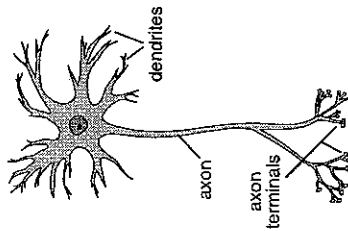


The Neuron

Neurons are cells that transport information. Like most cells, neurons have a cell body containing a nucleus. However, neurons also have special parts called dendrites and axons. Bundles of axons in the body are called nerves.



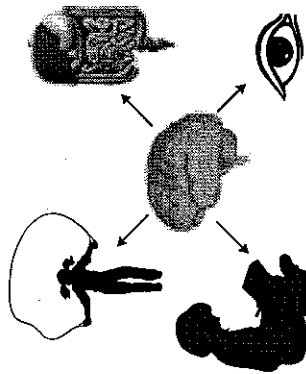
Dendrites pick up incoming signals and deliver them to the cell body. A neuron has many dendrites, so information can enter a neuron from many places at once.

Axons send signals out from the cell body. A neuron has one axon, but that axon may branch into many axon terminals. This allows information to be sent from one neuron to many places at once.

The Brain

The brain is a highly organized network of billions of cells protected by the skull. Information flows from all parts of the body to the brain.

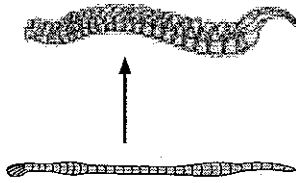
- The brain interprets this information.
- The brain then sends information out so the body can respond.



Voluntary actions, the things we choose to do, are directed by the brain. The brain also directs many involuntary actions. For instance, the brain controls blinking, heartbeat, and digestion.

The Spinal Cord

The spinal cord is a thin cord of neurons that is only about 1 inch in diameter ...



... protected by a series of bony disks called the vertebral column.

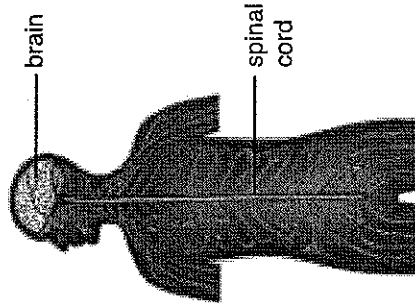
spinal cord vertebral column

The spinal cord has two major functions:

- It allows information flow between the body and brain.
- It directs reflex and complex motor actions.

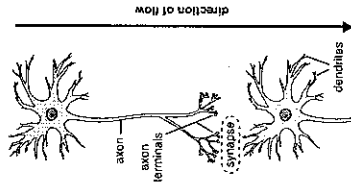
The Central Nervous System

The central nervous system is composed of the brain and the spinal cord:



Signaling

Neural signaling is the function of the nervous system. Each neuron

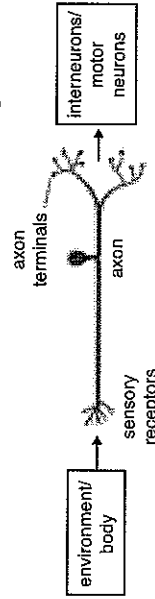


receives information through its dendrites from other neurons or from the environment,
 carries this information through its cell body and axon to its axon terminals, and
 delivers it either to the dendrites of the next neuron in the pathway or to the body.

- Information travels in the form of an *electrical signal* from one end of a single neuron to the other end (the axon terminal).
- Only a tiny space separates one neuron from the next neuron in the pathway. This space, together with the axon terminal of the signal-transmitting neuron and the dendrite of the signal-receiving neuron, is called the *synapse*.
- Information crosses the synapse between neurons in the form of a *chemical signal*.

There are three major types of neurons in the nervous system: sensory neurons, motor neurons, and interneurons.

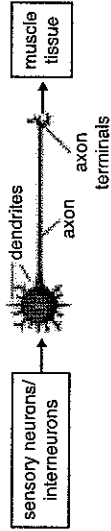
Sensory Neurons Carry Information from the Environment or the Body



Sensory neurons receive information from the *outside environment* or from *inside the body*.

Axons of sensory neurons then carry this information to other neurons located in the brain or spinal cord.

Motor Neurons Cause Actions



Motor neurons receive information from the axon terminals of *sensory neurons* or other *neurons*. The axons of motor neurons are often located in nerves together with axons of sensory neurons.

The axon terminals of motor neurons are located in *muscles*. The information delivered to muscle causes the muscle to contract.

Interneurons Carry Information within the Brain and Spinal Cord



Interneurons are neurons that are not motor neurons or sensory neurons.

The dendrites of interneurons receive signals from the axon terminals of *sensory neurons* or other *interneurons*.

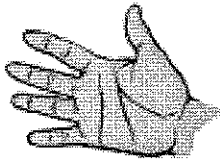
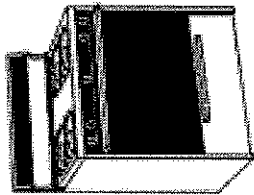
The axon terminals of interneurons deliver information to other neurons.

Neuroscience Reference Manual

Part 3: Neural Pathways

Reflex Actions

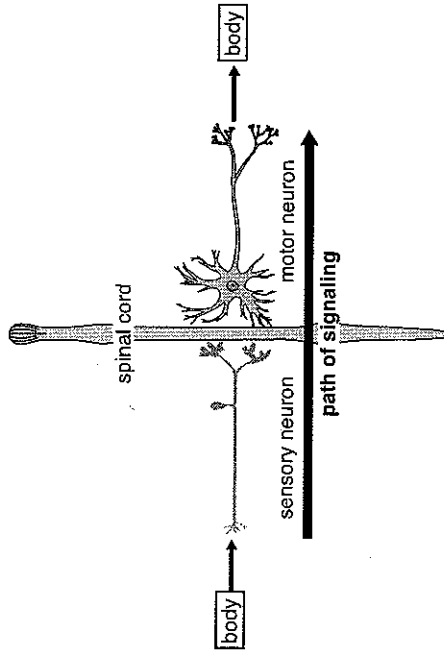
Sometimes the body must respond instantly to a signal from the environment.



If your hand touches a hot stove, you will pull your hand away without thinking about it. Such quick, automatic responses are called reflex actions.

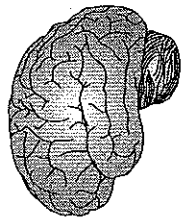
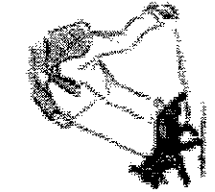
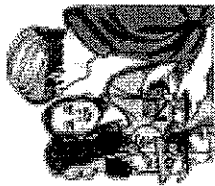
Information flows more quickly through short pathways than long ones. We can respond more quickly when information does not have to go all the way to the brain. The neurons of reflex pathways can function without instructions from the brain. Information flows from the body to the spinal cord, then back out to the body, and the body protects itself. Although the brain is not involved in the reflex, it is informed about what is going on, so learning can occur.

The simplest reflex pathways involve information flowing from a sensory neuron that connects to a motor neuron in the spinal cord.



Voluntary Actions

Voluntary actions, such as talking, eating, or walking, involve making a choice.



To make a choice, we use the brain.

Voluntary pathways require that information collected from sensory neurons goes to the brain. Interneurons carry information within the brain and spinal cord.

Information that activates a voluntary pathway can generate many different responses.

