Nerves as Information Pathways

by Sophia

WHAT'S COVERED

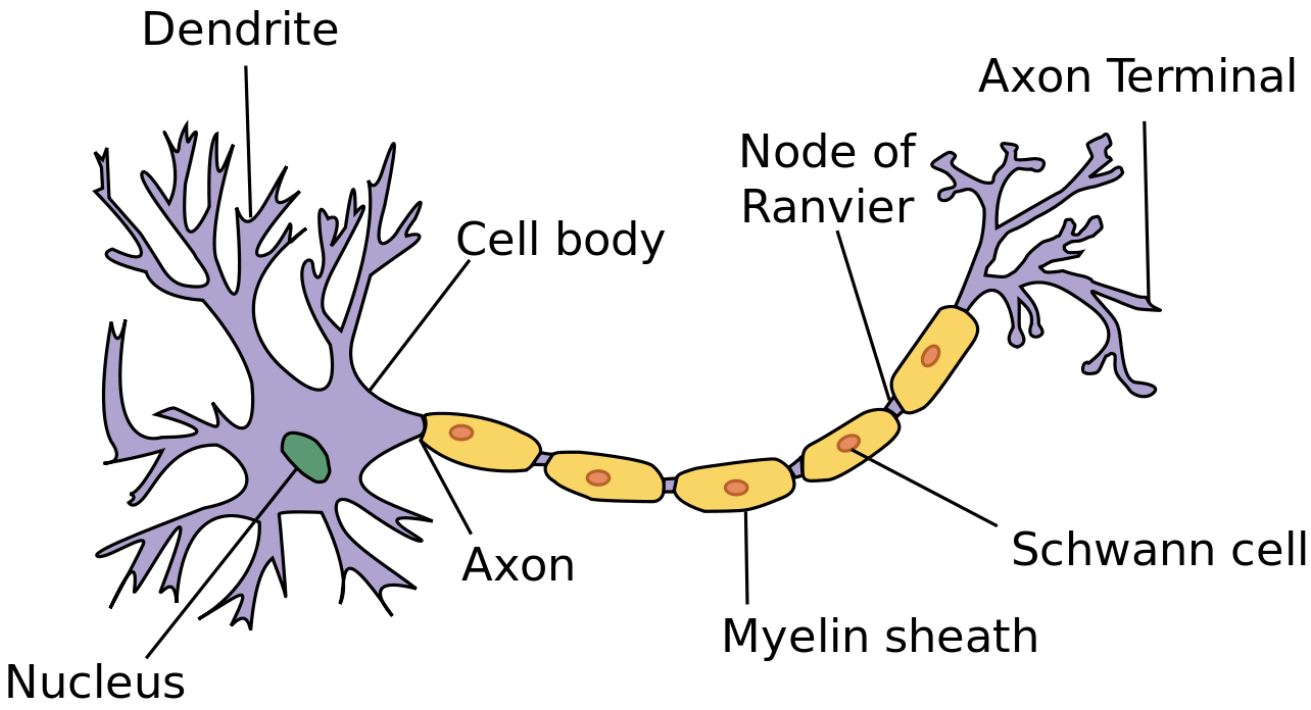
In this lesson, you will learn about the structure of a nerve as well as reflexes as the simplest nerve pathways. Specifically, this lesson will cover:

1. Nerve Structure

Nerves are basically just bundles of nerve fibers. Nerve fibers are the long axons of either a sensory or a motor neuron. Each axon of these sensory or motor neurons is surrounded by something called a **myelin sheath**.

In the illustration below, you see a neuron with its axon wrapped in several blue cells. These are glial cells; where most cells are roughly ball-shaped, glial cells are more like flattened sheets that wind around the axon like scrolls.

A myelin sheath covers the axon of this nerve, allowing action potentials to propagate faster. The myelin sheath is made of something called glial cells. These cells allow these action potentials to happen much faster than they would otherwise.



Because myelin sheaths are made mostly of the flattened glial cells' plasma membrane, they are mostly made of non-polar, hydrophobic (water-repelling) lipids of the plasma membrane's phospholipid bilayer. Lipids don't just repel water—they repel anything with an electrical charge (such as an electron: The "e-" in the picture). Thus, the myelin sheaths act as insulators surrounding the axon, which we can think of as an electrically-conductive wire. Because insulators repel charges, as the action potential flows down the length of the axon, the electrons will jump over the myelin sheaths, making them move faster than if they just strolled down the naked axon. Think of it like this: when myelin sheaths are present, an action potential moves like an Olympic hurdler; when myelin sheaths are not present, the action potential moves like it's strolling down the street.

Myelin sheaths are present around the axons of neurons all over the nervous system, but their structure is slightly different depending on where they are located. In the brain and spinal cord (the **central nervous system**), glial cells, called oligodendrocytes form the myelin sheath. In the rest of the nervous system (the **peripheral nervous system**), glial cells called **Schwann cells** form the myelin sheath. So they're a little bit different, but basically their structure is similar, allowing these action potentials to propagate much more quickly.

DID YOU KNOW

Action potentials can actually travel up to 400 feet per second thanks to these myelin sheaths made of glial cells.

TERMS TO KNOW

Nerve
A bundle of axons of neurons.

Myelin Sheath
An insulating layer that surrounds axons neurons in the nervous system and allows action potentials to propagate more quickly.

Central Nervous System (CNS)
Division of the nervous system that consists of the brain and spinal cord; is the processing center of the body, and contains interneurons.

Peripheral Nervous System (PNS)
Division of the nervous system that sends signals to and from the central nervous system and contains sensory and motor neurons.

Schwann Cells
The glial cells that compose the myelin sheath in the peripheral nervous system.

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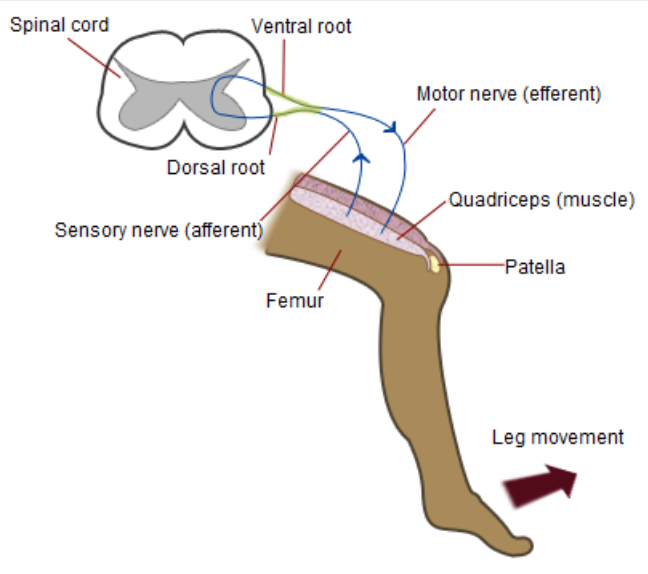
2. Reflexes

Reflexes are the simplest nerve pathway and are an automatic movement as a result of a stimulus, so it doesn't take conscious effort for a reflex to occur.

Reflexes can involve interneurons, or sometimes a motor neuron will synapse directly with a sensory neuron. A very simple reflex just involves sensory neurons and motor neuron synapsing with each other. However, most interactions involve an interneuron.

IN CONTEXT

Think about the patellar reflex arc as an example of a very simple reflex. If you've ever been to the doctor before, they may have tapped your knee with that little rubber mallet and it makes your foot kick upward.



When that mallet strikes your knee, it will strike the patellar tendon and that causes muscle spindles in your quad to stretch. Then, a signal will travel toward your spinal cord via a sensory neuron, and then in your spinal cord, it's going to synapse directly with a motor neuron. That motor neuron is going to carry that information back to your quadriceps muscle, triggering a contraction, and causing your leg to kick upward.

Sensory neuron, in this case, doesn't involve an interneuron. It is synapsing directly on a motor neuron with no interaction with an interneuron. This makes the patellar reflex a very simple reflex.

TERM TO KNOW

Reflex

An automatic movement of the body that occurs as a response to stimuli.

SUMMARY

This lesson has been an overview of the **nerve structure** and how **reflexes** cause nerves to work as information pathways. You also learned how action potentials will jump from one unsheathed node to another, allowing new action potentials to happen and how the myelin sheath helps speed up the action potential process.

Keep up the learning and have a great day!

Source: THIS WORK IS ADAPTED FROM SOPHIA AUTHOR AMANDA SODERLIND

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TERMS TO KNOW

Central Nervous System (CNS)
Division of the nervous system that consists of the brain and spinal cord, is the processing center of the body, and contains interneurons

Myelin Sheath
Each neuron's axon is surrounded at several intervals by a cell that acts as insulation. This cellular insulation is called a myelin sheath, and it helps action potentials travel faster down the length of the axon.

Nerve
A bundle of axons of neurons.

Peripheral Nervous System
Division of the nervous system that sends signals to and from the central nervous system and contains sensory and motor neurons

Reflex
An automatic movement of the body that occurs as a response to stimuli.

Schwann Cells
The glial cells that compose the myelin sheath in the peripheral nervous system.