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Central and peripheral nervous systems are the two components of the nervous system in animals. The central nervous system comprises the brain and spinal cord. The peripheral nervous system comprises the somatic nervous system and the autonomic nervous system. The main difference between central and peripheral nervous system is that the central nervous system receives sensory information and the processed information is sent into effector organs as the response whereas the peripheral nervous system is involved in sending information to the central nervous system and sending responses from the central nervous system into the effector organs. Key Areas Covered 1. What is Central Nervous System – Definition, Components, Function 2. What is Peripheral Nervous System – Definition, Components, function 3. What are the Similarities Between Central and Peripheral Nervous System – Outline of Common Features 4. What is the Difference Between Central and Peripheral Nervous System – Comparison of Key Differences Key Terms: Autonomic Nervous System (ANS), Brain, Central Nervous System (CNS), Enteric Nervous System (ENS), Parasympathetic Nervous System, Peripheral Nervous System (PNS), Somatic Nervous System (SNS), Spinal Cord, Sympathetic Nervous System What is Central Nervous System The central nervous system (CNS) is part of a vertebrate nervous system, which coordinates the sensory impulses and their relevant responses in the body. The CNS comprises the brain and spinal cord. The CNS can be roughly divided into gray and white matter. The outer cortex of the brain consists of gray matter and the inner area consists of white matter. The gray matter is composed of neurons and the white matter is mostly composed of axons of nerves. The retina, optic nerve, olfactory epithelium, and olfactory nerves also belong to the central nervous system. Figure 1: Central Nervous System Brain The brain consists of 100 billion nerve cells, which are protected by the skull and protective membranes called meninges. The support cells to the brain neurons are called glial cells or neuroglia. Astrocytes, oligodendrocytes, ependymal cells, and radial glia are found in the CNS as glial cells. The brain can be divided into four lobes: frontal, occipital, parietal, and temporal. The frontal lobes are responsible for the voluntary movements of the body. The occipital lobes receive visual impulses from the eye. The parietal lobes receive sensory information such as temperature, touch, taste, and pain. The temporal lobes are responsible for the memory and hearing. The brain initiates the voluntary movements of the body. Spinal Cord The spinal cord is protected by the vertebral column, which starts at the base of the brain. The main function of the spinal cord is to communicate with the brain and peripheral nerves. The spinal cord is composed of eight cervical segments, twelve thoracic segments, five lumbar segments, five sacral segment, and one coccygeal segment in humans. The peripheral nervous system (PNS) is the other part of the nervous system in vertebrates, which send sensory signals to the CNS and response of the body to the effector organs. The PNS is composed of neurons and neuron clusters called ganglia. The PNS can be divided into two as somatic nervous system and autonomic nervous system. Somatic Nervous System The somatic nervous system (SONS) controls actions of the body via voluntary movements and reflexes. The afferent fibers of the PNS carry sensory signals from the external stimuli. The sensory organs, which are connected by the afferent nerve fibers are eye, nose, tongue, ear, and skin. The efferent nerve fibers carry instructions from the CNS to the effector organs. The reflexes have no integration with the CNS for the response. The monosynaptic reflexes contain a single synapse between sensory and motor neuron and polysynaptic reflexes contain as least a single interneuron between the sensory and motor neurons. Autonomic Nervous System The autonomic nervous system (ANS) controls the unconscious or involuntary muscular movements. The ANS controls the functioning of the internal organs, breathing, heartbeat, and digestion. The two complementary parts of the ANS are sympathetic and parasympathetic nervous systems. The sympathetic nervous system prepares the body for fight-or-flight response under stressful conditions by raising the heartbeat, blood pressure, and dilating the pupil. The parasympathetic nervous system keeps the body at rest. The secretion and digestion are stimulated by the parasympathetic nervous system. The third component of the ANS is the enteric nervous system, which is capable of directly controlling the digestive system of the body. The nervous system of the body in humans is shown in figure 2. Figure 2: Nervous System in Humans Similarities Between Central and Peripheral Nervous System Both central and peripheral nervous systems are the two components of the nervous system of vertebrates. Both nervous systems are involved in responding different environmental stimuli in the environment, maintaining the life. Both nervous systems comprise neurons with the same physiology. Definition Central Nervous System: The central nervous system is the part of the nervous system in vertebrates, which comprises the brain and spinal cord, to which the sensory impulses are carried out and processed in order to coordinate functions in the body by sending the motor impulses to the effector organs. Peripheral Nervous System: The peripheral nervous system is the part of the nervous system in vertebrates, which comprises the somatic and autonomic nervous systems. Components Central Nervous System: The central nervous system consists of the brain and spinal cord. Peripheral Nervous System: The peripheral nervous system consists of sensory receptors, sensory neurons, and motor neurons. Nerve Axons Central Nervous System: The nerve axons of the central nervous system consist of slender projections and carry significantly short nerve impulses. Peripheral Nervous System: The peripheral nervous system is composed of long nerve fibers with a length up to 1m. Function Central Nervous System: The major function of the central nervous system is to organize and analyze the information obtained from sensory organs. Peripheral Nervous System: The major function of the peripheral nervous system is to transmit sensory information to the central nervous system and pass out motor impulses to the effector organs. Damage Central Nervous System: A damage in the central nervous system causes a global effect on the body. Peripheral Nervous System: A damage to the peripheral nervous system causes a local effect on the body. Regeneration Central Nervous System: Most of the nerves in the central nervous system are incapable of regenerating its nerve fibers. Peripheral Nervous System: Most of the nerves in the peripheral nervous system can be regenerated. Conclusion Central and peripheral nervous systems collectively make up the nervous system in vertebrates. The CNS comprises the brain and spinal cord. The PNS comprises somatic and autonomic nervous systems. The PNS is involved in the transmission of sensory impulses from its sensory receptors into the CNS. The receiving nerve impulses are processed in the brain and the relevant responses are sent to the effector organs through the PNS. The major function of the CNS is to coordinate the sensory impulses obtained from both external and internal environment of the body. Therefore, the main difference between central and peripheral nervous system is their role in coordinating the functions of the body. Reference: 1. Newman, Tim. “Central Nervous System: Structure, Functions and Diseases.” Medical News Today. MediLexicon International, 02 Mar. 2016. Web. Available here. 03 July 2017. 2. “Central Nervous System (CNS) Function, Parts, Diagram & Charts.” EMedicineHealth. N.p., n.d. Web. Available here. 03 July 2017. 3. “The Peripheral Nervous System (PNS) – Boundless Open Textbook.” Boundless. N.p., 08 Aug. 2016. Web. Available here. 03 July 2017. Image Courtesy: 1. “Central nervous system” (CC BY-SA 3.0) via Commons Wikimedia2. “1205 Somatic Autonomic Enteric StructuresN” By OpenStax – (CC BY 4.0) via Commons Wikimedia The respiratory system is composed of a group of muscles, blood vessels, and organs that enable us to breathe. The primary function of this system is to provide body tissues and cells with life-giving oxygen while expelling carbon dioxide. These gases are transported via the blood to sites of gas exchange (lungs and cells) by the circulatory system. In addition to breathing, the respiratory system also assists in vocalization and the sense of smell. Respiratory system structures help to bring air from the environment into the body and expel gaseous waste from the body. These structures are typically grouped into three main categories: air passages, pulmonary vessels, and respiratory muscles. Nose and Mouth: openings that allow outside air to flow into the lungs.Pharynx (throat): directs air from the nose and mouth to the larynx.Larynx (voice box): directs air to the windpipe and contains vocal cords for vocalization.Trachea (windpipe): splits into left and right bronchial tubes that direct air to the left and right lungs. Lungs: paired organs in the chest cavity that enable gas exchange between the blood and the air. The lungs are divided into five lobes.Bronchial tubes: tubes within the lungs that direct air into bronchioles and lets air out of the lungs.Bronchioles: smaller bronchial tubes within the lungs that direct air to small air sacs known as alveoli.Alveoli: bronchiole terminal sacs that are surrounded by capillaries and are the respiratory surfaces of the lungs.Pulmonary arteries: blood vessels that transport oxygen-depleted blood from the heart to the lungs.Pulmonary veins: blood vessels that transport oxygen-rich blood from the lungs back to the heart. Diaphragm: muscular partition that separates the chest cavity from the abdominal cavity. It contracts and relaxes to enable breathing.Intercostal muscles: several groups of muscles located between the ribs that help to expand and shrink the chest cavity to aid in breathing.Abdominal muscles: aid in faster exhalation of air. Dorling Kindersley/Getty Images Breathing is a complex physiological process that is performed by respiratory system structures. There are a number of facets involved in breathing. Air must be able to flow into and out of the lungs. Gases must be able to be exchanged between the air and blood, as well as between the blood and body cells. All of these factors must be under strict control and the respiratory system must able to respond to changing demands when necessary. Air is brought into the lungs by actions of respiratory muscles. The diaphragm is shaped like a dome and is at its maximum height when it is relaxed. This shape reduces the volume in the chest cavity. As the diaphragm contracts, the diaphragm moves downward and the intercostal muscles move outward. These actions increase volume in the chest cavity and lower air pressure within the lungs. The lower air pressure in the lungs causes air to be drawn into the lungs through the nasal passages until the pressure differences equalize. When the diaphragm relaxes again, space within the chest cavity decreases and the air is forced out of the lungs. Air is brought into the lungs from the external environment contains oxygen needed for body tissues. This air fills tiny air sacs in the lungs called alveoli. Pulmonary arteries transport oxygen-depleted blood containing carbon dioxide to the lungs. These arteries form smaller blood vessels called arterioles which send blood to capillaries surrounding millions of lung alveoli. Lung alveoli are coated with a moist film that dissolves air. Oxygen levels within the alveoli sacs is at a higher concentration than oxygen levels in the capillaries surrounding the alveoli. As a result, oxygen diffuses across the thin endothelium of the alveoli sacs into the blood within the surrounding capillaries. At the same time, carbon dioxide diffuses from the blood into the alveoli sacs and is exhaled through air passages. The oxygen-rich blood is then transported to the heart where it is pumped out to the rest of the body. A similar exchange of gases takes place at body tissues and cells. Oxygen used by cells and tissues must be replaced. Gaseous waste products of cellular respiration such as carbon dioxide must be removed. This is accomplished through cardiovascular circulation. Carbon dioxide diffuses from cells into blood and is transported to the heart by veins. Oxygen in arterial blood diffuses from the blood into cells. The process of breathing is under the direction of the peripheral nervous system (PNS). The autonomic system of the PNS controls involuntary processes such as breathing. The medulla oblongata of the brain regulates breathing. Neurons in the medulla send signals to the diaphragm and the intercostal muscles to regulate the contractions which initiate the breathing process. The respiratory centers in the medulla control breathing rate and can speed up or slow down the process when needed. Sensors in the lungs, brain, blood vessels and muscles monitor changes in gas concentrations and alert respiratory centers of these changes. Sensors in air passages detect the presence of irritants such as smoke, pollen, or water. These sensors send nerve signals to respiratory centers to induce coughing or sneezing to expel the irritants. Breathing can also be influenced voluntarily by the cerebral cortex. This is what allows you to voluntarily speed up your breathing rate or hold your breath. These actions, however, can be overridden by the autonomic nervous system. BSIP/UIG/Getty Images Respiratory system infections are common as respiratory structures are exposed to the external environment. Respiratory structures sometimes come in contact with infectious agents like bacteria and viruses. These germs infect respiratory tissue causing inflammation and can impact the upper respiratory tract as well as the lower respiratory tract. The common cold is the most notable type of upper respiratory tract infection. Other types of upper respiratory tract infections include sinusitis (inflammation of the sinuses), tonsillitis (inflammation of the tonsils), epiglottitis (inflammation of the epiglottis that covers the trachea), laryngitis (inflammation of the larynx) and influenza. Lower respiratory tract infections are often far more dangerous than upper respiratory tract infections. Lower respiratory tract structures include the trachea, bronchial tubes, and lungs. Bronchitis (inflammation of the bronchial tubes), pneumonia (inflammation of the lung alveoli), tuberculosis, and influenza are types of lower respiratory tract infections. The respiratory system enables organisms to breathe. Its components are a group of muscles, blood vessels, and organs. Its primary function is to provide oxygen while expelling carbon dioxide.Structures of the respiratory system can be grouped into three main categories: air passages, pulmonary vessels, and respiratory muscles.Examples of respiratory structures include the nose, mouth, lungs, and diaphragm.In the breathing process, air flows into and out of the lungs. Gases are exchanged between the air and blood. Gases are also exchanged between the blood and body cells.All facets of breathing are under strict control as the respiratory system must be able to adapt to changing needs.Respiratory system infections can be common since its component structures are exposed to the environment. Bacteria and viruses can infect the respiratory system and cause disease. "How the Lungs Work." National Heart Lung and Blood Institute, U.S. Department of Health and Human Services, www.nhlbi.nih.gov/health/health-topics/topics/hlw/system.

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