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Branches of anatomy and physiology pdf full word

(credit: modification of work by “Suseno”/Wikimedia Commons) Looking at nervous tissue, there are regions that predominantly contain cell bodies and regions that are largely composed of just axons. In 2003, the Nobel Prize in Physiology or Medicine was awarded to Paul C. There is an important point to make about these terms, which is that they can both be used to refer to the same bundle of axons. Self-Check Questions Take the quiz below to check your understanding of the Basic Structure and Function of the Nervous System: You didn’t decide to do that, and you may not have wanted to give your friend a reason to laugh at your expense, but it is a reflex involving skeletal muscle contractions. Dendrites are responsible for receiving most of the input from other neurons. This task does not even include all of the functions the brain performs. Figure 5. Somatic, Autonomic, and Enteric Structures of the Nervous System Somatic structures include the spinal nerves, both motor and sensory fibers, as well as the sensory ganglia (posterior root ganglia and cranial nerve ganglia). There is also a region of the peripheral nervous system that is called the enteric nervous system that is responsible for a specific set of the functions within the realm of autonomic control related to gastrointestinal functions. For example, skeletal muscle contracts to move the skeleton, cardiac muscle is influenced as heart rate increases during exercise, and smooth muscle contracts as the digestive system moves food along the digestive tract. The nervous system can be divided into two major regions: the central and peripheral nervous systems. Consider this possible experiment: the subject is told to look at a screen with a black dot in the middle (a fixation point). The enteric nervous system includes the nervous tissue within the organs of the digestive tract. Sensory input for autonomic functions can be from sensory structures tuned to external or internal environmental stimuli. In comparison, it is easy to see that the stomach is different than the esophagus or the liver, so you can imagine the digestive system as a collection of specific organs. This leads to the discovery of a hereditary condition that affects the brain and spinal cord. There is one important process that every neuron has called an axon, which is the fiber that connects a neuron with its target. See Figure 5 for examples of where these divisions of the nervous system can be found. The motor output extends to smooth and cardiac muscle as well as glandular tissue. Table 1. The trajectory of the ball and its speed will need to be considered. There are two ways to consider how the nervous system is divided functionally. Those axons are called the optic nerve as they leave the eye, but when they are inside the cranium, they are referred to as the optic tract. In this task, visual sensory areas would be active, integrating areas would be active, motor areas responsible for moving the eyes would be active, and motor areas for pressing the button with a finger would be active. This procedure is different from the standard MRI technique because it is measuring changes in the tissue in time with an experimental condition or event. Regardless of the appearance of stained or unstained tissue, the cell bodies of neurons or axons can be located in discrete anatomical structures that need to be named. The problem with trying to fit functional differences into anatomical divisions is that sometimes the same structure can be part of several functions. Integration Stimuli that are received by sensory structures are communicated to the nervous system where that information is processed. The nervous system can be divided into regions that are responsible for sensation (sensory functions) and for the response (motor functions). Some somatic motor responses are reflexes, and often happen without a conscious decision to perform them. First, the basic functions of the nervous system are sensation, integration, and response. It is as if the nervous system is composed of many organs that all look similar and can only be differentiated using tools such as the microscope or electrophysiology. A similar situation outside of science can be described for some roads. Those areas are distributed all around the brain and the fMRI images would show activity in more than just 10 percent of the brain (some evidence suggests that about 80 percent of the brain is using energy—based on blood flow to the tissue—during well-defined tasks similar to the one suggested above). By having the subject perform a visual task, activity all over the brain can be measured. This is a tool to see the structures of the body (not just the nervous system) that depends on magnetic fields associated with certain atomic nuclei. Gray matter is not necessarily gray. There are actually more senses than just those, but that list represents the major senses. These two regions within nervous system structures are often referred to as gray matter (the regions with many cell bodies and dendrites) or white matter (the regions with many axons). Figure 2 demonstrates the appearance of these regions in the brain and spinal cord. A bundle of axons, or fibers, found in the CNS is called a tract whereas the same thing in the PNS would be called a nerve. Autonomic structures are found in the nerves also, but include the sympathetic and parasympathetic ganglia. (b) The nucleus of a cell is the organelle that contains DNA. The role of the autonomic system is to regulate the organ systems of the body, which usually means to control homeostasis. Nervous tissue, present in both the CNS and PNS, contains two basic types of cells: neurons and glial cells. The underlying assumption is that active nervous tissue will have greater blood flow. Seeing a baseball pitched to a batter will not automatically cause the batter to swing. (a) The nucleus of an atom contains its protons and neutrons. It is a bit of an oversimplification to say that the CNS is what is inside these two cavities and the peripheral nervous system is outside of them, but that is one way to start to think about it. In order to describe the functional divisions of the nervous system, it is important to understand the structure of a neuron. It is a large part of the PNS, and is not dependent on the CNS. In actuality, there are some elements of the peripheral nervous system that are within the cranial or vertebral cavities. Visit this site to read about a woman that notices that her daughter is having trouble walking up the stairs. The distinction between gray matter and white matter is most often applied to central nervous tissue, which has large regions that can be seen with the unaided eye. Additional sensory stimuli might be from the internal environment (inside the body), such as the stretch of an organ wall or the concentration of certain ions in the blood. Response The nervous system produces a response on the basis of the stimuli perceived by sensory structures. The brain is contained within the cranial cavity of the skull, and the spinal cord is contained within the vertebral cavity of the vertebral column. If your friend jumps out from behind a corner and yells “Boo!” you will be startled and you might scream or leap back. A glial cell is one of a variety of cells that provide a framework of tissue that supports the neurons and their activities. Secondly, control of the body can be somatic or autonomic—divisions that are largely defined by the structures that are involved in the response. Sensory input needs to be integrated with other sensations, as well as with memories, emotional state, or learning (cognition). The somatic nervous system (SNS) is responsible for conscious perception and voluntary motor responses. A localized collection of neuron cell bodies in the CNS is referred to as a nucleus. (credit c: “Was a bee”/Wikimedia Commons) Terminology applied to bundles of axons also differs depending on location. (credit: “Superborsuk”/Wikimedia Commons) An easy way to see how much of the brain a person uses is to take measurements of brain activity while performing a task. That is not to say that central nervous tissue cannot be stained and viewed under a microscope, but unstained tissue is most likely from the CNS—for example, a frontal section of the brain or cross section of the spinal cord. Figure 3. What Is a Nucleus? That is a homeostatic mechanism. When you are hot, sweating helps cool your body down. Voluntary responses are governed by the somatic nervous system and involuntary responses are governed by the autonomic nervous system, which are discussed in the next section. An obvious response would be the movement of muscles, such as withdrawing a hand from a hot stove, but there are broader uses of the term. But there is a third function that needs to be included. Neurons are cells and therefore have a soma, or cell body, but they also have extensions of the cell; each extension is generally referred to as a process. The most obvious example of this is the axons that project from the retina into the brain. The equivalent structures in the CNS are not obvious from this overall perspective and are best examined in prepared tissue under the microscope. The subject has been instructed to push a button if the photograph is of someone they recognize. It is the center of an atom, where protons and neutrons are found; it is the center of a cell, where the DNA is found; and it is a center of some function in the CNS. The utility of this technique in the nervous system is that fat tissue and water appear as different shades between black and white. Those names are specific to whether the structure is central or peripheral. For example, the optic nerve carries signals from the retina that are either used for the conscious perception of visual stimuli, which takes place in the cerebral cortex, or for the reflexive responses of smooth muscle tissue that are processed through the hypothalamus. Maybe you have seen an advertisement on a website saying that there is a secret to unlocking the full potential of your mind—as if there were 90 percent of your brain sitting idle, just waiting for you to use it. Controlling the Body The nervous system can be divided into two parts mostly on the basis of a functional difference in responses. Voluntary motor response means the contraction of skeletal muscle, but those contractions are not always voluntary in the sense that you have to want to perform them. That suggests it is made of two organs—and you may not even think of the spinal cord as an organ—but the nervous system is a very complex structure. The same axons extend from the eye to the brain through these two bundles of fibers, but the chiasm represents the border between peripheral and central. The autonomic nervous system (ANS) is responsible for involuntary control of the body, usually for the sake of homeostasis (regulation of the internal environment). In the PNS, a cluster of neuron cell bodies is referred to as a ganglion. Figure 3 indicates how the term nucleus has a few different meanings within anatomy and physiology. The nervous system can cause the contraction of all three types of muscle tissue. (c) A nucleus in the CNS is a localized center of function with the cell bodies of several neurons, shown here circled in red. The sensory functions of the nervous system register the presence of a change from homeostasis or a particular event in the environment, known as a stimulus. Responses can be divided into those that are voluntary or conscious (contraction of skeletal muscle) and those that are involuntary (contraction of smooth muscles, regulation of cardiac muscle, activation of glands). In the PNS, they are called the optic nerve, and in the CNS, they are the optic tract. Table 1 helps to clarify which of these terms apply to the central or peripheral nervous systems. It isn’t true. Those five are all senses that receive stimuli from the outside world, and of which there is conscious perception. The colors ascribed to these regions are what would be seen in “fresh,” or unstained, nervous tissue. The CNS and the PNS both contribute to the same functions, but those functions can be attributed to different regions of the brain (such as the cerebral cortex or the hypothalamus) or to different ganglia in the periphery. The central nervous system (CNS) is the brain and spinal cord, and the peripheral nervous system (PNS) is everything else (Figure 1). Lipids can appear as white (“fatty”) material, much like the fat on a raw piece of chicken or beef. When looking at peripheral structures, often a microscope is used and the tissue is stained with artificial colors. It can be pinkish because of blood content, or even slightly tan, depending on how long the tissue has been preserved. The Central and Peripheral Nervous Systems Figure 1. There is no language response, the body is mostly lying still in the MRI machine, and it does not consider the autonomic functions that would be ongoing in the background. The enteric nervous system (ENS) is responsible for controlling the smooth muscle and glandular tissue in your digestive system. Within the brain, many different and separate regions are responsible for many different and separate functions. A photograph of a face is projected on the screen away from the center. That is not homeostatic, it is the physiological response to an emotional state. Another type of process that branches off from the soma is the dendrite. Because white matter is fatty (from myelin) and gray matter is not, they can be easily distinguished in MRI images. Sweat glands, for example, are controlled by the autonomic system. Some regions of the nervous system are termed integration or association areas. Responses also include the neural control of glands in the body as well, such as the production and secretion of sweat by the eccrine and merocrine sweat glands found in the skin to lower body temperature. Central and Peripheral Nervous System The structures of the PNS are referred to as ganglia and nerves, which can be seen as distinct structures. The electromyography and MRI tests indicated deficiencies in the spinal cord and cerebellum, both of which are responsible for controlling coordinated movements. Depending on different aspects of the nervous system, the dividing line between central and peripheral is not necessarily universal. The process of integration combines sensory perceptions and higher cognitive functions such as memories, learning, and emotion to produce a response. The subject has to look at the photograph and decipher what it is. There is a specific place where the name changes, which is the optic chiasm, but they are still the same axons (Figure 4). Other motor responses become automatic (in other words, unconscious) as a person learns motor skills (referred to as “habit learning” or “procedural memory”). Sensation The first major function of the nervous system is sensation—receiving information about the environment to gain input about what is happening outside the body (or, sometimes, within the body). If you see an ad like that, don’t click. An example of this kind of measurement is functional magnetic resonance imaging (fMRI), which generates a map of the most active areas and can be generated and presented in three dimensions (Figure 6). This is called integration. Or maybe the batter’s team is so far ahead, it would be fun to just swing away. But white matter is white because axons are insulated by a lipid-rich substance called myelin. There is also a potentially confusing use of the word ganglion (plural = ganglia) that has a historical explanation. This leads to the specific response that will be generated. To what functional division of the nervous system would these structures belong? Functional Divisions of the Nervous System The nervous system can also be divided on the basis of its functions, but anatomical divisions and functional divisions are different. Learning Objectives Identify the anatomical and functional divisions of the nervous system Relate the functional and structural differences between gray matter and white matter structures of the nervous system to the structure of neurons 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. Lauterbur and Sir Peter Mansfield for discoveries related to magnetic resonance imaging (MRI). It is sometimes valid, however, to consider the enteric system to be a part of the autonomic system because the neural structures that make up the enteric system are a component of the autonomic output that regulates digestion. Figure 4. Optic Nerve Versus Optic Tract This drawing of the connections of the eye to the brain shows the optic nerve extending from the eye to the chiasm, where the structure continues as the optic tract. Figure 6. fMRI This fMRI shows activation of the visual cortex in response to visual stimuli. But when you are nervous, you might start sweating also. How do the imaging techniques shown in this game indicate the separation of white and gray matter compared with the freshly dissected tissue shown earlier? The photograph might be of a celebrity, so the subject would press the button, or it might be of a random person unknown to the subject, so the subject would not press the button. Have you ever heard the claim that humans only use 10 percent of their brains? Also, the results from an MRI session are compared with images obtained from X-ray or computed tomography. In the central nervous system, there is a group of nuclei that are connected together and were once called the basal ganglia before “ganglion” became accepted as a description for a peripheral structure. Basic Functions The nervous system is involved in receiving information about the environment around us (sensation) and generating responses to that information (motor responses). Maybe the count is three balls and one strike, and the batter wants to let this pitch go by in the hope of getting a walk to first base. The stimuli for taste and smell are both chemical substances (molecules, compounds, ions, etc.), touch is physical or mechanical stimuli that interact with the skin, sight is light stimuli, and hearing is the perception of sound, which is a physical stimulus similar to some aspects of touch. Actually, gray matter may have that color ascribed to it because next to the white matter, it is just darker—hence, gray. There are some differences between the two, but for our purposes here there will be a good bit of overlap. There is another division of the nervous system that describes functional responses. Some sources refer to this group of nuclei as the “basal nuclei” to avoid confusion. When those axons are in the PNS, the term is nerve, but if they are CNS, the term is tract. The senses we think of most are the “big five”: taste, smell, touch, sight, and hearing. Figure 2. Gray Matter and White Matter A brain removed during an autopsy, with a partial section removed, shows white matter surrounded by gray matter. Imagine a road called “Broad Street” in a town called “Anyville.” The road leaves Anyville and goes to the next town over, called “Hometown.” When the road crosses the line between the two towns and is in Hometown, its name changes to “Main Street.” That is the idea behind the naming of the retinal axons. Gray matter makes up the outer cortex of the brain. Structures of the CNS and PNS CNS PNS Group of Neuron Cell Bodies (i.e., gray matter) Nucleus Ganglion Bundle of Axons (i.e., white matter) Tract Nerve Visit the Nobel Prize web site to play an interactive game that demonstrates the use of this technology and compares it with other types of imaging technologies. The neuron is the more functionally important of the two, in terms of the communicative function of the nervous system. Stimuli are compared with, or integrated with, other stimuli, memories of previous stimuli, or the state of a person at a particular time. The peripheral nervous system is so named because it is on the periphery—meaning beyond the brain and spinal cord.

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