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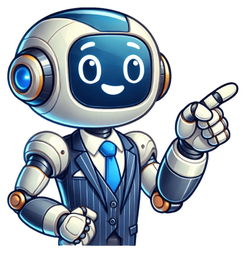

Your nervous system’s main function is to send messages from various parts of your body to your brain, and from your brain back out to your body to tell your body what to do. These messages regulate your:Thoughts, memory, learning and feelings.Movements (balance and coordination).Senses (how your brain interprets what you see, hear, taste, touch and feel).Wound healing.Sleep.Heartbeat and breathing patterns.Response to stressful situations, including sweat production.Digestion.Body processes, such as puberty and aging.How does the nervous system work?Your nervous system uses nerve cells called neurons to send signals, or messages, all over your body. These electrical signals travel among your brain, skin, organs, glands and muscles.The messages help you move your limbs and feel sensations, like pain. Your eyes, ears, tongue, nose and the nerves all over your body take in information about your environment. Then, nerves carry that data to and from your brain.There are different types of neurons. Each type of neuron has a different job:Motor neurons take signals from your brain and spinal cord to your muscles. They help you move. They also assist with breathing, swallowing and speaking.Sensory neurons take information from your senses (what you see, touch, taste, etc.) to your brain.Interneurons communicate between motor and sensory neurons. These neurons regulate your movement in response to sensory information (like moving away from a hot surface) and play a role in how you learn, think and remember. The nervous system has two main parts: The central nervous system is made up of the brain and spinal cord. The peripheral nervous system is made up of nerves that branch off from the spinal cord and extend to all parts of the body. The nervous system transmits signals between the brain and the rest of the body, including internal organs. In this way, the nervous system’s activity controls the ability to move, breathe, see, think, and more.1 The basic unit of the nervous system is a nerve cell, or neuron. The human brain contains about 100 billion neurons. A neuron has a cell body, which includes the cell nucleus, and special extensions called axons (pronounced AK-sonz) and dendrites (pronounced DEN-drahytz). Bundles of axons, called nerves, are found throughout the body. Axons and dendrites allow neurons to communicate, even across long distances. Different types of neurons control or perform different activities. For instance, motor neurons transmit messages from the brain to the muscles to generate movement. Sensory neurons detect light, sound, odor, taste, pressure, and heat and send messages about those things to the brain. Other parts of the nervous system control involuntary processes. These include keeping a regular heartbeat, releasing hormones like adrenaline, opening the pupil in response to light, and regulating the digestive system. When a neuron sends a message to another neuron, it sends an electrical signal down the length of its axon. At the end of the axon, the electrical signal changes to a chemical signal. The axon then releases the chemical signal with chemical messengers called neurotransmitters (pronounced noor-oh-TRANS-mit-erz) into the synapse (pronounced SIN-aps)—the space between the end of an axon and the tip of a dendrite from another neuron. The neurotransmitters move the signal through the synapse to the neighboring dendrite, which converts the chemical signal back into an electrical signal. The electrical signal then travels through the neuron and goes through the same conversion processes as it moves to neighboring neurons. The nervous system also includes non-neuron cells, called glia (pronounced GLEE-uh). Glia perform many important functions that keep the nervous system working properly. For example, glia: Help support and hold neurons in place Protect neurons Create insulation called myelin, which helps move nerve impulses Repair neurons and help restore neuron function Trim out dead neurons Regulate neurotransmitters The brain is made up of many networks of communicating neurons and glia. These networks allow different parts of the brain to “talk” to each other and work together to control body functions, emotions, thinking, behavior, and other activities.1,2,3 Your nervous system’s main function is to send messages from various parts of your body to your brain, and from your brain back out to your body to tell your body what to do. These messages regulate your:Thoughts, memory, learning and feelings.Movements (balance and coordination).Senses (how your brain interprets what you see, hear, taste, touch and feel).Wound healing.Sleep.Heartbeat and breathing patterns.Response to stressful situations, including sweat production.Digestion.Body processes, such as puberty and aging.How does the nervous system work?Your nervous system uses nerve cells called neurons to send signals, or messages, all over your body. These electrical signals travel among your brain, skin, organs, glands and muscles.The messages help you move your limbs and feel sensations, like pain. Your eyes, ears, tongue, nose and the nerves all over your body take in information about your environment. Then, nerves carry that data to and from your brain.There are different types of neurons. Each type of neuron has a different job:Motor neurons take signals from your brain and spinal cord to your muscles. They help you move. They also assist with breathing, swallowing and speaking.Sensory neurons take information from your senses (what you see, touch, taste, etc.) to your brain.Interneurons communicate between motor and sensory neurons. These neurons regulate your movement in response to sensory information (like moving away from a hot surface) and play a role in how you learn, think and remember. By the end of this section, you will be able to: Relate the anatomical structures to the basic functions of the nervous system. Identify the anatomical and functional divisions of the nervous system List the basic functions of the nervous system The picture you have in your mind of the nervous system probably includes the brain, the nervous tissue contained within the cranium, and the spinal cord, the extension of nervous tissue within the vertebral column. Additionally, the nervous tissue that reach out from the brain and spinal cord to the rest of the body (nerves) are also part of the nervous system. We can anatomically divide the nervous system into two major regions: the central nervous system (CNS) is the brain and spinal cord, the peripheral nervous system (PNS) is the nerves (Figure 12.1.1). The brain is contained within the cranial cavity of the skull, and the spinal cord is contained within the vertebral canal of the vertebral column. The peripheral nervous system is so named because it is in the periphery—meaning beyond the brain and spinal cord. Figure 12.1.1 – Central and Peripheral Nervous System: The CNS contains the brain and spinal cord, the PNS includes nerves. In addition to the anatomical divisions listed above, the nervous system can also be divided on the basis of its functions. The nervous system is involved in receiving information about the environment around us (sensory functions, sensation) and generating responses to that information (motor functions, responses) and coordinating the two (integration). Sensation. Sensation refers to receiving information about the environment, either what is happening outside (ie: heat from the sun) or inside the body (ie: heat from muscle activity). These sensations are known as stimuli (singular = stimulus) and different sensory receptors are responsible for detecting different stimuli. Sensory information travels towards the CNS through the PNS nerves in the specific division known as the afferent (sensory) branch of the PNS. When information arises from sensory receptors in the skin, skeletal muscles, or joints, it is transmitted to the CNS using somatic sensory neurons; when information arises from sensory receptors in the blood vessels or internal organs, it is transmitted to the CNS using visceral sensory neurons. Response. The nervous system produces a response in effector organs (such as muscles or glands) due to the sensory stimuli. The motor (efferent) branch of the PNS carries signals away from the CNS to the effector organs. When the effector organ is a skeletal muscle, the neuron carrying the information is called a somatic motor neuron; when the effector organ is cardiac or smooth muscle or glandular tissue, the neuron carrying the information is called an autonomic motor neuron. Voluntary responses are governed by somatic motor neurons and involuntary responses are governed by the autonomic motor neurons, which are discussed in the next section. Integration. Stimuli that are detected by sensory structures are communicated to the nervous system where information is processed. In the CNS, information from some stimuli is compared with, or integrated with, information from other stimuli or memories of previous stimuli. Then, a motor neuron is activated to initiate a response from the effector organ. This process during which sensory information is processed and a motor response generated is called integration (see Figure 12.1.2 below). Figure 12.1.2 – Nervous System Function: Integration occurs in the CNS where sensory information from the periphery is processed and interpreted. The CNS then creates a motor plan that is executed by the efferent branch working with effector organs. The nervous system can be separated into divisions on the basis of anatomy and physiology. The anatomical divisions are the central and peripheral nervous systems. The CNS is the brain and spinal cord. The PNS is everything else and includes afferent and efferent branches with further subdivisions for somatic, visceral and autonomic function. Functionally, the nervous system can be divided into those regions that are responsible for sensation, those that are responsible for integration, and those that are responsible for generating responses. autonomic nervous system functional division of the efferent branch of the PNS that is responsible for control of cardiac and smooth muscle, as well as glandular tissue brain the large organ of the central nervous system contained within the cranium and continuous with the spinal cord central nervous system (CNS) anatomical division of the nervous system that includes the brain and spinal cord integration nervous system function that processes sensory perceptions and produce a response peripheral nervous system (PNS) anatomical division of the nervous system that extends from the brain and spinal cord to the rest of the body response nervous system function that causes a target tissue (muscle or gland) to produce an event as a consequence to stimuli sensation nervous system function that receives information from the environment and translates it into the electrical signals of nervous tissue somatic nervous system (SNS) functional division of the nervous system that is concerned with conscious perception, voluntary movement, and skeletal muscle reflexes spinal cord organ of the central nervous system found within the vertebral cavity and connected with the periphery through spinal nerves; mediates reflex behaviors stimulus an event in the external or internal environment that registers as activity in a sensory neuron This work, Anatomy & Physiology, is adapted from Anatomy & Physiology by OpenStax, licensed under CC BY. This edition, with revised content and artwork, is licensed under CC BY-SA except where otherwise noted. Images, from Anatomy & Physiology by OpenStax, are licensed under CC BY except where otherwise noted. Access the original for free at . MeSH Heading Nervous System Tree Number(s) A08 Unique IDD009420 RDF Unique Identifier Annotationgeneral; prefer specifics; /innerv is available for organs; use for "nerves" but note NERVE TISSUE and terms for many specific nerves are available Scope NoteThe entire nerve apparatus, composed of a central part, the brain and spinal cord, and a peripheral part, the cranial and spinal nerves, autonomic ganglia, and plexuses. (Stedman, 26th ed) See Also Neurologic Manifestations Consider Also consider also terms at NERVE and NEUR- Entry Combination abnormalities:Nervous System Malformations injuries:Trauma, Nervous System physiology:Nervous System Physiological Phenomena surgery:Neurosurgical Procedures Date Established 1966/01/01 Date of Entry 1999/01/01 Revision Date 2016/04/19 Nervous System Preferred Concept UIM0014665 Scope NoteThe entire nerve apparatus, composed of a central part, the brain and spinal cord, and a peripheral part, the cranial and spinal nerves, autonomic ganglia, and plexuses. (Stedman, 26th ed) Terms Nervous System Preferred Term Term UI T028089 Date01/01/1999 LexicalTag NON ThesaurusID NLM (1966) How can financial brands set themselves apart through visual storytelling? Our experts explain how.Learn MoreThe Motorsport Images Collections captures events from 1895 to today’s most recent coverage.Discover The CollectionCurated, compelling, and worth your time. Explore our latest gallery of Editors’ Picks.Browse Editors' FavoritesHow can financial brands set themselves apart through visual storytelling? Our experts explain how.Learn MoreThe Motorsport Images Collections captures events from 1895 to today’s most recent coverage.Discover The CollectionCurated, compelling, and worth your time. Explore our latest gallery of Editors’ Picks.Browse Editors' FavoritesHow can financial brands set themselves apart through visual storytelling? Our experts explain how.Learn MoreThe Motorsport Images Collections captures events from 1895 to today’s most recent coverage.Discover The CollectionCurated, compelling, and worth your time. Explore our latest gallery of Editors’ Picks.Browse Editors' Favorites beginning of content The nervous system is made up of the brain, spinal cord and nerves. The nervous system is responsible for intelligence, learning, memory, movement, the senses and basic body functions such as your heartbeat and breathing. The basic building blocks of the nervous system are the nerve cells (neurons) which are responsible for carrying messages to and from different parts of the body. The brain is in constant communication with all parts of the body, sending instructions and receiving input from the senses. The nervous system is made up of the brain, spinal cord and nerves. It controls many aspects of what you think, how you feel and what your body does. It allows you to do things such as walk, speak, swallow, breathe and learn. It also controls how the body reacts in stressful situations. The nervous system interprets and responds to information gathered through the senses. What is function of the nervous system? The main function of the nervous system is to be the body's communication network. Its main job is to send and receive messages between you and the outside world, and within your own body. The nervous system is responsible for: intelligence, learning and memory: your thoughts and feelings physical movement basic body functions such as the beating of your heart, breathing, digestion, sweating and shivering the senses: sight, hearing, taste, touch and smell What are the parts of the nervous system? The nervous system is made up of: the central nervous system (CNS), which consists of the brain and spinal cord the peripheral nervous system (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 cerebellum thalamus hypothalamus brainstem The brain's cerebral cortex is the outermost layer of the brain that gives the brain its wrinkly appearance. The cerebral cortex is divided in half lengthways into two sides or hemispheres, the left hemisphere, and the right hemisphere. Each hemisphere specialises in different functions, but they share information and work together seamlessly. Each brain hemisphere (parts of the cerebrum) has 4 different sections called lobes. These lobes are the frontal, parietal, temporal and occipital lobes. Each lobe carries out different brain functions. Learn more about the structure of the central nervous system and how it works. What are nerve cells? The basic building blocks of the nervous system are the nerve cells, or neurons. The human brain has around 100 billion neurons. These cells are responsible for carrying messages to and from different parts of the body. Neurons have a cell body which contain the cell's nucleus as well as special extension called dendrites and axons. The synapse is the gap between the end of one neuron's axon and the tip of next neuron's dendrites. Messages travel from one neuron to the next across synapses. How does the nervous system work? The brain is in constant communication with all parts of the body, sending instructions and receiving input from the senses. Outgoing messages from the brain are sent along motor pathways, which carry messages from the brain to the muscles to tell them to move. The neurons that make up these motor pathways are called motor neurons. Incoming messages from the body to the brain are sent along sensory pathways. The sensory pathways detect things such as light and sound and carry information about these to the brain. The neurons that make up these sensory pathways are called sensory neurons. The spinal cord carries motor and sensory signals between the brain and nerves. The spinal cord also contains separate circuits for many reflexes. One part of the nervous system, called the autonomic nervous system, controls a lot of the body processes that function automatically, for example, breathing, sweating or shivering. There are 2 parts to the autonomic nervous system: the sympathetic nervous system, which controls how you respond in an emergency or when you are under stress (for example, it makes your heart beat faster and causes you to release adrenaline) the parasympathetic nervous system, which prepares the body for rest These parts work together to manage how the body responds to your changing environment and needs. For example, your pupils change size to allow the right amount of light into your eyes to allow effective vision. What medical conditions are related to the nervous system? There are thousands of conditions that start in or affect the central nervous system, including: CHECK YOUR SYMPTOMS — Use the Symptom Checker and find out if you need to seek medical help. What are the symptoms of problems with the nervous system? There are many different symptoms that could suggest a problem with the nervous system. They include: Other symptoms that might suggest a problem with the central nervous system include: emotional problems memory loss behavioural changes There are also many diseases that affect the peripheral nervous system. The peripheral nerves include the nerves outside the brain and spinal cord such as nerves of the face, arms, legs and torso. Read more on diseases of the peripheral nervous system. It is important to seek medical help if you have symptoms that do not go away on their own. FIND A HEALTH SERVICE — The Service Finder can help you find doctors, pharmacies, hospitals and other health services. ASK YOUR DOCTOR — Preparing for an appointment? Use the Question Builder for general tips on what to ask your GP or specialist. Resources and support Synapse has a lot of information about the anatomy and function of the nervous system Read more on Motor Neuron Disease (MND), including causes, symptoms and treatment options. Learn about peripheral neuropathy, including types, treatment, prognosis and where to get support. Peripheral neuropathy can also be a side effect of cancer treatment – read more on the cancer Council website. Call healthdirect on 1800 022 222 at any time to speak to a registered nurse (known as NURSE-ON-CALL in Victoria) for more information and advice. Learn more here about the development and quality assurance of healthdirect content. Last reviewed: September 2023 Neuromuscular system and diseases These trusted information partners have more on this topic. Results for medical professionals Top results This is a fact sheet on Restless Leg Syndrome. RLS or Willis-Ekbom Disease, is a neurological disorder characterised by uncomfortable sensations in the legs & an uncontrollable urge to move them. Read more on Sleep Health Foundation website Motor neurone disease (MND) is a progressive neurological disorder which usually strikes people in middle and later life. Read more on MyDoctor website People with dyslexia can have difficulty in reading, and in other language-based tasks such as writing and spelling. Read more on Brain Foundation website Explore blepharospasm, its symptoms, causes, and treatments. Learn about benign essential blepharospasm and how to manage excessive blinking. Read more on Brain Foundation website Learn about narcolepsy, its symptoms, causes, and treatment options. Understand how narcolepsy is diagnosed and managed. Read more on Brain Foundation website Epilepsy is a brain disorder in which brief, recurrent changes in the electrical activity of the brain lead to seizures or ‘fits’. Read more on Brain Foundation website The term ‘dementia’ is used to describe deteriorating intellectual function that can occur as a result of various neurological disorders. Read more on Brain Foundation website Cluster headache is a rare but extremely painful neurological disorder, causing headache attacks that occur in cyclical bouts. Read more on Migraine and Headache Australia website Gain insights into aphasia, its symptoms, and various types. Learn what aphasia is and how it affects communication. Read more on Brain Foundation website Essential tremor is around eight times more common than Parkinson's. Essential tremor is a common neurological disorder with involuntary shaking or trembling that often runs in families. Read more on Parkinson's Australia website Healthdirect Australia is not responsible for the content and advertising on the external website you are now entering. Neuromuscular system and diseases Worried about your health?Select a symptom, answer some questions, get advice. Start Your Symptom Check Check your symptoms Find a health service Your nervous system’s main function is to send messages from various parts of your body to your brain, and from your brain back out to your body to tell your body what to do. These messages regulate your:Thoughts, memory, learning and feelings.Movements (balance and coordination).Senses (how your brain interprets what you see, hear, taste, touch and feel).Wound healing.Sleep.Heartbeat and breathing patterns.Response to stressful situations, including sweat production.Digestion.Body processes, such as puberty and aging.How does the nervous system work?Your nervous system uses nerve cells called neurons to send signals, or messages, all over your body. These electrical signals travel among your brain, skin, organs, glands and muscles.The messages help you move your limbs and feel sensations, like pain. Your eyes, ears, tongue, nose and the nerves all over your body take in information about your environment. Then, nerves carry that data to and from your brain.There are different types of neurons. Each type of neuron has a different job:Motor neurons take signals from your brain and spinal cord to your muscles. They help you move. They also assist with breathing, swallowing and speaking.Sensory neurons take information from your senses (what you see, touch, taste, etc.) to your brain.Interneurons communicate between motor and sensory neurons. These neurons regulate your movement in response to sensory information (like moving away from a hot surface) and play a role in how you learn, think and remember. The nervous system is made up of neurons, specialized cells that can receive and transmit chemical or electrical signals, and glia, cells that provide support functions for the neurons by playing an information processing role that is complementary to neurons. A neuron can be compared to an electrical wire—it transmits a signal from one place to another. Glia can be compared to the workers at the electric company who make sure wires go to the right places, maintain the wires, and take down wires that are broken. Although glia have been compared to workers, recent evidence suggests that also usurp some of the signaling functions of neurons. There is great diversity in the types of neurons and glia that are present in different parts of the nervous system. There are four major types of neurons, and they share several important cellular components. Learning Objectives Differentiate between the nervous systems of different animals Differentiate between the central and peripheral nervous systems List and describe the functions of the structural components of a neuron List and describe the four main types of neurons Describe the process of neurogenesis Compare the functions of different types of glial cells Nervous systems throughout the animal kingdom vary in structure and complexity, as illustrated by the variety of animals shown in Figure 1. Some organisms, like sea sponges, lack a true nervous system. Others, like jellyfish, lack a true brain and instead have a system of separate but connected nerve cells (neurons) called a “nerve net.” Echinoderms such as sea stars have nerve cells that are bundled into fibers called nerves. Flatworms of the phylum Platyhelminthes have both a central nervous system (CNS), made up of a small “brain” and two nerve cords, and a peripheral nervous system (PNS) containing a system of nerves that extend throughout the body. The insect nervous system is more complex but also fairly decentralized. It contains a brain, ventral nerve cord, and ganglia (clusters of connected neurons). These ganglia can control movements and behaviors without input from the brain. Octopi may have the most complicated of invertebrate nervous systems—they have neurons that are organized in specialized lobes and eyes that are structurally similar to vertebrate species. Figure 1. Nervous systems vary in structure and complexity. In (a) cnidarians, nerve cells form a decentralized nerve net. In (b) echinoderms, nerve cells are bundled into fibers called nerves. In animals exhibiting bilateral symmetry such as (c) planarians, neurons cluster into an anterior brain that processes information. In addition to a brain, (d) arthropods have clusters of nerve cell bodies, called peripheral ganglia, located along the ventral nerve cord. Mollusks such as squid and (e) octopi, which must hunt to survive, have complex brains containing millions of neurons. In (f) vertebrates, the brain and spinal cord comprise the central nervous system, while neurons extending into the rest of the body comprise the peripheral nervous system. (credit e: modification of work by Michael Vecchione, Clyde F.E. Roper, and Michael J. Sweeney, NOAA; credit f: modification of work by NIH) Compared to invertebrates, vertebrate nervous systems are more complex, centralized, and specialized. While there is great diversity among different vertebrate nervous systems, they all share a basic structure: a CNS that contains a brain and spinal cord and a PNS made up of peripheral sensory and motor nerves. One interesting difference between the nervous systems of invertebrates and vertebrates is that the nerve cords of many invertebrates are located ventrally whereas the vertebrate spinal cords are located dorsally. There is debate among evolutionary biologists as to whether these different nervous system plans evolved separately or whether the invertebrate body plan arrangement somehow “flipped” during the evolution of vertebrates. Watch this video of biologist Mark Kirschner discussing the “flipping” phenomenon of vertebrate evolution. The Central and Peripheral Nervous Systems The nervous system has three main functions: sensory input, integration of data and motor output. Sensory input is when the body gathers information or data, by way of neurons, glia and synapses. The nervous system is composed of excitable nerve cells (neurons) and synapses that form between the neurons and connect them to centers throughout the body or to other neurons. These neurons operate on excitation or inhibition, and although nerve cells can vary in size and location, their communication with one another determines their function. These nerves conduct impulses from sensory receptors to the brain and spinal cord. The data is then processed by way of integration of data, which occurs only in the brain. After the brain has processed the information, impulses are then conducted from the brain and spinal cord to muscles and glands, which is called motor output. Glia cells are found within tissues and are not excitable but help with myelination, ionic regulation and extracellular fluid. Figure 2. The central and peripheral nervous systems The nervous system is comprised of two major parts, or subdivisions, the central nervous system (CNS) and the peripheral nervous system (PNS). The CNS includes the brain and spinal cord. The brain is the body’s “control center.” The CNS has various centers located within it that carry out the sensory, motor and integration of data. These centers can be subdivided to Lower Centers (including the spinal cord and brain stem) and Higher centers communicating with the brain via effectors. The PNS is a vast network of spinal and cranial nerves that are linked to the brain and the spinal cord. It contains sensory receptors which help in processing changes in the internal and external environment. This information is sent to the CNS via afferent sensory nerves. The PNS is then subdivided into the autonomic nervous system and the somatic nervous system. The autonomic has involuntary control of internal organs, blood vessels, smooth and cardiac muscles. The somatic has voluntary control of skin, bones, joints, and skeletal muscle. The two systems function together, by way of nerves from the PNS entering and becoming part of the CNS, and vice versa. We’ll further discuss the components and roles of these systems later in this module. Neurons The nervous system of the common laboratory fly, Drosophila melanogaster, contains around 100,000 neurons, the same number as a lobster. This number compares to 75 million in the mouse and 300 million in the octopus. A human brain contains around 86 billion neurons. Despite these very different numbers, the nervous systems of these animals control many of the same behaviors—from basic reflexes to more complicated behaviors like finding food and courting mates. The ability of neurons to communicate with each other as well as with other types of cells underlies all of these behaviors. Most neurons share the same cellular components. But neurons are also highly specialized—different types of neurons have different sizes and shapes that relate to their functional roles. Parts of a Neuron Like other cells, each neuron has a cell body (or soma) that contains a nucleus, smooth and rough endoplasmic reticulum, Golgi apparatus, mitochondria, and other cellular components. Neurons also contain unique structures, illustrated in Figure 3 for receiving and sending the electrical signals that make neuronal communication possible. Dendrites are tree-like structures that extend away from the cell body to receive messages from other neurons at specialized junctions called synapses. Although some neurons do not have any dendrites, some types of neurons have multiple dendrites. Dendrites can have small protrusions called dendritic spines, which further increase surface area for possible synaptic connections. Figure 3. Neurons contain organelles common to many other cells, such as a nucleus and mitochondria. They also have more specialized structures, including dendrites and axons. Once a signal is received by the dendrite, it then travels passively to the cell body. The cell body contains a specialized structure, the axon hillock that integrates signals from multiple synapses and serves as a junction between the cell body and an axon. An axon is a tube-like structure that propagates the integrated signal to specialized endings called axon terminals. These terminals in turn synapse on other neurons, muscle, or target organs. Chemicals released at axon terminals allow signals to be communicated to these other cells. Neurons usually have one or two axons, but some neurons, like amacrine cells in the retina, do not contain any axons. Some axons are covered with myelin, which acts as an insulator to minimize dissipation of the electrical signal as it travels down the axon, greatly increasing the speed on conduction. This insulation is important as the axon from a human motor neuron can be as long as a meter—from the base of the spine to the toes. The myelin sheath is not actually part of the neuron. Myelin is produced by glial cells. Along the axon there are periodic gaps in the myelin sheath. These gaps are called nodes of Ranvier and are sites where the signal is “recharged” as it travels along the axon. It is important to note that a single neuron does not act alone—neuronal communication depends on the connections that neurons make with one another (as well as with other cells, like muscle cells). Dendrites from a single neuron may receive synaptic contact from many other neurons. For example, dendrites from a Purkinje cell in the cerebellum are thought to receive contact from as many as 200,000 other neurons. Which of the following statements is false? The soma is the cell body of a nerve cell. Myelin sheath provides an insulating layer to the dendrites. Axons carry the signal from the soma to the target. Dendrites carry the signal to the soma. Types of Neurons There are different types of neurons, and the functional role of a given neuron is intimately dependent on its structure. There is an amazing diversity of neuron shapes and sizes found in different parts of the nervous system (and across species), as illustrated by the neurons shown in Figure 4. Figure 4. There is great diversity in the size and shape of neurons throughout the nervous system. Examples include (a) a pyramidal cell from the cerebral cortex, (b) a Purkinje cell from the cerebellar cortex, and (c) olfactory cells from the olfactory epithelium and olfactory bulb. While there are many defined neuron cell subtypes, neurons are broadly divided into four basic types: unipolar, bipolar, multipolar, and pseudounipolar. Figure 5 illustrates these four basic neuron types. Unipolar neurons have only one structure that extends away from the soma. These neurons are not found in vertebrates but are found in insects where they stimulate muscles or glands. A bipolar neuron has one axon and one dendrite extending from the soma. An example of a bipolar neuron is a retinal bipolar cell, which receives signals from photoreceptor cells that are sensitive to light and transmits these signals to ganglion cells that carry the signal to the brain. Multipolar neurons are the most common type of neuron. Each multipolar neuron contains one axon and multiple dendrites. Multipolar neurons can be found in the central nervous system (brain and spinal cord). An example of a multipolar neuron is a Purkinje cell in the cerebellum, which has many branching dendrites but only one axon. Pseudounipolar cells share characteristics with both unipolar and bipolar cells. A pseudounipolar cell has a single process that extends from the soma, like a unipolar cell, but this process later branches into two distinct structures, like a bipolar cell. Most sensory neurons are pseudounipolar and have an axon that branches into two extensions: one connected to dendrites that receive sensory information and another that transmits this information to the spinal cord. Figure 5. Neurons are broadly divided into four main types based on the number and placement of axons: (1) unipolar, (2) bipolar, (3) multipolar, and (4) pseudounipolar. Neurogenesis At one time, scientists believed that people were born with all the neurons they would ever have. Research performed during the last few decades indicates that neurogenesis, the birth of new neurons, continues into adulthood. Neurogenesis was first discovered in songbirds that produce new neurons while learning songs. For mammals, new neurons also play an important role in learning: about 1000 new neurons develop in the hippocampus (a brain structure involved in learning and memory) each day. While most of the new neurons will die, researchers found that an increase in the number of surviving new neurons in the hippocampus correlated with how well rats learned a new task. Interestingly, both exercise and some antidepressant medications also promote neurogenesis in the hippocampus. Stress has the opposite effect. While neurogenesis is quite limited compared to regeneration in other tissues, research in this area may lead to new treatments for disorders such as Alzheimer’s, stroke, and epilepsy. Figure 6. Micrograph which shows fluorescently labeled neurons in the hippocampus of a rat (credit: modification of work by Dr. Maryam Faiz, et. al., University of Barcelona; scale-bar data from Matt Russell) How do scientists identify new neurons? A researcher can inject a compound called bromodeoxyuridine (BrdU) into the brain of an animal. While all cells will be exposed to BrdU, BrdU will only be incorporated into the DNA of newly generated cells that are in S phase. A technique called immunohistochemistry can be used to attach a fluorescent label to the incorporated BrdU, and a researcher can use fluorescent microscopy to visualize the presence of BrdU, and thus new neurons, in brain tissue. Figure 6 shows fluorescently labeled new neurons in a rat hippocampus. Cells that are actively dividing have bromodoxyuridine (BrdU) incorporated into their DNA and are labeled in red. Cells that express glial fibrillary acidic protein (GFAP) are labeled in green. Astrocytes, but not neurons, express GFAP. Thus, cells that are labeled both red and green are actively dividing astrocytes, whereas cells labeled red only are actively dividing neurons. Glial Cells While glia are often thought of as the supporting cast of the nervous system, the number of glial cells in the brain actually outnumbers the number of neurons by a factor of ten. Neurons would be unable to function without the vital roles that are fulfilled by these glial cells. Glia guide developing neurons to their destinations, buffer ions and chemicals that would otherwise harm neurons, and provide myelin sheaths around axons. Scientists have recently discovered that they also play a role in responding to nerve activity and modulating communication between nerve cells. When glia do not function properly, the result can be disastrous—most brain tumors are caused by mutations in glia. Types of Glia There are several different types of glia with different functions, two of which are shown in Figure 7. Figure 7. Glial cells support neurons and maintain their environment. Glial cells of the (a) central nervous system include oligodendrocytes, astrocytes, ependymal cells, and microglial cells. Oligodendrocytes form the myelin sheath around axons. Astrocytes provide nutrients to neurons, maintain their extracellular environment, and provide structural support. Microglia scavenge pathogens and dead cells. Ependymal cells produce cerebrospinal fluid that cushions the neurons. Glial cells of the (b) peripheral nervous system include Schwann cells, which form the myelin sheath, and satellite cells, which provide nutrients and structural support to neurons. Astrocytes, shown in Figure 8a make contact with both capillaries and neurons in the CNS. They provide nutrients and other substances to neurons, regulate the concentrations of ions and chemicals in the extracellular fluid, and provide structural support for synapses. Astrocytes also form the blood-brain barrier—a structure that blocks entrance of toxic substances into the brain. Astrocytes, in particular, have been shown through calcium imaging experiments to become active in response to nerve activity, transmit calcium waves between astrocytes, and modulate the activity of surrounding synapses. Satellite glia provide nutrients and structural support for neurons in the PNS. Microglia scavenge and degrade dead cells and protect the brain from invading microorganisms. Oligodendrocytes, shown in Figure 8b form myelin sheaths around axons in the CNS. One axon can be myelinated by several oligodendrocytes, and one oligodendrocyte can provide myelin for multiple neurons. This is distinctive from the PNS where a single Schwann cell provides myelin for only one axon as the entire Schwann cell surrounds the axon. Radial glia serve as scaffolds for developing neurons as they migrate to their end destinations. Ependymal cells line fluid-filled ventricles of the brain and the central canal of the spinal cord. They are involved in the production of cerebrospinal fluid, which serves as a cushion for the brain, moves the fluid between the spinal cord and the brain, and is a component of the choroid plexus. Figure 8. (a) Astrocytes and (b) oligodendrocytes are glial cells of the central nervous system. (credit a: modification of work by Uniformed Services University; credit b: modification of work by Jurjen Broeke; scale-bar data from Matt Russell) Check Your Understanding Answer the question(s) below to see how well you understand the topics covered in the previous section. This short quiz does not count toward your grade in the class, and you can retake it an unlimited number of times. Use this quiz to check your understanding and decide whether to (1) study the previous section further or (2) move on to the next section. Share — copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt — remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution — You must give appropriate credit , provide a link to the license, and indicate if changes were made . You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrictions — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits. You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. It is usually not hard to find medical help if you become ill in Germany. There's an extensive network of easily accessible places to go for treatmen... If a fungus grows a lot it may lead to a medical condition. Tinea versicolor is one example. This skin condition is caused by a yeast fungus, and is ... Nitrous oxide (laughing gas) is increasingly being used to get high. This can affect your health. "Endometriosis? Never heard of it." Many people don't know what endometriosis is, even though it's one of the most common abdominal diseases in women... Cervical cancer nearly always develops as a rare consequence of a long-term infection with particular types of human papillomaviruses (HPV). Screenin... We all have hemorrhoids. They are nothing more than “cushions” of blood vessels and supporting tissue, found at the end of the rectum. Hemorrhoids on... Corns develop when an area of skin is repeatedly exposed to pressure or rubbing. They mainly occur on your toes and on the soles of your feet. If the... While some women hardly have any problems due to their period, others regularly feel tired and unwell. This is often due to pain, but also heavy peri... Plantar fasciitis is often the cause of pain in the heel or sole of the foot. It is an inflammation of the band of thick connective tissue beneath yo... If one part of the largest blood vessel in the belly (the abdominal aorta) starts bulging, it is known as an abdominal aortic aneurysm. This conditio... In Germany, women who decide to have an abortion must comply with certain legal requirements – like mandatory counseling beforehand. Abortions that f... Some screening tests help prevent disease. Many tests haven’t been proven to provide any health benefits. Some actually cause more harm than good. Th... Genital herpes is one of the most common sexually transmitted infections (STIs). Herpes virus infections actually don’t often lead to a disease, thou... Cold sores lead to the formation of painful blisters around the lips, typically only on one side of the mouth. People who have had a cold sore in the... Typical conjunctivitis symptoms include stuck-together eyelids when you wake up, and red and watery eyes. Both viral and bacterial conjunctivitis are... Your nervous system’s main function is to send messages from various parts of your body to your brain, and from your brain back out to your body to tell your body what to do. These messages regulate your:Thoughts, memory, learning and feelings.Movements (balance and coordination).Senses (how your brain interprets what you see, hear, taste, touch and feel).Wound healing.Sleep.Heartbeat and breathing patterns.Response to stressful situations, including sweat production.Digestion.Body processes, such as puberty and aging.How does the nervous system work?Your nervous system uses nerve cells called neurons to send signals, or messages, all over your body. These electrical signals travel among your brain, skin, organs, glands and muscles.The messages help you move your limbs and feel sensations, like pain. Your eyes, ears, tongue, nose and the nerves all over your body take in information about your environment. Then, nerves carry that data to and from your brain.There are different types of neurons. Each type of neuron has a different job:Motor neurons take signals from your brain and spinal cord to your muscles. They help you move. They also assist with breathing, swallowing and speaking.Sensory neurons take information from your senses (what you see, touch, taste, etc.) to your brain.Interneurons communicate between motor and sensory neurons. These neurons regulate your movement in response to sensory information (like moving away from a hot surface) and play a role in how you learn, think and remember. Your nervous system’s main function is to send messages from various parts of your body to your brain, and from your brain back out to your body to tell your body what to do. These messages regulate your:Thoughts, memory, learning and feelings.Movements (balance and coordination).Senses (how your brain interprets what you see, hear, taste, touch and feel).Wound healing.Sleep.Heartbeat and breathing patterns.Response to stressful situations, including sweat production.Digestion.Body processes, such as puberty and aging.How does the nervous system work?Your nervous system uses nerve cells called neurons to send signals, or messages, all over your body. These electrical signals travel among your brain, skin, organs, glands and muscles.The messages help you move your limbs and feel sensations, like pain. Your eyes, ears, tongue, nose and the nerves all over your body take in information about your environment. Then, nerves carry that data to and from your brain.There are different types of neurons. Each type of neuron has a different job:Motor neurons take signals from your brain and spinal cord to your muscles. They help you move. 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These messages regulate your:Thoughts, memory, learning and feelings.Movements (balance and coordination).Senses (how your brain interprets what you see, hear, taste, touch and feel).Wound healing.Sleep.Heartbeat and breathing patterns.Response to stressful situations, including sweat production.Digestion.Body processes, such as puberty and aging.How does the nervous system work?Your nervous system uses nerve cells called neurons to send signals, or messages, all over your body. These electrical signals travel among your brain, skin, organs, glands and muscles.The messages help you move your limbs and feel sensations, like pain. Your eyes, ears, tongue, nose and the nerves all over your body take in information about your environment. Then, nerves carry that data to and from your brain.There are different types of neurons. Each type of neuron has a different job:Motor neurons take signals from your brain and spinal cord to your muscles. They help you move. They also assist with breathing, swallowing and speaking.Sensory neurons take information from your senses (what you see, touch, taste, etc.) to your brain.Interneurons communicate between motor and sensory neurons. These neurons regulate your movement in response to sensory information (like moving away from a hot surface) and play a role in how you learn, think and remember. Author: Jana Vasković, MD • Reviewer: Nicola McLaren, MSc Last reviewed: November 03, 2023 Reading time: 21 minutes Nervous system (anterior view) The nervous system is a network of neurons whose main feature is to generate, modulate and transmit information between all the different parts of the human body. This property enables many important functions of the nervous system, such as regulation of vital body functions (heartbeat, breathing, digestion), sensation and body movements. Ultimately, the nervous system structures preside over everything that makes us human; our consciousness, cognition, behaviour and memories. The nervous system consists of two divisions; Key facts about the nervous system Definition A network of neurons that sends, receives and modulates neural impulses between different body parts. Divisions Central nervous system Peripheral nervous system Central nervous system Brain and spinal cord Peripheral nervous system Spinal and cranial nerves. Functional divisions: - Somatic nervous system - Autonomic nervous system; sympathetic, parasympathetic and enteric divisions Understanding the nervous system requires knowledge of its various parts, so in this article you will learn about the nervous system breakdown and all its various divisions. Two basic types of cells are present in the nervous system; Neurons, or nerve cell, are the main structural and functional units of the nervous system. Every neuron consists of a body (soma) and a number of processes (neurites). The nerve cell body contains the cellular organelles and is where neural impulses (action potentials) are generated. The processes stem from the body, they connect neurons with each other and with other body cells, enabling the flow of neural impulses. There are two types of neural processes that differ in structure and function; Axons are long and conduct impulses away from the neuronal body. Dendrites are short and act to receive impulses from other neurons, conducting the electrical signal towards the nerve cell body. Every neuron has a single axon, while the number of dendrites varies. Based on that number, there are four structural types of neurons; multipolar, bipolar, pseudounipolar and unipolar. Learn more about the neurons in our study unit: Learn faster Neurons Explore study unit The morphology of neurons makes them highly specialized to work with neural impulses; they generate, receive and send these impulses onto other neurons and non-neural tissues. There are two types of neurons, named according to whether they send an electrical signal towards or away from the CNS; Efferent neurons (motor or descending) send neural impulses from the CNS to the peripheral tissues, instructing them how to function. Afferent neurons (sensory or ascending) conduct impulses from the peripheral tissues to the CNS. These impulses contain sensory information, describing the tissue's environment. The site where an axon connects to another cell to pass the neural impulse is called a synapse. The synapse doesn't connect to the next cell directly. Instead, the impulse triggers the release of chemicals called neurotransmitters from the very end of an axon. These neurotransmitters bind to the effector cell’s membrane, causing biochemical events to occur within that cell according to the orders sent by the CNS. Ready to reinforce your knowledge about the neurons? Try out our quiz below: Glial cells, also called neuroglia or simply glia, are smaller non-excitatory cells that act to support neurons. They do not propagate action potentials. Instead, they myelinate neurons, maintain homeostatic balance, provide structural support, protection and nutrition for neurons throughout the nervous system. This set of functions is provided for by four different types of glial cells; Myelinating glia produce the axon-insulating myelin sheath. These are called oligodendrocytes in the CNS and Schwann cells in the PNS. Remember these easily with the mnemonic "COPS" (Central - Oligodendrocytes; Peripheral - Schwann) Astrocytes (CNS) and satellite glial cells (PNS) both share the function of supporting and protecting neurons. Other two glial cell types are found in CNS exclusively; microglia are the phagocytes of the CNS and ependymal cells which line the ventricular system of the CNS. The PNS doesn’t have a glial equivalent to microglia as the phagocytic role is performed by macrophages. Most axons are wrapped by a white insulating substance known as a myelin sheath, which is produced by oligodendrocytes and Schwann cells. Myelin encloses an axon segmentally, leaving interruptions between the segments known as myelin sheath gaps (a.k.a. nodes of Ranvier). The neural impulses propagate through the myelin sheath gaps only, skipping the myelin sheath. This significantly increases the speed of neural impulse propagation. The white color of myelinated axons is distinguished from the gray colored neuronal bodies and dendrites. Based on this, nervous tissue is divided into white matter and gray matter, both of which has a specific distribution; White matter comprises the outermost layer of the spinal cord and the inner part of the brain. Gray matter is located in the central part of the spinal cord, outermost layer of the brain (cerebral cortex), and in several subcortical nuclei of the brain deep to the cerebral cortex. Master the histology of nervous tissue with our customizable quiz: We got you covered with neurons, nerves and ganglia! Learn faster Nervous tissue structure Start quiz Nervous system breakdown (diagram) So nervous tissue, comprised of neurons and neuroglia, forms our nervous organs (e.g. the brain, nerves). These organs unite according to their common function, forming the evolutionary perfection that is our nervous system. The nervous system (NS) is structurally broken down into two divisions; Central nervous system (CNS) - consists of the brain and spinal cord Peripheral nervous system (PNS) - gathers all neural tissue outside the CNS Functionally, the nervous system can be categorized into three main areas: sensation, integration and response. The sensory (afferent) nervous system is responsible for detecting stimuli through receptors and transmitting this information to the central nervous system. Sensory inputs are further divided into somatic, visceral, and special senses. Integration occurs within the brain, processing sensory information at both lower and higher levels, including basic bodily functions and complex decision-making. Finally, the motor (efferent) nervous system carries signals from the brain to effectors, facilitating responses such as muscle movement or glandular secretion. This motor division includes somatic (voluntary) and autonomic (involuntary) systems, the latter further divided into sympathetic and parasympathetic responses, which regulate stress-related and resting activities, respectively. Learn more about the functional divisions of the nervous system in the video below: Although divided structurally into central and peripheral parts, the nervous system divisions are actually interconnected with each other. Axon bundles pass impulses between the brain and spinal cord. These bundles within the CNS are called afferent and efferent neural pathways or tracts. Axons that extend from the CNS to connect with peripheral tissues belong to the PNS. Axons bundles within the PNS are called afferent and efferent peripheral nerves. They say that the nervous system is one of the hardest anatomy topic. But you're in luck, as we've got a learning strategy for you to master neuroanatomy in a lot shorter time than you though you'll need. Check out our quizzes and more for the nervous system anatomy practice! The central nervous system (CNS) consists of the brain and spinal cord. These are found housed within the skull and vertebral column respectively. The brain is made of four parts; cerebrum, diencephalon, cerebellum and brainstem. Together these parts process the incoming information from peripheral tissues and generate commands; telling the tissues how to respond and function. These commands tackle the most complex voluntary and involuntary human body functions, from breathing to thinking. The spinal cord continues from the brainstem. It also has the ability to generate commands but for involuntary processes only, i.e. reflexes. However, its main function is to pass information between the CNS and periphery. Learn more about the CNS anatomy here: Learn faster Nervous system Explore study unit The PNS consists of 12 pairs of cranial nerves, 31 pairs of spinal nerves and a number of small neuronal clusters throughout the body called ganglia. Peripheral nerves can be sensory (afferent), motor (efferent) or mixed (both). Depending on what structures they innervate, peripheral nerves can have the following modalities; Cranial nerves are peripheral nerves that emerge from the cranial nerve nuclei of the brainstem and spinal cord. They innervate the head and neck. Cranial nerves are numbered one to twelve according to their order of exit through the skull fissures. Namely, they are: olfactory nerve (CN I), optic nerve (CN II), oculomotor nerve (CN III), trochlear nerve (CN IV), trigeminal nerve (CN V), abducens nerve (VI), facial nerve (VII), vestibulocochlear nerve (VIII), glossopharyngeal nerve (IX), vagus nerve (X), accessory nerve (XI), and hypoglossal nerve (XII). These nerves are motor (III, IV, VI, XI, and XII), sensory (I, II and VIII) or mixed (V, VII, IX, and X). Among many strategies for learning cranial nerves anatomy, our experts have determined that one of the most efficient is through interactive learning. Check out Kenhub’s interactive cranial nerves quizzes and labeling exercises to cut your studying time in half. Jump right into our cranial nerves quiz in multiple difficulty levels: Or learn more about the cranial nerves in this study unit. Learn faster 12 cranial nerves Explore study unit Spinal nerves emerge from the segments of the spinal cord. They are numbered according to their specific segment of origin. Hence, the 31 pairs of spinal nerves are divided into 8 cervical pairs, 12 thoracic pairs, 5 lumbar pairs, 5 sacral pairs, and 1 coccygeal spinal nerve. All spinal nerves are mixed, containing both sensory and motor fibers. Spinal nerves innervate the entire body, with the exception of the head. They do so by either directly synapsing with their target organs or by interlacing with each other and forming plexuses. There are four major plexuses that supply the body regions; Want to learn more about the spinal nerves and plexuses? Check out our resources. Ganglia (sing. ganglion) are clusters of neuronal cell bodies outside of the CNS, meaning that they are the PNS equivalents to subcortical nuclei of the CNS. Ganglia can be sensory or visceral motor (autonomic) and their distribution in the body is clearly defined. Dorsal root ganglia are clusters of sensory nerve cell bodies located adjacent to the spinal cord. They are a component of the posterior root of a spinal nerve. Autonomic ganglia are either sympathetic or parasympathetic. Sympathetic ganglia are found in the thorax and abdomen, grouped into paravertebral and prevertebral ganglia. Paravertebral ganglia lie on either side of vertebral column (para- means beside), comprising two ganglionic chains that extend from the base of the skull to the coccyx, called sympathetic trunks. Prevertebral ganglia (collateral ganglia, preaortic ganglia) are found anterior to the vertebral column (pre- means in front of), closer to their target organ. They are further grouped according to which branch of abdominal aorta they surround; celiac, aorticorenal, superior and inferior mesenteric ganglia. Parasympathetic ganglia are found in the head and pelvis. Ganglia in the head are associated with relevant cranial nerves and are the ciliary, pterygopalatine, otic and submandibular ganglia. Pelvic ganglia lie close to the reproductive organs comprising autonomic plexuses for innervation of pelvic viscera, such as prostatic and uterovaginal plexuses. Find everything about ganglia needed for your neuroanatomy exam here. Learn faster Ganglia of the nervous system Explore study unit The somatic nervous system is the voluntary component of the peripheral nervous system. It consists of all the fibers within cranial and spinal nerves that enable us to perform voluntary body movements (efferent nerves) and feel sensation from the skin, muscles and joints (afferent nerves). Somatic sensation relates to touch, pressure, vibration, pain, temperature, stretch and position sense from these three types of structures. Sensation from the glands, smooth and cardiac muscles is conveyed by the autonomic nerves. The autonomic nervous system is the involuntary part of the peripheral nervous system. Further divided into the sympathetic (SANS), parasympathetic (PANS) systems, it is comprised exclusively of visceral motor fibers. Nerves from both these divisions innervate all involuntary structures of the body; Balanced functioning of these two systems plays a crucial role in maintaining homeostasis, meaning that the SANS and PANS do not oppose each other but rather, they complement each other. They do so by potentiating the activity of different organs under various circumstances; for example, the PSNS will stimulate higher intestine activity after food intake, while SANS will stimulate the heart to increase the output during exercise. Autonomic nerves synapse within autonomic ganglia before reaching their target organ, thus all of them have presynaptic and postsynaptic parts. Presynaptic fibers originate from CNS and end by synapsing with neurons of the peripheral autonomic ganglia. Postsynaptic fibers are the axons of ganglion neurons, extending from the ganglion to peripheral tissues. In sympathetic nerves, the presynaptic fiber is short as the ganglia are located very close to the spinal cord, while the postsynaptic fiber is much longer in order to reach the target organ. In parasympathetic nerves it’s the opposite; the presynaptic fiber is longer than the postsynaptic. The autonomic nervous system seems to be the only thing that can act without your free will. Learn about how it does that here. Learn faster Autonomic nervous system Explore study unit The sympathetic system (SANS) adjusts our bodies for situations of increased physical activity. Its actions are commonly described as the “fight-or-flight” response as it stimulates responses such as faster breathing, increased heart rate, elevated blood pressure, dilated pupils and redirection of blood flow from the skin, kidneys, stomach and intestines to the heart and muscles, where it’s needed. Sympathetic nerve fibers have a thoracolumbar origin, meaning that they stem from the T1-L2/L3 spinal cord segments. They synapse with prevertebral and paravertebral ganglia, from which the postsynaptic fibers travel to supply the target viscera. The parasympathetic nervous system (PSNS) adjusts our bodies for energy conservation, activating “rest and digest” or “feed and breed” activities. The nerves of the PSNS slow down the actions of cardiovascular system, divert blood away from muscles and increase peristalsis and gland secretion. Parasympathetic fibers have craniosacral outflow, meaning that they originate from the brainstem (cranio-) and S2-S4 spinal cord segments (-sacral). These fibers travel to thoracic and abdominal organs, where they synapse in ganglia located close to or within the target organ. Enteric nervous system comprises the SANS and PANS fibers that regulate the activity of the gastrointestinal tract. This system is made of parasympathetic fibers of the vagus nerve (CN X) and sympathetic fibers of the thoracic splanchnic nerves. These fibers form two plexuses within the wall of the intestinal tube which are responsible for modulating intestinal peristalsis, i.e. propagation of consumed food from esophagus to rectum; Mnemonic You can easily remember these two plexuses using a simple mnemonic! ' SMP & MAPS', which stands for: Submucosal Meissner's Parasympathetic Myenteric Auerbach's Parasympathetic Sympathetic Vagotomy for gastric ulcers is an old procedure which is used as surgical management in patients with recurrent gastric ulcers when there is no effect of diet alterations or antiulcer drugs. The vagus nerve stimulates the secretion of gastric acid. Three types of vagotomy can be performed which would greatly diminish this effect. The 12 cranial nerves all leave/enter the skull through various foramina. Narrowing of these foramina or any constriction along the nerves course results in nerve palsy. For example, Bell’s palsy affects the facial nerve. On the affected side of the face, the patient has: hemiplegia dry eyesan an absent corneal reflex overloud hearing affected taste in the anterior 2/3 of the tongue Limb nerve palsies often result from fracture, constriction or overuse. For example, carpal tunnel syndrome affects the median nerve, and occurs when the nerve is compressed within the tunnel. This is due to enlargement of the flexor tendons within the tunnel or swelling due to oedema. It often occurs in pregnancy and acromegaly. This is colonic atony secondary to a failure of the ganglion cells (described in the enteric nervous system section) to migrate into the enteric nervous system. This results in a severely constipated and malnourished child, which is in desperate need of corrective surgery. Failure of normal development of the meninges and/or vertebral neural arch results in a defect usually in the lumbar spine, where part of the spinal cord is covered only by meninges and therefore sits outside the body. Both environmental and genetic factors contribute to its cause. Folate supplements are now given to all pregnant mothers in early pregnancy for its prevention. Dopamine is essential for the correct functioning of the basal ganglia, structures in the brain that control our cognition and movement. Parkinson’s patients suffer degradation of these dopaminergic neurons in the substantia nigra, resulting in: difficulty initiating movement shuffling gait masked facies cog-wheel/lead-pipe rigidity in the limbs All content published on Kenhub is reviewed by medical and anatomy experts. The information we provide is grounded on academic literature and peer-reviewed research. Kenhub does not provide medical advice. You can learn more about our content creation and review standards by reading our content quality guidelines. References: Blumenfeld, H. (2018). Neuroanatomy through clinical cases. Sunderland, MA: Sinauer. Goodfellow, J., Collins, D., Silva, D., Dardis, R., & Nagaraya, S. (2016). Neurology & neurosurgery. New Delhi, India: Jp medical pub. Patestas, M. A., & Gartner, L. P. (2016). A textbook of neuroanatomy. Hoboken: Wiley Blackwell Waxman, S. G. (2010). Clinical neuroanatomy. New York: McGraw-Hill Medical. Author, review and layout: Illustrators: Nervous system (anterior view) - Begoña Rodriguez 12 cranial nerves (diagram) - Paul Kim Articles within this topic: Videos within this topic: Overview of the nervous system: want to learn more about it? Our engaging videos, interactive quizzes, in-depth articles and HD atlas are here to get you top results faster. What do you prefer to learn with? “I would honestly say that Kenhub cut my study time in half.” – Read more. Kim Bengochea, Regis University, Denver 