The Brain

- largest most complex organ
- more than 100 billion nerves
- cortex is the outermost layer of brain cells
- brain stem is between the spinal cord and the rest of the brain
- basal ganglia are a cluster of structures in the center of the brain
- cerebellum is at the base and the back of the brain
- frontal lobes are responsible for problem solving
- parietal lobes manage sensation
- temporal lobes are involved with memory
- occipital lobes contain the brain's visual processing
- is located inside the cranial cavity, where the bones of the skull surround and protect it.
- The brain and spinal cord together form the central nervous system (CNS), where information is processed and responses originate.
Frontal Lobe

- positioned behind your forehead
- responsible for emotion and judgement related to sympathy
- recognizes sarcasm
The spinal cord is a long, thin mass of bundled neurons that carries information through the vertebral cavity of the spine beginning at the medulla oblongata of the brain on its superior end and continuing inferiorly to the lumbar region of the spine.

Nerves—Extending from the left and right sides of the spinal cord are 31 pairs of spinal nerves. The spinal nerves are mixed nerves that carry both sensory and motor signals between the spinal cord and specific regions of the body. The 31 spinal nerves are split into 5 groups named for the 5 regions of the vertebral column. Thus, there are 8 pairs of cervical nerves, 12 pairs of thoracic nerves, 5 pairs of lumbar nerves, 5 pairs of sacral nerves, and 1 pair of coccygeal nerves.
Parietal Lobe

- located in the middle section of the brain
- tactile sensory information such as pressure, touch, and pain
- impaired ability to control eye gaze
Temporal Lobe

- bottom section of the brain
- important for interpreting sounds and the language
- lead to problems with memory, speech perception, and language skills
Occipital Lobe

- Located at the back portion of the brain
- Interprets visual stimuli and information
- Visual problems such as difficulty recognizing objects, an inability to identify colors, and trouble recognizing words

![Image of the brain with the occipital lobe highlighted.](image.png)
Nerves are bundles of axons in the peripheral nervous system (PNS) that act as information highways to carry signals between the brain and spinal cord and the rest of the body. Each axon is wrapped in a connective tissue sheath called the endoneurium.
Some of the nerves in the body are specialized for carrying information in only one direction, similar to a one-way street. Nerves that carry information from sensory receptors to the central nervous system only are called afferent nerves. Other neurons, known as efferent nerves, carry signals only from the central nervous system to effectors such as muscles and glands. Finally, some nerves are mixed nerves that contain both afferent and efferent axons. Mixed nerves function like 2-way streets where afferent axons act as lanes heading toward the central nervous system and efferent axons act as lanes heading away from the central nervous system.
The majority of the nervous system is tissue made up of two classes of cells: neurons and neuroglia.

**Neurons** - Neurons, also known as nerve cells, communicate within the body by transmitting electrochemical signals.

There are 3 basic classes of neurons: afferent neurons, efferent neurons, and interneurons.

Afferent neurons. Also known as sensory neurons, afferent neurons transmit sensory signals to the central nervous system from receptors in the body.

Efferent neurons. Also known as motor neurons, efferent neurons transmit signals from the central nervous system to effectors in the body such as muscles and glands.

Interneurons. Interneurons form complex networks within the central nervous system to integrate the information received from afferent neurons and to direct the function of the body through efferent neurons.

**Neuroglia** - Neuroglia, also known as glial cells, act as the “helper” cells of the nervous system.
Cranial Nerves

Extending from the inferior side of the brain are 12 pairs of cranial nerves. Each cranial nerve pair is identified by a Roman numeral 1 to 12 based upon its location along the anterior-posterior axis of the brain. Each nerve also has a descriptive name (e.g. olfactory, optic, etc.) that identifies its function or location. The cranial nerves provide a direct connection to the brain for the special sense organs, muscles of the head, neck, and shoulders, the heart, and the GI tract.
Meninges

The meninges are the protective coverings of the central nervous system (CNS). They consist of three layers: the dura mater, arachnoid mater, and pia mater.

The dura mater, which means “tough mother,” is the thickest, toughest, and most superficial layer of meninges. Made of dense irregular connective tissue, it contains many tough collagen fibers and blood vessels. Dura mater protects the CNS from external damage, contains the cerebrospinal fluid that surrounds the CNS, and provides blood to the nervous tissue of the CNS.
The arachnoid mater, which means “spider-like mother,” is much thinner and more delicate than the dura mater. It lines the inside of the dura mater and contains many thin fibers that connect it to the underlying pia mater. These fibers cross a fluid-filled space called the subarachnoid space between the arachnoid mater and the pia mater.

The pia mater, which means “tender mother,” is a thin and delicate layer of tissue that rests on the outside of the brain and spinal cord. Containing many blood vessels that feed the nervous tissue of the CNS, the pia mater penetrates into the valleys of the sulci and fissures of the brain as it covers the entire surface of the CNS.
The space surrounding the organs of the CNS is filled with a clear fluid known as cerebrospinal fluid (CSF).

---Cerebrospinal fluid provides several vital functions to the central nervous system:

1. CSF absorbs shocks between the brain and skull and between the spinal cord and vertebrae. This shock absorption protects the CNS from blows or sudden changes in velocity, such as during a car accident.

2. The brain and spinal cord float within the CSF, reducing their apparent weight through buoyancy. The brain is a very large but soft organ that requires a high volume of blood to function effectively. The reduced weight in cerebrospinal fluid allows the blood vessels of the brain to remain open and helps protect the nervous tissue from becoming crushed under its own weight.

3. CSF helps to maintain chemical homeostasis within the central nervous system. It contains ions, nutrients, oxygen, and albumins that support the chemical and osmotic balance of nervous tissue. CSF also removes waste products that form as byproducts of cellular metabolism within nervous tissue.
Sense Organs

--- All of the body’s many sense organs are components of the nervous system. What are known as the special senses—vision, taste, smell, hearing, and balance—are all detected by specialized organs such as the eyes, taste buds, and olfactory epithelium. Sensory receptors for the general senses like touch, temperature, and pain are found throughout most of the body. All of the sensory receptors of the body are connected to afferent neurons that carry their sensory information to the CNS to be processed and integrated.
The nervous system has 3 main functions: sensory, integration, and motor.

- The sensory function of the nervous system involves collecting information from sensory receptors that monitor the body’s internal and external conditions. These signals are then passed on to the central nervous system (CNS) for further processing by afferent neurons (and nerves).

- The process of integration is the processing of the many sensory signals that are passed into the CNS at any given time. These signals are evaluated, compared, used for decision making, discarded or committed to memory as deemed appropriate. Integration takes place in the gray matter of the brain and spinal cord and is performed by interneurons. Many interneurons work together to form complex networks that provide this processing power.

- Motor- Once The networks of interneurons in the CNS evaluate sensory information and decide on an action, they stimulate efferent neurons. Efferent neurons (also called motor neurons) carry signals from the gray matter of the CNS through the nerves of the peripheral nervous system to effector cells. The effector may be smooth, cardiac, or skeletal muscle tissue or glandular tissue. The effector then releases a hormone or moves a part of the body to respond to the stimulus.
works Cited
