Nerve and Muscle physiology (N&M)

Part 02: The skeletal muscle

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Topics of the lecture

A. Types of muscles

B. Organization and structure of skeletal muscle

C. Excitation – contraction coupling

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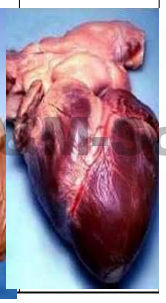
Types of muscles

	Skeletal	*Cardiac*	*Smooth*
L.M	Striated	Striated	Non-satiated

Types of muscles

	Skeletal	*Cardiac*	*Smooth*
			

Skeletal muscles

	Skeletal
L.M	**Striated**
Control	**Voluntary**
Nervous control	**Somatic. nerves**
Example	**Body muscles attached to skeleton**

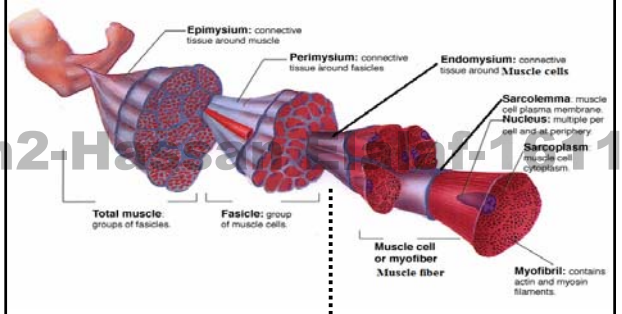
Topics of the lecture

A. Types of muscles

B. Organization and structure of skeletal muscle

C. Motor end plate

Organization and structure of skeletal muscle



Seen by naked unassisted eye | Seen ONLY under microscope

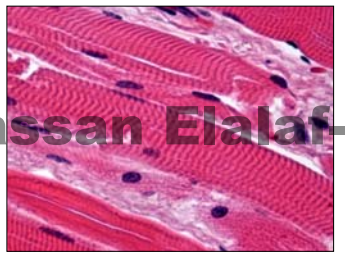
structure of skeletal muscle cell

Muscle cell = muscle fiber = Myofiber

Each Muscle cell (muscle fiber – Myofiber) has,

- Cell membrane (Sarcolemma).
- Many nuclei .??????
- Cytoplasm (Sarcoplasm)
- Mitochomdria
- Myofibrils (contractile proteins) = Actin myofilaments and Myosin myofilamants
- Elastic proteins

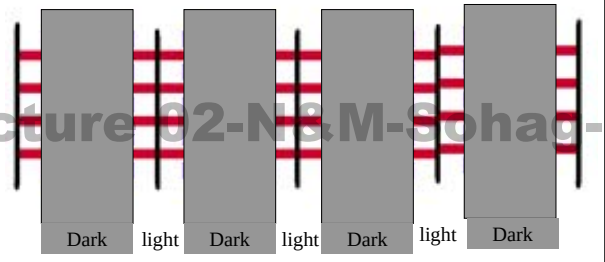
skeletal muscle (Striated muscle) ?



Myofibrils = Actin myofilaments and Myosin myofilamants

= Myosin filament (**Thick** filament)

= Actin filament (Thin filament)

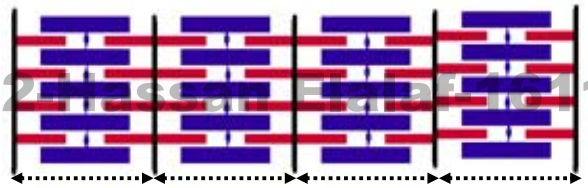


Myofibrils = Actin myofilaments and Myosin myofilamants

= Myosin filament (**Thick** filament)

= Actin filament (Thin filament)

= Z line = in between line



Each Sarcomere contain One Myosin and ends of 2 Actins

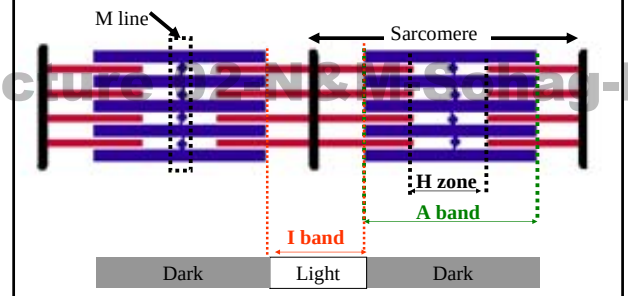
M and AA

Sarcomere (functional unit)

= Myosin filament (**Thick** filament)

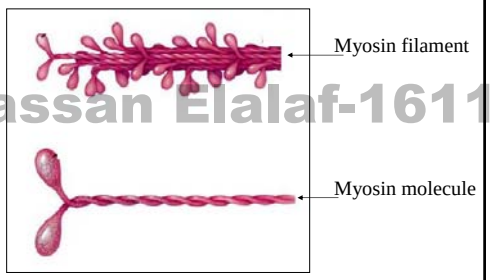
= Actin filament (Thin filament)

= Z line



Myosin Filament (Thick filament structure)

Each Mysosin filament is composed of Myosin Molecules



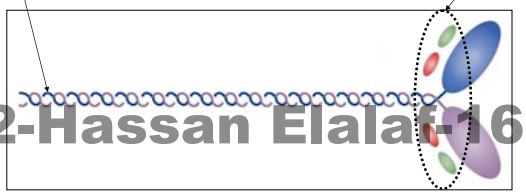
Myosin Molecule structure

2 heavy Polypeptide chains forming a helix

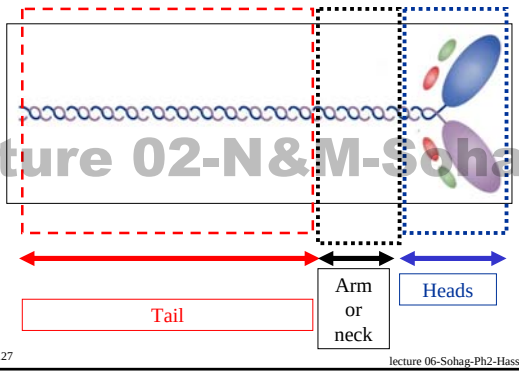
Myosin Molecule structure

4 light Polypeptide chain

2 heavy Polypeptide chains forming a helix



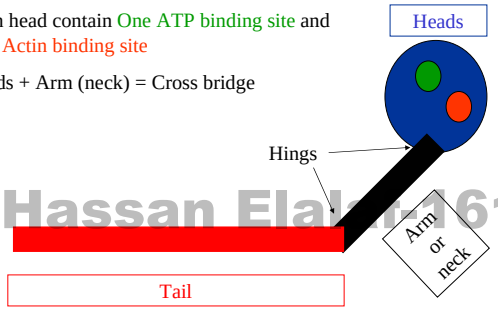
Myosin Molecule structure



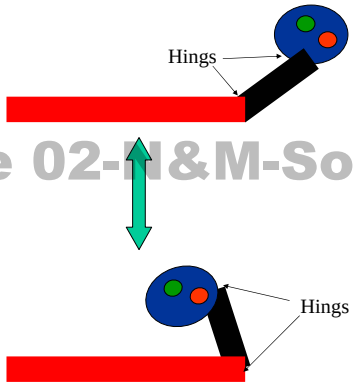
Myosin Molecule structure

Each head contain One ATP binding site and
One Actin binding site

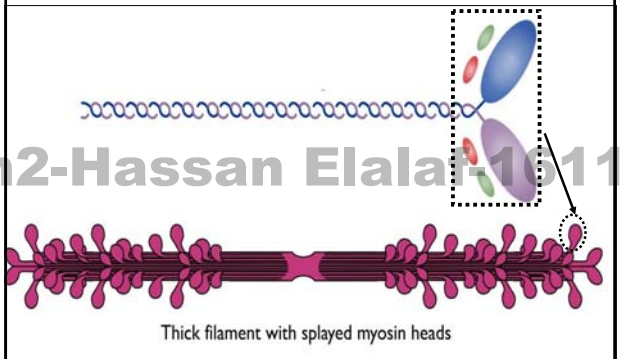
Heads + Arm (neck) = Cross bridge



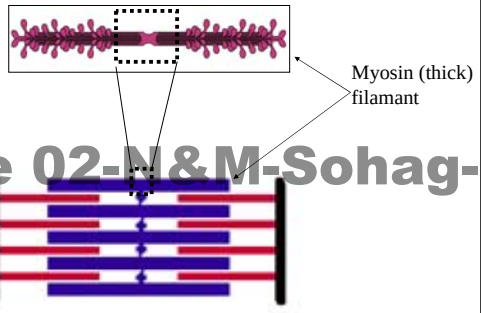
Myosin Molecule structure



Myosin filament

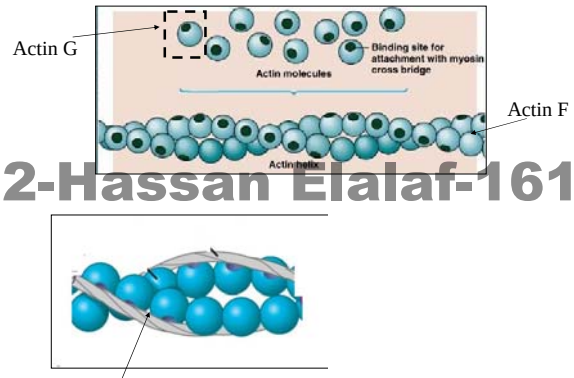


Myosin filament

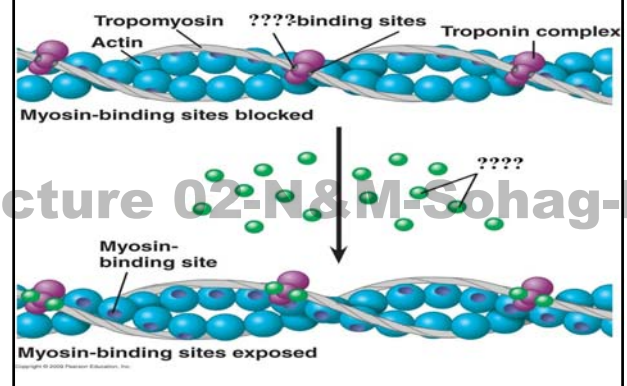


Most central part of the myosin filamant is empty (without heads)!!!???

Actin filament structure



Actin filament structure

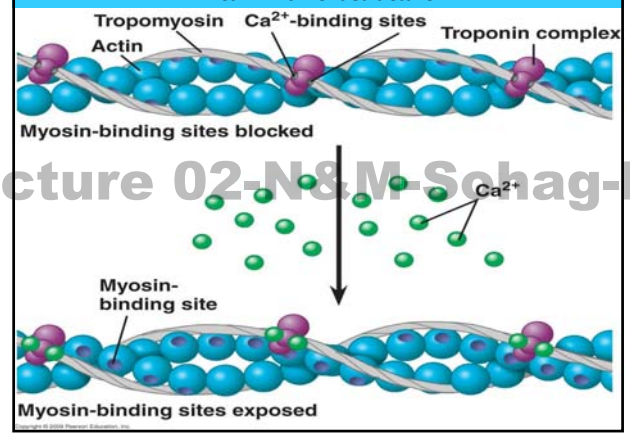


Actin filament structure

Actin filament is composed of,

- Actin F , which contians binding sites with heads of Myosin
- Tropomyosin which block interaction between Head of myosin and its binding site on action molecule if contraction is not needed .
- Troponin ,upon appropriate signal , move tropomyosin away from binding site at actin F so head of myosin can bind

Actin filament structure



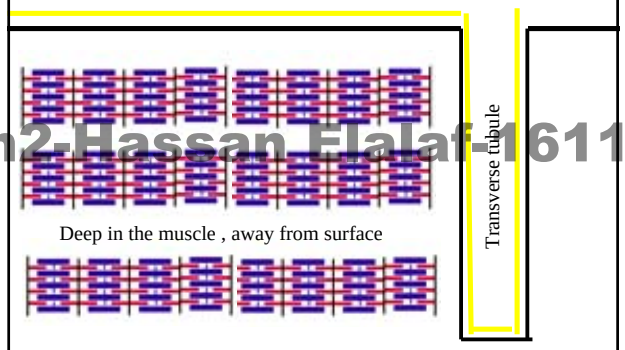
Actin filament structure

Troponin ,is composed of 3 subunits(parts),

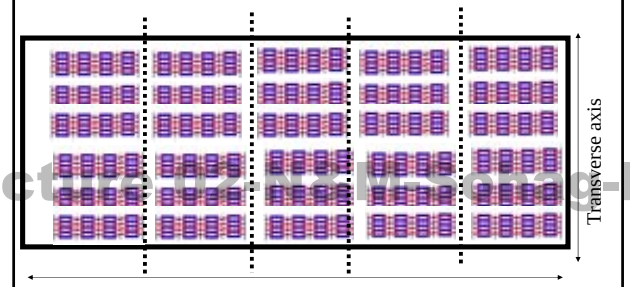
- Troponin I , always bind to Actin
- Troponin T , always bind to Tropomysoin
- Troponin C , binding site for Ca

T –tubules (why)

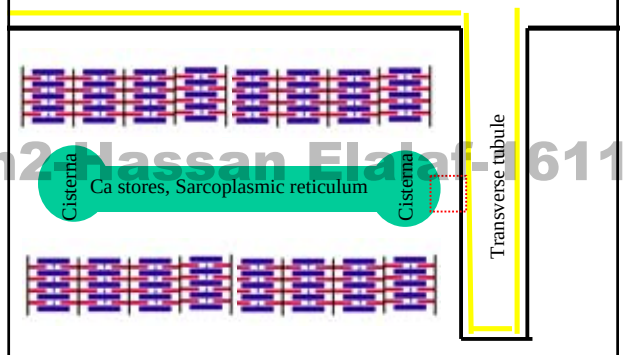
T –tubule (how)



Muscle cell and transverse tubule



T -tubule



Topics of the lecture

A. Types of muscles

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C. Excitation – contraction coupling

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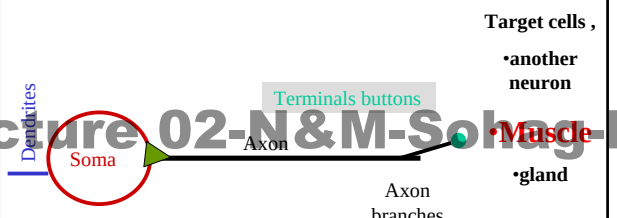
C. How skeletal muscle is controlled

= single muscle fiber = single muscle cell

=single somatic motor neuron

Structure of the neuron (nerve cell)



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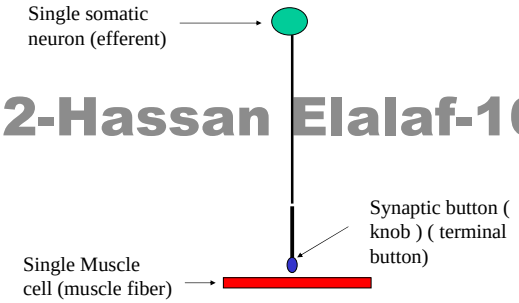
C. How skeletal muscle is controlled



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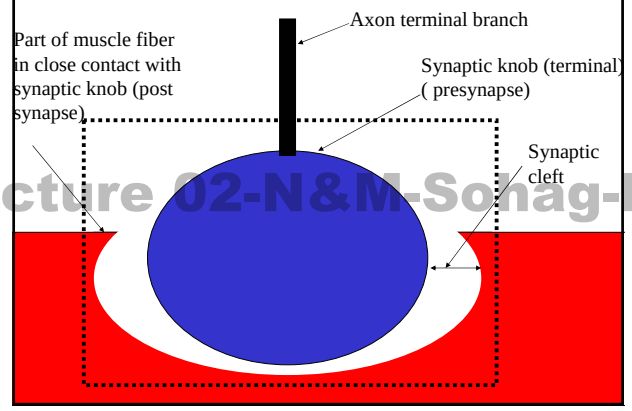
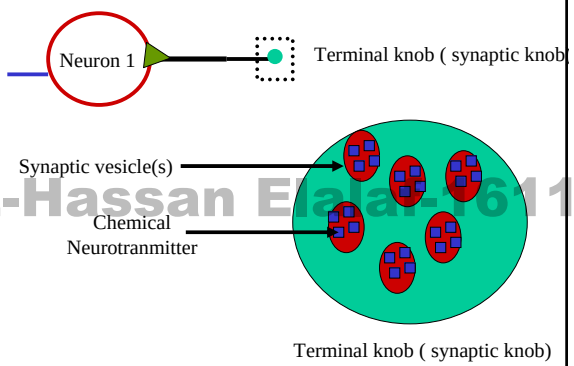
C. Myo-neural junction-(motor end plate) – (Synapse)



Synaptic vesicles



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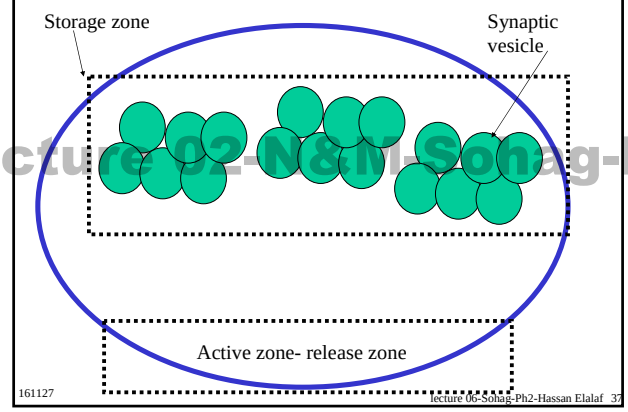
C. Presynapstic Events (at rest)



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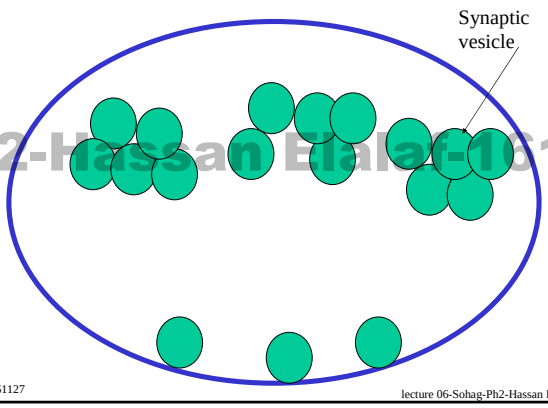
C. Presynapstic Events (with activity)



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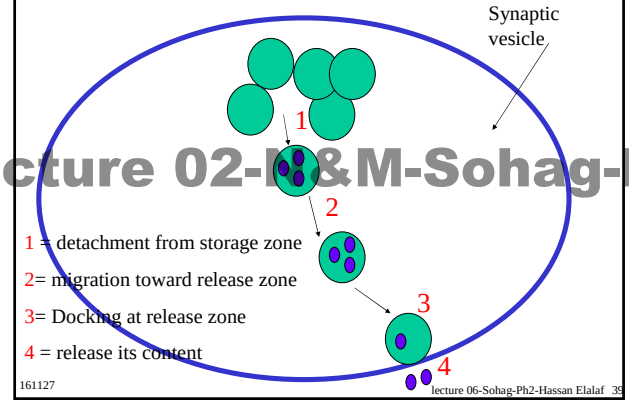
C. Presynapstic Events (with activity)



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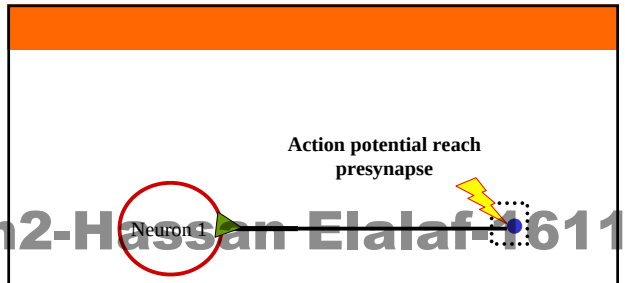

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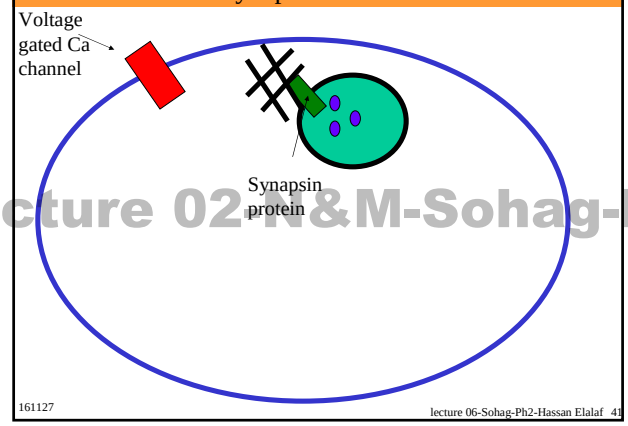
C. Presynapstic Events at rest



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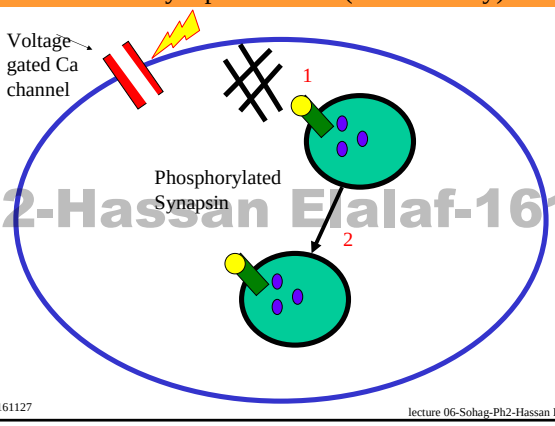
C. Presynapstic Events (with activity)



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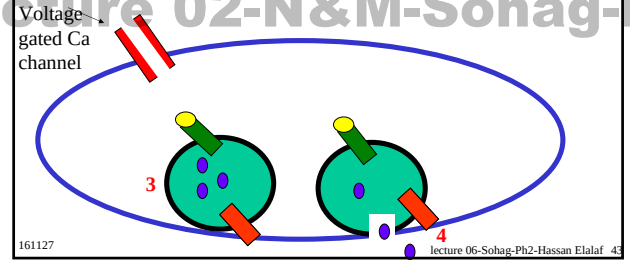
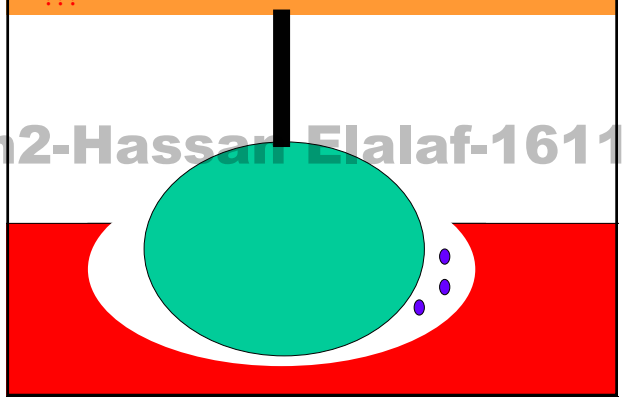
C. Presynapstic Events (with activity)

= synapsin

= synaptotagmin



C. Ach (neurotranmitter pass through cleft to bind to ???



C. Ach (neurotranmitter pass through cleft to bind to ???

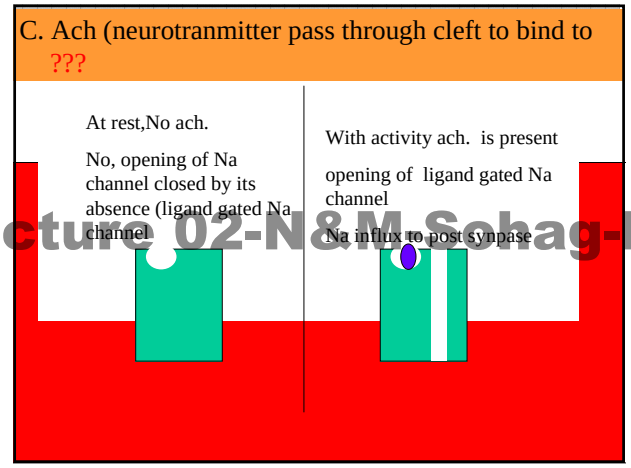
At rest,No ach.

No, opening of Na channel closed by its absence (ligand gated Na channel

With activity ach. is present

opening of ligand gated Na channel

Na influx to post synpase



C. Ach (neurotranmitter pass through cleft to bind to ???

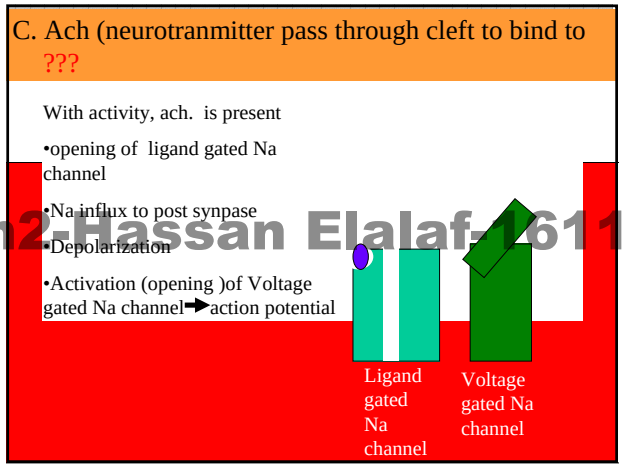
With activity, ach. is present

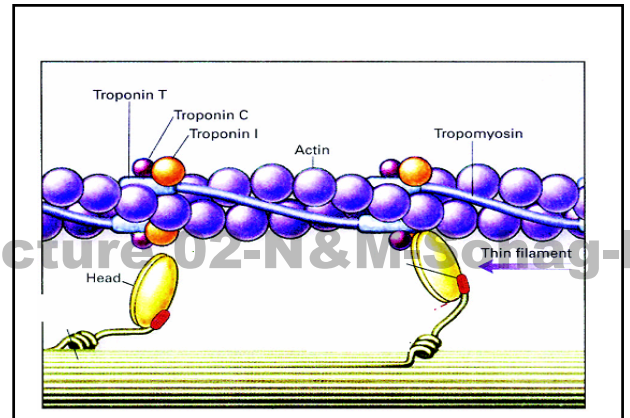
•opening of ligand gated Na channel

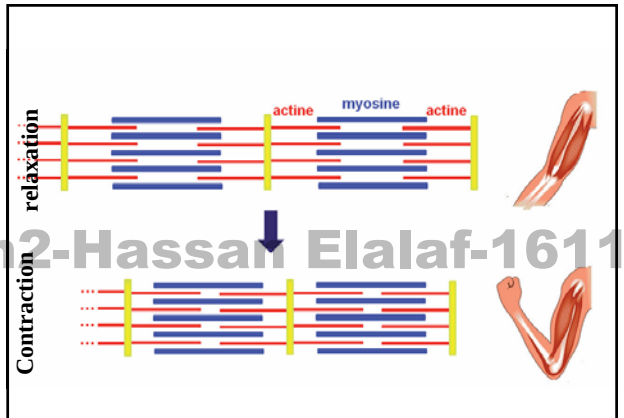
•Na influx to post synpase

•Depolarization

•Activation (opening)of Voltage gated Na channel➡action potential







Thanks,

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