Electrical conduction

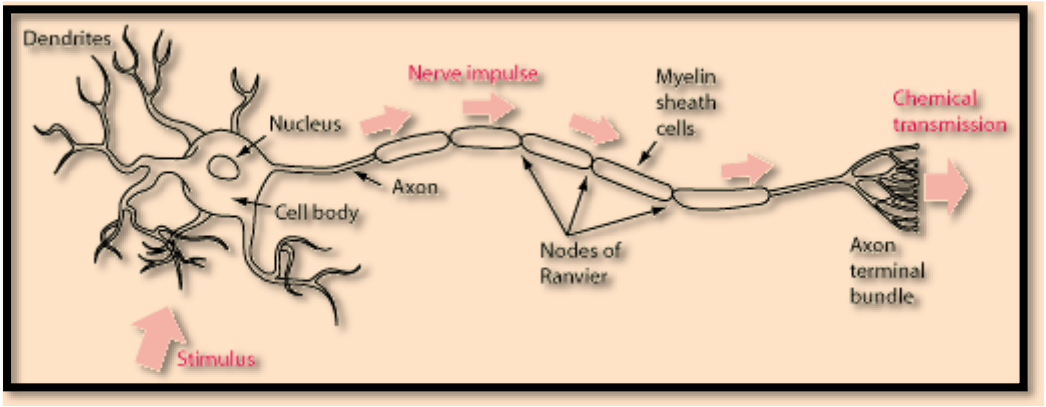
Electrical conduction is the movement of electrically charged particles through a transmission medium (electrical conductor). The movement of charge constitutes an electric current.

Electrical conduction in the human body:

AN ELECTRICAL AND CHEMICAL MACHINE in brain: The brain consists of about 100 billion cells. Most of these cells are called neurons. The brain can be divided into three separate areas that are the Cerebrumالمخ, the Cerebellumالمخيخ and the Brain Stemجذع الدماغ.

The nervous system is made up of cells called **neurons الخاليا العصبيه** and it is through these neurons that your body communicates. Read about each of the parts that make up a neuron because this will help you better understand how neurons communicate information throughout your body. A neuron is basically an on/off switch just like the one you use to control the lights in your home.

Nerve Cell



Structure	Function
Cell body	The cell body is the location where the cell's nucleus and most of the cell's organelles العضيات can be found.
Nucleus	The nucleus is the site where the cell's DNA is located.
Dendrites	Dendrites are structures that extend from the cell body. They receive information from other cells and carry the information towards the cell body.
Axon	The axon is a long membrane covered structure that extends and

Nerve cell function:

- Sensory nerves, which carries the message to brain.

- Allows us to react to a stimulus.
- They conduct electrical impulses away from the neuron's cell body.
- It carries messages from other neurons to a cell body.

A receptor cell receives the stimulus and this generates electrical activity in a neighboring nerve cell. The afferent or sensory neuron conducts a specific effector system, which may be a muscle or a gland.

The dendrites serve as the stimulus receptors for the neuron, but they respond to a number of different types of stimuli. The neurons in the optic nerve العصب البصري respond to electrical stimuli sent by the cells of the retina شبكية العين.

EEG :An electroencephalogram (EEG) is a test to measure the electrical activity of the brain. The Electroencephalograph does not record the activity of single neurons but records the gross electrical activity between two electrodes placed on the scalp فروة الراس of a participant.

Flat metal disks called electrodes are placed all over your scalp. The disks are held in place with a sticky paste. The electrodes are connected by wires to a speaker and recording machine.

The recording machine changes the electrical signals into patterns that can be seen on a computer. It looks like a bunch of wavy lines.

You will need to lie still during the test with your eyes closed because movement can change the results. But, you may be asked to do certain things during the test, such as breathe fast and deeply for several minutes or look at a bright flashing light.

How to Prepare for the Test

Wash your hair the night before the test. Do not use any oils, sprays, or conditioner on your hair before this test. If you have a hair weave, you may want to ask your doctor or nurse for special instructions تعليمات.

Your health care provider may want you to stop taking certain medications دواء before the test. Do not change or stop taking medications without first talking to your health care provider. Bring a list of your medications with you.

Avoid all food and drinks containing caffeine for 8 hours before the test.

Why the Test is Performed

EEG is used to look at your brain activity. It can help diagnose seizures. It may also be used to diagnose or monitor the following health conditions:

- Abnormal changes in body chemistry that affect the brain
- Brain diseases such as Alzheimer's disease
- Confusion اضرابات
- Head injuries
- Infections
- Tumors(االورام).

- Evaluate problems with sleep (sleep disorders)
- Monitor the brain during brain surgery.

Normal Results

Brain electrical activity has a certain number of waves per second (frequencies) that are normal for different levels of alertness. For example, brain waves are faster when you are awake, and slower when you are sleeping.

There are also normal patterns to these waves.

Deep الابداعي النخيل visualization ,creative الهدوءCalm الوعي Consciousness a. النوم بال احالم sleep Dreamless العميق الاسترخاء relaxation.

Electrical in the heart:

The heart's electrical signal is produced by a tiny structure known as the *sinus node*, which is located in the upper portion of the right atrium. From the sinus node, the electrical signal spreads across the right atrium and the left atrium, causing both atria to contract, and to push their load of blood into the right and left ventricles. The electrical signal then passes through the *AV node* to the ventricles, where it causes the ventricles to contract in turn.

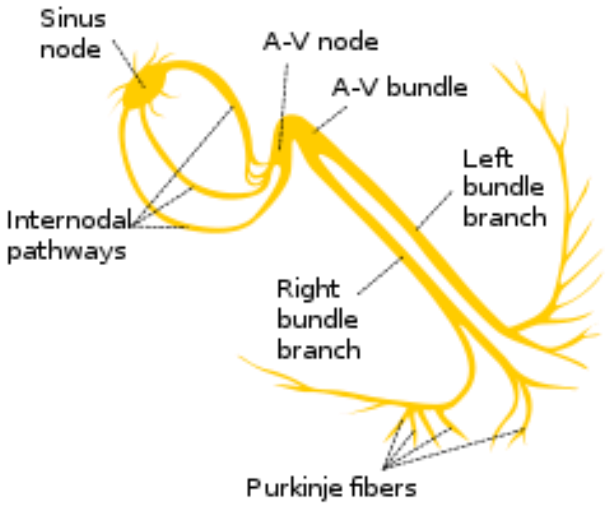
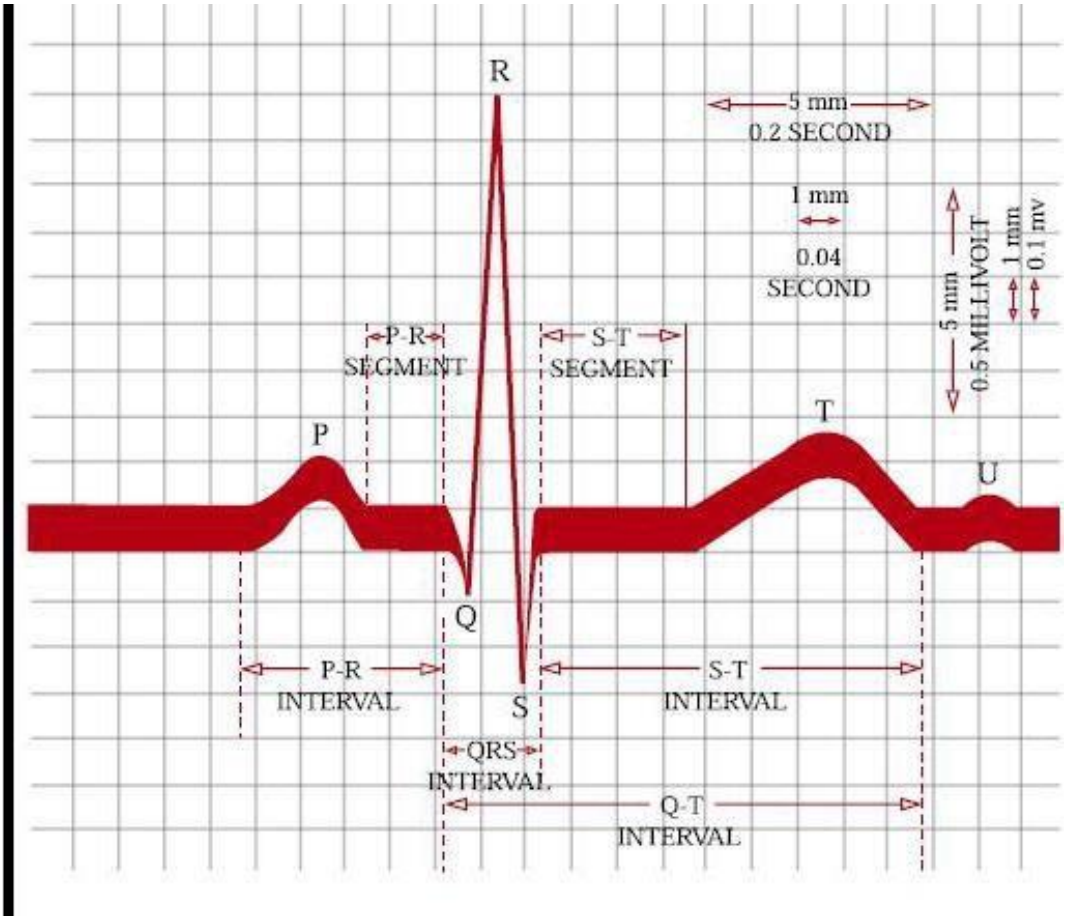


Fig. shows (Electrical conduction of the heart)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The Electrical in skeletal muscles:

Muscle is a soft tissue , Muscle cells contain protein filamentsخيوط of actin and myosin that slide past one another, producing a contraction that changes both the length and the shape of the cell. Muscles function to produce force and motion. They are primarily responsible for maintaining and changing posture, locomotion,الوضع والتحرك as well as movement of internal organs, such as the contraction of the heart and the movement of food through the digestive system .

A muscle is a bundle of many cells called **fibers**. You can think of muscle fibers as long **cylinders**, and compared to other cells in your body, muscle fibers are quite big. They are from about 1 to 40 microns long and 10 to 100 microns in diameter.

A muscle fiber contains many **myofibrils**الليفات العضلية, which are cylinders of muscle proteins. These proteins allow a muscle cell to contract. Myofibrils contain two types of **filaments** that run along the long axis of the fiber, and these filaments are arranged in **hexagonal** سداسي االضالع patterns. There are thick and thin filaments. Each thick filament is surrounded by six thin filaments.

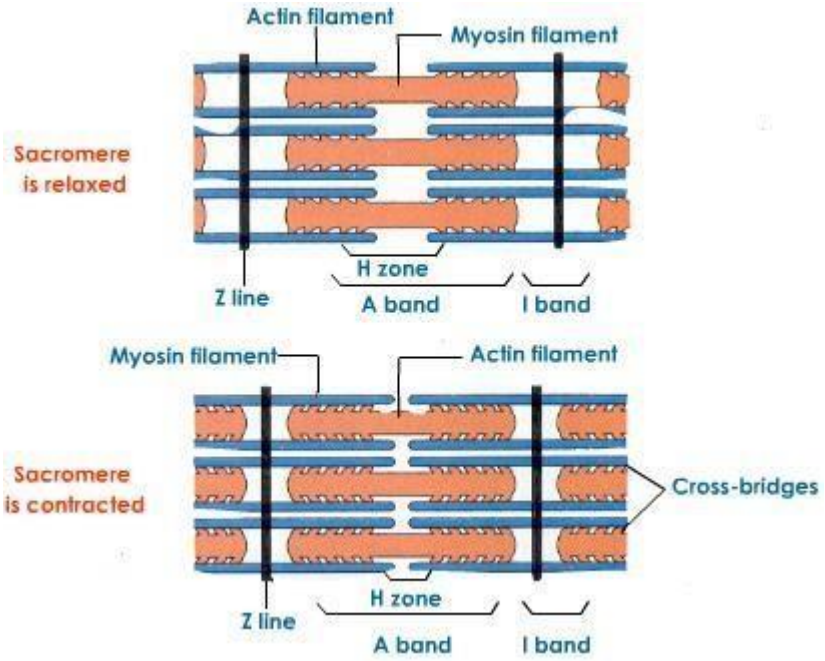
The basic action of any muscle is **contraction**. For example, when you think about moving your arm using your biceps muscleعضلة ذات الراسين, your brain sends a signal down a nerve cell telling your biceps muscle to contract. The amount of force that the muscle creates varies -- the muscle can contract a little or a lot depending on the signal that the nerve sends.

Muscle fiber contains:

- **Myofibril:** A cylindrical organelleعضية running the length of the muscle fibre, containing Actin and Myosin filaments.
- **Sarcomere**القطعة العضلية The functional unit of the Myofibril, divided into I, A and H bands.
- **Actin**: A thin, contractile protein filament, containing 'active' or 'binding' sites.which bind with Ca
- **Myosin**: A thick, contractile protein filament, with protusionsنتوءات known as Myosin Heads.which bind with Mg
- **Tropomyosin:** An actin-binding protein which regulates muscle contraction.
- **Troponin:** A complex of three proteins, attached to Tropomyosin.

Mechanism of Muscle Contraction

- During muscle contraction, the laterally projecting heads (cross bridges) of the thick myosin myofilaments come in contact with the thin actin myofilaments and rotate on them. This pulls the thin myofilaments towards the middle of the sarcomere past the thick myofilaments. The Z lines come closer together and the sarcomere becomes shorter. Length of the A band remains constant. Myofilaments stay the same length. Free end of actin myofilaments move closer to the centre of the sarcomere, bringing Z lines closer together. I bands shorten and H zone narrows. A similar action in all the sarcomeres results in shortening of the entire myofibril, and thereby of the whole fibre and the whole muscle. A contracted muscle becomes shorter and thicker and its volume remains the same.



- **The energy for the muscular contraction**

- The energy for the muscular contraction is provided by the conversion of adenosine triphosphate (ATP) into adenosine diphosphate(ADP) and inorganic phosphate, releasing energy. A enzyme myosin ATP as catalyst the reaction in the presence of Ca^{2+} and Mg^{2+} ions

Electromyography (**EMG**) is a technique for evaluating and recording the electrical activity produced by skeletal muscles.

<u>Electromyography</u> is a test that measures and records the activity of contracting muscles in response to electrical stimulation. It checks the health of the muscles and the nerves that control the muscles.

When a muscle is contracted, a small electric potential is produced. Surface electrodes can sense this muscle activity potential when placed over the muscle. The signal detected by the electrodes is amplified and recorded with instrumentation, and is known as the EMG.

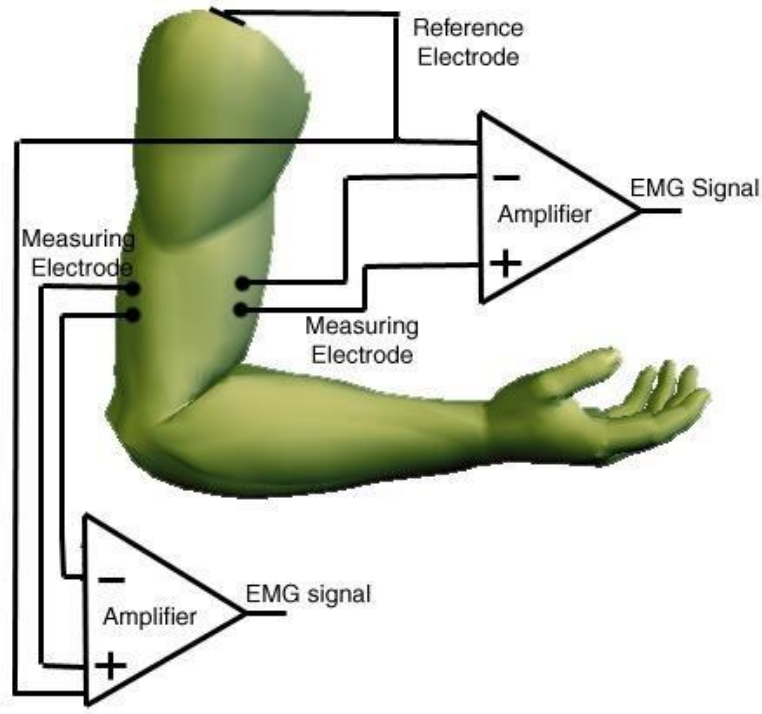
Why is an EMG test done?

The EMG helps to distinguish between muscle conditions in which the problem begins in the muscle and muscle weakness due to nerve disorders. EMGs can also be used to isolate the level of nerve irritationتهيج االعصاب.

How is an intramuscular EMG done?

A needle is inserted through the skin into the muscle. The electrical activity is detected by this needle (which serves as an electrode). The activity is displayed visually on an oscilloscope .Since skeletal muscles are often large, several needle electrodes may need to be placed at various locations to obtain an informative EMG. After placement of the electrode(s), the patient may be asked to contract the muscle (for example, to bend the leg).

The presence, size, and shape of the wave form (the action potential) produced on the oscilloscope provide information about the ability of the muscle to respond to nervous stimulation. Each muscle fiber that contracts produces an action potential. The size of the muscle fiber affects the rate and the size (the amplitude) of the action potential.



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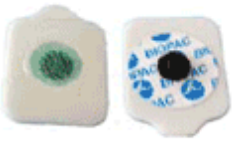

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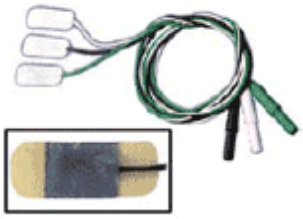

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