

Lesson Plan

NEUROHEADWAY

Neuroscience Into Education

Lesson plan outlines **BRAIN, SPINAL CORD, MOVEMENT BASICS**

Lesson objective	Introduction	Main activity	Reflection	Success criteria
I. The basics of movement	Explain that motor behavior is facilitated by muscles and neurons that control them. Explain that motor neurons are located in the CNS and PNS, and that they form synapses with muscles. Explain how motor neurons order muscles to contract when a person bends his/her arm.	FEEL YOUR MUSCLES MOVE and DESCRIBE THE CHAIN OF COMMAND (older kids)	The foundation of movement is that neurons and muscles work together. Muscle movement is the result of a hierarchical propagation of signals emanating from the brain. To bend the arm, several muscles have to contract and pull the bones.	Know that motor neurons control muscle movement. Know that the signal "move" is generated in the brain, propagated to the spinal cord and finally ends at the muscles. Know that muscles pull bones when someone bends the arm.
II. Reflex	Explain that some motor behaviors are controlled by the spinal cord, among those the knee jerk reflex. Explain knee jerk reflex.	TEST YOUR KNEE JERK REFLEX	A reflex such as the knee jerk reflex is generated in the spinal cord. The brain is not involved in this type of motor behavior.	Know the knee jerk reflex and that it is the spinal cord not the brain that controls it.
III. Motor areas	Explain that motor cortex, cerebellum and basal ganglia are motor areas in the brain and that they communicate with each other. Explain the functions of cerebellum, basal ganglia and motor cortex. Explain the reflex-like behavior in response to a nociceptive stimulus	TEST YOUR CEREBELLUM TEST THE EYE BLINK REFLEX OF THE STUDENTS (SURPRISE TEST)	The brain harbors several areas that control movement. Among those the motor cortex control voluntary movement. A reflex in response to a painful stimulus involves the brain.	Know that the brain has several motor areas and that the motor cortex is the most important one for voluntary movement. Know that reflex-like behavior in response to painful stimuli is generated in the brain.
IV. When muscles fail to work	Explain that muscles can be deliberately paralyzed. Explain that spinal cord injury can result in paralysis. Explain the motor neuron disease ALS.		Muscles can be paralyzed by specific toxins such as botulinum toxin (botox). Injuries of the spinal cord and motor neuron diseases including ALS lead to muscle weakness and paralysis.	Know that botox is a powerful poison that paralyzes the muscles. Know that accidents and diseases can have detrimental effects on movement.

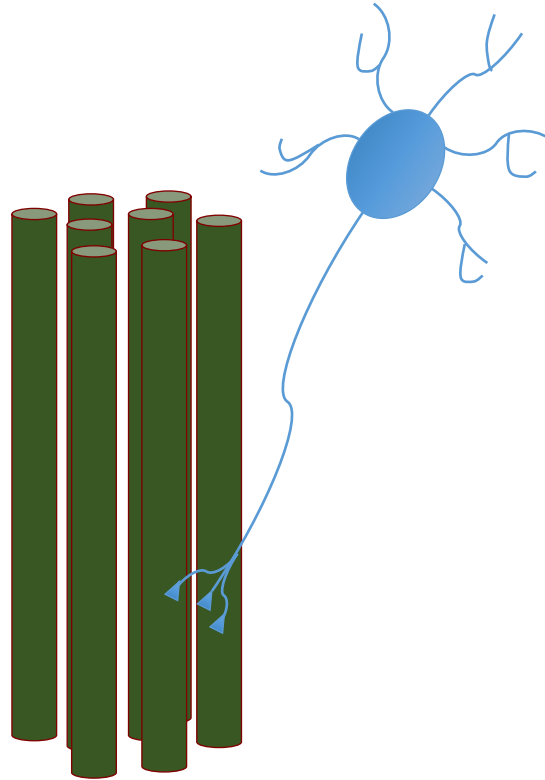
Power point Example

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At the core of movement are neurons that give orders to muscles

You can think of it as orders given by military members!



Sergeant Neuron:

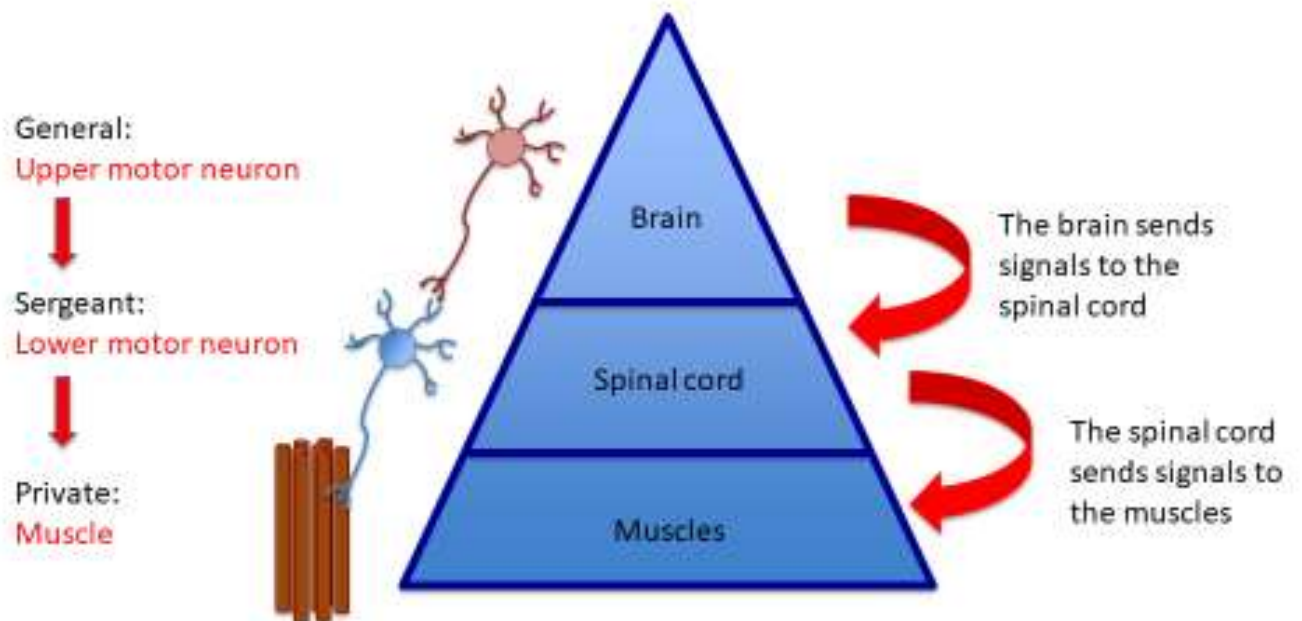
When I tell you to
move, you move!



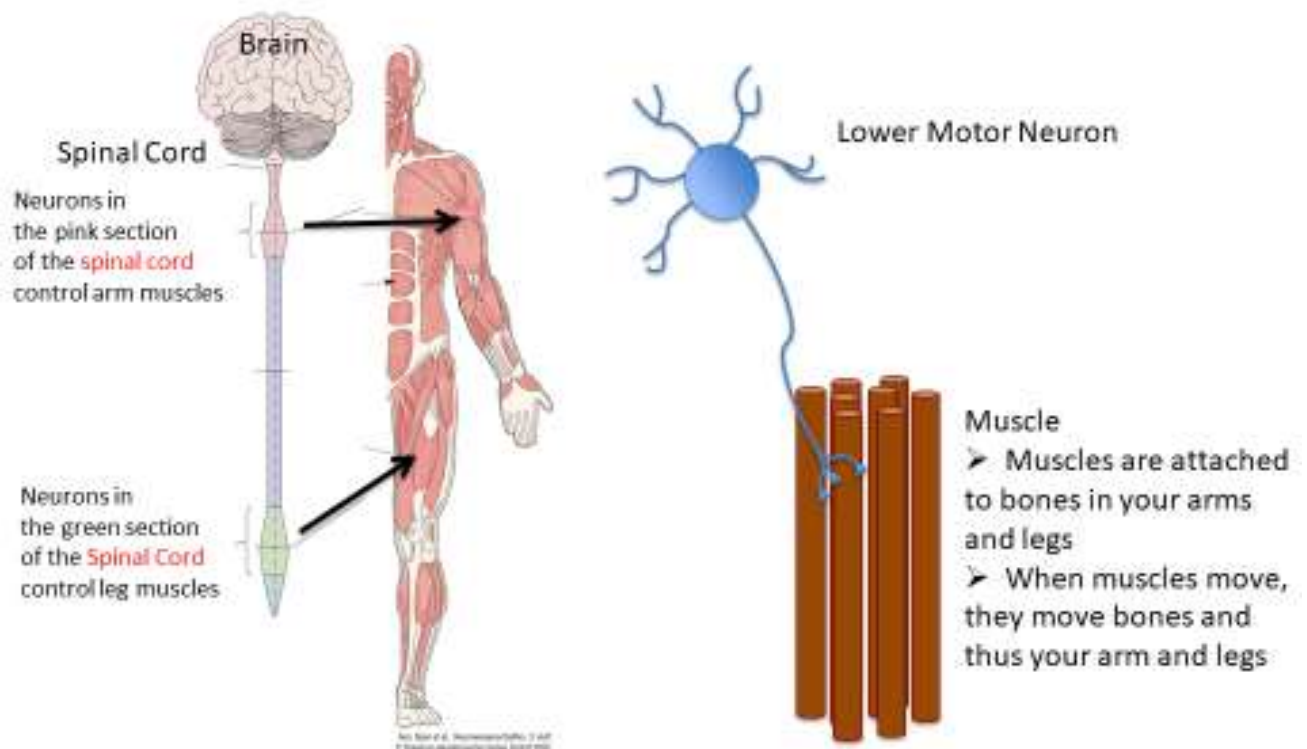
Private Muscle:

Yes, Sir!

Just like the chain of command in the military, there is a hierarchy when it comes to the coordination of movement

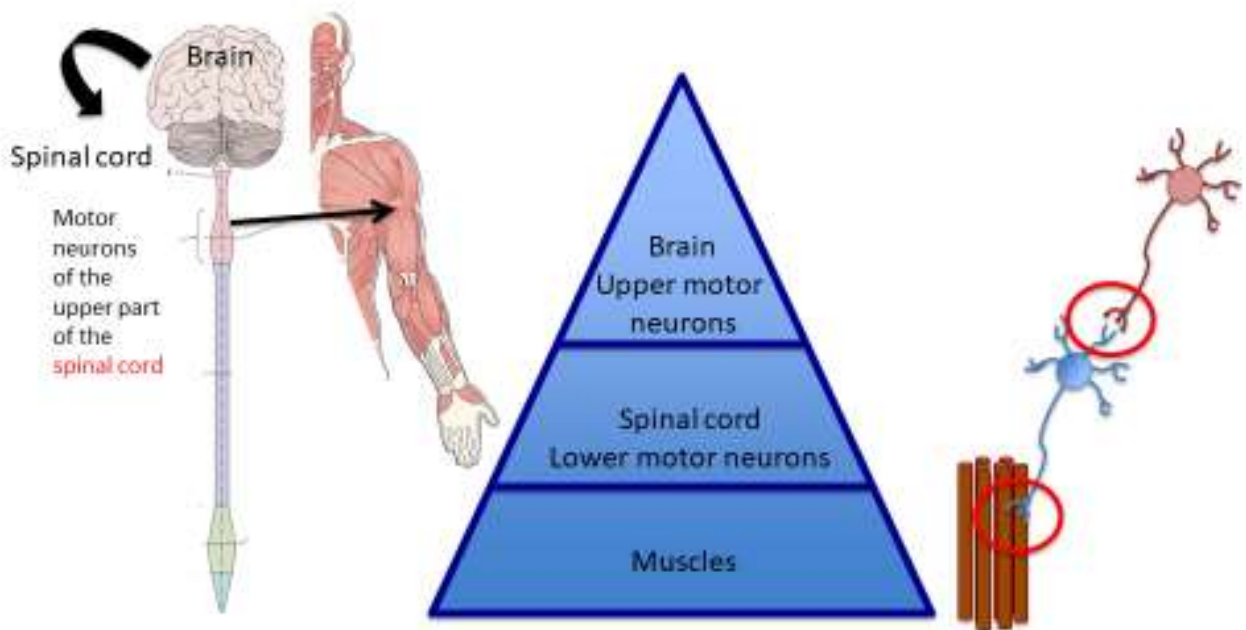


Let's have a look at how motor neurons in the spinal cord work: Lower motor neurons



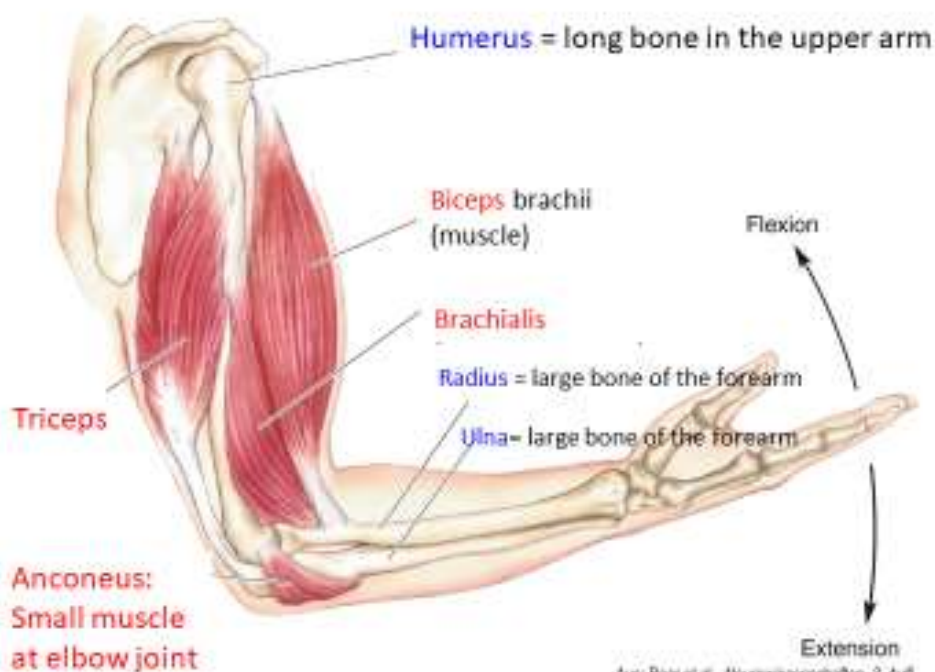
Bear, Neuroscience

Let's check out how upper motor neurons, lower motor neurons and muscles work together when you e.g. bend your arm



Older Kids

At a closer look, it is a complicated mechanism that makes your arm bend



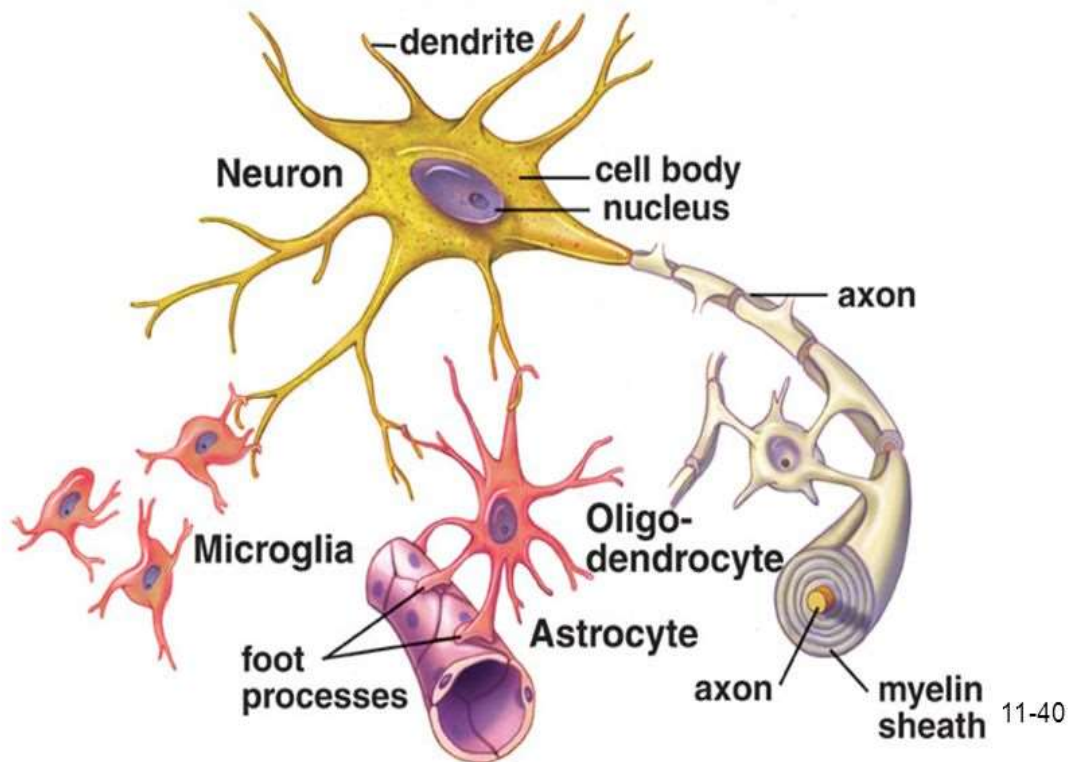
- Movement that bends your arm is called **FLEXION**
- Movement that straightens your arm is called **EXTENSION**
- **Muscles always pull, they cannot push!**

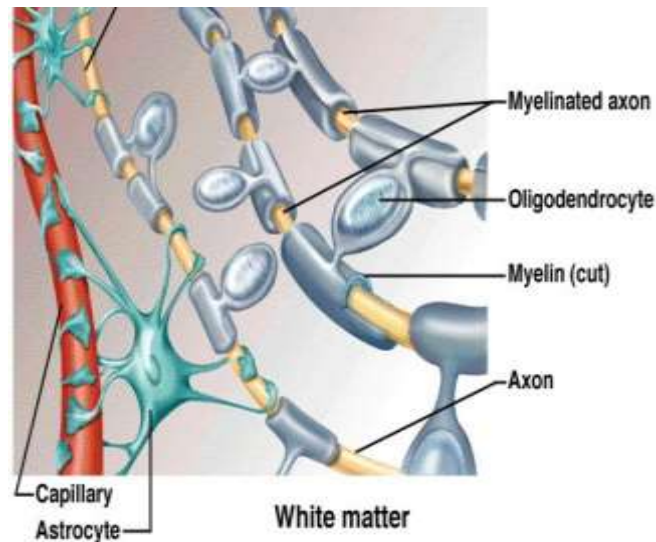
Aus: Biel et al., Neurowissenschaften, 3. Aufl.
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Teachers Evaluation and Handouts

A neuron and some types of neuroglia

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The frozen face



- To fight wrinkles, famous (and many not so famous) people think that Botox is a great idea!
- What's behind Botox?
- Botox (= botulinum toxin) is a powerful poison.
- 1 g is sufficient to kill 100,000 people (it is a bioweapon!!!), a teaspoon of sugar is approx 5g!!!



- The toxin is produced by a bacterium (the scientific name is :Clostridium botulinum) that grows on food that is not canned properly (beware of bulging cans!!!)
- The toxin causes overall weakness of muscles and trouble breathing, seeing and speaking
- For a Botox wrinkle treatment, the tiniest amounts are sufficient to paralyze the muscles.