



AUTONOMIC NERVOUS SYSTEM

DR. AZZA SAJID

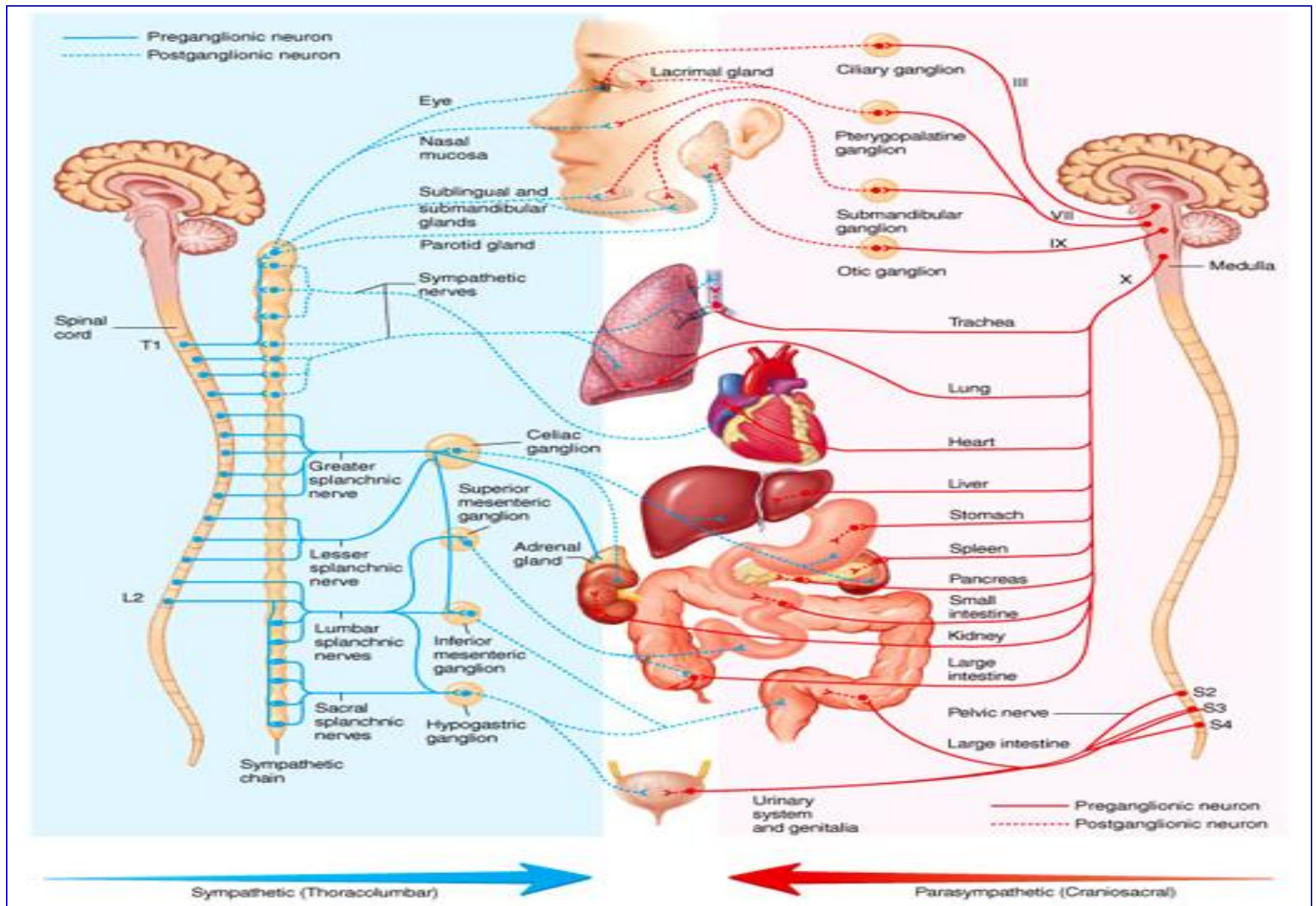
Physiology -2nd stage

2018-2019

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 preganglionic 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 Horner's syndrome .
- ❑ Autonomic hyperactivity can be basic for neurogenic hypertension, cardiac arrhythmias, neurogenic pulmonary edema, and myocardial injury.

THANKS

The word "THANKS" is rendered in a bold, blue, 3D sans-serif font. Each letter has a slight shadow and a highlight, giving it a three-dimensional appearance. Below the text is a soft, semi-transparent reflection of the word, creating a sense of depth and balance on the white background.