Neurons and Neural Impulses

Slide One:

The nervous system plays an important role in coordinating our body's movements. These world-class soccer players' depends on the split-second interplay of billions of neurons in the body to win games just as you depend on them to help you make navigate your local mall.

Neurons are the basic building block to the body's circuitry. Neurons transmit messages from the foot to the brain and anywhere in-between.

Slide Two:

The nervous system is made up of billions of neurons. A neuron is made up of a cell body which acts to support the cell; the dendrite fibers receive messages from other cells which causes a neural impulse in the form of an electrical charge to travel down the axon. The axon passes messages away from the cell body to other neurons, muscles, or glands, Many axons are insulated with a myelin sheath which helps speed neural impulses. Multiple Sclerosis or MS is caused by a breakdown of the myelin sheath which interrupts the ability of the neural impulse to travel down the axon.

At the end of the axon are terminal branches which form the junctions with other cells. The impulse will leave the neuron through the terminal buttons on the end of each terminal branches.

Slide Three:

Neurons transmit messages to other neurons through neural impulses. A neural impulse can be stimulated by pressure, heat, light, or chemical messages within the body. Neural impulses pass from one neuron to another neuron only if the excitatory signal exceeds a minimum intensity called the threshold. A neuron's reaction is an all-or-nothing response. It's much like firing a gun. It either fires or it doesn't and can't half-way fire.

The neural impulse, called the action potential, is a brief electrical charge traveling down the axon. During the resting potential the fluid interior of the axon carries mostly negatively charged atoms called ions, while the fluid outside the axon has mostly positively charged atoms.

Then, the first bit of the axon is depolarized by the axon's selectively permeable surface allowing positive ions in. The electrical impulse travels down the axon as channels open

admitting ions with a positive charge. When these channels close, others open and positive ions are pumped back out, restoring the neuron to its polarized state.

Slide Four:

There is small gap between the axon terminal of one neuron and the surface of the dendrite of the next neuron. Chemical messengers called neurotransmitters are released when electrical impulses reach the axon terminal. After the neurotransmitter molecules cross the synaptic gap between neurons, they combine with receptor sites on neighboring neurons to pass on their excitatory or inhibitory messages. The sending neuron, now in a process called reuptake, absorbs the excess neurotransmitter molecules in the synaptic gap. In other words, the sending neuron is cleaning up the left over neurotransmitters the receiving neuron left behind.

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Slide Six:

This table summarizes for you the function of many of the neurotransmitters in the body. Under- or over-supplies of these neurotransmitters affect the function of the brain in different ways. Note that while we most often associate an undersupply of serotonin with depression, that other neurotransmitters can influence mood as well.

Slide Seven:

Neurotransmitters are affected by drugs. When the brain is flooded with “feel good” opiate drugs such as heroin and morphine, the brain may stop producing its own natural opiates, and withdrawal of these drugs results in discomfort until the brain resumes natural production of its natural opiates.

Antiagonist drugs such as botulin, also known as Botox, prevent a neurotransmitter’s release. Botulin is a poison that can form in improperly canned foods and causes paralysis by blocking ACh release from sending neurons.

While we often associate Botox with cosmetic improvements, it is also used to treat the uncontrolled facial muscles of cerebral palsy, to help improve speech.

Another drug, Curare, is a poison some South American Indians apply to the tips of hunting darts. When an animal is struck with a dart containing Curare, the ACh receptor sites are blocked leaving the neurostransmitter unable to affect the muscles. The animal becomes paralyzed.

Researchers use information about brain neurotransmitters to create therapeutic drugs, such as those to alleviate depression and schizophrenia. The problem is the natural blood brain barrier enables the brain to keep out unwanted chemicals. For example, Parkinson's Disease is caused by the gradual breakdown of dopamine producing sites in the brain. Doctors cannot treat Parkinson's Disease by simply injecting the sufferer with dopamine. The blood brain barrier will not allow the molecules into the brain. Instead, doctors can provide the brain with more Ldopa, the raw ingredient the brain uses to create more dopamine. The problem is that eventually all of the dopamine producing sites shut down and no amount of Ldopa will prevent the tremors associated with the disease.