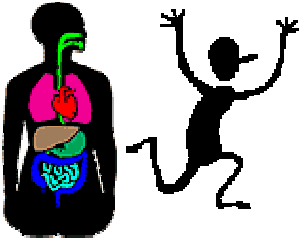


The Autonomic Nervous System

Some background info that might help us understand why it is preferable that we develop alternative reactions to stress ...




The organs (the "viscera") of our body, such as the heart, stomach and intestines, are regulated by a part of the nervous system called the **autonomic nervous system (ANS)**. The ANS is part of the peripheral nervous system and it controls many organs and muscles within the body. In

most situations, we are unaware of the workings of the ANS because it functions in an involuntary, reflexive manner. 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.

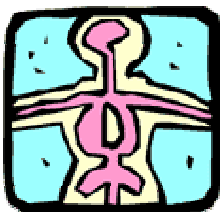
The ANS is most important in two situations:

In emergencies that cause stress and require us to

"fight" or take "flight" (run away) and in non-emergencies 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

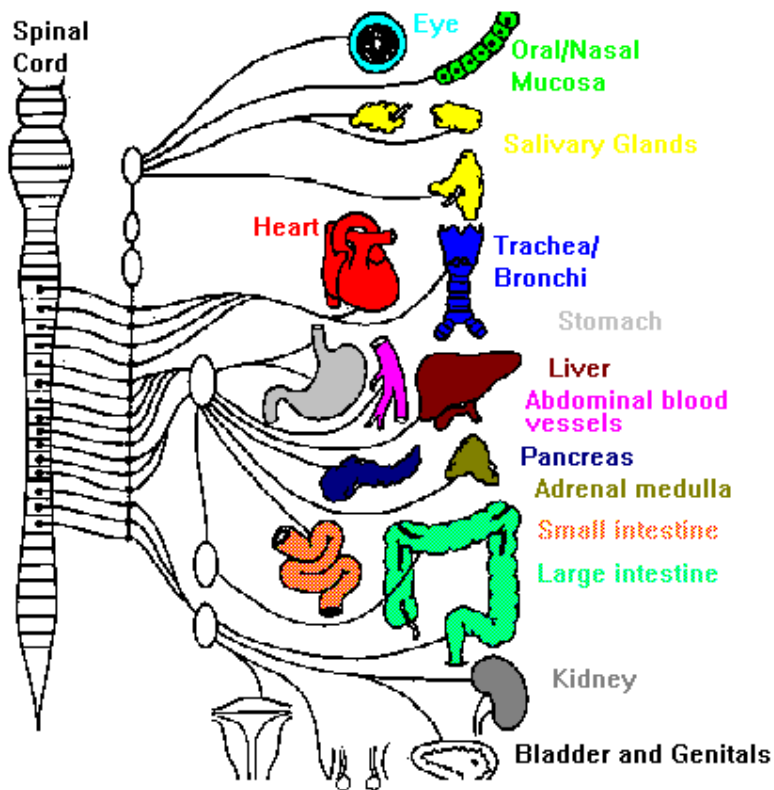
The ANS is divided into three parts:

The sympathetic nervous system

The parasympathetic nervous system

The enteric nervous system.

The Sympathetic Nervous System



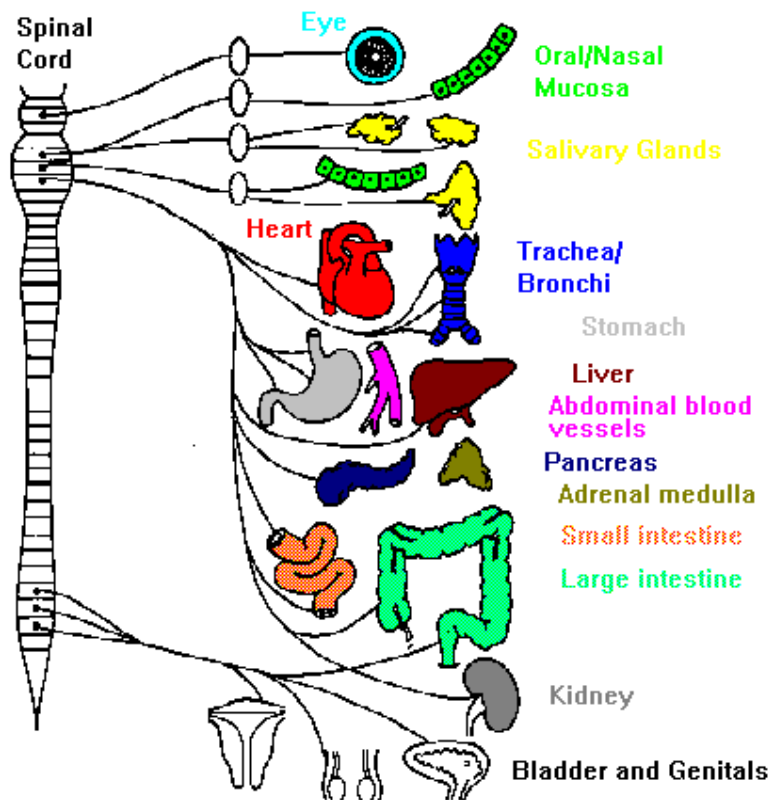
It's a nice, sunny day...you're taking a pleasant walk in the park. Suddenly, an angry bear appears in your path. Do you stay and fight OR do you turn and run away? These are "Fight or Flight" responses.

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 this picture that the sympathetic nervous system originates in the spinal chord. Specifically, the cell bodies of the first neuron (the preganglionic neuron) are located in the thoracic and lumbar spinal chord. Axons from these neurons project to a chain of ganglia located near the spinal chord. 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



Another nice, sunny

day...you're taking a pleasant walk in the park. This time, however, you decide to relax in a 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 - your

blood pressure decreases, your heart beats slower, and digestion can start.

Notice in the picture, 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 fibres. The preganglionic fibre 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.

Here is a summary of some of the effects of sympathetic and parasympathetic stimulation. Notice that effects are generally in opposition to each other:

The Autonomic Nervous System		
Structure	Sympathetic Stimulation	Parasympathetic Stimulation
Iris (eye muscle)	Pupil dilation	Pupil constriction
Salivary Glands	Saliva production reduced	Saliva production increased
Oral/Nasal Mucosa	Mucus production reduced	Mucus production increased
Heart	Heart rate and force increased	Heart rate and force decreased
Lung	Bronchial muscle relaxed	Bronchial muscle contracted
Stomach	Peristalsis reduced	Gastric juice secreted; motility increased
Small Intestine	Motility reduced	Digestion increased
Large Intestine	Motility reduced	Secretions and motility increased
Liver	Increased conversion of glycogen to glucose	
Kidney	Decreased urine secretion	Increased urine secretion
Adrenal medulla	Norepinephrine and epinephrine secreted	
Bladder	Wall relaxed Sphincter closed	Wall contracted Sphincter relaxed

It should be noted that the autonomic nervous system is always working. It is NOT only active during "fight or flight" or "rest and digest" situations. Rather, the autonomic nervous system acts to maintain normal internal functions and works with the somatic nervous system.

The **enteric nervous system** is a third division of the autonomic nervous system that you do not hear much about. The enteric nervous system is a meshwork of nerve fibres that innervate the viscera (gastrointestinal tract, pancreas, and gall bladder).

An excerpt from a website, "Neuroscience for Kids",

<http://faculty.washington.edu/chudler/neurok.html>