

The Nervous System



The Nervous System



- We have covered many different body systems which automatically control and regulate our bodies.
- There is one master system which controls all of these other systems.
- That is the nervous system.

The Nervous System



- The nervous system coordinates body system so that they work in harmony.
- It receives, stores and transmits information from both inside and outside the body.
- It receives information thanks to specialized receptors in various organs and tissues such as the retina, inner ear and the stomach

The Nervous System



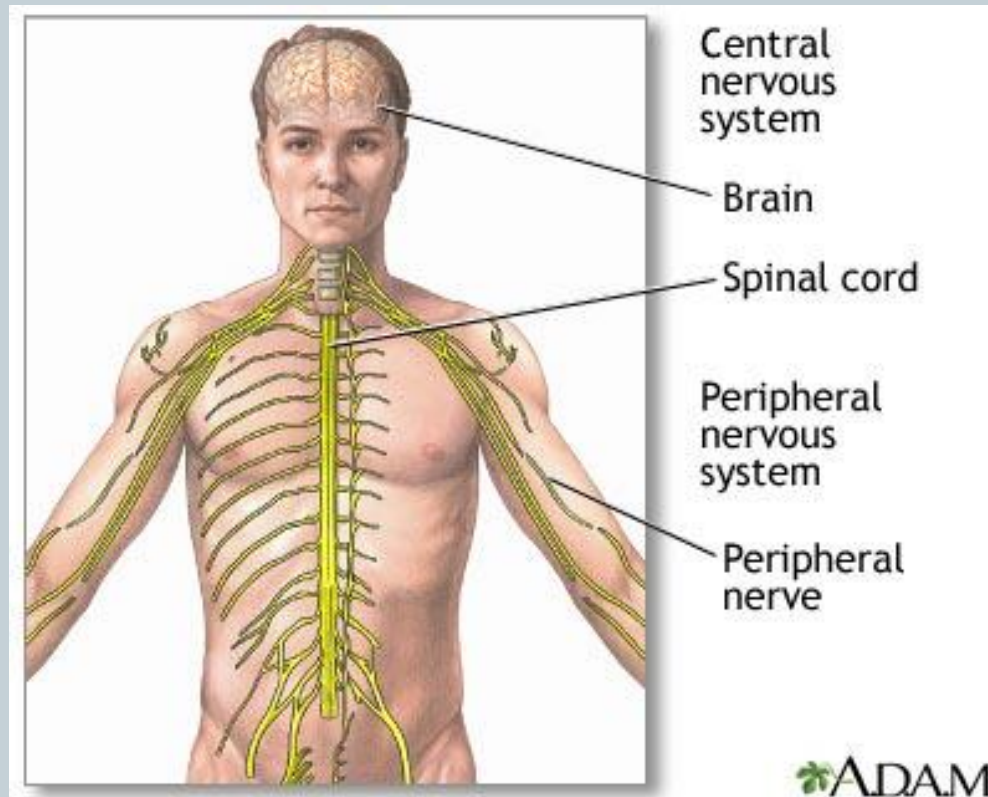
- It transmits this information through nerves to processing centers, like the brain.
- Once the information gets to the brain, it is interpreted into a sound or sensation.
- Information can be stored for either long or short term use.
- This is what enables us to recognize a sounds, smell or sight.

The Nervous System

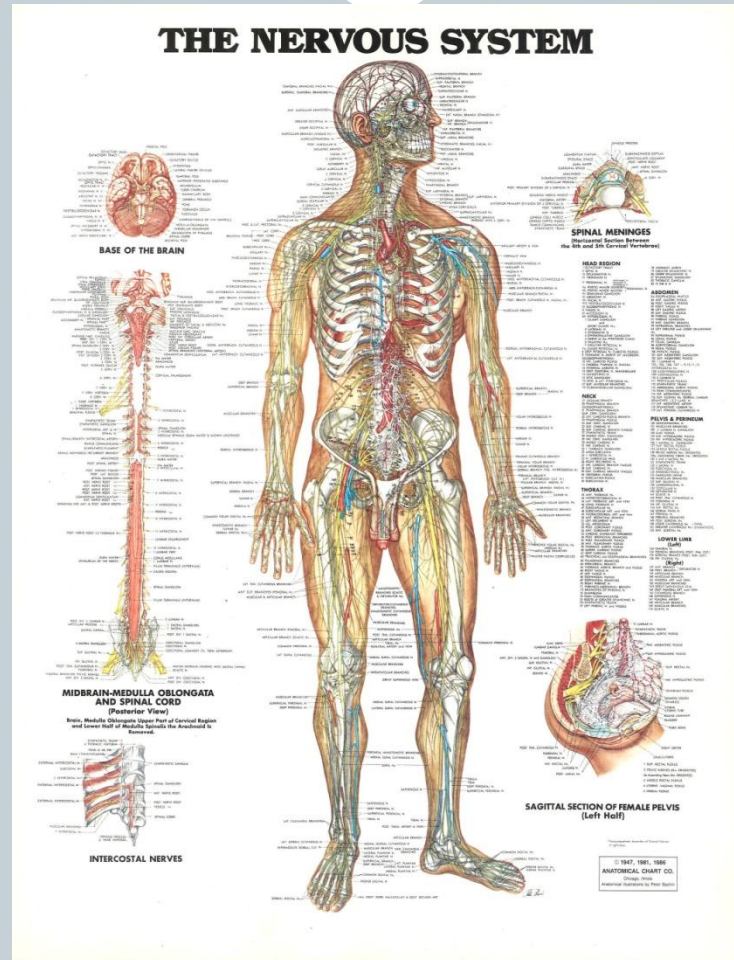


- The nervous system also transmits information from the brain to various parts of the body to produce a desired event.
- The desired event could be a muscle contraction or a signal to a gland to secrete an enzyme or hormone.
- The nervous system is also broken down into two parts
 - The central nervous system (CNS)
 - The peripheral nervous system (PNS)

The Nervous System



The Nervous System

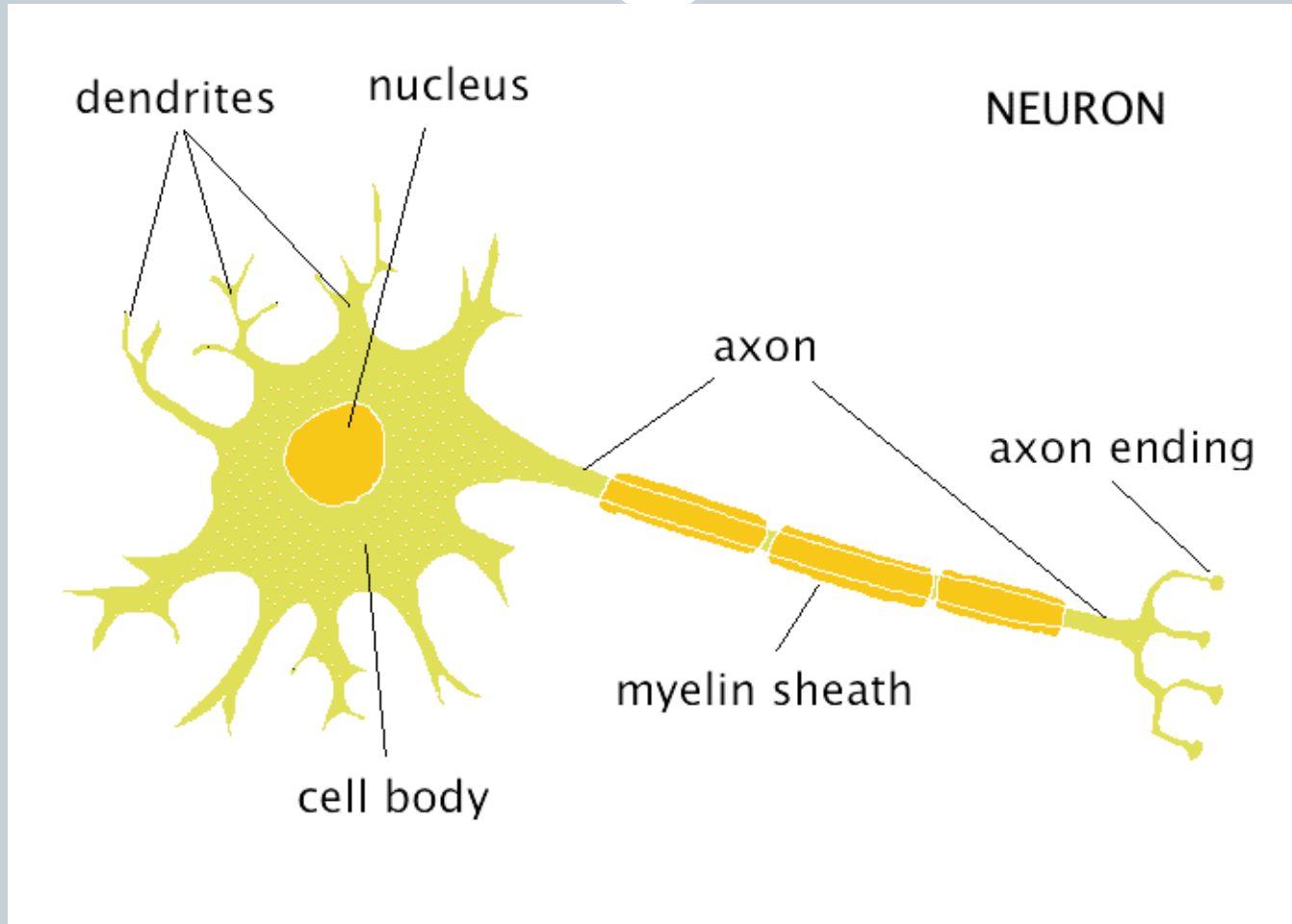


The Neuron



- The neuron is a specialized nerve cell in the nervous system that receives and transmits messages.
- A neuron is composed of 4 parts:
 - Dendrites
 - Cell body
 - Axon
 - Axon terminals

Neuron



Neuron



- A stimulus is anything that can be perceived by a living organism and that can trigger a reaction.
- Sound, light, heat, electrical shocks, odours and hormones are examples of stimuli.
- A nerve impulse is an electrical signal transmitted by a neuron.

Neuron



- Neurons can be stimulated. They change a stimulus to a electrical signal (nerve impulse)
- Neurons are conductive. They transmit a nerve impulse from one neuron to another until it reaches the target organ.
- Neurons consume a lot of oxygen and glucose and can only survive a few minutes without oxygen.

Neuron



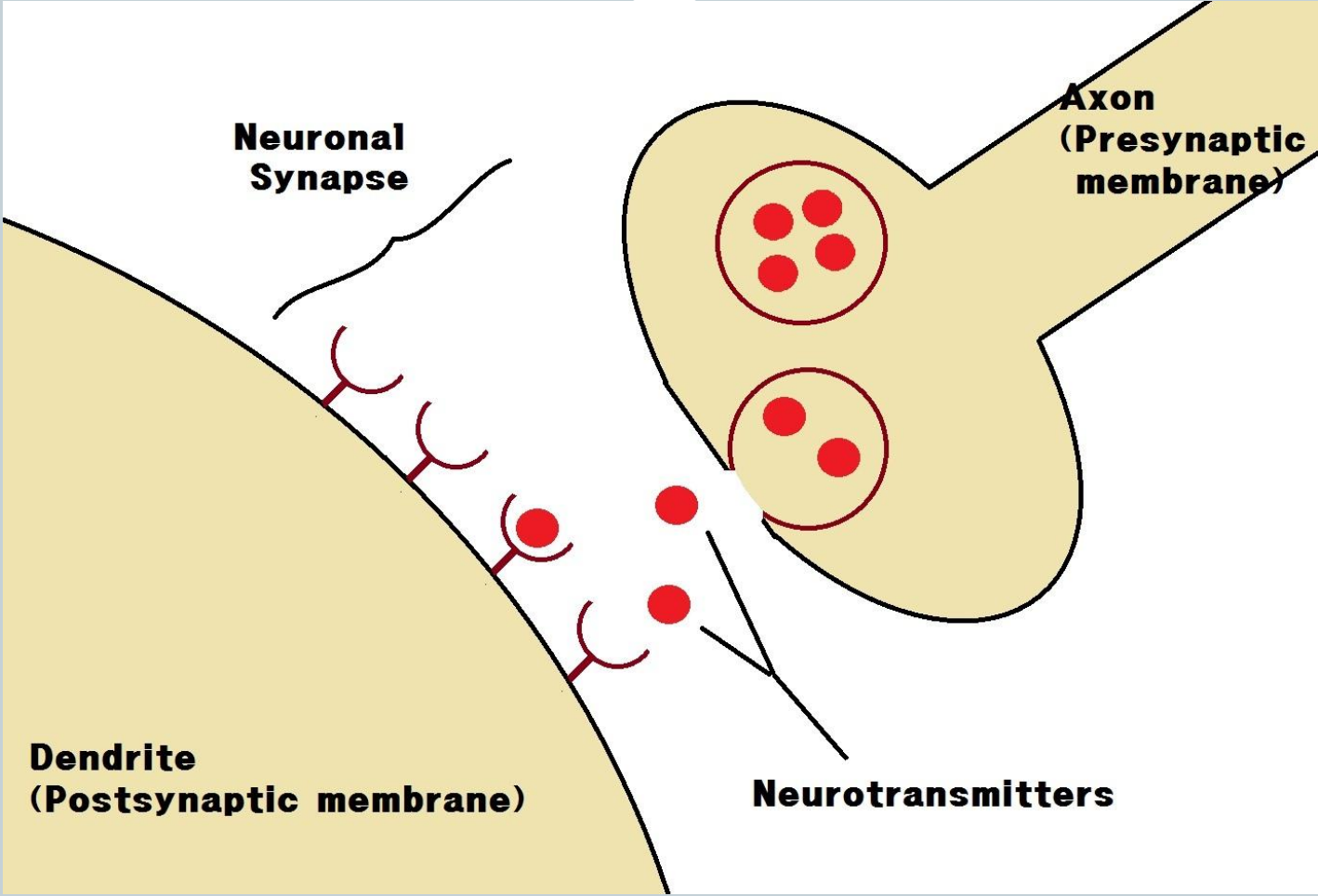
- Neurons can live over 100 years.
- You only have one set of nerves your entire life.
- A neuron cannot undergo mitosis.
- Once destroyed, it cannot be replaced or repaired.

Nerve Impulse



- Dendrites receive a message or stimuli and convert it to a nerve impulse.
- The nerve impulse is then transmitted down the axon to the axon terminals.
- Nerve impulses are transmitted from one axon to another with the use of neurotransmitters.
- They are secreted from one to another using a chemical signal.
- The connection between the two axons is called an synapse.

Synapse



Nerve Impulse



- A nerve impulse can reach speeds of 430 km/h
- Many axons are combined together to form nerves.
- A nerve is a structure that helps transmit information between the central nervous system and the various regions of the body.
- An axon only transmits a nerve impulse in one direction.

Peripheral Nervous System



- The nervous system is broken down into two main parts.
- The first one we will be covering is the peripheral nervous system.
- The peripheral nervous system is defined as connection between every part of your body and your brain.

Peripheral Nervous System



- The peripheral nervous system includes all of the nerves in your body.
- There're are two different types of nerves in our bodies
 - Sensory
 - Motor

Sensory Receptors



- A sensory receptor picks up stimuli and transforms the stimuli into nerve impulses.
- The stimuli can either be internal or external.
- They are in muscles, your skin, eyes, ears, tongue, etc.

Sensory Nerves



- Sensory nerves transmit information, in the form of a nerve impulse from the sensory receptor to the central nervous system.
- This is how information about the stimuli reach the parts of the brain which interpret the signals.
- They pick up stimuli from external sensors (eyes, skin, etc.) and internal sensors (CO₂ levels, blood pressure, etc.)

Motor Nerves



- Motor nerves primarily transmit nerve impulses sent from the central nervous system to the muscles, as well as the glands.
- They stimulate the muscles to react and produce various voluntary and involuntary movements.
- When the blood oxygen levels get too low, the heart will beat faster, when there is food in our stomachs or intestine, peristalsis!

Central Nervous System



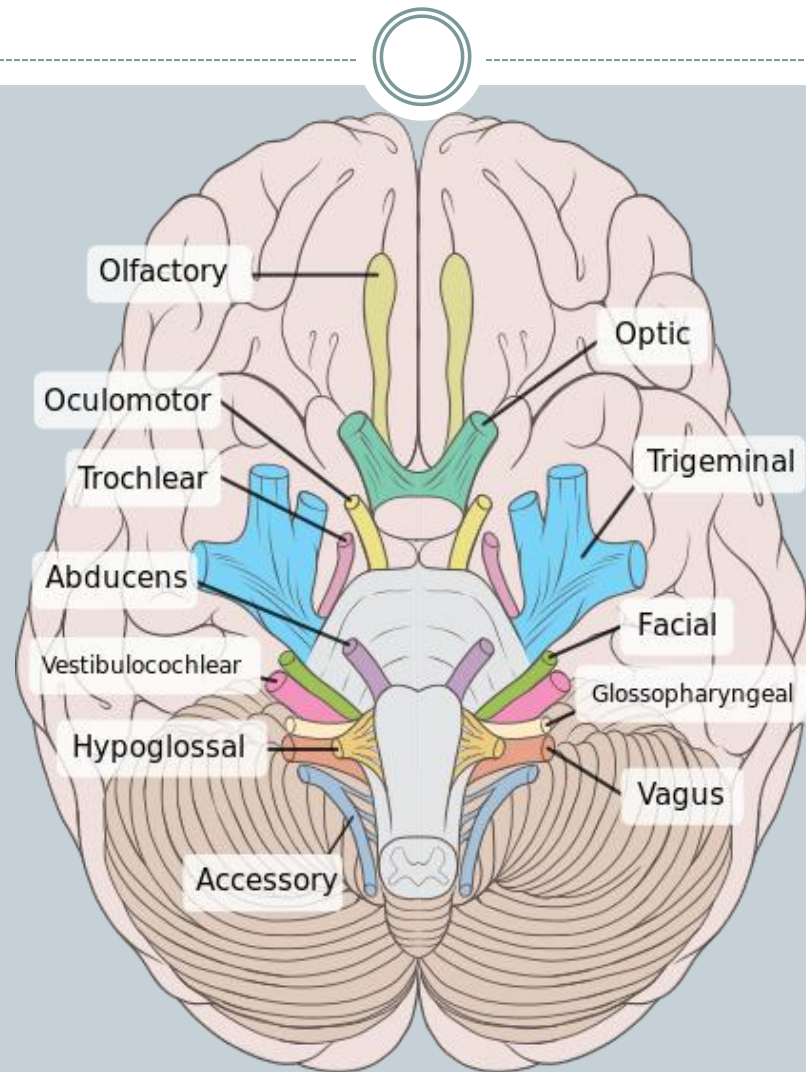
- The second part of the nervous system is the central nervous system.
- The CNS can be broken down into two parts.
 - The Brain
 - ✦ Cerebrum
 - ✦ Cerebellum
 - ✦ Brain stem
 - The Spinal Cord

The Brain

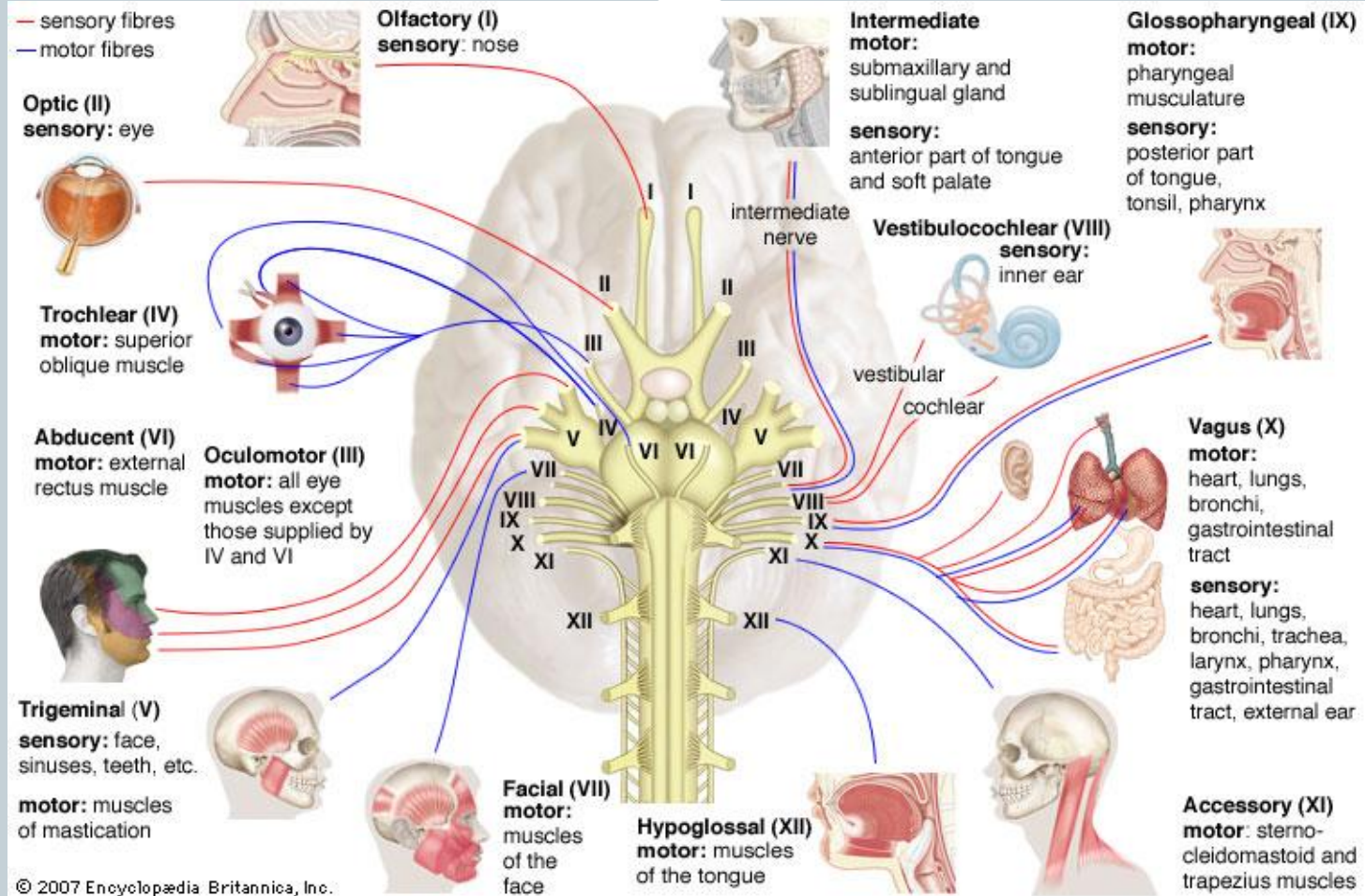


- The brain is composed of the parts of the CNS located in the cranium (skull).
- The brain communicates with the entire organism through 12 pairs of nerves called the cranial nerves.
- The brain is broken down into 3 sections:
 - Cerebrum
 - Cerebellum
 - Brain stem

Central Nervous System



Central Nervous System



The Cerebrum



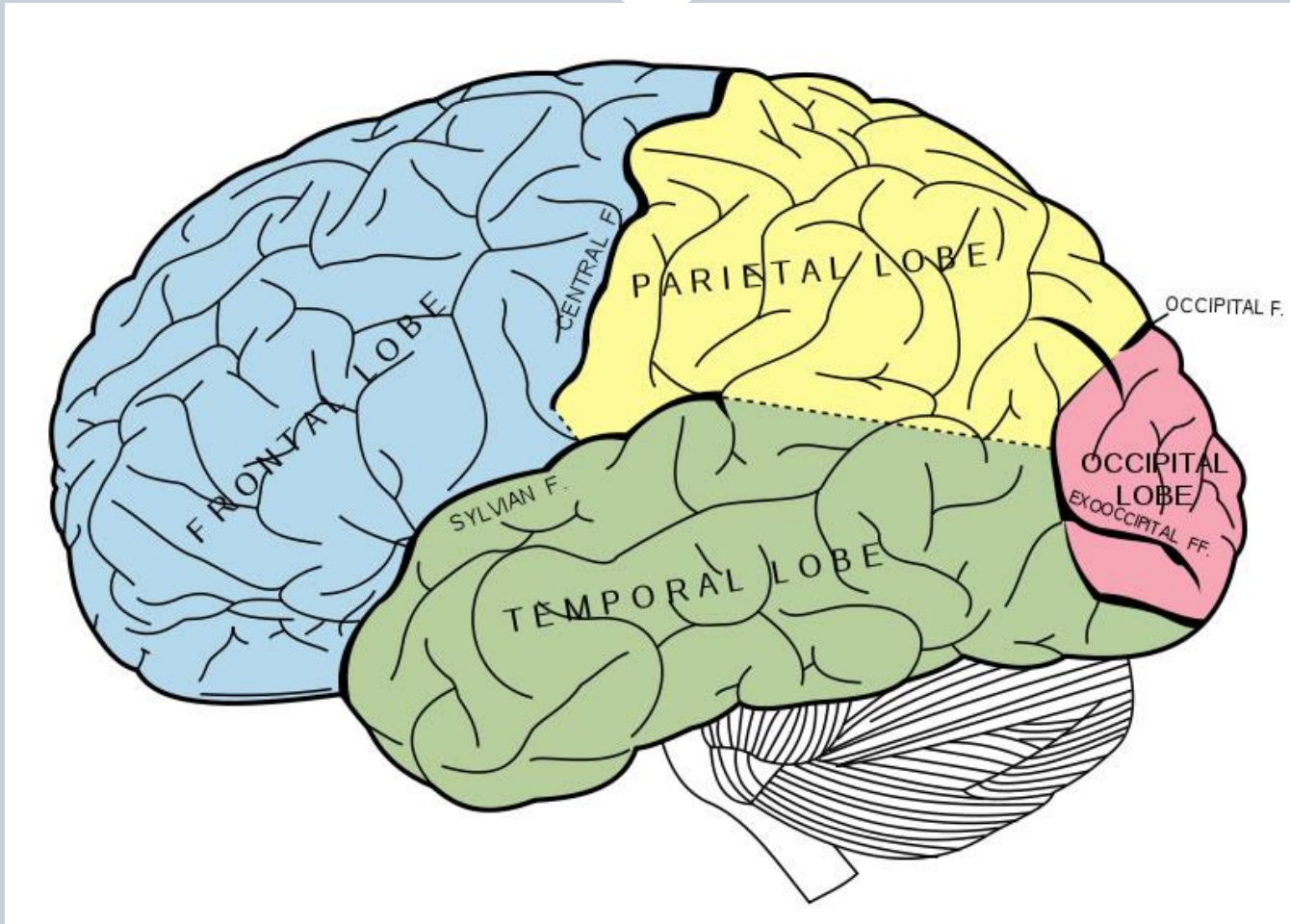
- The cerebrum is the control center of all voluntary movement.
- The cerebrum is divided into two hemispheres, the left and the right.
- The left side controls the right side and the right side controls the left side.
- The cerebrum is also broken down into 4 lobes.

Cerebrum



- The cerebrum has the following functions:
 - Controls voluntary movements
 - Interprets messages picked up by the senses
 - Controls intelligence
 - Controls emotions
 - Regulates physiological functions

Cerebrum



Frontal Lobe



- The frontal lobe is responsible for the recognition of future consequences resulting from current actions to choose between good and bad actions, override and suppress socially unacceptable responses and determine similarities and differences between things or events.
- The frontal lobe is also responsible for retaining long term memories.

Parietal Lobe



- The parietal lobe plays a role in integrating sensory information from various parts of the body, knowledge of numbers and their relations and in the manipulations of objects.
- It also processes the sense of touch.
- It also plays a part in hand eye coordination.

Temporal Lobe



- The temporal lobe takes care of long term memory.
- It also deals with the sense of hearing and interprets the meaning of visual stimuli and establish object recognition.
- This is where we process high-level visual processing of complex stimuli such as faces and scenes.

Occipital Lobe



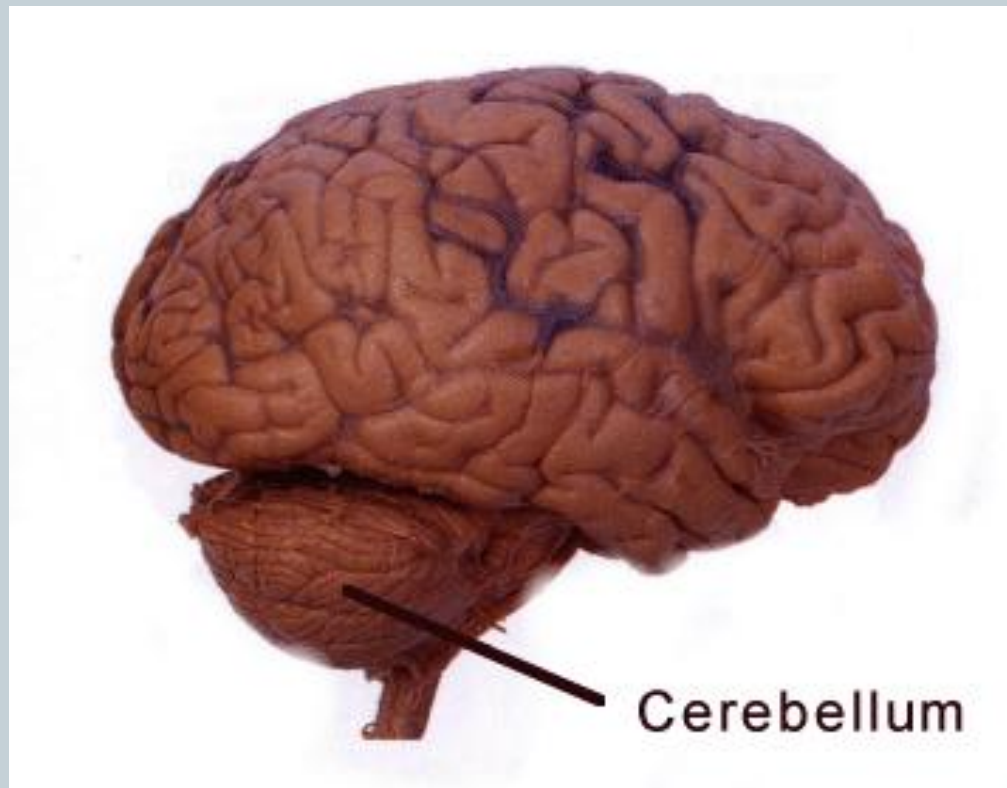
- The occipital lobe is the primary zone for vision.
- The nerves from the eyes to directly from to the occipital lobe where the stimuli are processed into images.

Cerebellum



- The cerebellum is the center of balance and movement coordination.
- The cerebellum enables us to walk in a straight line and perform complex movements without falling down.
- The cerebellum also enables us to perform different actions such as sign speak and play the piano.

Cerebellum



Cerebellum

Brain Stem



- The brain stem is the control center of internal stimuli as well as involuntary movement.
- When food is eaten, the brain stem triggers the digestive system to start working.
- When CO₂ levels are too high, breathing and heart rate increases.

The Spinal Cord



- The spinal cord is a nervous system organ that carries information from the various parts of the body to the brain.
- It also contains the reflex center.

Reflex

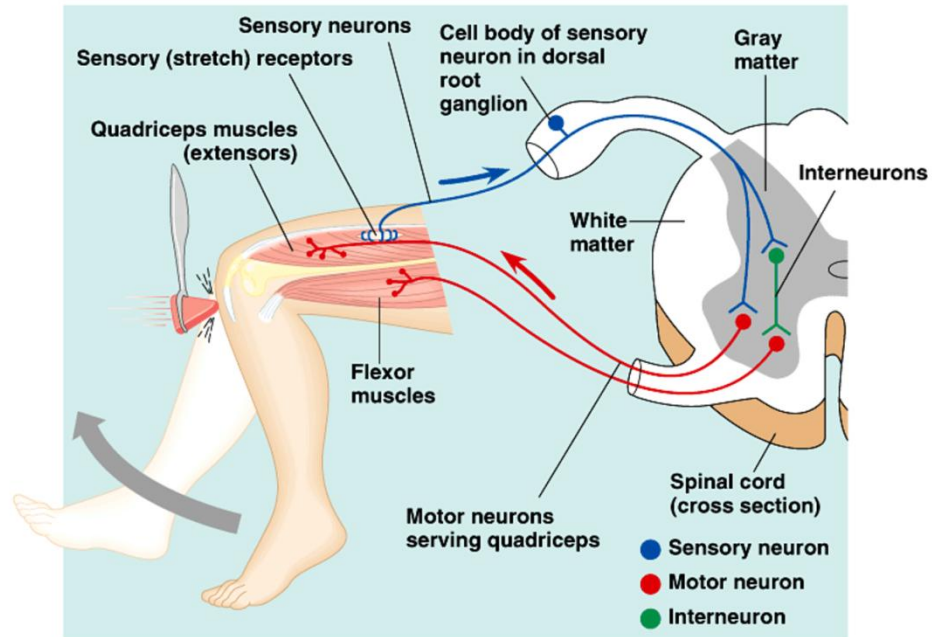


- A reflex is a rapid and involuntary reaction to a stimulus
- A reflex arc is the path taken by a nerve impulse during a reflex.

Reflex Arc



Reflex Arc



Voluntary and Involuntary Movement



- To compare a reflex arc to voluntary movement, voluntary movements must go through the cerebrum.
- Involuntary movement does not go through the cerebrum, but the cerebellum.

Neurological Diseases



- Here we will discuss 3 of the more common neurological disorders which affect a high number of individuals in our society.
- We will discuss the causes, treatments and risk factors for:
 - Alzheimer's
 - Multiple sclerosis
 - Parkinson's

Alzheimer's Disease



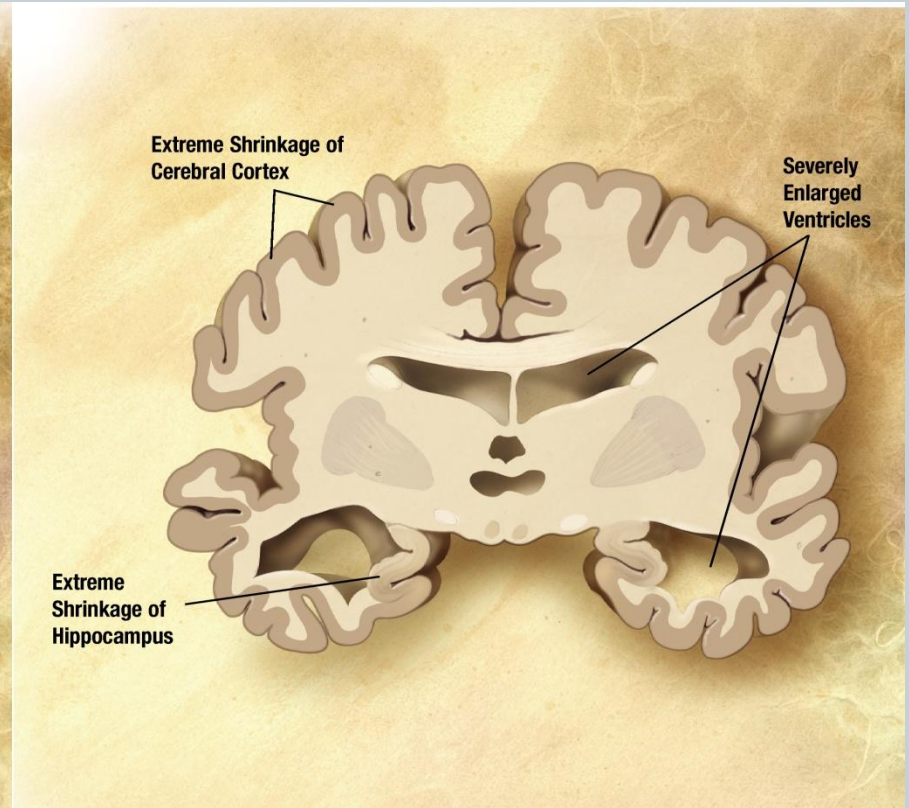
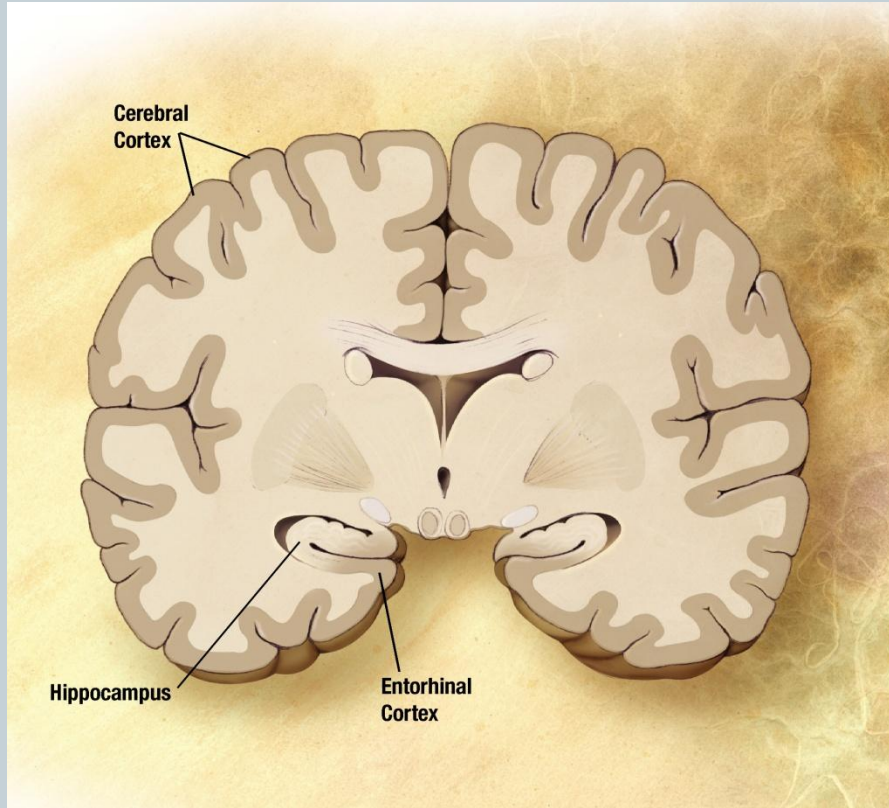
- There are several potential causes for Alzheimer's disease.
- Genetics can play a factor in contracting the disease.
- There are 3 genes which have been identified which increase your chances.
- These account for a relative small percentage of the diagnosed cases.

Alzheimer's Disease



- There are also hypotheses regarding certain proteins not being produced or a lack of a neurotransmitter.
- Herpes simplex 1 (cold sores) may have an effect.
- Diet may have an affect as well as air pollution.
- All this to say, no one is 100% sure what causes this disease.

Alzheimer's Disease



Alzheimer's Disease



- Treatments for the disease is to medicate.
- These help slow the progression of the disease but there is nothing which can repair the damage.
- Alzheimer's affects about 150-200 individuals per 100,000 in Canada.

Multiple Sclerosis



- Multiple sclerosis, more commonly known as MS, is a neurological disorder caused by the breakdown of the insulating covers of the neurons.
- The exact cause is unknown at this time, but there are a few factors which could increase your chances.
- Populations who are further from the equator have a higher incidence of the disease. This could be due to lower amounts of Vitamin D.

Multiple Sclerosis



- MS is not considered to be a hereditary disease, but there are a few genetic variations which have shown to increase the risks.
- Again, causes are unknown but it is believed to be a combination of environmental and genetic factors.

Multiple Sclerosis



How Multiple Sclerosis Works Demyelination

Neuron

Nucleus
Dendrites
Myelin Sheath
Cell Body
Synapses

Normal Nerve

Axon
Nucleus
Myelin

Damaged Nerve

Damaged Myelin

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Multiple Sclerosis



- Much like Alzheimer's, there is no cure, only treatment.
- Various medications can be given to slow the onset of symptoms and delay the progression.
- Life expectancy is roughly 30 years from the onset, which is only slightly lower than an unaffected.
- Roughly 30-40 people are diagnosed per 100,000 individuals.

Parkinson's Disease

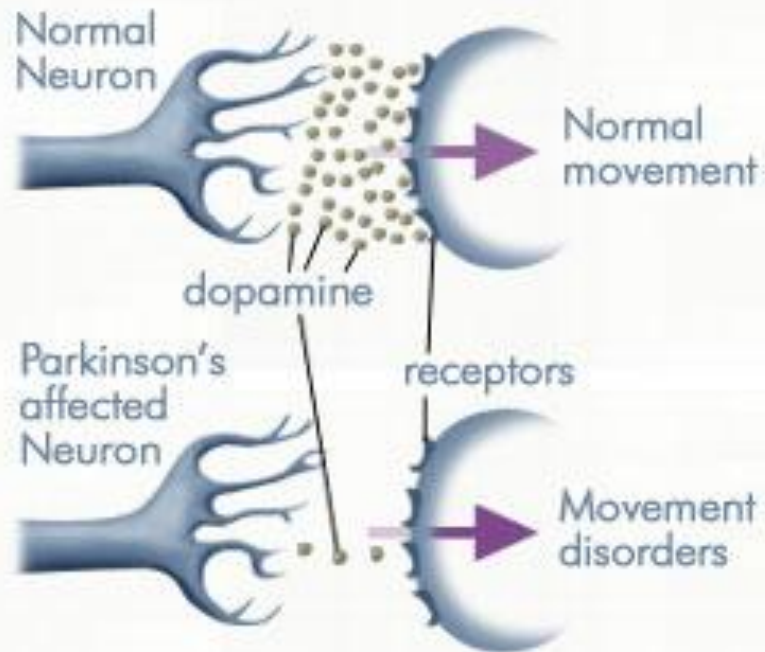


- Parkinson's is caused by the breakdown of the dopamine-generating cells in the brain.
- Dopamine helps stop neurons from firing.
- The lack of dopamine is what causes the traditional “shakes” cause by Parkinson's.
- This is due to the neurons firing and sending messages when they should be relaxing.

Parkinson's Disease.



Dopamine levels in a normal and a Parkinson's affected neuron.



Parkinson's Disease



- Causes of Parkinson's disease is not completely understood.
- There are some environmental factors, such as pesticide exposure, head injuries or living on a farm or in the country.
- There are some possible genetic factors which may have an affect.
- 15% of people diagnosed have a 1st degree relative with the disease.

Parkinson's Disease



- Treatments are only management of the disease.
- There are many medications available and finding the right one and in the right dosage that will work for you can be a long process.
- Rehabilitation to lessen effects and helping with balance is essential to maintain a healthy lifestyle.

Diseases Recap



- As you can see, the way to brain works is still rather mysterious.
- Causes, treatments and cures for common neurological disorders are all very vague.
- Progress is made everyday, but we are still far from having a full understanding of how our brains work.