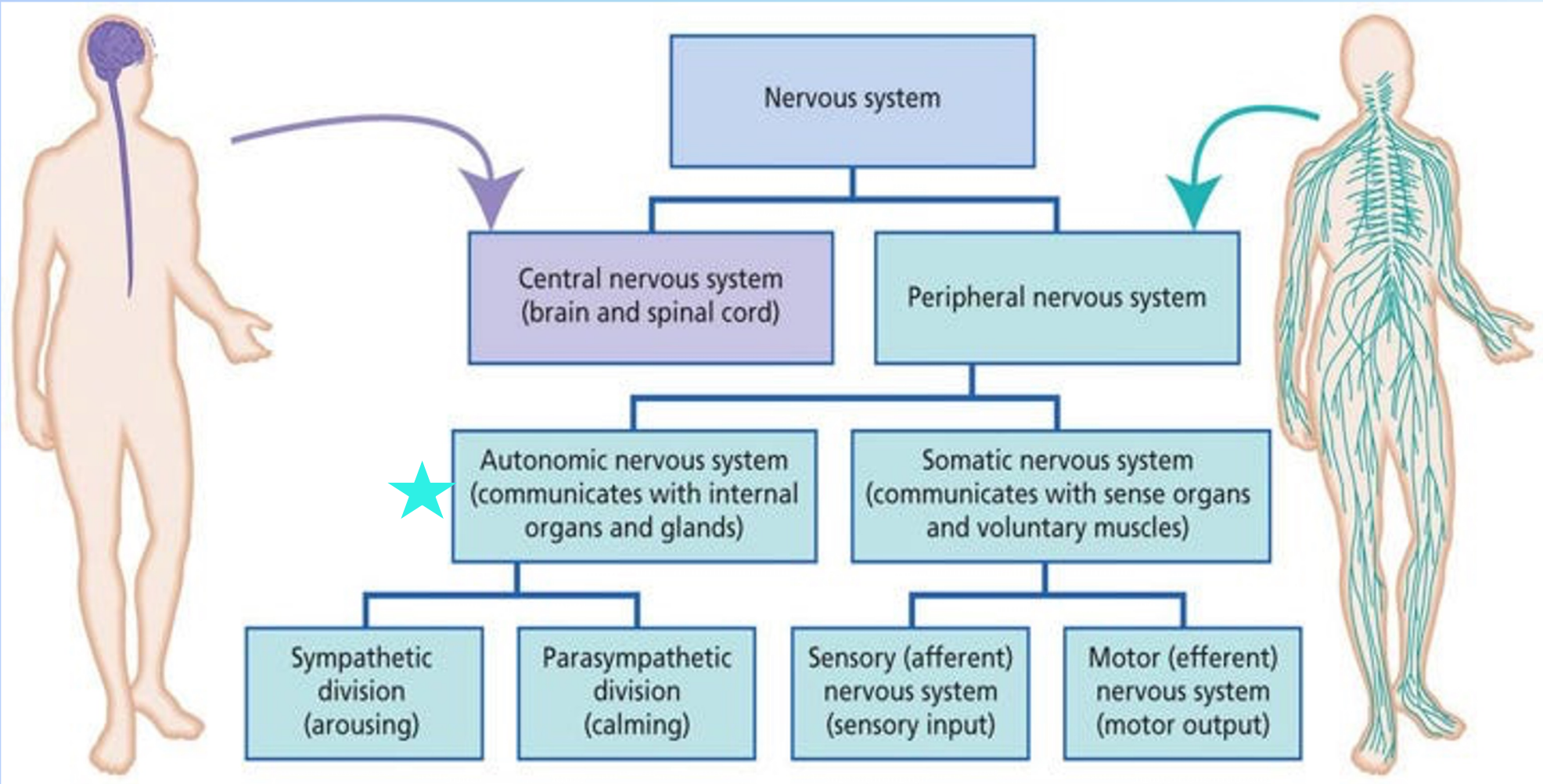


Autonomic Nervous system

By Michelle Kaminski

Overview

- General aspects of ANS
- Division of ANS
- Parasympathetic
- Sympathetic
- Neurotransmission
- Pupillary Light reflex
- Exam clinical correlations
- WooClap!



General Aspects of ANS

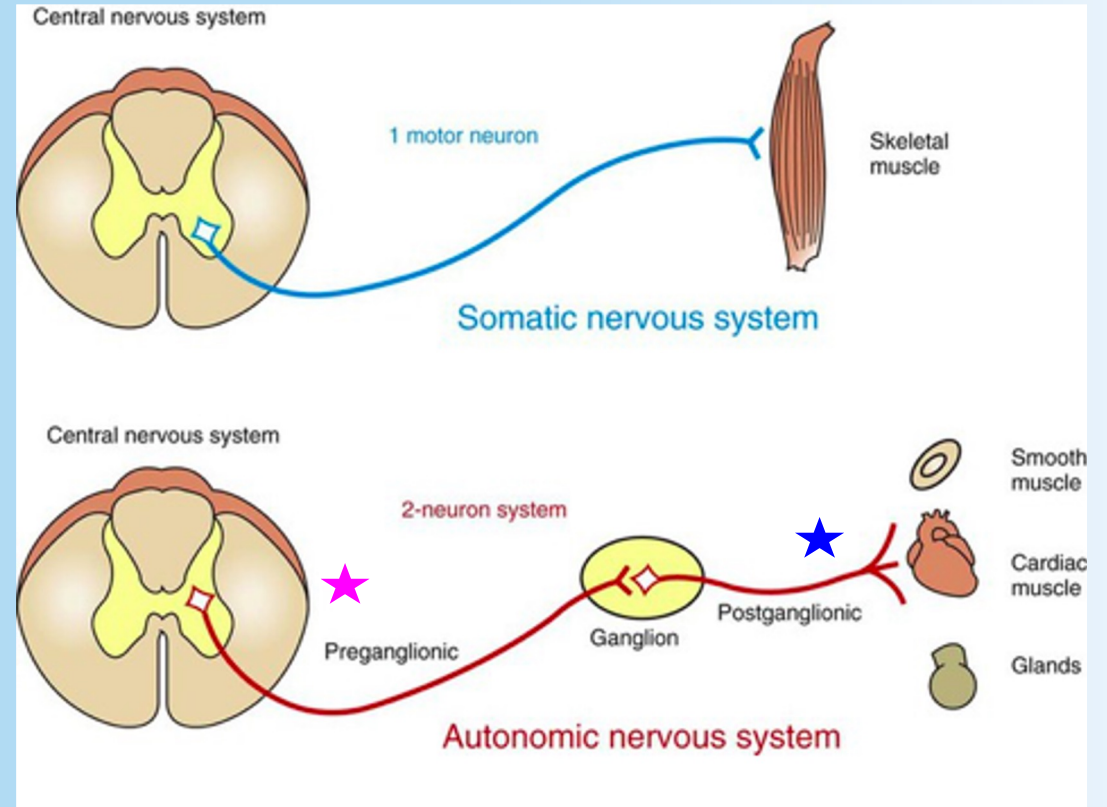
- Unlike the CNS, ANS has a **2-neuron connection** system to transport signals from spinal cord to target organ.

1st neuron ★

- The **preganglionic** neuron that goes from the spinal cord or brain stem to a ganglion.

2nd neuron ★

- The **postganglionic** neuron that goes from ganglion to the tissue it is supposed innervate.



Ganglion: group of cell bodies in the peripheral nervous system

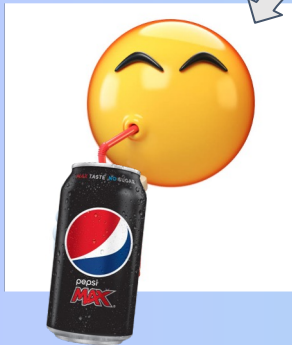
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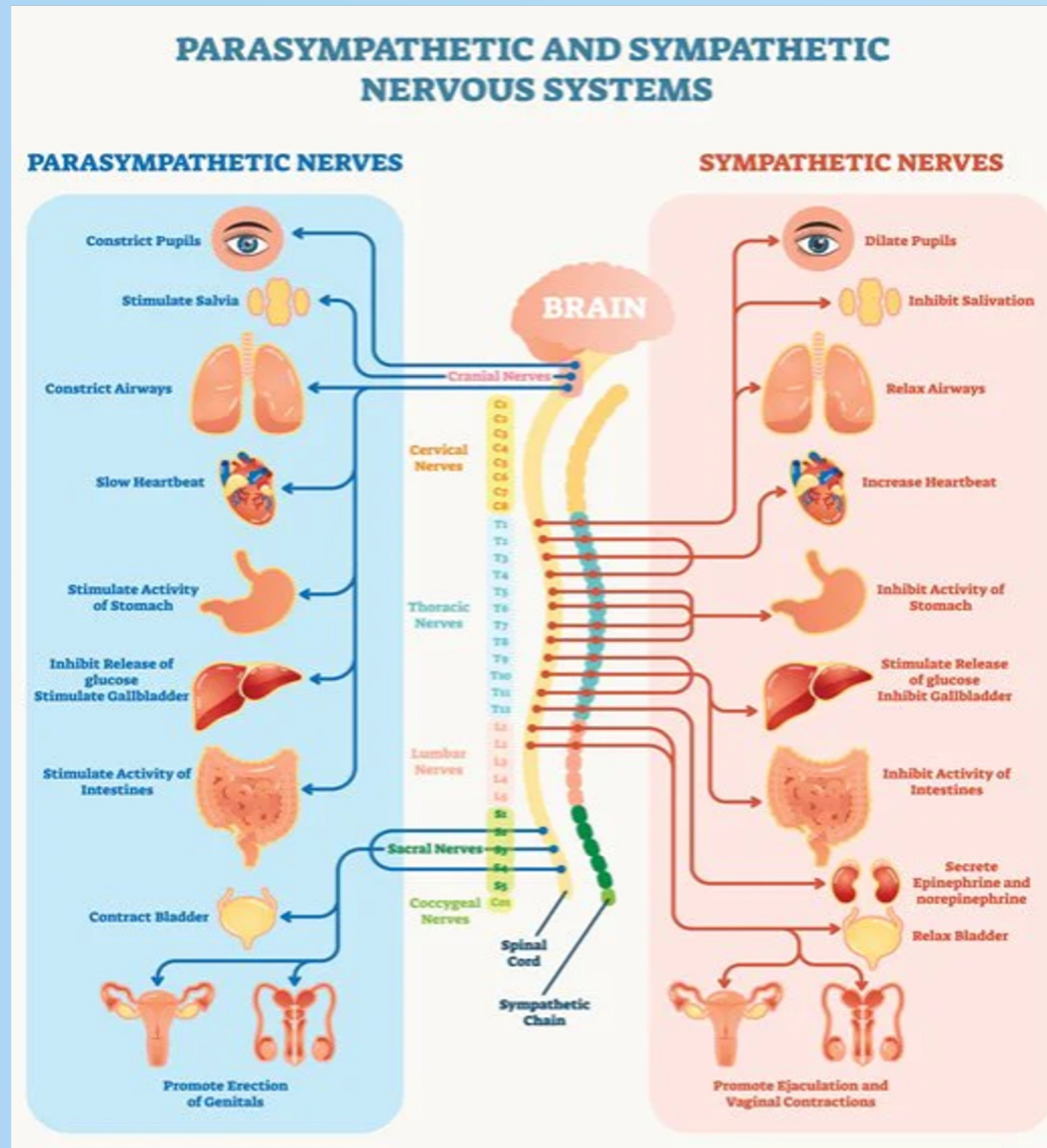
Parasympathetic

“Rest and Digest”

Stimulation of this division allows our body to regenerate and rest after long days of work, studying, and partying.



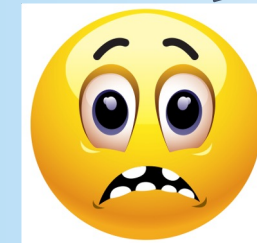
you sipping on pepsi max on the couch watching greys anatomy after a loong day of touching beef jerky cadaveurs



Sympathetic

“Fight or Flight”

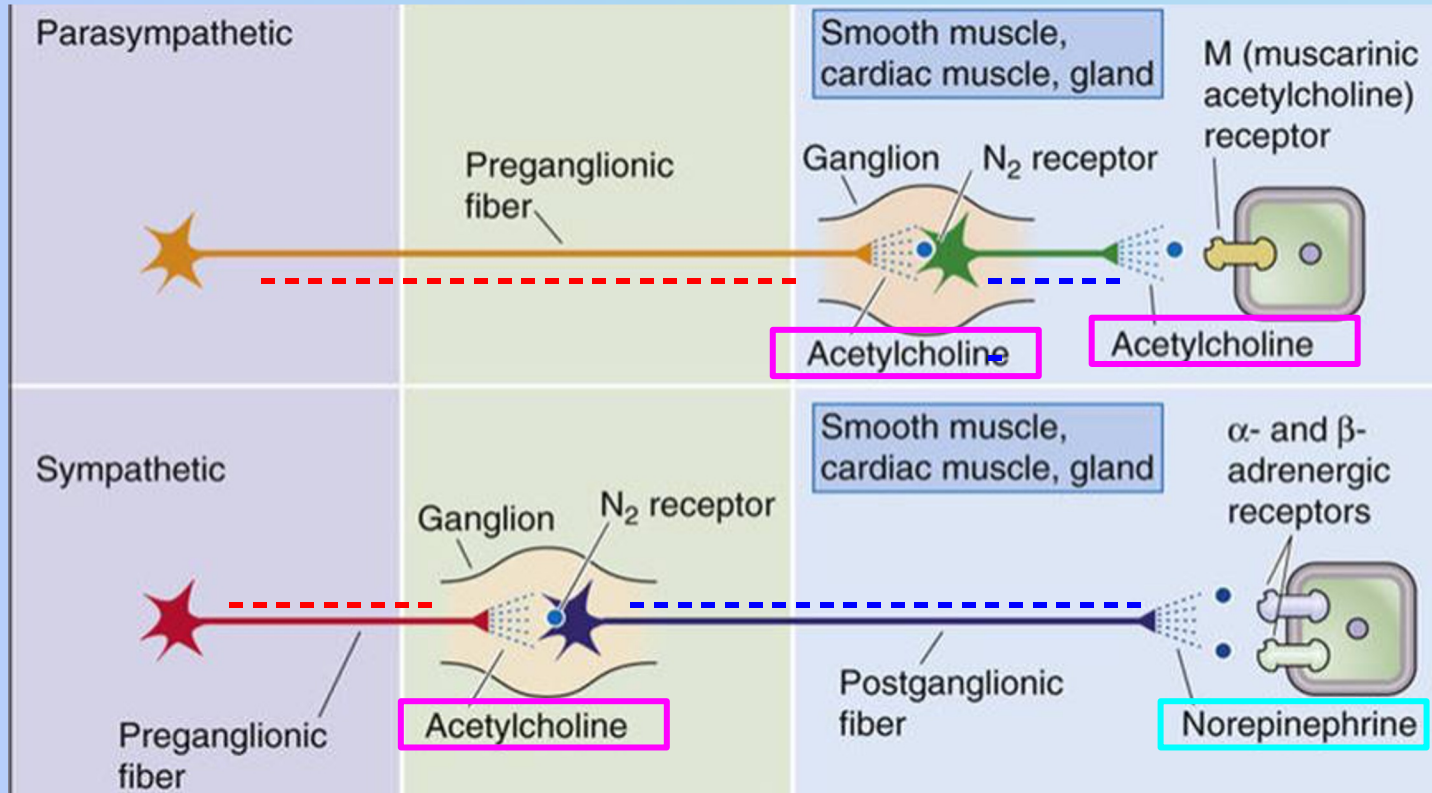
Stimulation of this division allows your body to prepare for survival mode.



you seeing the person you went home with the first week that you thought didn't go to school in your anatomy lab

notice those dilated pupils from the fear you just experienced ;)

Parasympathetic vs Sympathetic



Cholinergic Fibers:

Neurons that use Acetylcholine as their neurotransmitter at the synapse

Adrenergic Fibers:

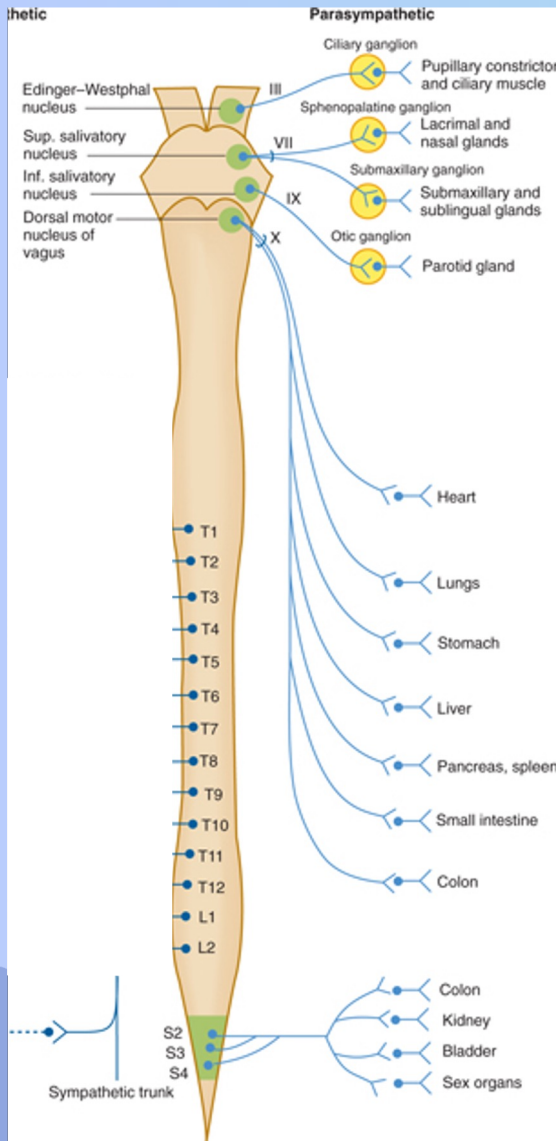
Neurons that use Norepinephrine or noradrenaline as their neurotransmitter at the synapse

Note the relative difference in preganglionic and postganglionic fibers between parasympathetic and sympathetic

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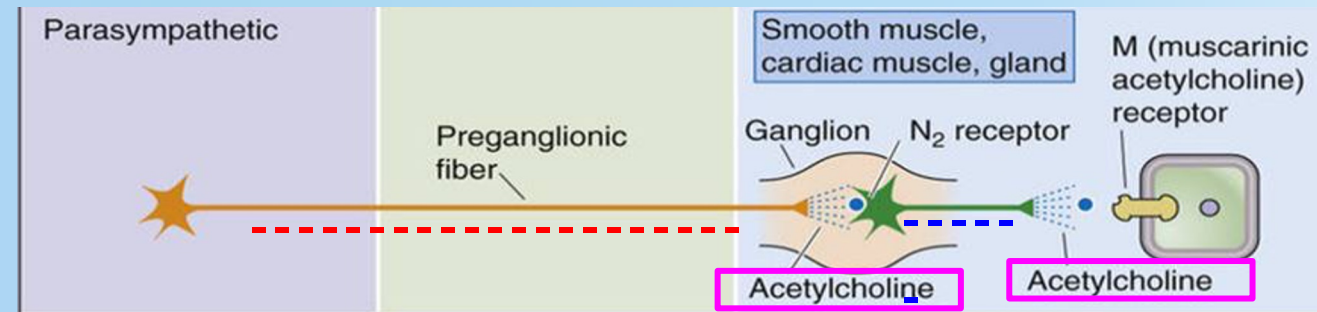
Parasympathetic Division of ANS



Preganglionic fibers: CN 3,7,9, and 10 innervate the autonomic ganglia of their target organs. S2, S3, S4 are the origins for the innervation of the lower periphery autonomic ganglia

Postganglionic Fibers: innervate from ganglions to target organs

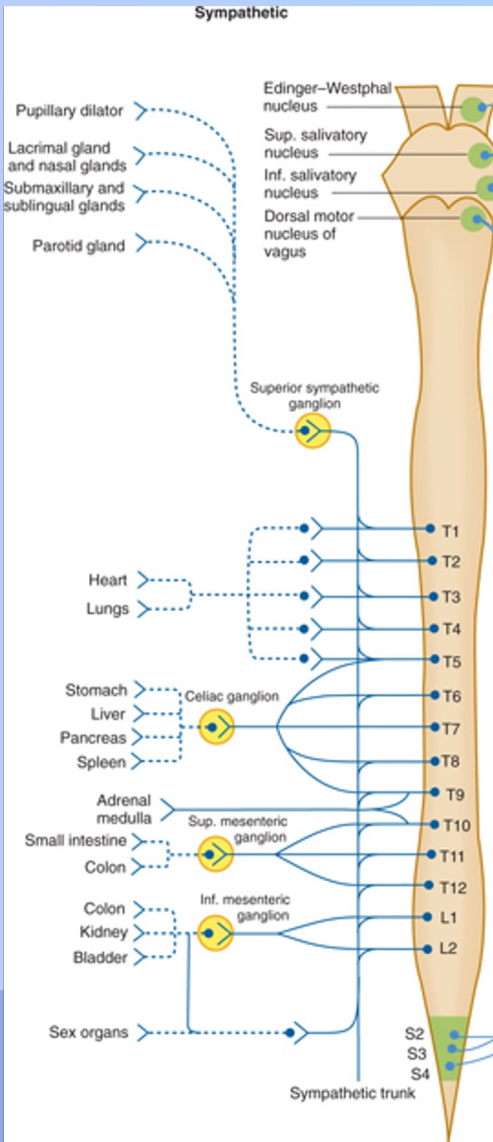
Parasympathetic division only has cholinergic fibers



Overview

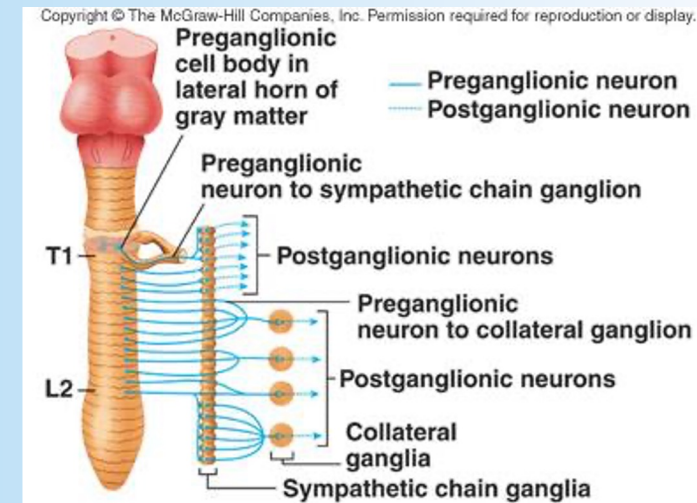
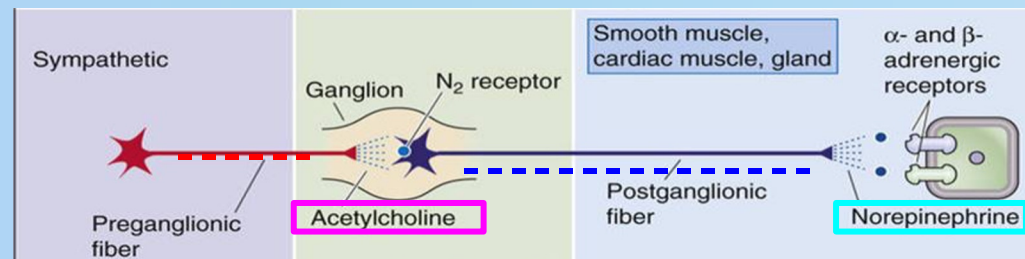
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Sympathetic Division of ANS



Preganglionic fibers: Originate in the **Thoracolumbar** spinal cord. Terminate in the sympathetic chain ganglia. These fibers are cholinergic

Postganglionic fibers: Originate from Sympathetic chain ganglia or preaortic ganglia. Fibers go on to then innervate the target tissues. These fibers are typically adrenergic.



a.k.a paravertebral chain ganglia

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Neurotransmission to target organs

G-protein-linked second messengers

RECEPTOR	G-PROTEIN CLASS	MAJOR FUNCTIONS
Adrenergic		
α_1	q	↑ vascular smooth muscle contraction, ↑ pupillary dilator muscle contraction (mydriasis), ↑ intestinal and bladder sphincter muscle contraction
α_2	i	↓ sympathetic (adrenergic) outflow, ↓ insulin release, ↓ lipolysis, ↑ platelet aggregation, ↓ aqueous humor production
β_1	s	↑ heart rate, ↑ contractility (one heart), ↑ renin release, ↑ lipolysis
β_2	s	Vasodilation, bronchodilation (two lungs), ↑ lipolysis, ↑ insulin release, ↑ glycogenolysis, ↓ uterine tone (tocolysis), ↑ aqueous humor production, ↑ cellular K^+ uptake
β_3	s	↑ lipolysis, ↑ thermogenesis in skeletal muscle, ↑ bladder relaxation
Cholinergic		
M_1	q	Mediates higher cognitive functions, stimulates enteric nervous system
M_2	i	↓ heart rate and contractility of atria
M_3	q	↑ exocrine gland secretions (eg, lacrimal, sweat, salivary, gastric acid), ↑ gut peristalsis, ↑ bladder contraction, bronchoconstriction, ↑ pupillary sphincter muscle contraction (miosis), ciliary muscle contraction (accommodation), ↑ insulin release, endothelium-mediated vasodilation

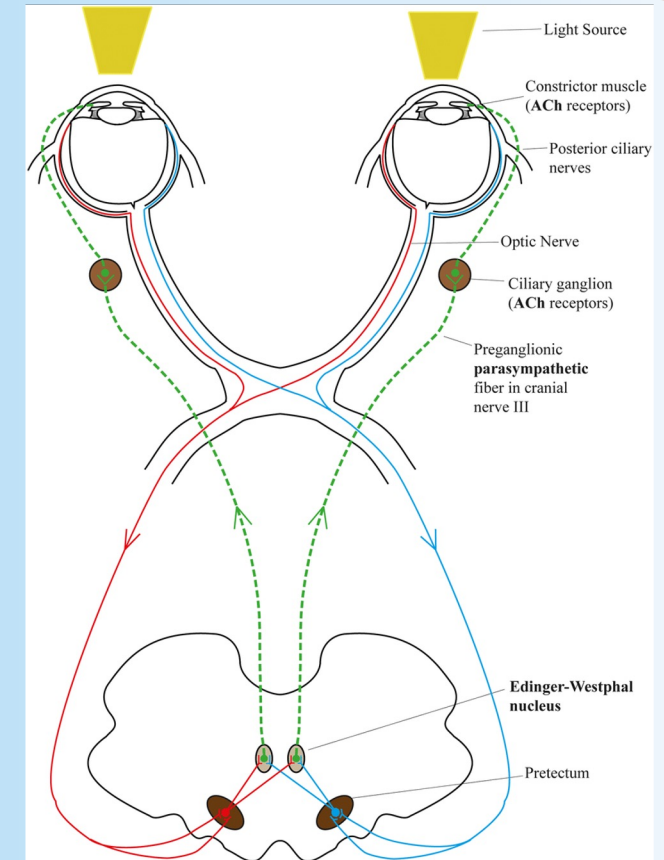
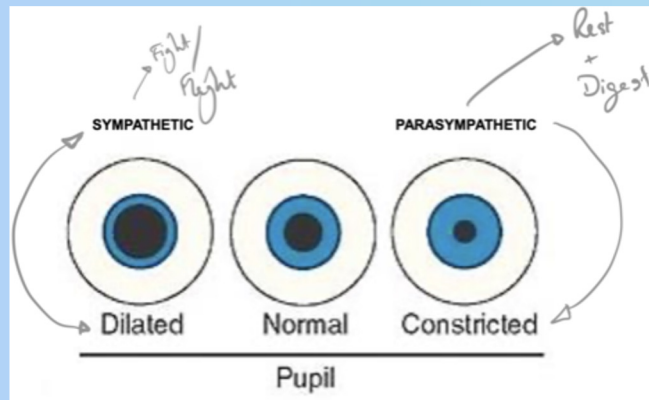
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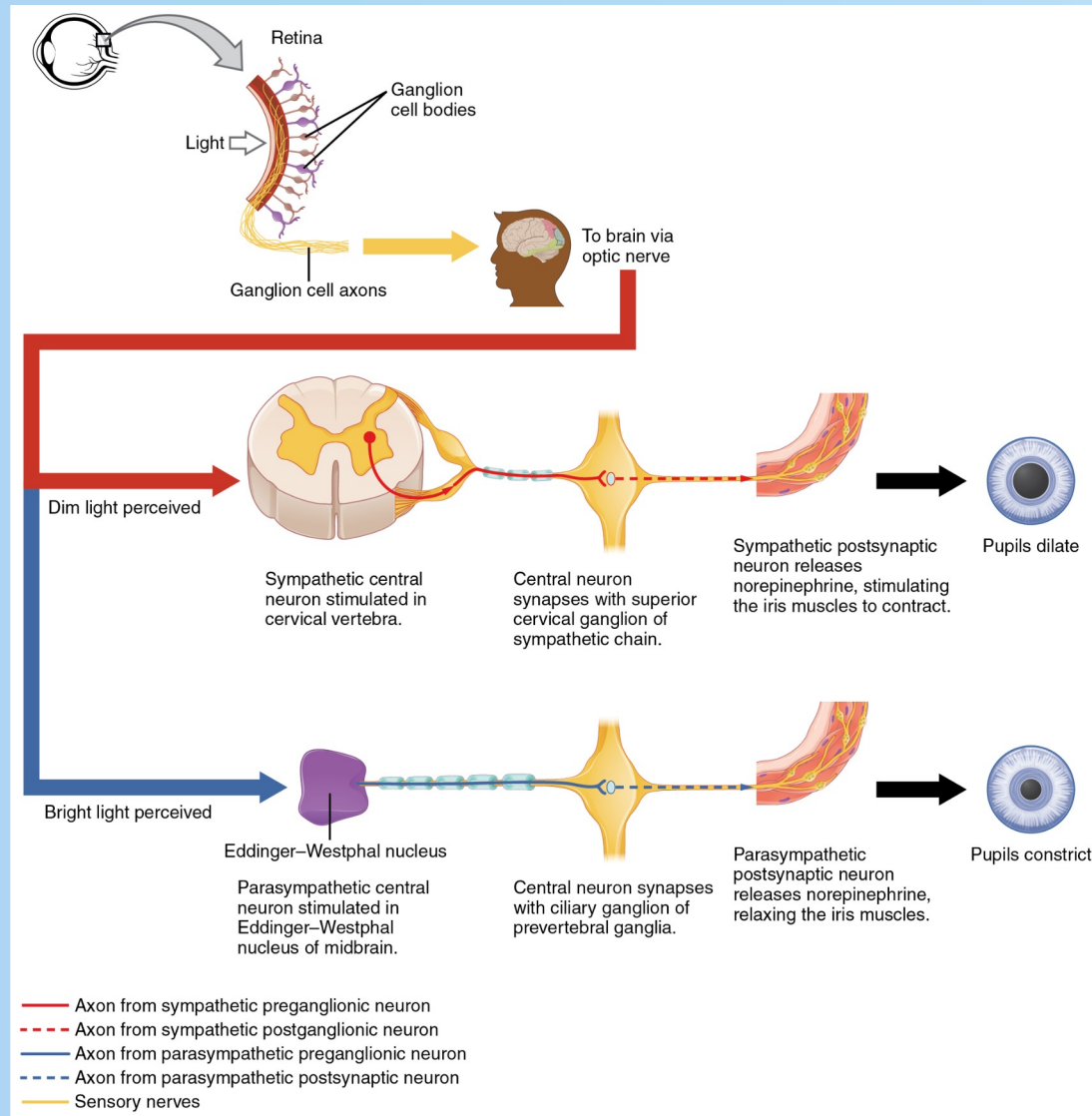
Pupillary light reflex

To assess pupillary light reflex: shine light in each eye individually while looking for a positive direct and consensual response upon shining the light in each eye.

- Parasympathetic supply is through CN 3
- Sympathetic supply is through long ciliary nerve from the superior cervical ganglion



Pupillary light reflex



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Clinical correlations

Atropine:

- Blocks cholinergic receptors (M1, M1, M3)
- Inhibits parasympathetic stimulation on target tissue
- Useful in:
 - Vagal Nerve suppression before intubation
 - administered before ophthalmological procedures to induce mydriasis (dilation of pupil)

Cocaine:

- Blocks norepinephrine reuptake from synaptic cleft by blocking SERT (also blocks reuptake of dopamine and serotonin)

clinical correlation

- causes vasoconstriction that could manifest as a myocardial infarction