

Nervous System

Dentalelle Tutoring

Basics

- ▶ The nervous system along with the endocrine (hormonal) system works to control all activities within the human body. It does this by communicating messages between the brain and the body very quickly using nerve impulses (action potentials).
- ▶ The four main functions of the nervous system are:
 - ▶ **1. Control of body's internal environment to maintain 'homeostasis'**
 - ▶ An example of this is the regulation of body temperature. As we exercise we create heat, in order to maintain a relatively constant core temperature the nervous system sends messages to the blood vessels to dilate (expand), increasing blood flow to the skin, and increasing sweating to help disperse the accumulating heat.
 - ▶ **2. Programming of spinal cord reflexes**
 - ▶ An example of this is the stretch reflex. This reflex functions to protect us from injury. If we were out jogging and accidentally ran into a pot-hole and rolled our ankle, the stretch reflex would instantly sense the stretch in the muscles around the ankle and send messages to those muscles telling them to contract and resist the stretch. This reflex serves to protect the ankle from breaking and results in a minor sprain rather than a severe break.
 - ▶ **3. Memory and learning**
 - ▶ You didn't learn to read or write overnight did you? A certain amount of repetition was required to learn and memorise these key functions. The same applies with exercise. New movements, especially complex ones, take time for the nervous system to learn. Remember this when teaching new exercises to people - a certain amount of repetition will need to occur before their nervous system gets it right!
 - ▶ **4. Voluntary control of movement**
 - ▶ Every voluntary movement that a person performs is under the direct control of the nervous system as the nervous system sends the messages to the particular body parts to move. If the movement has been repeated numerous times (walking for most of us...) the movement will be very efficient. If however the movement is new and still requires some repetition then we would expect the movement to be less efficient and in some cases look awkward and ungainly (such as a person learning the squat for the first time).

We Need It!

- ▶ The nervous system is integral to our ability to function in everyway. As we know muscle creates movement by contracting and pulling on our bones. However it is the nervous system that is responsible for stimulating the muscles and causing them to contract. Without the neural impulses of the nervous system, muscle would simply not work.
- ▶ When someone experiences a severe trauma to their spinal cord, it will often result in paralysis of their body below the point of trauma. For example if the spinal cord is damaged above the nerves that stimulate their lower body (legs etc), then they will not be able to walk again. This is because the messages which are intended for the legs can no longer reach them. In essence it is like the power cable to your house being cut and the lights going out.
- ▶ The nervous system is not just responsible for stimulating muscle; it stimulates every tissue and organ within the body. It is therefore important that you understand the nervous system so that you can train clients safely and effectively.

Central Nervous System

- ▶ The structures of the CNS are the brain and spinal cord. Their job is to integrate information coming back from the peripheral nervous system and to respond automatically or make decisions on actions that should be taken. You can think of the CNS as the 'head office' of the body, it works consciously and subconsciously to control all activities within the body.
- ▶ **Peripheral Nervous System (PNS)**

The structures of the PNS include the cranial nerves (nerves of the head) and spinal nerves. Their job is to communicate information between the CNS and the rest of the body.

Sensory (afferent) division personal training sensory

- ▶ The sensory (also known as afferent) division of the nervous system contains nerves that come from the viscera (internal organs) and the somatic areas (muscles, tendons, ligaments, ears, eyes and skin).
- ▶ These nerves conduct impulses to the PNS/CNS providing information on what is happening within and outside the body. The senses include; hearing, sight, touch, and proprioception (the awareness of where you are in space and what position you're in).

Continued

Motor (efferent) division

- ▶ The motor (also known as efferent) division of the nervous system contains motor nerves.
- ▶ These nerves conduct impulses from the CNS and PNS to the muscles, organs and glands' effecting what happens in those tissues.

Somatic nervous system

- ▶ The somatic division of the nervous system contains nerves which end in the skeletal muscles.
- ▶ These nerves conduct impulses which control the skeletal muscles in response to a directive that comes from the brain. This conscious control means we call the activity of this division 'voluntary'.

Autonomic nervous system

- ▶ The autonomic division of the nervous system contains nerves which end in the viscera (internal organs). They are therefore called visceral motor nerves.
- ▶ These nerves conduct impulses which control the heart, lungs, smooth muscle in blood vessels, digestive tract and glands. These nerves are active without conscious input from the brain so are said to be 'involuntary'.

Divisions

Sympathetic division

- ▶ The sympathetic division of the nervous system is part of the autonomic nervous system. It works 'automatically' to mobilise the body's systems during activity (for example the fight or flight response).
- ▶ If you have ever had a fright and afterward realise your heart is still beating rapidly, you're tense and your palms are sweating, then you have experienced the activity of the sympathetic portion of the autonomic nervous system.

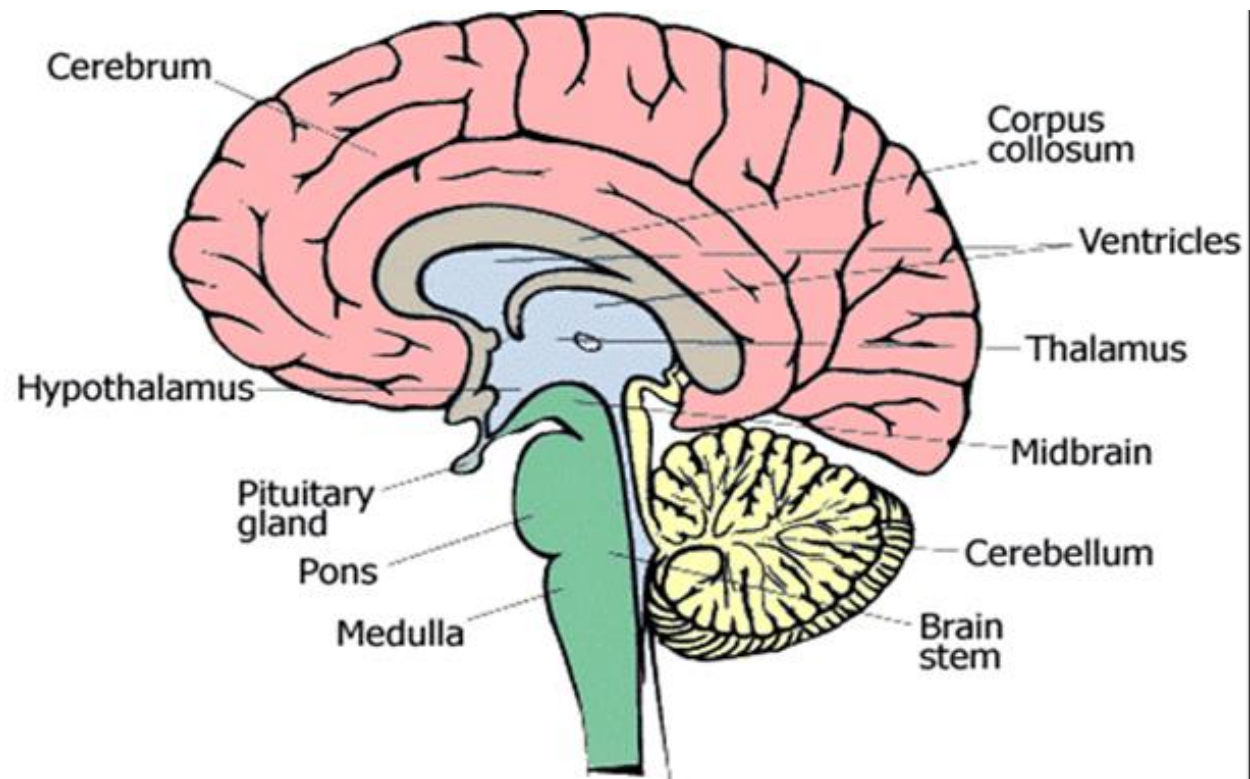
Parasympathetic division

- ▶ The parasympathetic division of the nervous system is part of the autonomic nervous system as well. It works 'automatically' to inhibit or relax the body's systems. It promotes digestion and other 'housekeeping' functions when the body is at rest. The following diagram highlights how the sympathetic and parasympathetic divisions have different effects on various organs.

The CNS

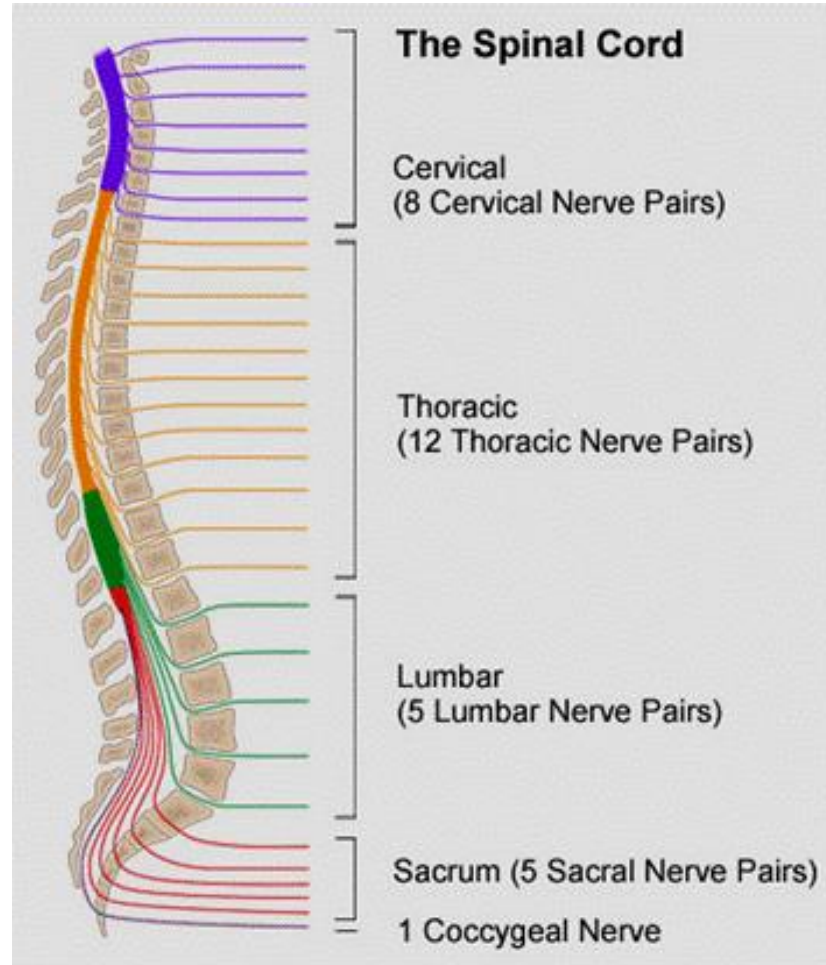
The brain

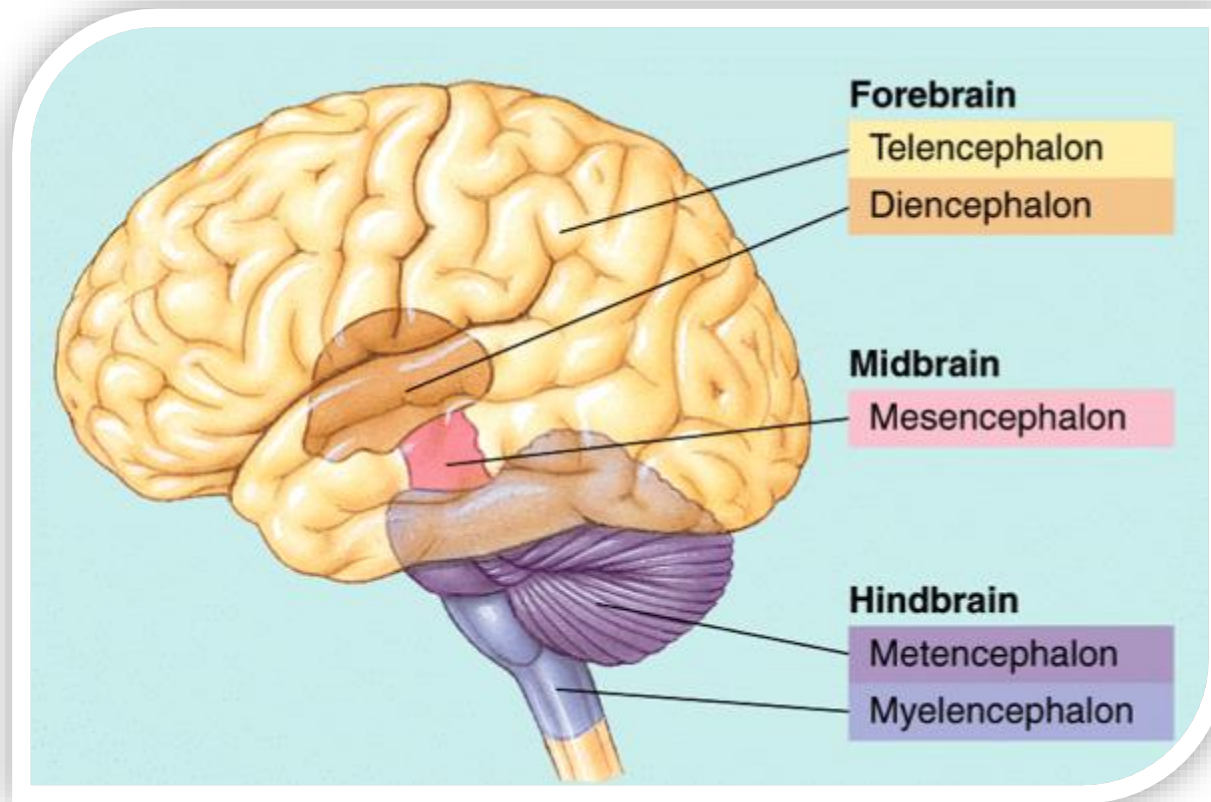
- ▶ The brain is organised into areas responsible for processing information, making decisions and then carrying out the appropriate task. As you know from the previous section it can do this consciously and subconsciously. Examples of some of these tasks are:
 - ▶ 1. maintaining homeostasis
 - ▶ 2. interpreting sensory information
 - ▶ 3. creating motor responses (movement)
 - ▶ 4. learning
 - ▶ 5. thinking
 - ▶ 6. talking
- ▶ By looking at the following diagram you can see that the brain has distinguishable anatomical divisions that operate simultaneously. Essentially the brain is modular by design, with each module responsible for a particular function, but the brain also has the ability to integrate information in a split second between modules

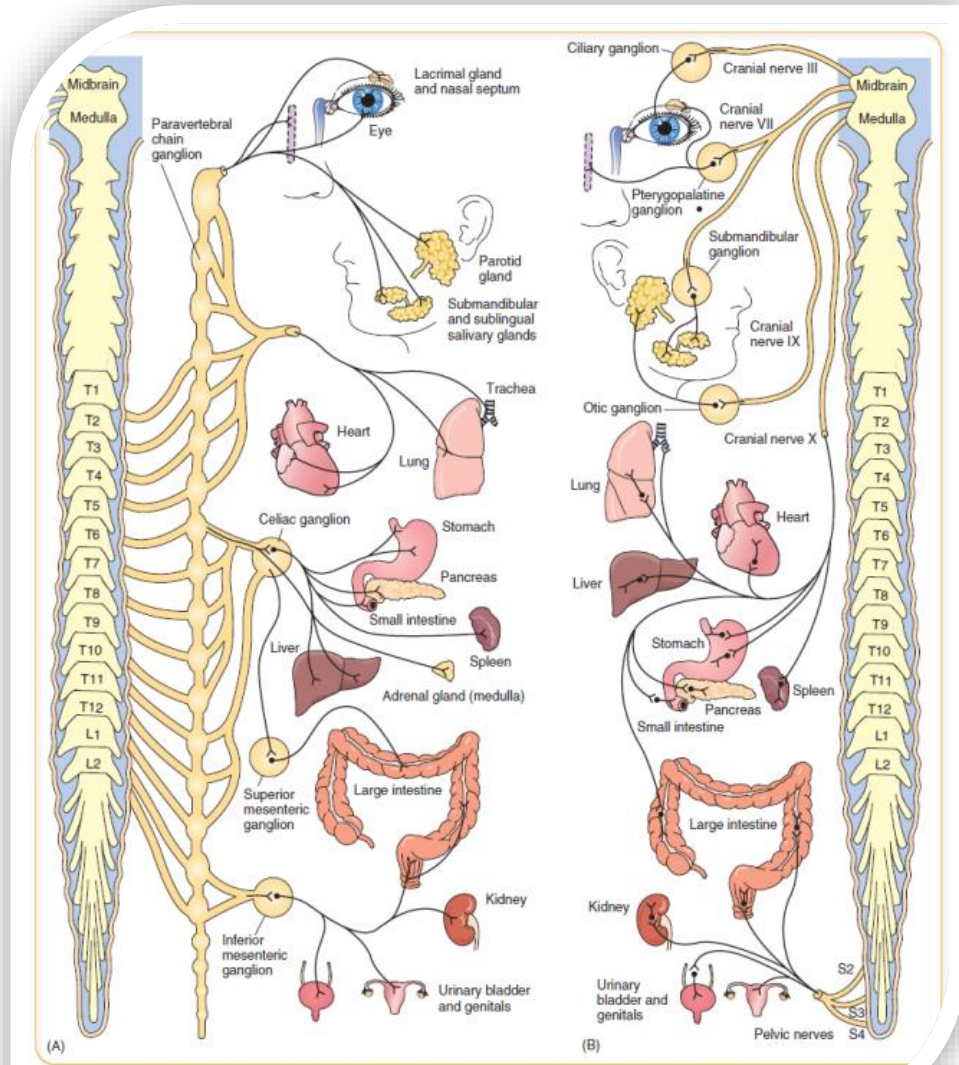


Spinal

- ▶ The spinal cord provides an ASCENDING pathway for sensory information travelling from sensory receptors in the body up to the brain and a DESCENDING pathway for motor information travelling down from the brain to the motor units.
- ▶ The spinal cord also acts like a switchboard for reflexes or movements requiring speed. With reflexes, motor responses (movements) are initiated at the spinal cord rather than the brain. This is because with reflexes speed is the absolute key - precious time would be lost if the message had to travel to and from the brain. Withdrawal and jerk are the most common types of reflexes.
- ▶ An example of a withdrawal reflex is putting your hand on a hot element and moving it away before the sensation of pain is registered. In this reflex sensory information is relayed to the spinal cord through a sensory neuron. The spinal cord then sends a command via a motor neuron back to the motor unit telling it to contract the muscle and move the hand off the element.







(A) The sympathetic division of the autonomic nervous system (B) The parasympathetic division of the autonomic nervous system. <http://pharmacology-notes-free.blogspot.com/>

