Autonomic Nervous System

The **autonomic nervous system (ANS)** regulates the functions of our internal organs (the viscera) such as the heart, stomach and intestines. The ANS is part of the peripheral nervous system and it also controls some of the muscles within the body. We are often unaware of the ANS because it functions involuntary and reflexively. For example, we do not notice when blood vessels change size or when our heart beats faster. However, some people can be trained to control some functions of the ANS such as heart rate or blood pressure.

The ANS is most important in two situations:

- In emergencies that cause stress and require us to **"fight" or take "flight"** (run away)
- In nonemergencies that allow us to **"rest" and "digest."**

The ANS regulates:

- Muscles

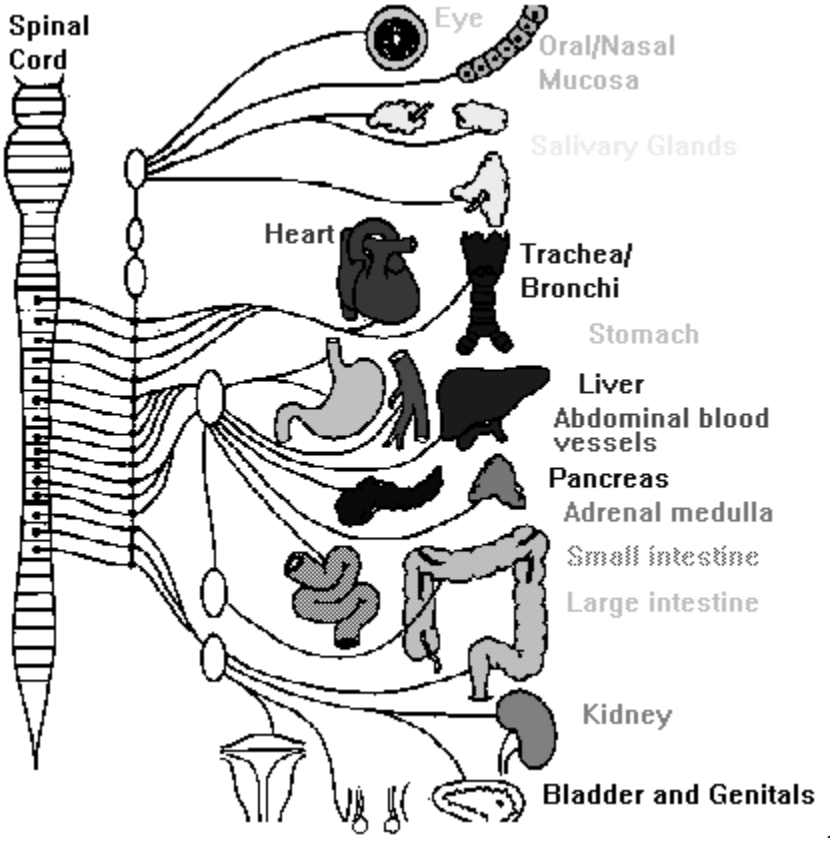
-- in the skin (around hair follicles; smooth muscle
-- around blood vessels (smooth muscle)
-- in the eye (the iris; smooth muscle)
-- in the stomach, intestines and bladder (smooth muscle)
-- of the heart (cardiac muscle)

- Glands

The ANS is divided into three parts:

- The sympathetic nervous system
- The parasympathetic nervous system
- The enteric nervous system

The Sympathetic Nervous System

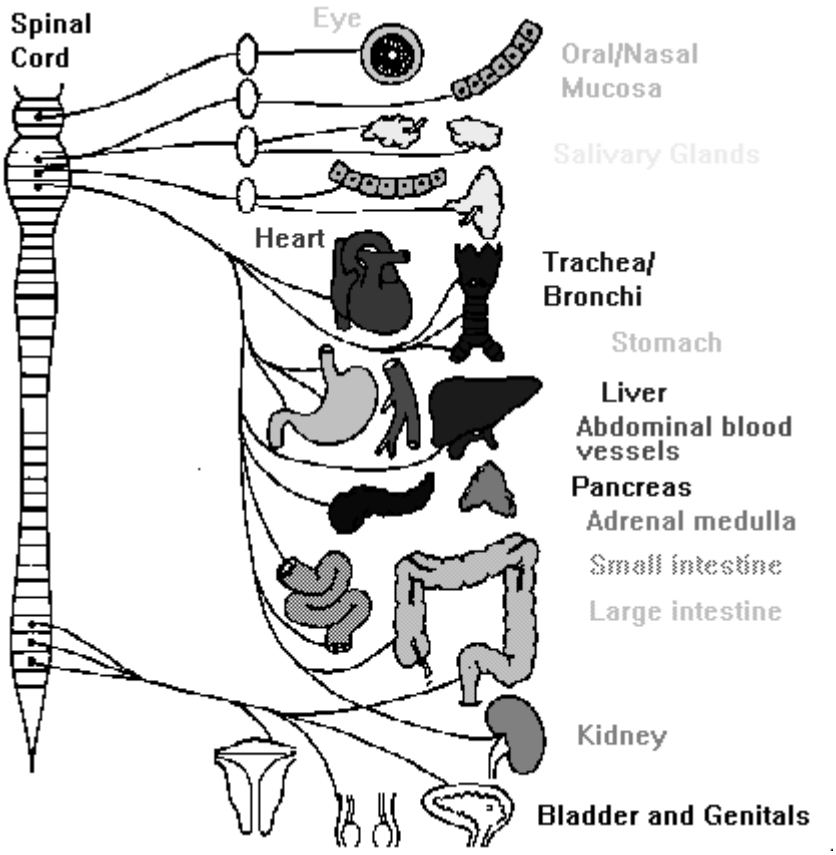


It is a nice, sunny day...you are taking a nice walk in the park.Suddenly, an angry bear appears in your path. Do you stay and fight OR do you turn and run away? These are "Fight or Flight" responses. In these types of situations, your sympathetic nervous system is called into action - it uses energy - your blood pressure increases, your heart beats faster, and digestion slows down.

Notice in the picture on the left that the sympathetic nervous system originates in the spinal cord. Specifically, the cell bodies of the first neuron (the preganglionic neuron) are located in the thoracic and lumbar spinal cord. Axons from these neurons project to a chain of ganglia located near the spinal cord. In most cases, this neuron makes a synapse with another neuron (post-ganglionic neuron) in the ganglion. A few preganglionic neurons go to other ganglia outside of the sympathetic chain and synapse there. The post-ganglionic neuron then projects to the "target" - either a muscle or a gland.

Two more facts about the sympathetic nervous system: the synapse in the sympathetic ganglion uses **acetylcholine** as a neurotransmitter; the synapse of the post-ganglionic neuron with the target organ uses the neurotransmitter called **norepinephrine**. (Of course, there is one exception: the sympathetic post-ganglionic neuron that terminates on the sweat glands uses acetylcholine.)

The Parasympathetic Nervous System



It is a nice, sunny day...you are taking a nice walk in the park. This time, however, you decide to relax in comfortable chair that you have brought along. This calls for "Rest and Digest" responses. Now is the time for the parasympathetic nervous to work to save energy. This is when blood pressure can decrease, pulse rate can slow, and digestion can start.

Notice in the picture on the left, that the cell bodies of the parasympathetic nervous system are located in the spinal cord (sacral region) and in the **medulla**. In the medulla, the cranial nerves III, VII, IX and X form the preganglionic parasympathetic fibers. The preganglionic fiber from the medulla or spinal cord projects to ganglia very close to the target organ and makes a synapse. This synapse uses the neurotransmitter called **acetylcholine**. From this ganglion, the post-ganglionic neuron projects to the target organ and uses **acetylcholine** again at its terminal.