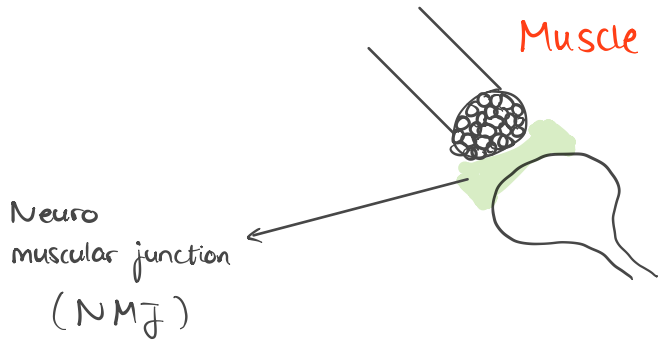
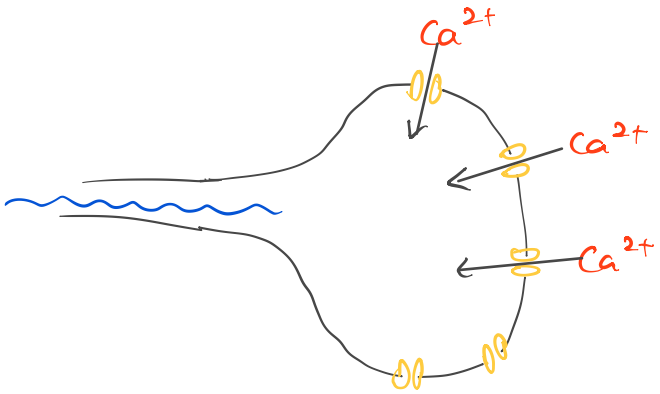
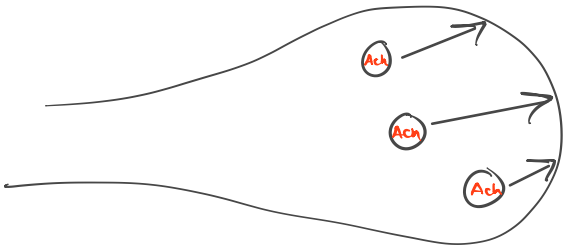
Neuron : Bundle of fibres

Muscle : Bundle of muscle fibres



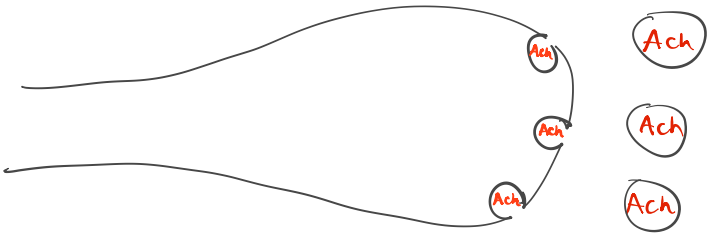


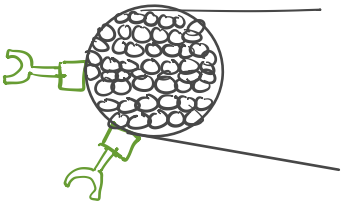
① Voltage-gated Ca^{2+} channels open



② Once inside, Ca^{2+} Stimulates vesicles carrying Acetylcholine (Ach) to bind to peripheral of nerve cell

Ligand-gated Na^+ channels



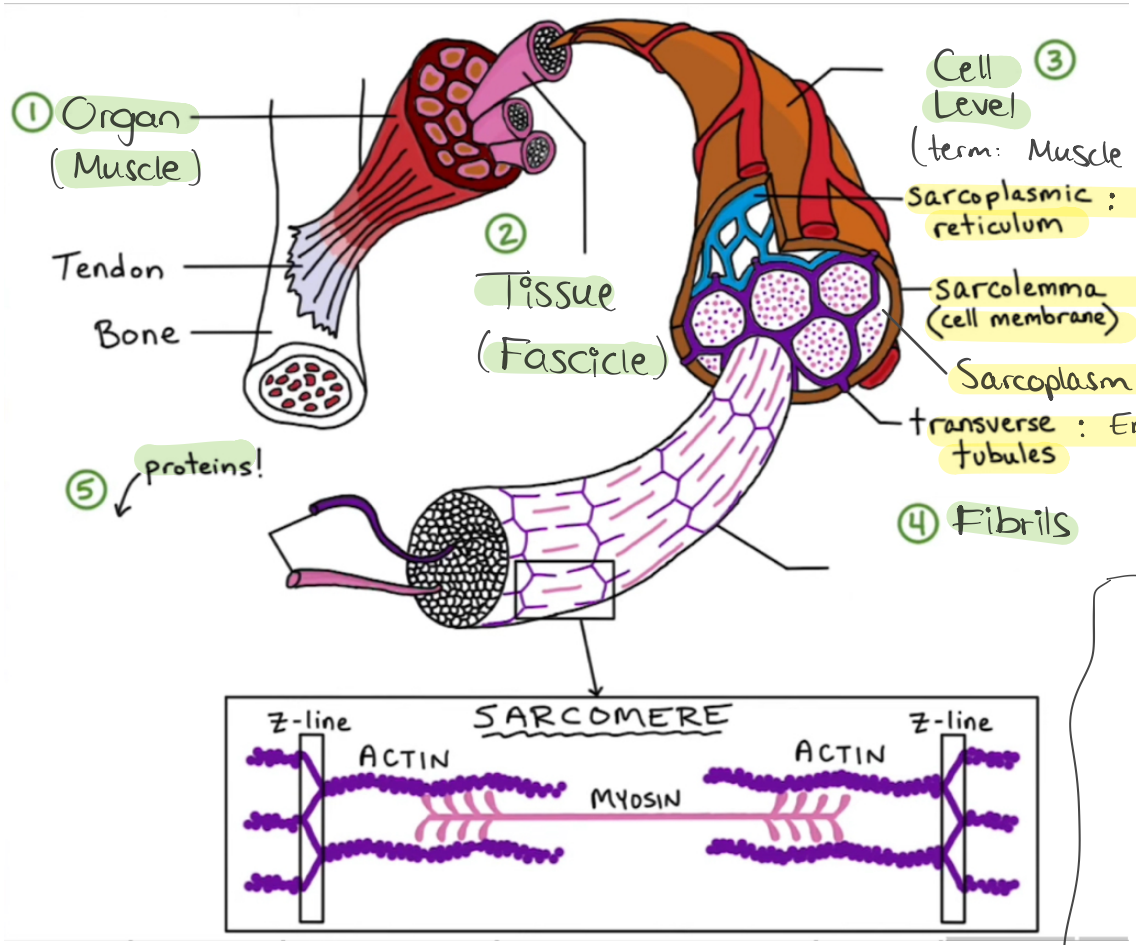


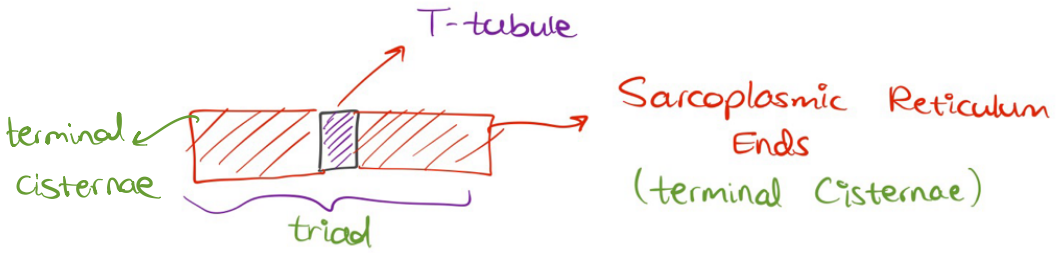
③ Ach Vesicles now diffuse in Synapse toward Ligand-gated Na^+ channels on muscle

④ Once bound, Ach neurotransmitter causes Na^+ channels to open in Muscle ⇒ contraction

⑤ Ach removed by: A. Acetylcholinesterase B. Diffusion C. Recycling

(A, B, C are 3 ways Ach is removed.)





Sarcoplasmic Reticulum Ends (terminal Cisternae)

T-tubule + 2 terminal Cisternae = Triad

① Organ (Muscle) → ② Tissue (Fasciacle)

② Tissue (Fasciacle) → ③ Cell (Muscle fibre)

③ Cell (fibre) → ④ Fibrils

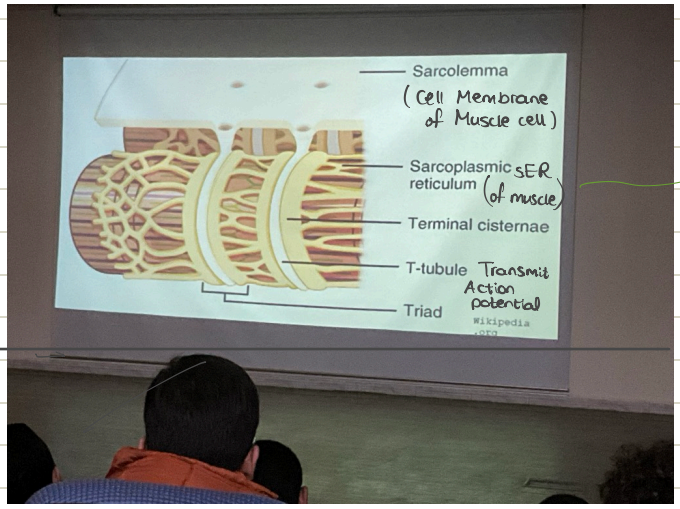
④ Fibrils → ⑤ Filaments (proteins)

Duration of AP :	Speed of AP :
Muscle longer than nerve	Nerve faster than muscle

Myofibrils ⇒ made from many Sarcomeres

Many myofibrils ⇒ Myofibre

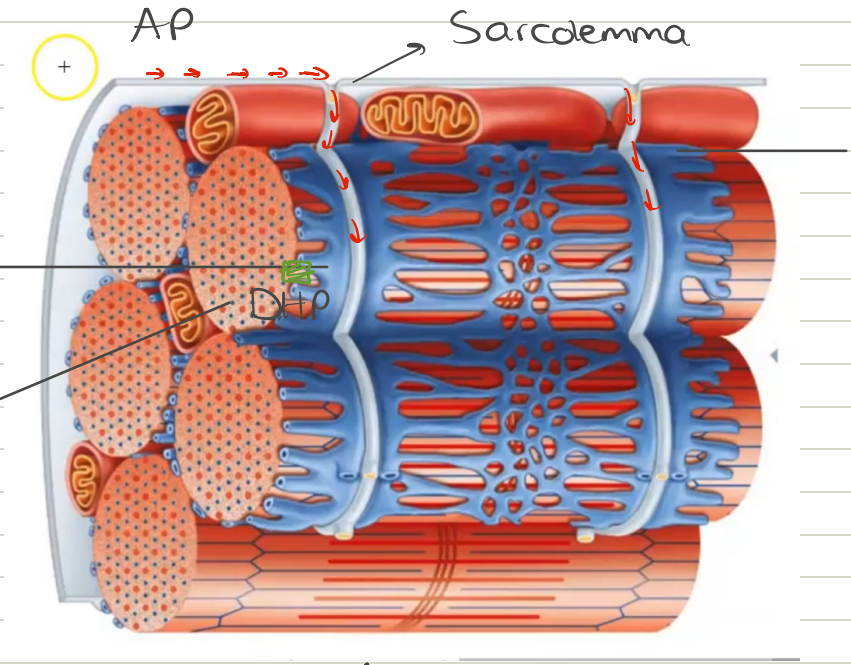
Many Myofibres ⇒ Muscle tissue



remember:

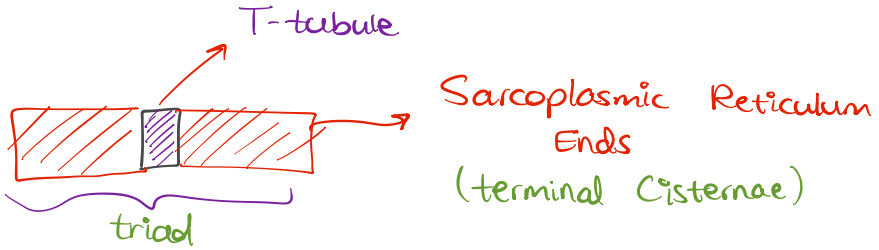
Ca^{2+} is needed for muscle contraction

SER stores Ca^{2+}



AP generated in neuron travels through Sarcolemma (Cell Membrane), because the CM is good conductor of electricity

Action Potential moves through Sarcolemma to myofibrils ⇒ until it reaches T-tubules (specifically, dilated ends called terminal cisternae), the Sarcoplasmic Reticulum releases Ca^{2+} ions to myofilaments through a Ca^{2+} channel called DHP



T-tubule + 2 terminal Cisternae = Triad

Myofilaments ⟶ THICK Myosin

THIN Actin

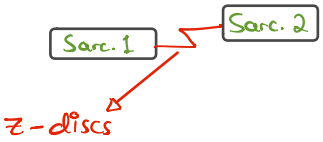
Ratio of Thin : Thick

2 : 1

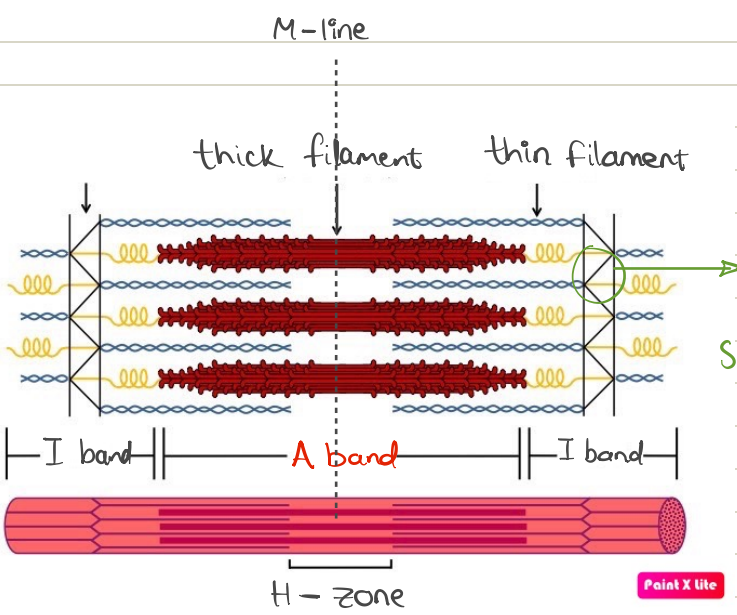
Actin : Myosin Arranged in units called Sarcomeres

Separated by

z-discs



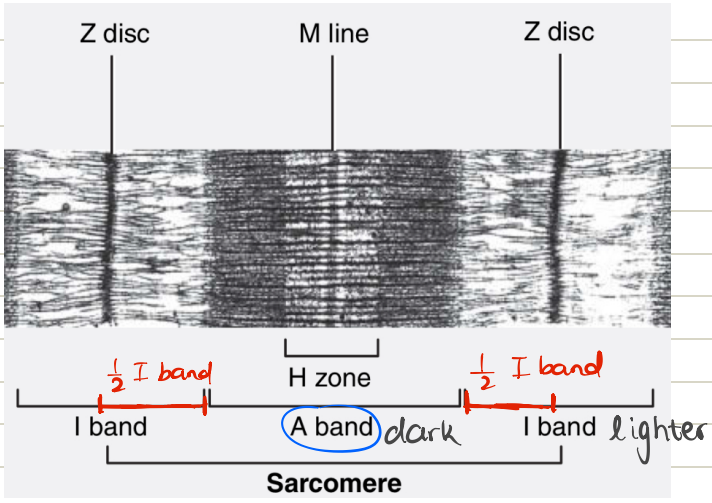
Sarcomere structure



Z-line Separates Sarcomeres from each other

A band: All Thick + some thin — near A band: zone of overlap b/w A & H bands
H zone: Thick only (no thin) ⇒ narrow region
I band: Thin only
M Line: Middle of Sarcomere : Supporting protein

Note: 1 full Sarcomere is 1 A band + 2 half-I bands (see below)



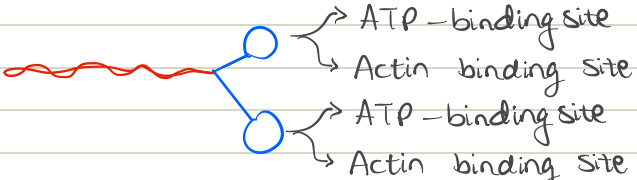
1 A-band + 2 ($\frac{1}{2}$) I-bands = 1 Sarcomere
(half)

Proteins

Contractile Proteins: Proteins that are directly involved in contraction (+ relaxation)

① Myosin — 2 Myosin heads, 1 tail ⇒ each Myosin head has:

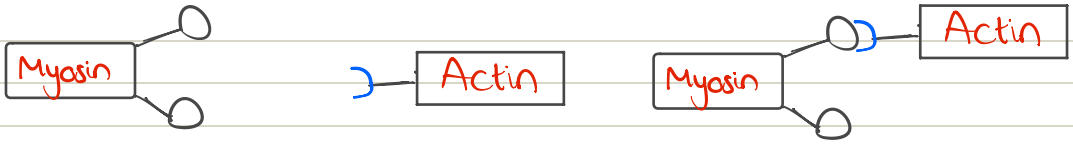
* ATP binding site
* Actin binding site



(2)

Actin 1 Myosin binding site

usually: Myosin binds to Actin through Myosin-binding site.



Myosin binding site

✓ Contraction

Once Actin & Myosin bind

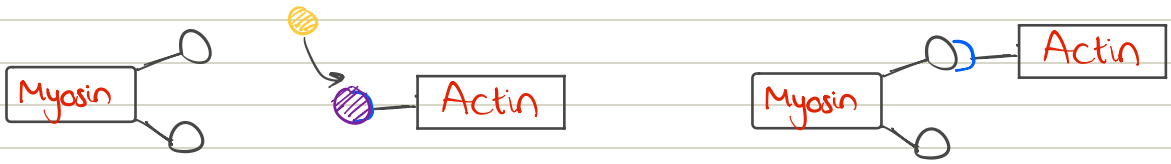
Regulatory Proteins: Switch Contraction on & off.

Tropomyosin

(Switches off contraction)

Tropomyosin binds to Myosin-binding site instead of Myosin head; no binding of Myosin head to Actin ⇒ No Contraction ✗

Troponin (Switches on Contraction)



Troponin induces conformational change in tropomyosin that kicks it out of Myosin-binding site ⇒ Myosin heads can bind to Actin ⇒ contraction ✓

Structural proteins (got tired of writing bruv)

Structural proteins	Proteins that keep thick and thin filaments of myofibrils in proper alignment, give myofibrils elasticity and extensibility, and link myofibrils to sarcolemma and extracellular matrix.
Titin	Structural protein that connects Z disc to M line of sarcomere, thereby helping to stabilize thick filament position; can stretch and then spring back unharmed, and thus accounts for much of the elasticity and extensibility of myofibrils.
α-Actinin	Structural protein of Z discs that attaches to actin molecules of thin filaments and to titin molecules.
Myomesin	Structural protein that forms M line of sarcomere; binds to titin molecules and connects adjacent thick filaments to one another.
Nebulin	Structural protein that wraps around entire length of each thin filament; helps anchor thin filaments to Z discs and regulates length of thin filaments during development.
Dystrophin	Structural protein that links thin filaments of sarcomere to integral membrane proteins in sarcolemma, which are attached in turn to proteins in connective tissue matrix that surrounds muscle fibers; thought to help reinforce sarcolemma and help transmit tension generated by sarcomeres to tendons.