Anatomy

Overview the nervous system

The nervous system is made up of the brain, spinal cord and nerves. It controls much of what you think and feel and what your body does. It allows you to do things like walk, speak, swallow, breathe and learn. It also controls how the body reacts in an emergency.

The nervous system is made up of: * the central nervous system, or CNS, which consists of the brain and spinal cord * the peripheral nervous system, or PNS, which consists of nerves that connect the CNS to the rest of the body

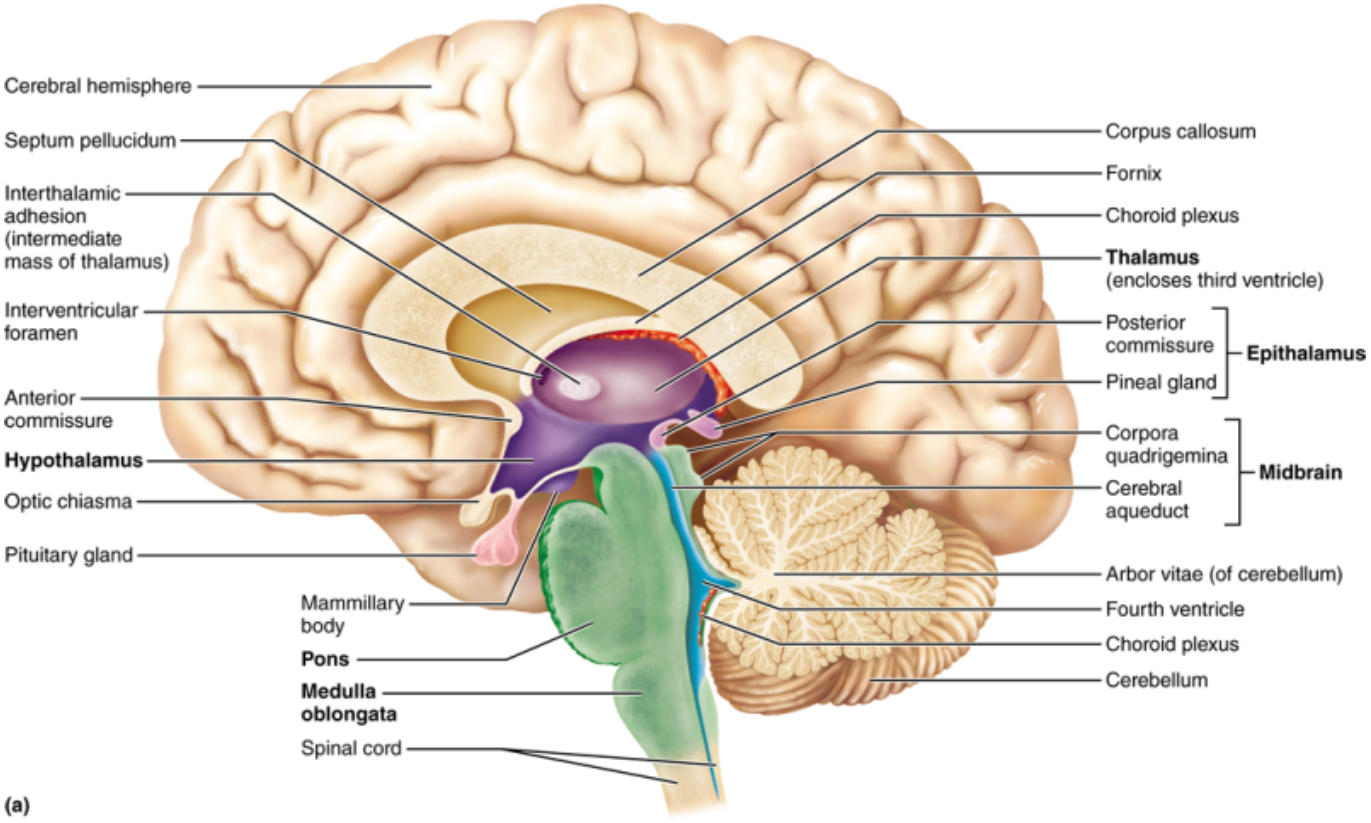
The brain is made up of different parts. These include the cerebrum, the cerebellum, the thalamus, the hypothalamus and the brainstem.

The spinal cord carries motor and sensory signals between the brain and nerves. It also contains separate circuits for many reflexes.

Peripheral nerves carry messages between the brain and other parts of the body. Nerves have different kinds of pathways within them:

* Motor pathways carry messages from the brain to the muscles so you can move. * Sensory pathways detect things such as light and sound and carry information about these to the brain.

The nervous system is mainly made up of cells called neurons. These are responsible for carrying messages to and from different parts of the body. Neurons are connected to each other, and to other cells, by synapses, which carry electrical signals, and neurotransmitters, which are the body's chemical messengers. (https://www.healthdirect.gov.au/nervous-system)



The Central Nervous system (CNS)

The central nervous system (CNS) is made up of the brain and spinal cord. It is one of 2 parts of the nervous system. The other part is the peripheral nervous system, which consists of nerves that connect the brain and spinal cord to the rest of the body.

The central nervous system is the body's processing centre. The brain controls most of the functions of the body, including awareness, movement, thinking, speech, and the 5 senses of seeing, hearing, feeling, tasting and smelling.

The spinal cord is an extension of the brain. It carries messages to and from the brain via the network of peripheral nerves connected to it.

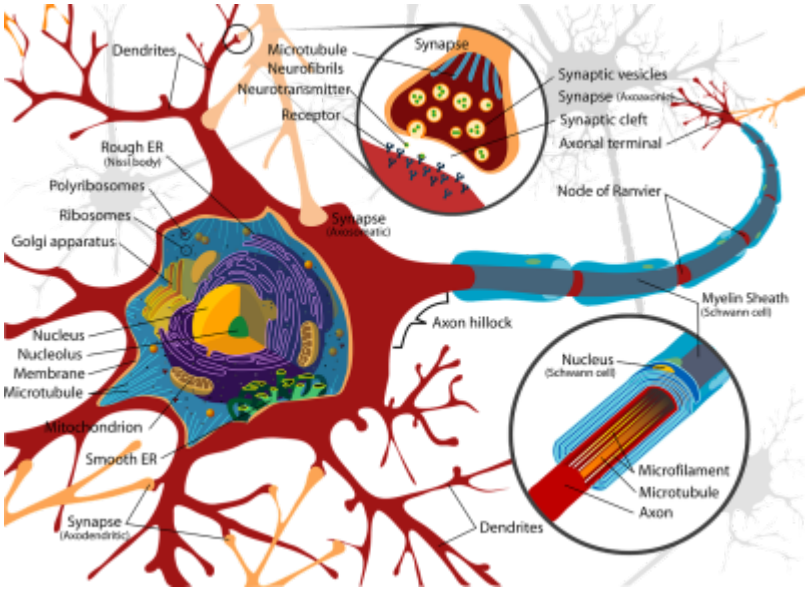
Nerves also connect the spinal cord to a part of the brain called the brainstem.

PARTS OF CNS

The nervous system is made up of basic units called neurons. The neurons are arranged in networks that carry electrical or chemical messages to and from the brain.

The tissue of the central nervous system is made up of grey matter and white matter. Grey matter is made up of neurons, cells and blood vessels. White matter is made up of axons, which are long cords that extend from the neurons. They are coated in myelin, which is a fatty insulation.

The brain and spinal cord are protected from damage by a clear liquid called cerebrospinal fluid, 3 layers of membranes called the meninges, and the hard bones of the skull and backbone.



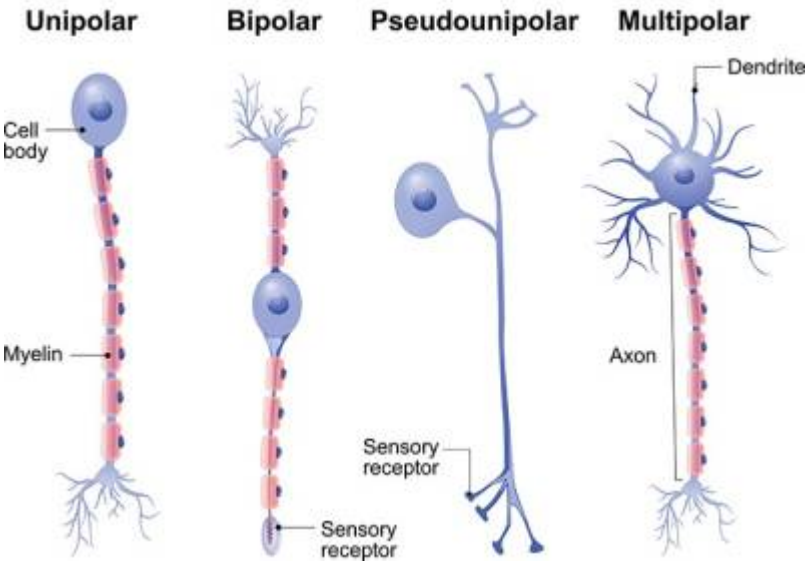
NEURONS

Neurons (also called neurones or nerve cells) are the fundamental units of the brain and nervous system, the cells responsible for receiving sensory input from the external world, for sending motor

commands to our muscles, and for transforming and relaying the electrical signals at every step in between. More than that, their interactions define who we are as people. Having said that, our roughly 100 billion neurons do interact closely with other cell types, broadly classified as glia (these may actually outnumber neurons, although it's not really known). The creation of new neurons in the brain is called neurogenesis, and this can happen even in adults.

A useful analogy is to think of a neuron as a tree. A neuron has three main parts: dendrites, an axon, and a cell body or soma (see image below), which can be represented as the branches, roots and trunk of a tree, respectively. A dendrite (tree branch) is where a neuron receives input from other cells. Dendrites branch as they move towards their tips, just like tree branches do, and they even have leaf-like structures on them called spines. The axon (tree roots) is the output structure of the neuron; when a neuron wants to talk to another neuron, it sends an electrical message called an action potential throughout the entire axon. The soma (tree trunk) is where the nucleus lies, where the neuron's DNA is housed, and where proteins are made to be transported throughout the axon and dendrites. (https://qbi.uq.edu.au/brain/brain-anatomy/types-neurons)

There are different types of neurons, both in the brain and the spinal cord. They are generally divided according to where they orginate, where they project to and which neurotransmitters they use.



Neurons are the cells that make up the brain and the nervous system. They are the fundamental units that send and receive signals which allow us to move our muscles, feel the external world, think, form memories and much more. Just from looking down a microscope, however, it becomes very clear that not all neurons are the same. So just how many types of neurons are there? And how do scientists decide on the categories? For neurons in the brain, at least, this isn't an easy question to answer. For the spinal cord though, we can say that there are three types of neurons: sensory, motor, and interneurons.

Sensory neurons

Sensory neurons are the nerve cells that are activated by sensory input from the environment - for example, when you touch a hot surface with your fingertips, the sensory neurons will be the ones firing and sending off signals to the rest of the nervous system about the information they have received. The inputs that activate sensory neurons can be physical or chemical, corresponding to all five of our senses. Thus, a physical input can be things like sound, touch, heat, or light. A chemical input comes from taste or smell, which neurons then send to the brain.

Most sensory neurons are pseudounipolar, which means they only have one axon which is split into two branches.

Motor neurons

Motor neurons of the spinal cord are part of the central nervous system (CNS) and connect to muscles, glands and organs throughout the body. These neurons transmit impulses from the spinal cord to skeletal and smooth muscles (such as those in your stomach), and so directly control all of our muscle movements. There are in fact two types of motor neurons: those that travel from spinal cord to muscle are called lower motor neurons, whereas those that travel between the brain and spinal cord are called upper motor neurons.

Motor neurons have the most common type of ‘body plan’ for a nerve cell - they are multipolar, each with one axon and several dendrites.

Interneurons

As the name suggests, interneurons are the ones in between - they connect spinal motor and sensory neurons. As well as transferring signals between sensory and motor neurons, interneurons can also communicate with each other, forming circuits of various complexity. They are multipolar, just like motor neurons.

Neurons in the brain

In the brain, the distinction between types of neurons is much more complex. Whereas in the spinal cord we could easily distinguish neurons based on their function, that isn’t the case in the brain. Certainly, there are brain neurons involved in sensory processing – like those in visual or auditory cortex – and others involved in motor processing – like those in the cerebellum or motor cortex.

However, within any of these sensory or motor regions, there are tens or even hundreds of different types of neurons. In fact, researchers are still trying to devise a way to neatly classify the huge variety of neurons that exist in the brain.

Looking at which neurotransmitter a neuron uses is one way that could be a useful for classifying neurons. However, within categories we can find further distinctions. Some GABA neurons, for example, send their axon mostly to the cell bodies of other neurons; others prefer to target the dendrites. Furthermore, these different neurons have different electrical properties, different shapes, different genes expressed, and different projection patterns and receive different inputs. In other words, a particular combination of features is one way of defining a neuron type.

This is really the purpose of trying to classify neurons: in the same way as we can say that spinal cord sensory neurons bring sensory input from the periphery to the central nervous system, we would like to be able to say that the role of ‘neuron X’ in the hippocampus is to (for example) let you distinguish between similar but slightly different memories.

So the answer to the question ‘What types of neurons are there?’ isn’t something we can fully answer yet. In the spinal cord, it is pretty simple. But part of what gives the brain its complexity is the huge

number of specialised neuron types. Researchers are still trying to agree on what these are, and how they should be classified. Once we can do that, we'll be in a good position to delve even deeper into how the brain operates.

THE BRAIN

The brain is made up of different parts. These include the cerebrum, the cerebellum, the thalamus, the hypothalamus and the brainstem.

The cerebrum is the largest part of the brain. It controls intelligence, memory, personality, emotion, speech, and ability to feel and move. It is divided into left and right hemispheres, linked by a band of nerve fibres in the centre of the brain called the corpus callosum.

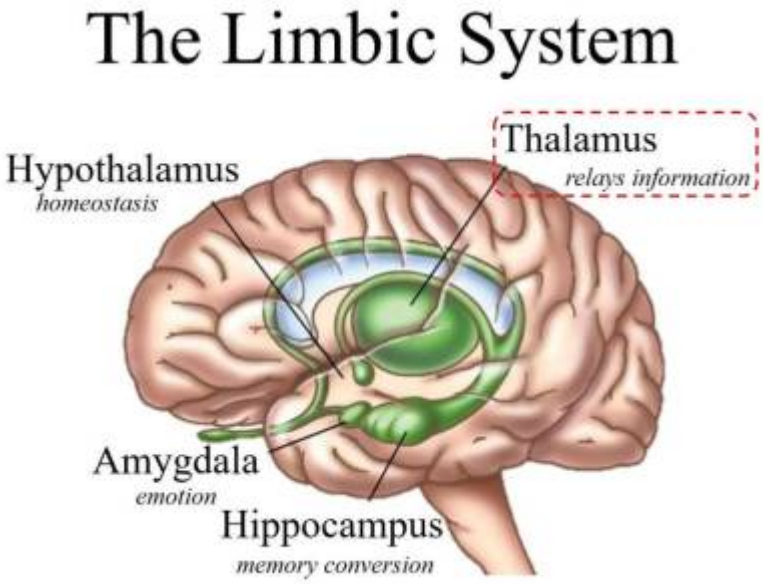
Each hemisphere is divided into 4 lobes, or sections, which are all connected.

* The frontal lobes control movement, speech and some of the functions of the mind like behaviour, mood, memory and organisation. * The temporal lobes play an important part in memory, hearing, speech and language. * The parietal lobes play an important part in taste, touch, temperature and pain, and also in the understanding of numbers, awareness of the body and feeling of space. *The occipital lobes are vital for being able to see clearly.

Deep inside the brain are the thalamus and the hypothalamus. The thalamus moves information to and from the lobes, and controls movements and memory. The hypothalamus controls appetite, thirst and body temperature, and produces hormones that control the release of other hormones in the pituitary gland.

At the base of the brain is the brainstem. It is important for breathing, blood pressure and how the body reacts to danger. 

Relationship between the CNS and the Limbic System



- Thalamus: Telephone exchange, all sense information less smell come here. It redirects the information to the relative areas.
- Hypothalamus is involved in the “hungers” and the “drives”
- Hippocampus: highly involved in memory
- Amygdala: Highly involved in emotional discrimination (Fight or flight response, trauma…)

For more info inthe Limbic system:

https://integraleyemovementtherapy.wiki/limbic_system