Unit 4 Lecture 13

AUTONOMIC SYSTEM (ANS)

A key characteristic of the autonomic system is that it functions without conscious effort (i.e. they happen automatically), primarily controlling visceral activities that maintain homeostasis. The autonomic system exerts some control over skeletal muscles but is primarily considered to control smooth muscles, cardiac muscles, and glands. Autonomic functions are reflexes controlled from the hypothalamus, brain stem, and spinal cord (the primitive parts of the brain) and do not waste time going to the cortex of the brain. This has allowed the human being to survive the evolutionary challenges besetting our fore parents. The ANS is divided into the sympathetic and parasympathetic divisions. Sympathetic division prepares the body for stressful and emergency situations, mainly to protect the body. Parasympathetic division is most active under normal conditions. Sympathetic fibers leave the spinal cord and synapse in specific ganglia. Parasympathetic fibers begin in the brain stem and sacral region of the spinal cord and synapse in ganglia near various visceral organs or in the organs themselves.

An autonomic pathway is composed of preganglionic neurons from the CNS that synapses with a postganglionic neuron in an autonomic ganglion. Autonomic ganglia can modulate and integrate information passing through them. That is, they act by themselves without having us have to consciously think and act on the stimulus. Most sympathetic ganglia originate in the thoracic and lumbar regions of the spinal cord. Most sympathetic ganglia lie close to the spinal cord or along the descending aorta. Parasympathetic pathways originate in the brain stem or in the sacral region. Parasympathetic ganglia are located on or near their target organ. The Sympathetic division prepares the body for stressful and emergency situations. Parasympathetic division is most active under normal conditions.

The primary autonomic neurotransmitters are acetylcholine (ACh) and norepinephrine. All preganglionic neurons secrete ACh. As a rule, sympathetic neurons secrete norepinephrine and parasympathetic neurons secrete Ach. The synapse between the autonomic neuron and its target cells is called the neuroeffector junction. The adrenal medulla secretes epinephrine and is controlled by sympathetic preganglionic neurons. Adrenergic receptors are G protein linked receptors. Alpha receptors respond most strongly to norepinephrine. β_1 receptors respond equally to norepinephrine and epinephrine. β_2 receptors are not associated with sympathetic neurons and respond most strongly to epinephrine.

Why is this chapter important?

This brief chapter compares the sympathetic and the parasympathetic divisions of the autonomic nervous system. You would want to know when each system is the primary controlling system in the body. Also covered are cholinergic and adrenergic neurons and receptors, receptor agonists (helpers) and antagonists (blockers).