Human Physiology/The Nervous System

The central nervous system includes the brain and spinal cord. The brain and spinal cord are protected by bony structures, membranes, and fluid. The brain is held in the cranial cavity of the skull and it consists of the cerebrum, cerebellum, and the brain stem. The nerves involved are cranial nerves and spinal nerves.

Overview of the entire nervous system

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.

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 Nervous system 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.

General functions of the CNS

Structure and function of neurons

Structure

Neurons are highly specialized for the processing and transmission of cellular signals. Given the diversity of functions performed by neurons in different parts of the nervous system, there is, as expected, a wide variety in the shape, size, and electrochemical properties of neurons. For instance, the soma of a neuron can vary in size from 4 to 100 micrometers in diameter.

The soma (cell body) is the central part of the neuron. It contains the nucleus of the cell, and therefore is where most protein synthesis occurs. The dendrites of a neuron are cellular extensions with many branches, and metaphorically this overall shape and structure is referred to as a dendritic tree. This is where the majority of input to the neuron occurs.. The axon is a finer, cable-like projection which can extend tens, hundreds, or even tens of thousands of times the diameter of the soma in length. The axon carries nerve signals away from the soma (and also carry some types of information back to it). Many neurons have only one axon, but this axon may - and usually will - undergo extensive branching, enabling communication with many target cells. The axon terminal is a specialized structure at the end of the axon that is used to release neurotransmitter chemicals and communicate with target neurons.

Excitatory and inhibitory process

The release of a excitatory neurotransmitter (ACHe) at the synapses will cause an inflow of positively charged sodium ions (Na^+) making a localized depolarization of the membrane. The current then flows to the resting (polarized) segment of the axon.

Inhibitory synapse causes an inflow of Cl- (chlorine) or outflow of K+ (potassium) making the synaptic membrane hyperpolarized. This increase prevents depolarization, causing a decrease in the possibility of an axon discharge. . There are two types of summation: spatial and temporal. Spatial summation requires several excitatory synapses (firing several times) to add up,thus causing an axon discharge. It also occurs within inhibitory synapses, where just the opposite will occur. In temporal summation, it causes an increase of the frequency at the same synapses until it is large enough to cause a discharge. Spatial and temporal summation can occur at the same time as well.

The neurons of the brain release inhibitory neurotransmitters far more than excitatory neurotransmitters, which helps explain why we are not aware of all memories and all sensory stimuli simultaneously. The majority of information stored in the brain is inhibited most of the time.

Central Nervous System

The central nervous system is the control center for the body. It regulates organ function, higher thought, and movement of the body. The central nervous system consists of the brain and spinal cord.

Generation & propagation of an action potential

The Nerve Impulse

When a nerve is stimulated the resting potential changes. Examples of such stimuli are pressure, electricity, chemicals, etc. Different neurons are sensitive to different stimuli(although most can register pain). The stimulus causes sodium ion channels to open. The rapid change in polarity that moves along the nerve fiber is called the "ACTION POTENTIAL." This moving change in polarity has several stages:

Brain

The brain is found in the cranial cavity. Within it are found the higher nerve centers responsible for coordinating the sensory and motor systems of the body (forebrain). The brain stem houses the lower nerve centers (consisting of midbrain, pons, and medulla),

Medulla

The medulla is the control center for respiratory, cardiovascular and digestive functions. A color-coded image of the brain, showing the main sections.

Pons

The pons houses the control centers for respiration and inhibitory functions. Here it will interact with the cerebellum.

Cerebrum

The cerebrum, or top portion of the brain, is divided by a deep crevice, called the longitudinal sulcus. The longitudinal sulcus separates the cerebrum in to the right and left hemispheres. In the hemispheres you will find the cerebral cortex, basal ganglia and the limbic system. The two hemispheres are connected by a bundle of nerve fibers called the corpus callosum. The right hemisphere is responsible for the left side of the body while the opposite is true of the left hemisphere. Each of the two hemispheres are divided into four separated lobes: the frontal in control of specialized motor control, learning, planning and speech; parietal in control of somatic sensory functions; occipital in control of vision; and temporal lobes which consists of hearing centers and some speech. Located deep to the temporal lobe of the cerebrum is the insula.

Cerebellum

The cerebellum is the part of the brain that is located posterior to the medulla oblongata and pons. It coordinates skeletal muscles to produce smooth, graceful motions. The cerebellum receives information from our eyes, ears, muscles, and joints about what position our body is currently in (proprioception). It also receives output from the cerebral cortex about where these parts should be. After processing this information, the cerebellum sends motor impulses from the brainstem to the skeletal muscles. The main function of the cerebellum is coordination. The cerebellum is also responsible for balance and posture. It also assists us when we are learning a new motor skill, such as playing a sport or musical instrument. Recent research shows that apart from motor functions cerebellum also has some emotional role.

The Limbic System and Higher Mental Functions

The Limbic System

The Limbic System is a complex set of structures found just beneath the cerebrum and on both sides of the thalamus. It combines higher mental functions, and primitive emotion, into one system. It is often referred to as the emotional nervous system. It is not only responsible for our emotional lives, but also our higher mental functions, such as learning and formation of memories. The Limbic system explains why some things seem so pleasurable to us, such as eating and why some medical conditions are caused by mental stress, such as high blood pressure. There are two significant structures within the limbic system and several smaller structures that are important as well. They are:

1. The Hippocampus 2. The Amygdala 3. The Thalamus 4. The Hypothalamus.5. The Cingulate Gyrus

Structures of the Limbic System

Hippocampus

The Hippocampus is found deep in the temporal lobe, shaped like a seahorse. It consists of two horns that curve back from the amygdala. It is situated in the brain so as to make the prefrontal area aware of our past experiences stored in that area. The prefrontal area of the brain consults this structure to use memories to modify our behavior. The hippocampus is responsible for memory.

Amygdala

The Amygdala is a little almond shaped structure, deep inside the anteroinferior region of the temporal lobe, connects with the hippocampus, the septi nuclei, the prefrontal area and the medial dorsal nucleus of the thalamus. These connections make it possible for the amygdala to play its important role on the mediation and control of such activities and feelings as love, friendship, affection, and expression of mood. The amygdala is the center for identification of danger and is fundamental for self preservation. The amygdala is the nucleus responsible for fear.

Thalamus

Lesions or stimulation of the medial, dorsal, and anterior nuclei of the thalamus are associated with changes in emotional reactivity. However, the importance of these nuclei on the regulation of emotional behavior is not due to the thalamus itself, but to the connections of these nuclei with other limbic system structures..

Hypothalamus

The Hypothalamus is a small part of the brain located just below the thalamus on both sides of the third ventricle. Lesions of the hypothalamus interfere with several vegetative functions and some so called motivated behaviors like sexuality, combativeness, and hunger. The hypothalamus also plays a role in emotion. Specifically, the lateral parts seem to be involved with pleasure and rage, while the medial part is linked to aversion, displeasure, and a tendency to uncontrollable and loud laughing. However, in general the hypothalamus has more to do with the expression of emotions. When the physical symptoms of emotion appear, the threat they pose returns, via the hypothalamus, to the limbic centers and then the prefrontal

The Cingulate Gyrus

The Cingulate Gyrus is located in the medial side of the brain between the cingulated sulcus and the corpus callosum. There is still much to be learned about this gyrus, but it is already known that its frontal part coordinates smells and sights, with pleasant memories of previous emotions. The region participates in the emotional reaction to pain and in the regulation of aggressive behavior..

Diseases of the Limbic System

There are several well known diseases that are disorders of the limbic system. Several are discussed here.

Schizophrenia

An increased dopamine (DA) response in the limbic system results in schizophrenia. DA may be synthesized or secreted in excess, DA receptors may be supersensitive, and DA regulatory mechanism may be defective. Symptoms are decreased by drugs which block DA receptors. Symptoms of schizophrenia are:

1. Loss of touch with reality 2. Decreased ability to think and reason 3. Decreased ability to concentrate 4. Decreased memory 5. Regress in child-like behavior 6. Altered mood and impulsive behavior 7. Auditory hallucinations

Symptoms may be so severe that the individual cannot function.

Depression

Depression is the most common major mental illness and is characterized by both emotional and physical symptoms. Symptoms of depression are:

1. Intense sadness and despair 2. Anxiety 3. Loss of ability to concentrate 4. Pessimism 5. Feelings of low self esteem 6. Insomnia or hypersomnia 7. Increased or decreased appetite 8. Changes in body temperature and endocrine gland function

10 to 15% of depressed individuals display suicidal behavior during their lifetime.

The cause of depression and its symptoms are a mystery but we do understand that it is an illness associated with biochemical changes in the brain. A lot of research goes on to explain that it is associated with a lack of amines serotonin and norephinephrine. Therefore pharmacological treatment strategies often try to increase amine concentrations in the brain.

One class of antidepressants is monoamine oxidase inhibitors. Mono amine oxidase is a enzyme that breaks down your amines like norephinephrine and serotonin. Because the antidepressants inhibit their degradation they will remain in the synaptic cleft for a longer period of time making the effect just as if you had increased theses types of neurotransmitters.

A newer class of antidepressants is selective serotonin reuptake inhibitors (SSRI's). With SSRI's decreasing the uptake of serotonin back into the cell that will increase the amount of serotonin present in the synaptic cleft. SSRI's are more specific than the monoamine oxidase inhibitors because they only affect serotonergic synapses. You might recognize these SSRI's by name as Prozac and Paxil.

Bipolar Disorder

Another common form of depression is manic depression. Manic is an acute state characterized by:

1. Excessive elation and impaired judgment 2. Insomnia and irritability 3. Hyperactivity 4. Uncontrolled speech

Manic depression, also known as bipolar disorder, displays mood swings between manic and depression. The limbic system receptors are unregulated. Drugs used are unique mood stabilizers.

The hippocampus is particularly vulnerable to several disease processes, including ischemia, which is any obstruction of blood flow or oxygen deprivation, Alzheimer's disease, and epilepsy. These diseases selectively attack CA1, which effectively cuts through the hippocampal circuit.

An Autism Link

A connection between autism and the limbic system has also been noted as well. URL: http:/ / www. autism. org/ limbic. html

Case Study

Central Pain Syndrome

I was 42 years old when my life changed forever. I had a stroke. As an avid viewer of medical programs on television I assumed that I would have physical therapy for my paralyzed left side and get on with my life. No one ever mentioned pain or the possibility of pain, as a result of the stroke. I did experience unusual sensitivity to touch while still in the hospital, but nothing to prepare me for what was to come.

The part of my brain that is damaged is the Thalamus. This turns out to be the pain center and what I have now is an out of control Thalamus, resulting in Thalamic Pain syndrome, also called Central Pain Syndrome. This means that 24 hours a day, seven days a week, my brain sends messages of pain and it never goes away. I am under the care of physicians, who not only understand chronic pain, but are also willing to treat it with whatever medications offer some help. None of the medications, not even narcotic medications, take the pain away. They just allow me to manage it so I can function.

The Peripheral Nervous System

The Autonomic System

The Autonomic system deals with the visceral organs, like the heart, stomach, gland, and the intestines. It regulates systems that are unconsciously carried out to keep our body alive and well, such as breathing, digestion (peristalsis), and regulation of the heartbeat. The Autonomic system consists of the sympathetic and the parasympathetic divisions. Both divisions work without conscious effort, and they have similar nerve pathways, but the sympathetic and parasympathetic systems generally have opposite effects on target tissues (they are antagonistic). By controlling the relative input from each division, the autonomic system regulates many aspects of homeostasis. One of the main nerves for the parasympathetic autonomic system is Cranial Nerve X, the Vagus nerve.

The Sympathetic and Parasympathetic Systems

The sympathetic nervous system activates what is often termed the fight or flight response, as it is most active under sudden stressful circumstances (such as being attacked). This response is when you secrete acetylcholine, which activates the secretion of adrenaline (epinephrine) and to a lesser extent noradrenaline (norepinephrine) from it. Therefore, this response that acts primarily on the cardiovascular system is mediated directly via impulses transmitted through the sympathetic nervous system and indirectly via catecholamines secreted from the adrenal medulla.

The parasympathetic nervous system is part of the autonomic nervous system. Sometimes called the rest and digest system or feed and breed. The parasympathetic system conserves energy as it slows the heart rate, increases intestinal and gland activity, and relaxes sphincter muscles in the gastrointestinal tract.

After high stress situations (ie: fighting for your life) the parasympathetic nervous system has a backlash reaction that balances out the reaction of the sympathetic nervous system. For example, the increase in heart rate that comes along with a sympathetic reaction will result in an abnormally slow heart rate during a parasympathetic reaction.

Information transmission

Messages travel through the SNS in a bidirectional flow. Efferent messages can trigger changes in different parts of the body simultaneously. For example, the sympathetic nervous system can accelerate heart rate; widen bronchial passages; decrease motility (movement) of the large intestine; constrict blood vessels; increase peristalsis in the esophagus; cause pupil dilation, piloerection (goose bumps) and perspiration (sweating); and raise blood pressure. Afferent messages carry sensations such as heat, cold, or pain.

Relationship to sympathetic

While an oversimplification, it is said that the parasympathetic system acts in a reciprocal manner to the effects of the sympathetic nervous system; in fact, in some tissues innervated by both systems, the effects are synergistic.

Nervous Tissue

The nervous system coordinates the activity of the muscles, monitors the organs, constructs and also stops input from the senses, and initiates actions. Prominent participants in a nervous system include neurons and nerves, which play roles in such coordination.Our nervous tissue only consists of two types of cells. These cells are neurons and neuroglia cells. The neurons are responsible for transmitting nerve impulses. Neuroglia cells are responsible for supporting and nourishing the neuron cells.

Types of Neurons

There are three types of neurons in the body. We have sensory neurons, interneurons, and motor neurons. Neurons are a major class of cells in the nervous system. Neurons are sometimes called nerve cells, though this term is technically imprecise, as many neurons do not form nerves. In vertebrates, neurons are found in the brain, the spinal cord and in the nerves and ganglia of the peripheral nervous system. Their main role is to process and transmit information. Neurons have excitable membranes, which allow them to generate and propagate electrical impulses. Sensory neuron takes nerve impulses or messages right from the sensory receptor and delivers it to the central nervous system. A sensory receptor is a structure that can find any kind of change in it's surroundings or environment.

Structure of a neuron

Neurons have three different parts to them. They all have an axon, a cell body and dendrites. The axon is the part of the neuron that conducts nerve impulses. Axons can get to be quite long. When an axon is present in nerves, it is called a nerve fiber. A cell body has a nucleous and it also has other organelles. The dendrites are the short pieces that come off of the cell body that receive the signals from sensory receptors and other neurons.

Myelin Sheath

Schwann cells contain a lipid substance called myelin in their plasma membranes. When schwann cells wrap around axons, a myelin sheath forms. There are gaps that have no myelin sheath around them; these gaps are called nodes of Ranvier. Myelin sheathes make excellent insulators. Axons that are longer have a myelin sheath, while shorter axons do not. The disease multiple sclerosis is an autoimmune disease where the body attacks the myelin sheath of the central nervous system.

Case Study

A 35-year-old male in 1986 had been admitted to a hospital in Florida three weeks previous to being diagnosed, with complaints of weakness and spasticity in the right leg, difficulties with balance, and fatigue and malaise. Tests performed at the Florida hospital had revealed abnormalities in spinal fluid and MRI brain scan. The patient complained of being severely depressed and anxious. He had anger at his circumstances and frequent crying spells. One month previously he had noticed aching and loss of vision in the left eye that had since improved.

This man was diagnosed with Multiple Sclerosis. MS is a chronic, degenerative, and progressive disorder that affects the nerve fibers in the brain and spinal cord. Myelin is a fatty substance that surrounds and insulates the nerve fibers and facilitates the conduction of the nerve impulse transmissions. MS is characterized by intermittent damage to myelin (called demyelination) caused by the destruction of specialized cells (oligodendrocytes) that form the substance. Demyelination causes scarring and hardening (sclerosis) of nerve fibers usually in the spinal cord, brain stem, and optic nerves, which slows nerve impulses and results in weakness, numbness, pain, and vision loss.

Because different nerves are affected at different times, MS symptoms often worsen (exacerbate), improve, and develop in different areas of the body. Early symptoms of the disorder may include vision changes (blurred vision, blind spots) and muscle weakness. MS can progress steadily or cause acute attacks (exacerbations) followed by partial or complete reduction in symptoms (remission). Most patients with the disease have a normal lifespan.

There are different types of MS

Multiple sclerosis is classified according to frequency and severity of neurological symptoms, the ability of the CNS to recover, and the accumulation of damage.

Drugs

A drug is, generally speaking, any substance that changes the way your body works. Some drugs have a medicinal effect, and some are used recreationally. They have diverse effects, depending on the drug. Drugs can do anything from diminish pain, to preventing blood clots, to helping a depressed person.

Different drugs work in different ways, called the mechanism of action, the drugs covered here will all act on the nervous system via receptors on different neurons. There are also drugs that change how enzymes work, but that's not part of the nervous system (at least directly) and will not be discussed here.

You've probably heard the terms stimulant (excitatory) and depressant (inhibitory). This is a broad way of classifying drugs that work on the CNS. Depressants slow down neural function, and stimulants speed it up.

Most of the common depressants (including alcohol, benzodiazepines, barbiturates and GHB) work on GABA receptors, although there are others. Opiates, for example, work on mu opioid receptors and also produce inhibitory effects, and some antipsychotics block serotonin. See the alcohol section below to see one way this can work.

Stimulants work mostly with epinephrine, dopamine or serotonin (or a combination of them). Many of them either mimic one, or stop them from leaving the synapse, causing more action potentials to be fired. Methamphetamine, discussed below, is a fairly typical stimulant drug.

Drug Abuse

Scientists have long accepted that there is a biological basis for drug addiction, though the exact mechanisms responsible are only now being identified. It is believed that addictive substances create dependence in the user by changing the brain's reward functions, located in the mesolimbic dopamine system—the part of the brain that reinforces certain behaviors such as eating, sexual intercourse, exercise, and social interaction. Addictive substances, through various means and to different degrees, cause the synapses of this system to flood with excessive amounts of dopamine, creating a brief rush of euphoria more commonly called a "high". Some say that abuse begins when the user begins shirking responsibility in order to afford drugs or to have enough time to use them.

Alcohol

Alcohol is, and has been for thousands of years, one of the most commonly used drugs in the world. It is legal, with some restrictions and exceptions, nearly everywhere. It is a common misconception that somehow alcohol is 'better' or 'safer' than other recreational drugs. This is simply NOT the case. Alcohol is a depressant, and as such it has the potential to cause coma, respiratory depression/arrest and possibly death. Compared with some other (illegal in most places) drugs of recreational value (such as marijuana, serotonin based hallucinogens like LSD or psilocybin) alcohol is far more toxic and has more risk of overdose. That doesn't mean that moderate drinking will probably hurt you, though, either.

Short term effects from drinking (listed roughly as they appear, and as dosage goes up) are: decreased inhibitions and thusly judgment, flushing of the face, drowsiness, memory problems begin, severe motor impairment, blurry vision, dizziness, confusion, nausea, possible unconsciousness, coma, death (due to respiratory arrest or possibly aspiration on vomit).

Alcohol produces these effects mainly via the GABA receptors in the brain. When GABA (or in this case alcohol) binds to it's receptor, it lets either Cl- ions in, or K+ out. This is called hyperpolarization, or an inhibitory postsynaptic potential (IPSP). It makes it harder for the neuron to depolarize and hence harder for it to fire an action potential, slowing neural function. At higher doses alcohol will start to block NMDA. NMDA is involved in memory (see the long-term potentiation section) so this is thought to account for memory blackouts.

Methamphetamine

In the US, medically prescribed methamphetamine is distributed in tablet form under the brand name Desoxyn®, generally for Attention Deficit Hyperactivity Disorder (ADHD) but also for narcolepsy or obesity.

Illicit methamphetamine comes in a variety of forms. Most commonly it is found as a colorless crystalline solid, sold on the street under a variety of names, such as: crystal meth or crystal. Methamphetamine may also be referred to as shards, rock, pony, crissie, crystal, glass, ice, Jib, critter, Tina, tweak or crank. Dope may refer to methamphetamine or other drugs, especially heroin or marijuana. The term "speed" can denote any stimulant including other amphetamines (e.g. adderall), cocaine and methylphenidate (Ritalin).

Methamphetamine is neurotoxic to at least some areas of the brain, and owes most of it's effects to the neurotransmitters dopamine, norepinephrine and serotonin it releases. It also blocks the reuptake of those neurotransmitters, causing them to stay in the synaptic cleft longer than normal.

Marijuana

Marijuana contains a myriad of chemicals, called cannabinoids, that have psychoactive and medicinal effects when consumed, the major one being tetrahydrocannabinol (THC). THC serves to mimic the endogenous neurotransmitter anandamide (also found in chocolate) at the CB1 receptors in the brain. Other cannabinoids include Cannabidiol (CBD), cannabinol (CBN) and tetrahydrocannabivarin (THCV). Although THC is found in all parts of the plant, the flower of the female plant has the highest concentration, commonly around eight percent.

Cannabis has a very long, very good safety record. Nobody on record has ever died because of marijuana, directly atleast. It is estimated that it would take 1-1.8 kilograms of average potency marijuana, taken orally, to have a fifty percent chance of killing a 68kg human. Despite this, the possession, use, or sale of psychoactive cannabis products became illegal in many parts of the world in the early 20th century. Since then, while some countries have intensified the enforcement of cannabis prohibition, others have reduced the priority of enforcement to the point of de facto legality. Cannabis remains illegal in the vast majority of the world's countries.

The nature and intensity of the immediate effects of cannabis consumption vary according to the dose, the species or hybridization of the source plant, the method of consumption, the user's mental and physical characteristics (such as possible tolerance), and the environment of consumption. This is sometimes referred to as set and setting. Smoking the same cannabis either in a different frame of mind (set) or in a different location (setting) can alter the effects or perception of the effects by the individual. Effects of cannabis consumption may be loosely classified as cognitive and physical. Anecdotal evidence suggests that the Cannabis sativa species tends to produce more of the cognitive or perceptual effects, while Cannabis indica tends to produce more of the physical effects.

Glossary

Afferent Messages: carry sensations such as heat, cold, or pain

Autonomic System: deals with the visceral organs, like the heart, stomach, gland, and the intestines

Axon: the part of the neuron that conducts nerve impulses

Cannabis: a psychoactive drug produced from parts of the cannabis plant

Central Nervous System (CNS): the system that includes the brain and the spinal cord

Cerebellum: part of the brain that is located posterior to the medulla oblongata and pons, coordinates skeletal muscles to produce smooth, graceful motions

Cerebrospinal Fluid (CSF): acts a shock absorber for the central nervous system, protecting the brain and spinal cord from injury; it also has a high glucose content which serves as a nutritional factor

Cerebrum motor control, learning, speech, somatic sensory functions, vision,hearing and more.

Dendrites: short pieces that come off of the cell body that receive the signals from sensory receptors and other neurons

Episodic Memory: represents our memory of events and experiences in a serial form

Excitatory Neurotransmitter: a neurotransmitter that acts to elicit an action potential by opening chloride ion channels

Longitudinal Sulcus: separates the cerebrum in to the right and left hemispheres

Long Term Memory: used for storage of information over a long time

Long-Term Potentiation (LTP) long term communication enhancement between two neurons. Results in neural pathways that store memoris.

Medulla control center for respiratory, cardiovascular and digestive functions.

Myelin: a fatty substance that surrounds and insulates the nerve fibers and facilitates the conduction of the nerve impulse transmissions

Multiple Sclerosis (MS): disease that affects the CNS by causing hardening and scaring of the myelin

Nodes of Ranvier: unmyelinated gaps between sections of myelin

Peripheral Nervous System (PNS): a way of communication from the central nervous system to the rest of the body by nerve impulses that regulate the functions of the human body

Pons control centers for respiration and inhibitory functions.

Postganglionic Cells: have their cell bodies in the ganglia and send their axons to target organs or glands

Postsynaptic Cells the cell on the receiving (second) end of the synapse.

Presynaptic Cell The cell on the sending (first) end of the synapse.

Proprioception the sense that indicates whether the body is moving with required effort, as well as where various parts of the body are located in relation to each other.

Sensory Receptor: structure that can find any kind of change in it's surroundings or environment

Somatic Nervous System (SNS): the part of the peripheral nervous system associated with the voluntary control of body movements through the action of skeletal muscles, and also reception of external stimuli

Synapses: the gap between two neurons; new synapses lead to learning

Complete the outline and put the definition on each part of the outline.

Nervous system Outline

I. Nervous system
    A.
    B.
    C.
II. Central Nervous system
    A. Parts
        1.
        2.
    B. Functions
        1.
        2.
        3.
III. Peripheral Nervous System
    A.
    B.
IV. Neuron
    A. Soma
    B. Dendrite
V. Excitatory and Inhibitory Process (Explain)
VI. Action Potential
VII. Brain
    A. Medulla
    B. Pons
    C. Cerebral Lobes
        1. Occipital
        2. Temporal
        3. Frontal
        4. Parietal
    D. Cerebellum
    E. Limbic System
        1. Hippocampus
        2. Amygdala
        3. Thalamus
        4. Hypothalamus
        5. Cingulate Gyrus
VIII. Diseases
    A. Schizophrenia
    B. Depression
    C. Bipolar
    D. Autism Case Study
IX. PNS
    A. Autonomic
    B. Sympathetic
    C. Parasympathetic
X. Neuron Tissue
    A. Types of Neurons
        1.
        2.
        3.
    B. Myelin Sheath
    C. Case Study
XI. Drugs and our system
    A. Alcohol
        1.
        2.
    B. Methamphetamine
        1.
        2.
    C. Marijuana
        1.
        2.