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Lecture title: # The Autonomic Nervous System

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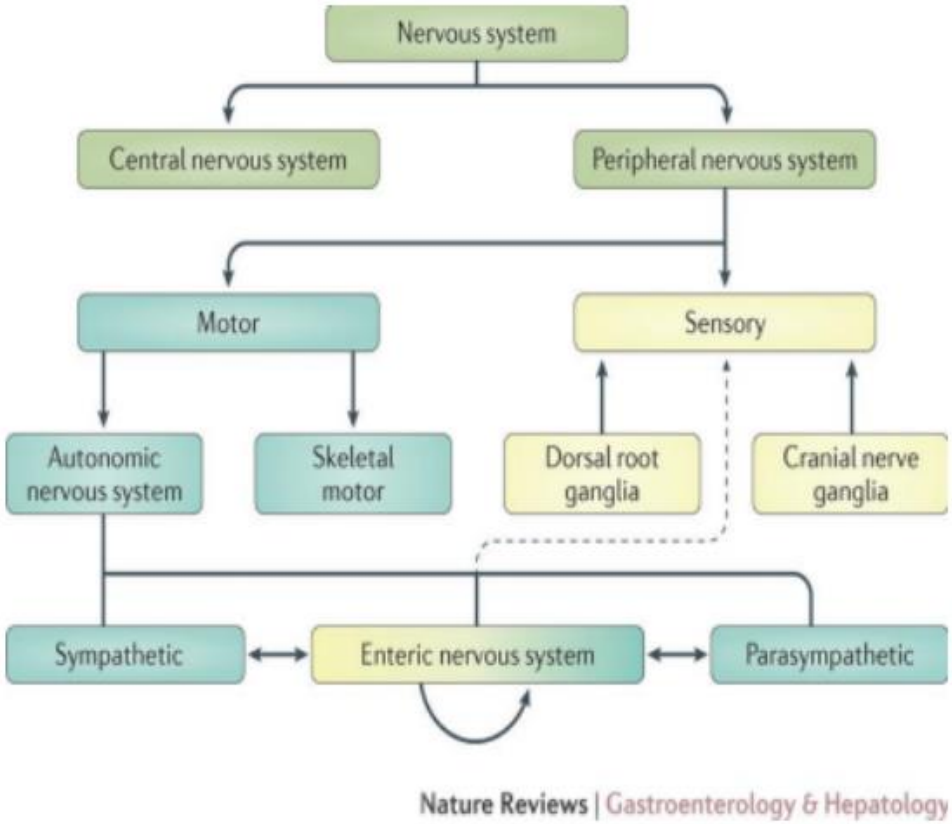
Summary:

The Autonomic Nervous System and the Adrenal Medulla (ANS)



Definition

*The autonomic nervous system (ANS) is a part of the nervous system that is generally not under conscious, voluntary control, nor is the organism usually conscious of its operation.

*The ANS is commonly defined as a peripheral motor system innervating smooth muscle, cardiac muscle, glandular tissue and the organs of the body cavity, known as viscera (e.g., stomach, urinary bladder), that these tissues often comprise.
It should be kept in mind, however, that these peripheral targets and their motor innervation are usually part of reflex pathways that also include visceral afferents and central nervous system structures (e.g., hypothalamus), both of which are sometimes included in broader definitions of the ANS.
*A principal function of the ANS is maintaining the constancy of the body's internal environment, or homeostasis. Toward this end, it regulates such functions as blood pressure, heart rate, intestinal motility, bladder emptying, sweating, and the diameter of the eye's pupil.
*The ANS has unique anatomy, synaptic transmission, and effects on its various target organs.

GENERAL ORGANIZATION OF THE AUTONOMIC NERVOUS SYSTEM
*The autonomic nervous system is activated mainly by centers located in the spinal cord, brain stem, and hypothalamus.
*In addition, portions of the cerebral cortex, especially of the limbic cortex, can transmit signals to the lower centers and in this way can influence autonomic control. *The autonomic nervous system also often operates through visceral reflexes. That is, subconscious sensory signals from visceral organs can enter the autonomic ganglia, the brain stem, or the hypothalamus and then return subconscious reflex responses directly back to the visceral organs to control their activities.
*The efferent autonomic signals are transmitted to the various organs of the body through two major subdivisions called the sympathetic nervous system and the parasympathetic nervous system.

The Peripheral Autonomic Nervous System Differs from the Somatic Motor System in a Number of Important Ways

1- The ANS differs from the somatic motor system in its target organs, in the number of neurons in its peripheral circuit, and in the nature of the synapse at the target organ. 2- The somatic motor system innervates skeletal muscle, which is the muscle responsible for all movements of the body.

*In contrast, the ANS innervates smooth muscle, cardiac muscle, and glandular tissue. Cardiac muscle is the muscle of the heart. Smooth muscle is the muscle in blood vessels, in most of the gastrointestinal tract, in the bladder, and in other hollow visceral structures. Gland cells can also be part of visceral organs, as well as comprising non visceral glands (e.g., salivary glands, lacrimal glands).

3- The ANS also differs in the number of neurons it has in the peripheral nervous system.

*The somatic nervous system has one neuron whose cell body is located in the central nervous system (CNS) and whose axon extends, uninterrupted, to the skeletal muscle, where the peripheral chemical synapse occurs.

*In contrast, the ANS has two peripheral neurons. The first, called a preganglionic neuron, also has its cell body in the CNS, but its axon innervates a second neuron in the chain, called the postganglionic neuron. The latter's cell body is in a peripheral structure called a ganglion which is a collection of neuronal cell bodies outside the CNS.

*There are chemically mediated synapses both between the preganglionic and postganglionic neurons and between the postganglionic neuron and the cells of its target organ.

4- The ANS also differs from the somatic motor system in the amount of myelin along the peripheral axons; the autonomic postganglionic neurons usually have slowly conducting, unmyelinated axons.

5- Somatic motor neurons always excite their skeletal muscle targets, whereas the autonomic postganglionic neurons can either excite or inhibit their targets.

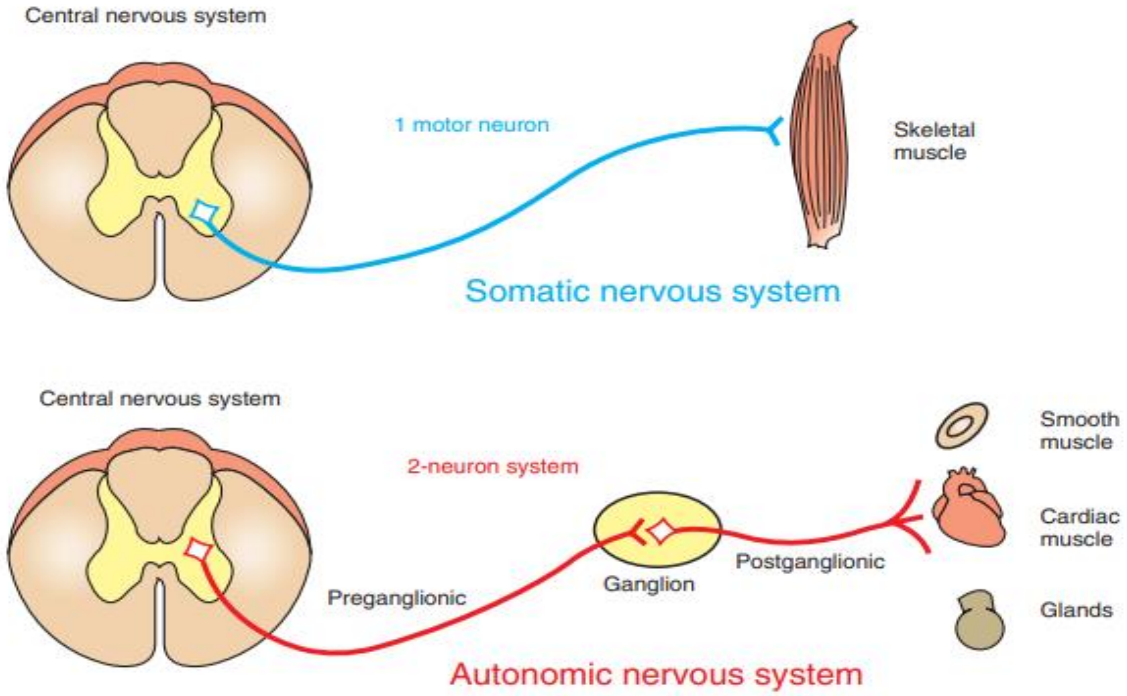


FIGURE 13-1 The autonomic nervous system (ANS) differs from the somatic motor system in the number of neurons that it has in the peripheral nervous system. The somatic motor system has one neuron, whose cell body is located in the central nervous system (CNS) and whose axon extends, uninterrupted, to the skeletal muscle, where the peripheral chemical synapse occurs. In contrast, the ANS has two neurons in the path from the CNS to the target. The first, called a *preganglionic neuron,* also has its cell body in the CNS, but its axon innervates a second neuron in the chain, called the *postganglionic neuron.* Its cell body is in a peripheral structure called a *ganglion.*