AUTONOMIC NERVOUS SYSTEM

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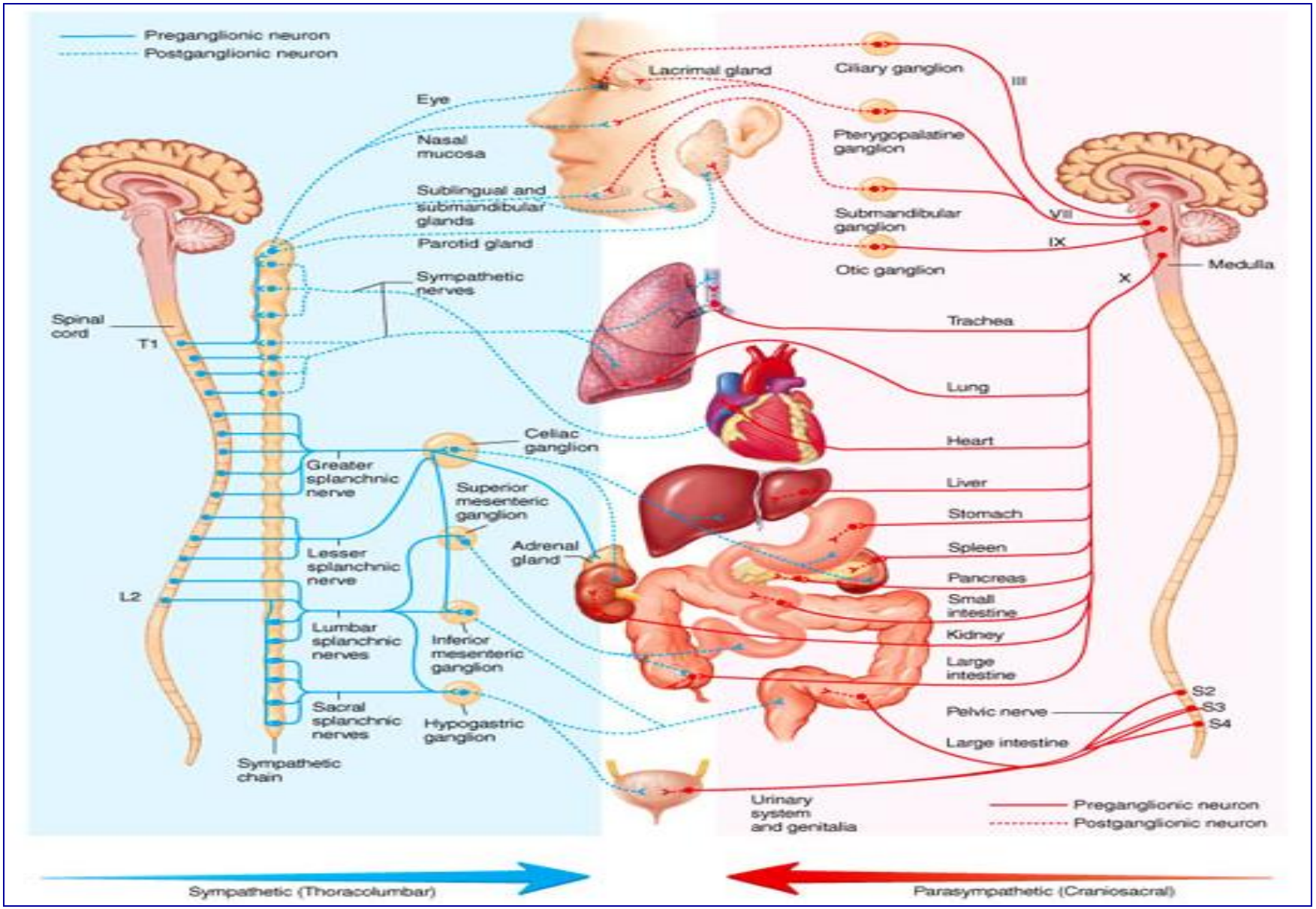
Autonomic nervous system

- **Autonomic nervous system (ANS)** is the part of nervous system that is responsible for **homeostasis.**It consists of three subsystems :
- **The sympathetic nervous system.**
- **The parasympathetic nervous system.**
- **The enteric (ENS) nervous system.**

  - **The ANS regulates the activities of smooth muscles, cardiac muscles, endocrine glands and exocrine glands.**

- These functions are regulated by **brain centers** in the **hypothalamus** and **brainstem.**
- Some target organs are innervated by both sympathetic and parasympathetic nervous system .Others are controlled by one.
- The ENS controls the activity of gastrointestinal tract



Autonomic Nervous system

- The ANS functions involuntarily (reflexively) in an automatic manner without conscious control.
- The ANS operates through visceral reflexes. (e.g., response to cold).

➢ Peripheral motor portion of ANS are made up of two neurons:

1)Periganglionic neurons 2) Postganglionic neurons.

- The cell bodies of periganglionic neurons are located in the **intermediolateral (IML)** column of the spinal cord and **motor nuclei** of some cranial nerves.
- Periganglionic axons are small diameter myelinated, relatively slowly conducted.
- Autonomic output diffuse by diverging periganglionic axon to average 8-9 postganglionic neurons.
- Postganglionic axons are unmyelinated and terminate on the **visceral effectors.**
- Periganglionic neurons release **acetylcholine (ACh)** at their nerve terminals.

Sympathetic nervous system

- The sympathetic nervous system is called "**fight or flight system**" because it is most active in times of stress ,fear or excitement
- The system originates in the spinal cord as **pre-ganglionic neurons**, which connect with **post-ganglionic neurons** going to the organ they act upon.
- This prepares for physical activity by:
- Increasing ventilation and expanding the respiratory passages.

- Increasing the cardiac output, blood pressure (so the blood is pumped faster) and blood distribution through vasoconstriction (blood to the muscles at the expense of the gut).
- Increasing the concentration of blood glucose above normal, by releasing glucose from the liver.
- Increasing sweating (to cool the body during activity)
- Inhibiting digestion.

The parasympathetic nervous system.

- The parasympathetic nervous system is called the **"rest and digest system"** because it is most active in times of rest and relaxation.
- Parasympathetic pathways are composed **preganglionic** and **postganglionic** neurons.
- The perganglionic nerve fibers originate in the cranial nerve nuclei in the brainstem and in lower spinal cord.
- This system prepares for resting activities by
  - **Promoting digestion, defecation and urination.**
  - **Slowing respiration.**
  - **Slowing the heart beat.**

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The enteric nervous system

- This system comprises **submucosal and myenteric plexuses**; entirely contained within the gut wall.
- Stimulation of the myenteric plexus increases the **intestinal motility** by stimulation peristalsis and inhibiting contraction of sphincter muscles throughout the intestinal tract.

- The ANS influences functioning of the enteric nervous system :
  - The sympathetic stimulation inhibits peristalsis and increases sphincter tone, thereby inhibiting digestion.
  - The parasympathetic stimulation promotes peristalsis and relaxes the sphincters, thereby enhancing digestion.

Chemical transmission

- Transmission at the synaptic junction between preganglionic and postganglionic neurons, and between postganglionic neurons and autonomic effectors are chemically mediated.
- The principle transmitter agents involved are: **acetylcholine (ACh) and norepinephrine.**
- The autonomic neurons that are **cholinergic(release ACh)**are:
- All periganglionic neurons
- All parasympathetic postganglionic neurons
- Sympathetic postganglionic neurons that innervate sweat glands.
- Sympathetic postganglionic neurons that end on blood vessels in some skeletal muscles and produce vasodilatation when stimulated.

- The remaining sympathetic postganglionic neurons are **noradrenergic (release norepinephrine).**
- Transmission in autonomic ganglia is mediated by the action of **ACh** on **nicotinic cholinergic receptors** that are blocked by **hexamethonium (Nn receptors**) to distinguish them from the **nicotinic cholinergic receptors (Mm)** located at the neuromuscular junction and blocked by **D-tubocurane.**

- **Noradrenergic neurotransmission :**
- **Norepineprine** spreads farther and has more prolonged action than ACh
- **Norepinephrine, epinephrine** and **dopamine** are all found in plasma.
- The epinephrine and some of dopamine come from the **adrenal medulla,** but most of the norepinephrine diffuses into the blood stream from sympathetic nerve endings.

Autonomic dysfunction

- Drugs, neurodegenerative diseases, trauma, inflammatory processes and neoplasia are factors that can lead to dysfunction of the ANS.
- The types of dysfunction may range from **complete autonomic failure** to **autonomic hyperactivity.**
- Among disorders associated with autonomic failure are orthostatic hypotension, neurogenic syncope, impotence, neurogenic bladder, gastrointestinal dysmotility and Horners syndrome .
- Autonomic hyperactivity can be basic for neurogenic hypertension, cardiac arrhythmias, neurogenic pulmonary edema, and myocardial injury.

THANKS