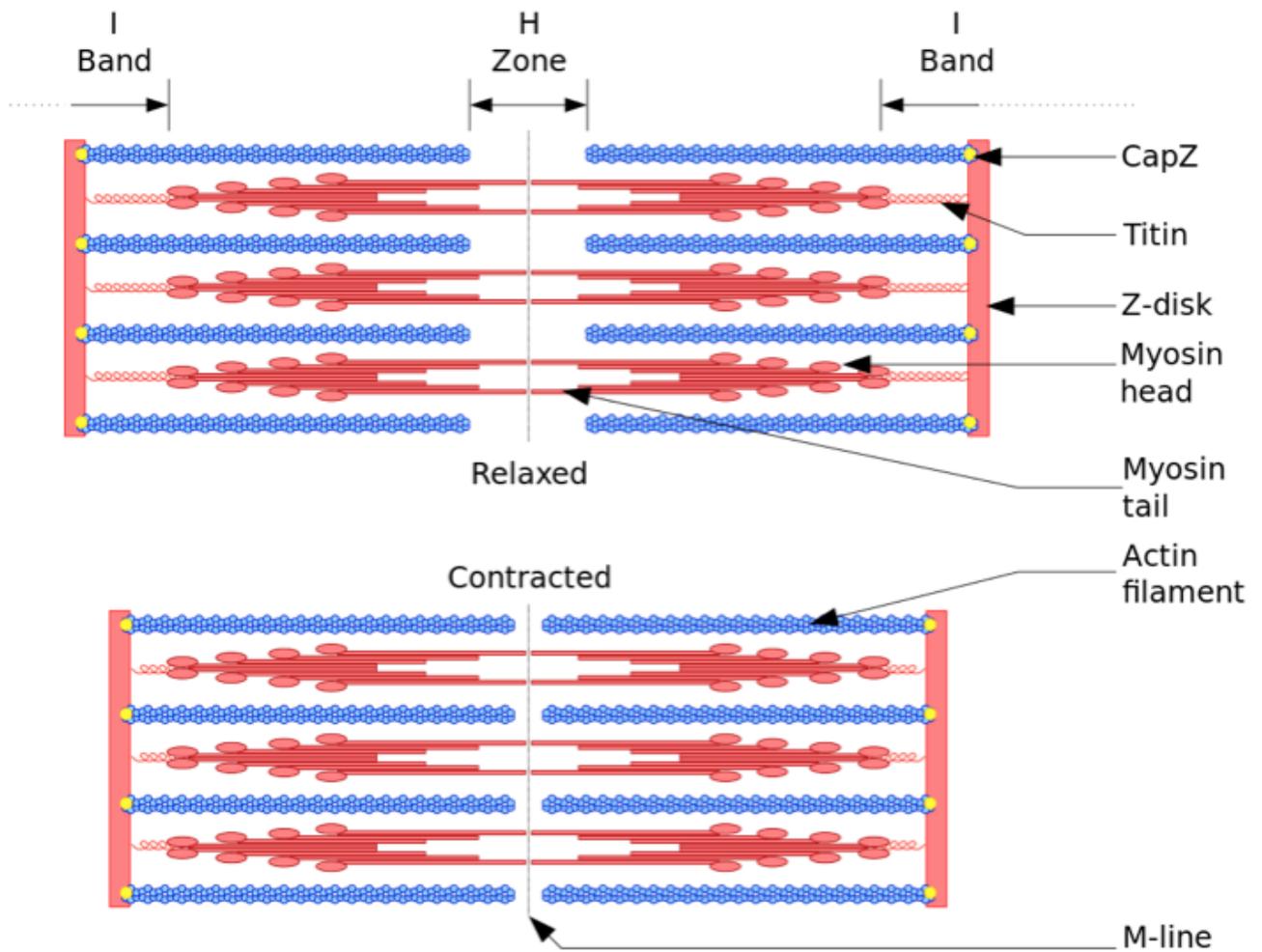
- O₂ and CO₂ diffuse through cells
- H₂O passes between aqueous pores between cells
- Most plasma proteins cannot pass through

Endothelial membranes

- Continuous - most capillaries, lungs, CNS
- Fenestrated - kidney, small intestine, endocrine
- Sinusoidal (large gaps) - hepatocytes, spleen, bone marrow
 - Large proteins and blood cells can pass between for mixing

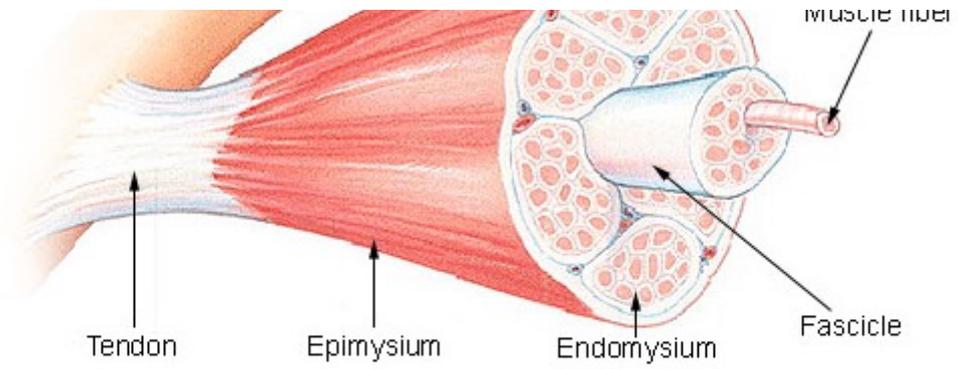
Excess tissue fluid drained by lymphatics

Capillary filtration controlled by hydrostatic pressure by afferent and efferent arterioles (e.g. glomerulus pressure)

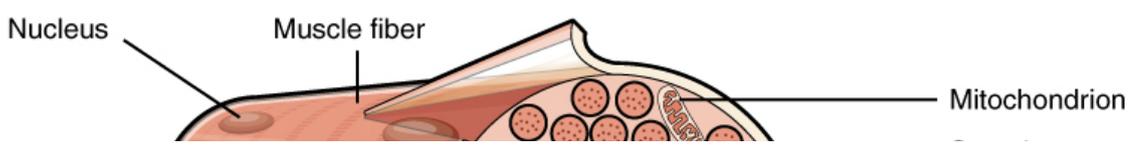
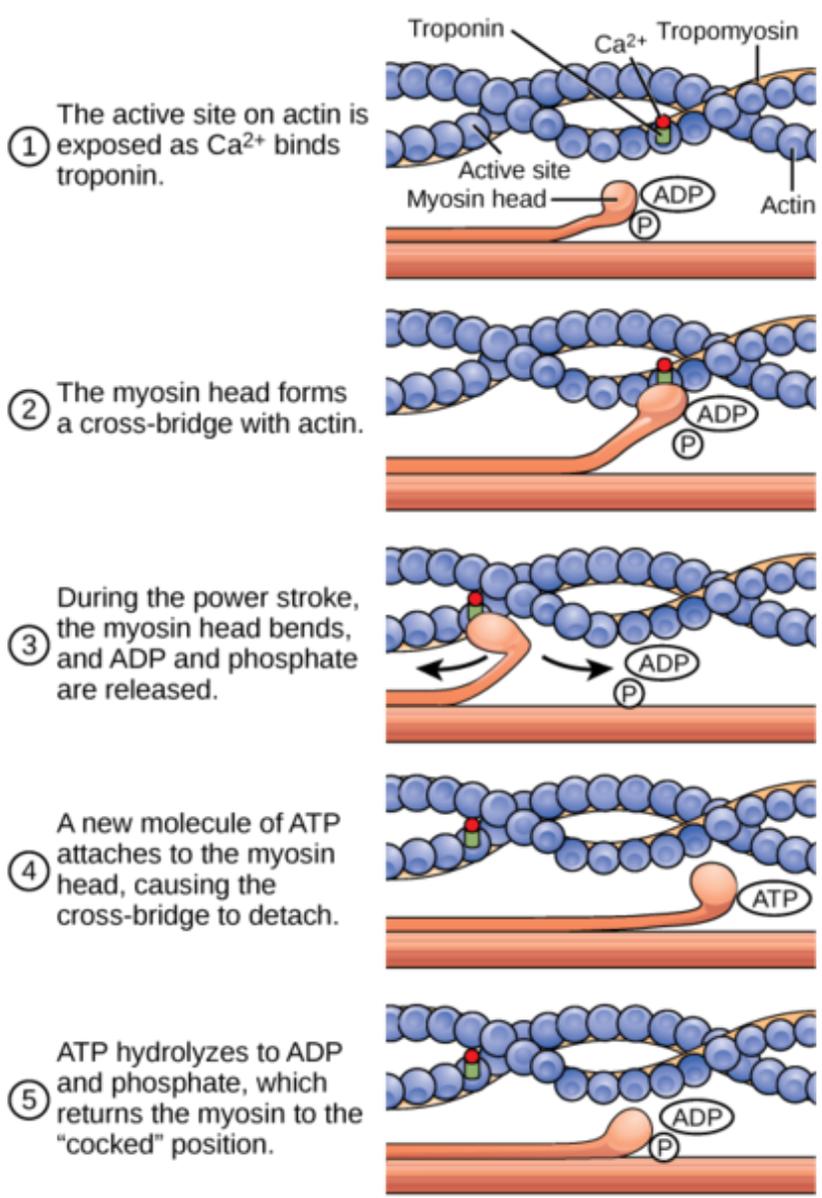


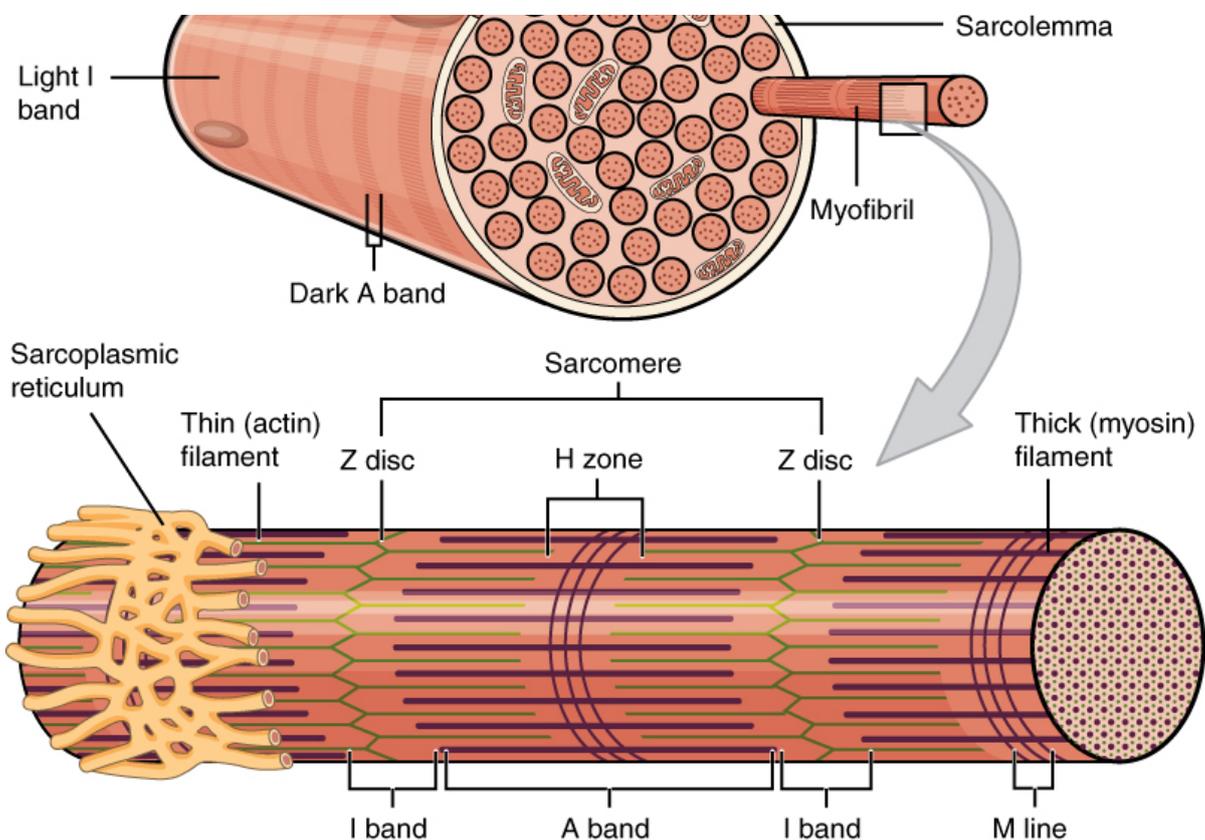
Structure of a Skeletal Muscle



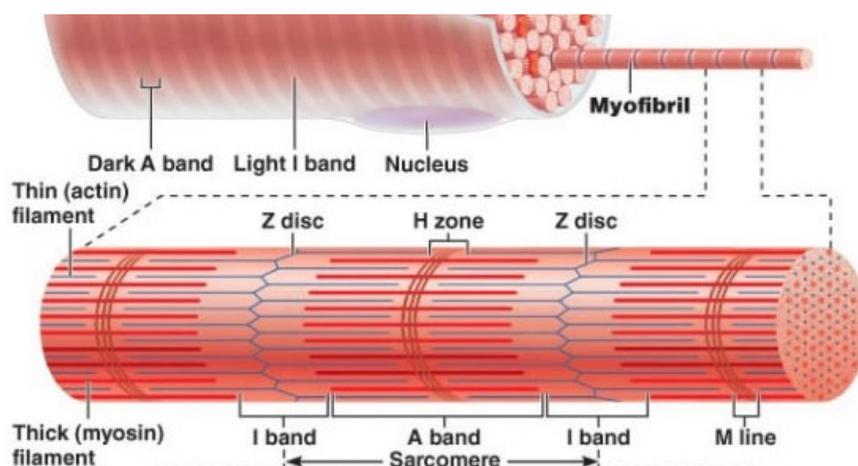


- Muscle fibre = endomysium
- Fascicle = perimysium
- Skeletal muscle = epimysium

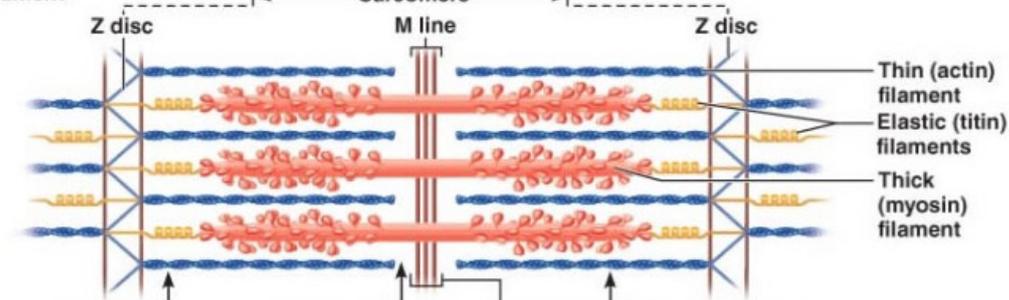




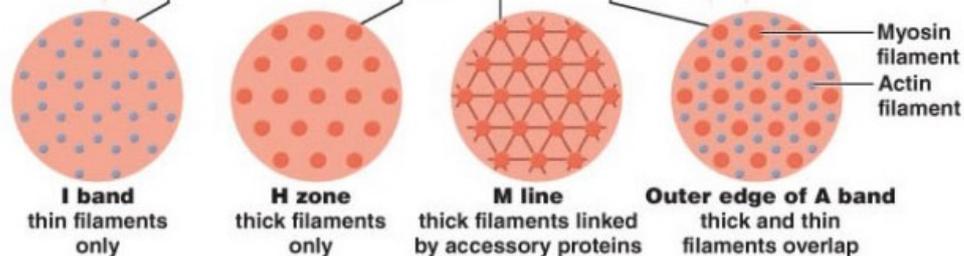
(c) Small part of one myofibril enlarged to show the myofilaments responsible for the banding pattern. Each sarcomere extends from one Z disc to the next.



(d) Enlargement of one sarcomere (sectioned lengthwise). Notice the myosin heads on the thick filaments.



(e) Cross-sectional view of a sarcomere cut through in different locations.



- Myeloid - erythrocytes, neutrophils, eosinophils, platelets (megakaryocytes), monocytes, basophils
- Lymphoid - T and B lymphocytes, plasma cells

Neutrophils

- Rise within 1 hr of tissue injury - *hallmark of acute inflammation*
- Rise: causes
 - Heavy exercise, MI, infarct, necrosis, smoking, steroids → can all raise neutrophils
 - Most common is infection
 - Nervousness can cause a slight rise (due to cortisol release)
 - Persistent elevation ?CML
- Drop: causes
 - Commonly seen in viral infection
 - Chemo, connective tissue disease (e.g. RA, Sjogren's)

Lymphocytes

- Rise:
 - Common in viral infections
 - Stress lymphocytosis - e.g. MI, status epilepticus etc
 - Persistent lymphocytosis ?lymphoproliferative disorder
- Drop:
 - Immunosuppressive agents
 - HIV, immunocompromised, Hodgkin lymphoma

Platelets

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