



Physiology Team 432



Sixth Lecture: Neuromuscular Transmission

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REVIEWED BY:

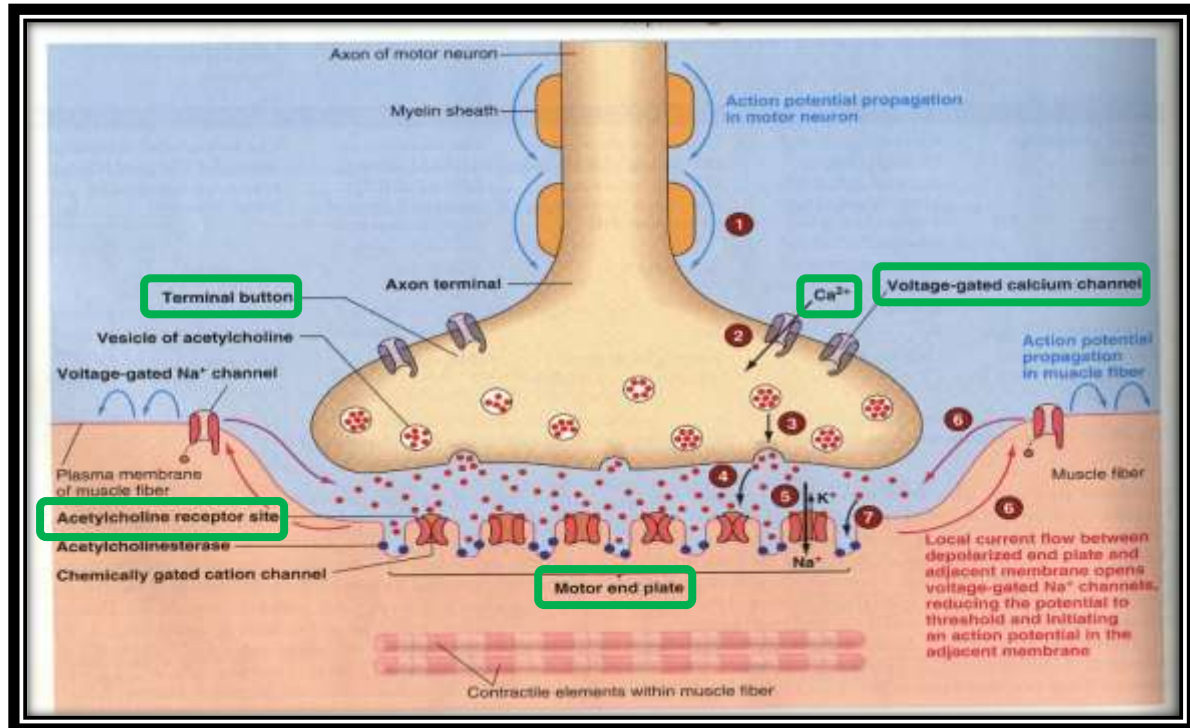
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No Need to study from the slides

Neuromuscular Transmission

(كيف تنتقل الـ AP بين العضلة والعصب)



Steps involved (mechanism)

Action Potential (AP) at the **synaptic knob** (end of the nerve) -----» **Ca channels** open (increase Ca permeability) -----» release of **Acetylcholine (ACh)** from synaptic knob to **synaptic cleft** -----» ACh combines with specific **receptors** on the other membrane (motor end plate) -----» Na permeability increase -----» end plate potential (EPP) develop -----» AP spread on the **membrane** -----» muscle contraction.

فيديو يوضح الآلية باختصار:

- <http://www.youtube.com/watch?v=X-4Yi3CNJC0>
- <http://www.youtube.com/watch?v=ZscXOvDgCmQ>

Synaptic transmission:

Synapse is the junction between two neurones where electrical activity of one neurone is transmitted to the other.

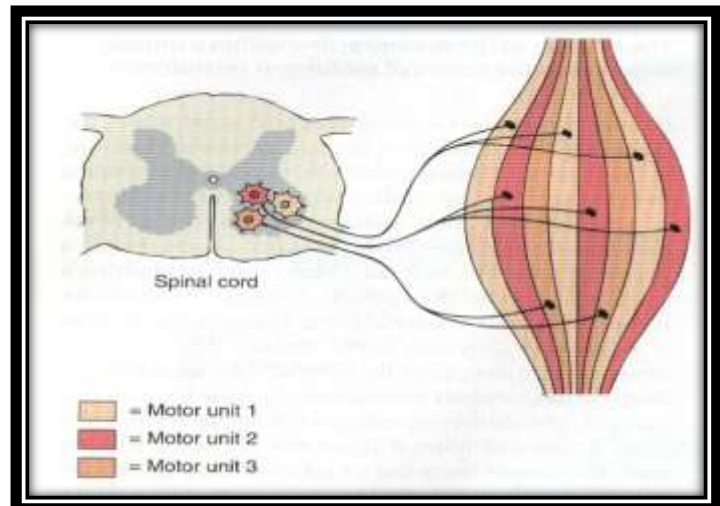
Synaptic → two neurones

Junction → muscles & nerves

Motor Unit

Is the motor neuron and all the muscle fibers it supplies all of these fibers will have the same type (either fast twitch or slow twitch) When a motor unit is activated.

Each neuron is responsible for a specific set of fiber muscles (notice the colors)



Motor unit: anterior horn cell originate from spinal cord supplying muscle fibers

The Neuromuscular junction consists of

Axon Terminal:

Contains around 300,000 vesicles which contain the neurotransmitter acetylcholine (Ach).

Synaptic Cleft:

20 – 30 nm (nanometers) space between the axon terminal & the muscle cell membrane. It contains the enzyme cholinesterase which can destroy Ach.

Acetylcholine:

- Ach is synthesized locally in the cytoplasm of the nerve terminal, from active **acetate** (acetylcoenzyme A) and choline.
- Then it is rapidly absorbed into the synaptic vesicles and stored there.
- The synaptic vesicles themselves are made by the **Golgi** Apparatus in the nerve soma (cell-body).
- Then they are carried by **Axoplasmic Transport** to the nerve terminal, which contains around 300,000 vesicles.
- Each vesicle is then filled with around 10,000 Ach molecules.

Related more to Pharmacology

Important to know

***Axoplasmic transport**, also called axonal transport, is a cellular process responsible for movement of mitochondria, lipids synaptic vesicles, proteins and other cell parts.

***acetate** is a derivative of acetic acid. This term includes salts and esters.

***Golgi** transport of lipids around the cell.

Neuromuscular transmission: Transmission of impulse from nerve to muscle (neuromuscular junction).

Notes

- الـ nerve fiber تكون وسيعة من تحت (button) والـ muscle fiber يصير فيها انخفاض (depression plate).
- الـ Ach يصنع في الـ nerve terminal بخطوات معينة ويحفظ داخل vesicles ويصنع بكميات كبيرة أكثر من اللازم، فلما تنتهي العضلة من الـ contraction يصير له break down بواسطة انزيم Achsterase .
- لما يوصل الـ AP للـ nerve terminal راح يعمل opening لقنوات الكالسيوم الموجودة عليه ويزيد تركيز Ca فيدخل من ECF الى ICF ويسوي stimulation للـ Ach فيطلع من الـ vesicles الى synaptic cleft .
- Ach يعمل binding مع الـ receptor الموجود على motor end plate مما يؤدي لانتقال الـ AP للـ muscle fiber ويحدث الـ **Muscle Contraction** .

GOOD LUCK