

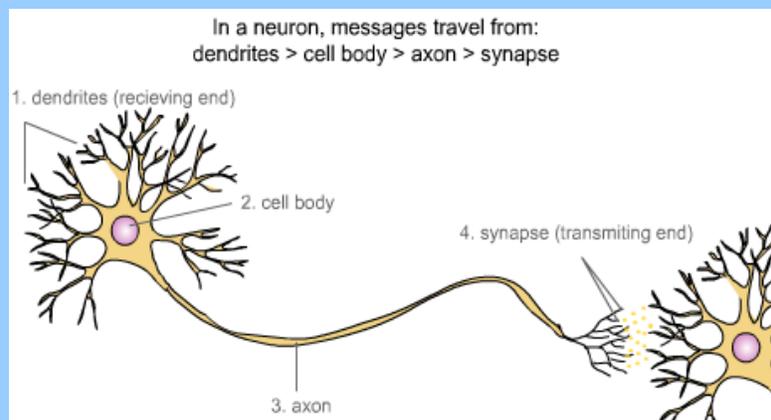
What is Your Reaction Time?

What is it?

Our nervous system is the control center for our body. It is about senses and action. Our senses detect changes in our environment and send messages to the brain to tell the body how to respond. Sensory neurons (nerve cells) carry information to our brain and motor neurons carry messages away from our brain and to our muscles.

This communication between our brain and body is happening constantly. We are able to sense what is happening in our surroundings and do something in reaction to it. For example, if we see a skateboarder coming towards us, our brain can figure that the skater might hit us, and our brain will tell our muscles to jump out of the way. Our senses acted.

Our brain and the neurons in our body are part of our nervous system. Neurons extend from our brain like branches of a tree. Fingertips are like the outermost twigs.



Conversation starters / Dialogue samples

- **How many nerve cells are in the brain?**
It is estimated that there are 100 billion (100,000,000,000) neurons (nerve cells) in the human brain.
- **How does your brain communicate with the body?**
Different parts of the brain do different things. Your body's senses take in information and your brain decides how to react. Your eyes may take in light, but your brain interprets what you see.
- **How do nerves pass along messages to and from the brain?**
When a neuron is stimulated, by heat, cold, touch, or some other message, it actually generates a tiny electrical impulse that travels from cell to cell.
- **How fast does information travel to and from our brain and through our nerves?**
Information travels at different speeds within different types of neurons (nerve cells). Signals can travel as slow as about 1 mph or as fast as about 268 mph.
- **How many nerve impulses can be sent each second?**
Nerve cells can transmit 1,000 nerve impulses per second

Deeper Content

Axon – a long, single nerve fiber that transmits messages, via chemical and electrical impulses, from the body of a neuron to dendrites of other neurons, or directly to body tissues such as muscles.

Ions: Atoms or groups of atoms carrying a negative or positive charge of electricity. When a nerve impulse is fired, ions flow through channels in the membrane of a nerve cell, changing the charge in that local area of the cell to positive from its resting, negatively charged state. This sets off a chain reaction of positive charges that carries the nerve impulse along the cell's axon to the synapse, where it releases neurotransmitters into the synaptic cleft.

Dendrite: Short nerve fibers that project from a nerve cell, generally receiving messages from the axons of other neurons and relaying them to the cell's nucleus.

Myelin: The fatty substance that sheaths most nerve cell axons, helping to insulate and protect the nerve fiber and helping to speed up the transmission of nerve impulses.

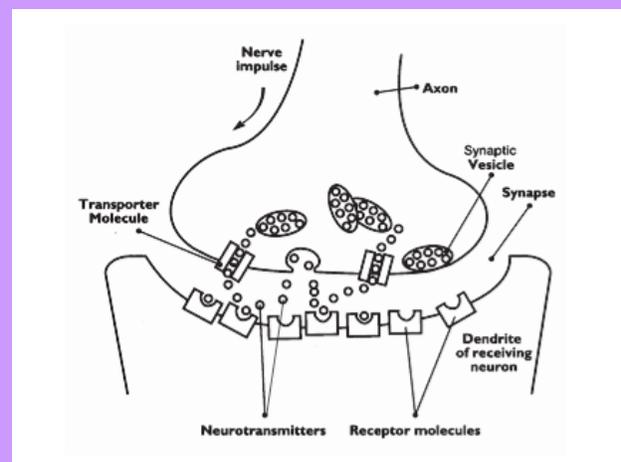
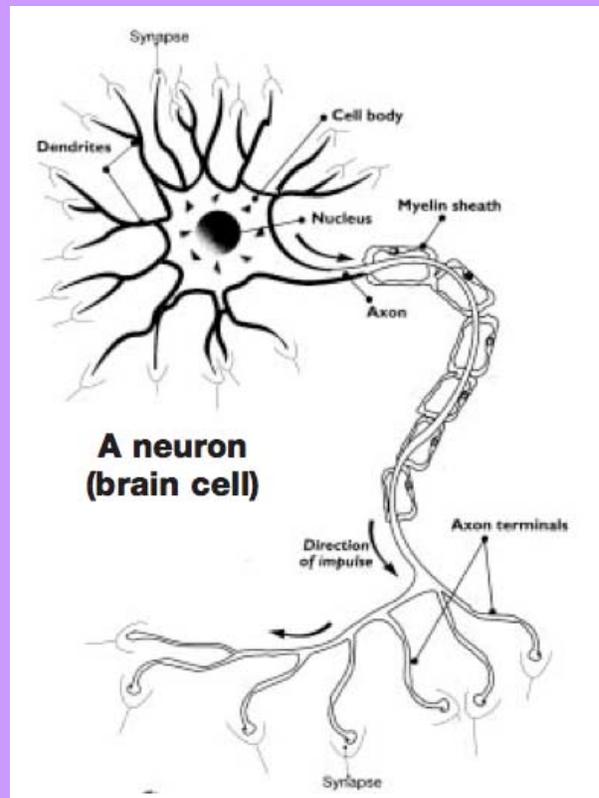
Neuron: Nerve cell. The basic units of the central nervous system, neurons are responsible for the transmission of nerve impulses. Unlike any other cell in the body, neurons consist of a central cell body as well as several threadlike "arms" called axons and dendrites, which transmit nerve impulses. Scientists estimate there are more than 100 billion neurons in the brain.

Neurotransmitter: A chemical that acts as a messenger between neurons, and is released into the synaptic cleft when a nerve impulse reaches the end of an axon. Several dozen neurotransmitters have been identified in the brain so far, each with specific, often complex roles in brain function and human behavior.

Receptors: Molecules on the surfaces of neurons whose structures precisely match those of chemical messengers (such as neurotransmitters or hormones) released during synaptic transmission. The chemicals attach themselves to the receptors, in lock-and-key fashion, to activate the receiving cell structure (usually a dendrite or cell body).

Synapse: The junction where an axon approaches another neuron or its extension (a dendrite or axon); the point at which nerve-to-nerve communication occurs. Nerve impulses traveling down the axon reach the synapse and release neurotransmitters into the synaptic cleft, the tiny gap between neurons.

Synaptic Transmission: The process of cell-to-cell communication in the central nervous system, where one neuron sends a chemical signal across the synaptic cleft to another neuron.



Resources

Ecstasy Invaders <http://www.sfn.org/BAW/SfNResources/files/ei.swf>
The Virtual Body <http://www.medtropolis.com/VBody.asp>
Reaction Time Game: http://www.bbc.co.uk/science/humanbody/sleep/sheep/reaction_version5.swf

Nuts and Bolts: Set-Up

Materials:

Metric Ruler Collecting Vials Beer Goggles
Multi-colored Foam Coins

- Hold the ruler near the end (highest number) and let it hang down (0cm mark at the bottom).
- Have another person put his or her hand at the bottom of the ruler ready to pinch the ruler, but not touching it. Hold the 0 cm mark just above the visitor's fingers.
- Explain that the brain works by sensing our environment and communicating information to the brain. The brain then plans actions and sends electrical impulses to muscles. Here, visitors' eyes will see the ruler drop, then the brain will plan to close fingers. Finally, impulse will be sent to close fingers on the ruler.
- Tell the person that you will drop the ruler sometime in the next 5 seconds and that he or she is supposed to catch the ruler as fast as he or she can after it is dropped.
- Identify the level in centimeters, at which he or she caught the ruler.
- Give each person three chances (drops). Note their best time. You can improve your reaction time with practice.
- Let the visitor put the appropriate marker into the vial for their distance (foam coin colored by age)
 - Age 0-9: Red indicator
 - Age 10-18: Yellow indicator
 - Age 19-65: Green indicator
 - Age 66 and better: Blue indicator
- Have the visitor put on beer goggles and run test again. You should see a slower reaction time. Explain that alcohol is a depressant and slows down the transmission of messages in the brain.

Distance of Catch	Reaction Time	Your Rating
1-9 cm	~0.10 sec	Blinding baseball
10-14 cm	~0.14 sec	Sonic soccer ball
15-19 cm	~0.17 sec	Voyaging volleyball
20-24 cm	~0.20 sec	Slaloming snowboard
25-29 cm	~0.23 sec	Brisk bicycle
30+ cm	~0.25 sec	Meandering marble

Nuts and Buts: How It Works

Objects, including rulers, accelerate down toward Earth at 9.8 m/s/s. By taking the acceleration of gravity into account, we can determine how fast it takes to catch a falling ruler.

Nuts and Bolts: Clean Up

- Collect all rulers.
- Leave foam coins in the collecting vials.
- At the end of the day, place an orange coin into each vial.

Safety

- Do not drop the rulers on your toes.

Sources

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