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A Brief Note on Sympathetic Nervous System

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Commentary

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DESCRIPTION

The Sympathetic Nervous System (SNS) is one of two autonomic nervous system divisions, the other being the parasympathetic nervous system. The enteric nervous system is a component of the autonomic nervous system and is sometimes referred to as an independent system.

Any signal transmitted through the sympathetic system is transmitted by two sensory receptors. Pre-ganglionic and post-ganglionic. The relatively short preganglionic neurons emerge from the spinal cord's thoracolumbar branch, where they synapse with a postganglionic neuron. From there, the long post-ganglionic neurons spread throughout the body. In response to this stimulus, post-ganglionic neurons release norepinephrine, which activates adrenergic receptors on peripheral target tissues. The effects of the sympathetic nervous system are caused by the activation of target tissue receptors.

Except for areas of thick skin, such as the palms and plantar surfaces of the feet, where norepinephrine is released and acts on adrenergic receptors, sweat gland postganglionic neurons release acetylcholine for muscarinic receptor activation. This causes sudomotor function to be activated, which is measured by electrochemical skin conductance. The chromaffin cells of the adrenal medulla are similar to post-ganglionic neurons; the adrenal medulla develops alongside the sympathetic nervous system and functions as a modified sympathetic ganglion. Within this endocrine gland, pre-ganglionic neurons synapse with chromaffin cells, resulting in the release of two transmitters: a small proportion of norepinephrine and, more importantly, epinephrine. Another feature that distinguishes chromaffin cells from postganglionic sympathetic neurons is the production and release of epinephrine rather than norepinephrine.

Dopamine is released by postganglionic sympathetic nerves that terminate in the kidney and acts on dopamine D1 receptors in blood vessels to regulate the amount of blood the kidney filters. Dopamine is the immediate metabolic precursor to norepinephrine, but it is also a signalling molecule in and of itself. Beginning at the first thoracic vertebra of the vertebral column and extending to the second or third lumbar vertebra, sympathetic nerves emerge from the intermediolateral nucleus of the lateral grey column near the middle of the spinal cord. Because its cells begin in the thoracolumbar division the thoracic and lumbar regions of the spinal cord and sympathetic nervous system is said to have a thoracolumbar outflow. The axons of these nerves exit the spinal cord through the anterior root. Before entering the anterior rami of the spinal nerves, they pass close to the spinal ganglion. Unlike somatic innervation, however, they quickly separate out through white rami connectors that connect to either the paravertebral or paravertebral ganglia that extend alongside the spinal column.

To reach target organs and glands, axons must travel long distances in the body, and many axons relay their message to a second cell *via* synaptic transmission. The synapse connects the ends of the axons to the dendrites of the second cell. A neurotransmitter is sent across the synaptic cleft by the presynaptic cell, activating the second cell. At the level of the originating spinal nerve, the axon always enters the paravertebral ganglion. The desired end effector is then innervated by the postsynaptic cell (i.e. gland, smooth muscle, etc.). Presynaptic neurons are much shorter than postsynaptic neurons, which must travel throughout the body to reach their destinations because paravertebral and prevertebral ganglia are so close to the spinal cord.

The sympathetic innervation of the suprarenal (adrenal) medulla is an important exception to the previously mentioned routes. Presynaptic neurons in this case travel through paravertebral ganglia, then prevertebral ganglia, and finally synapse with suprarenal tissue directly. This tissue is made up of cells that have pseudo-neuron-like properties in that when activated by the presynaptic neuron, they release their neurotransmitter (epinephrine) directly into the bloodstream. These synapses form at ganglia in the sympathetic nervous system and other peripheral nervous system components. A preganglionic cell sends its fibre, whereas a postganglionic cell has its fibre leave the ganglion. As previously stated, the

sympathetic nervous system's preganglionic cells are located in the spinal cord between the first thoracic and third lumbar segments. Postganglionic cells have cell bodies that are based on ganglia and send axons to target organs or glands.

The ganglia include not only the sympathetic trunks, but also the cervical ganglia (superior, middle, and inferior), which send sympathetic nerve fibres to organs in the head and thorax, and the celiac and mesenteric ganglia, which send sympathetic fibres to the gut. Messages are transmitted in both directions by the sympathetic nervous system. Efferent messages have the ability to affect multiple parts of the body at the same time.