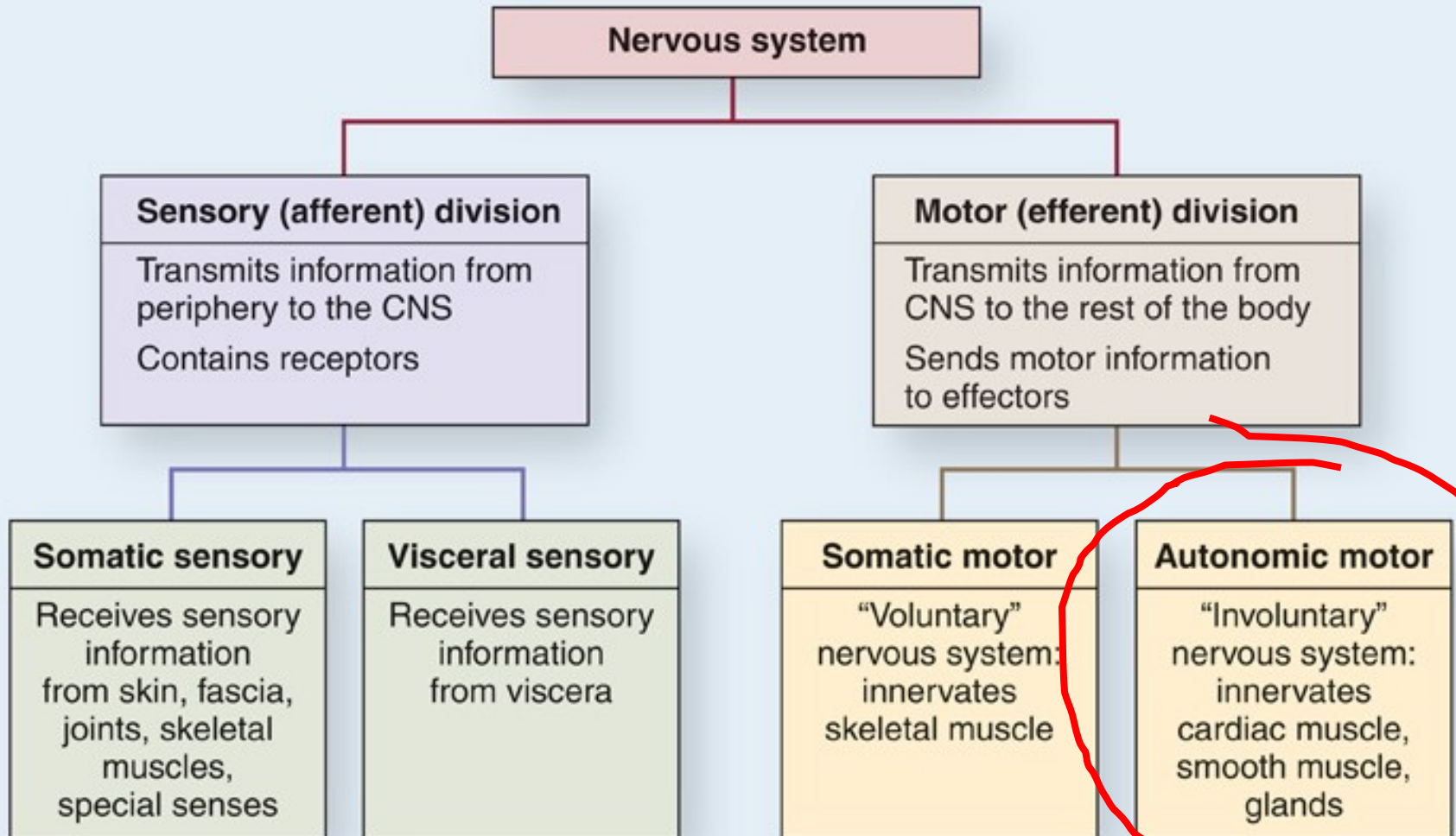


AUTONOMIC NERVOUS SYSTEM

Functional Organization of the Nervous System



AUTONOMIC NERVOUS SYSTEM

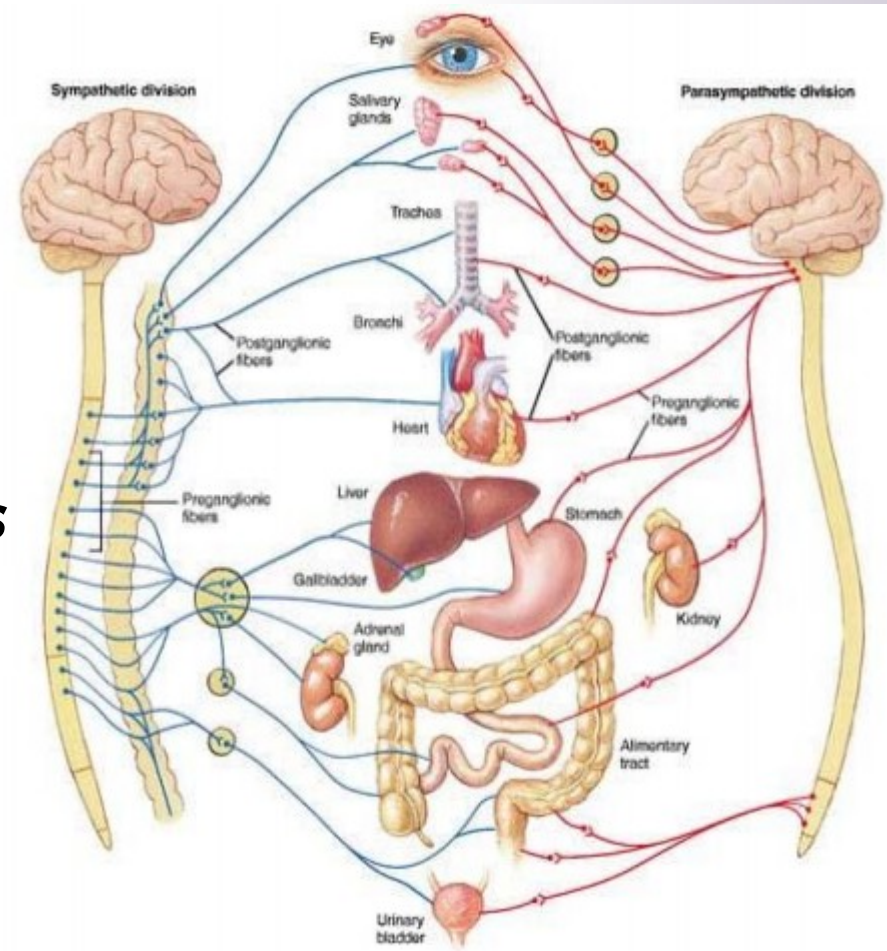
Functions:

Contraction and relaxation of smooth muscles

Function of all exocrine glands

Heart rate

Some metabolic processes

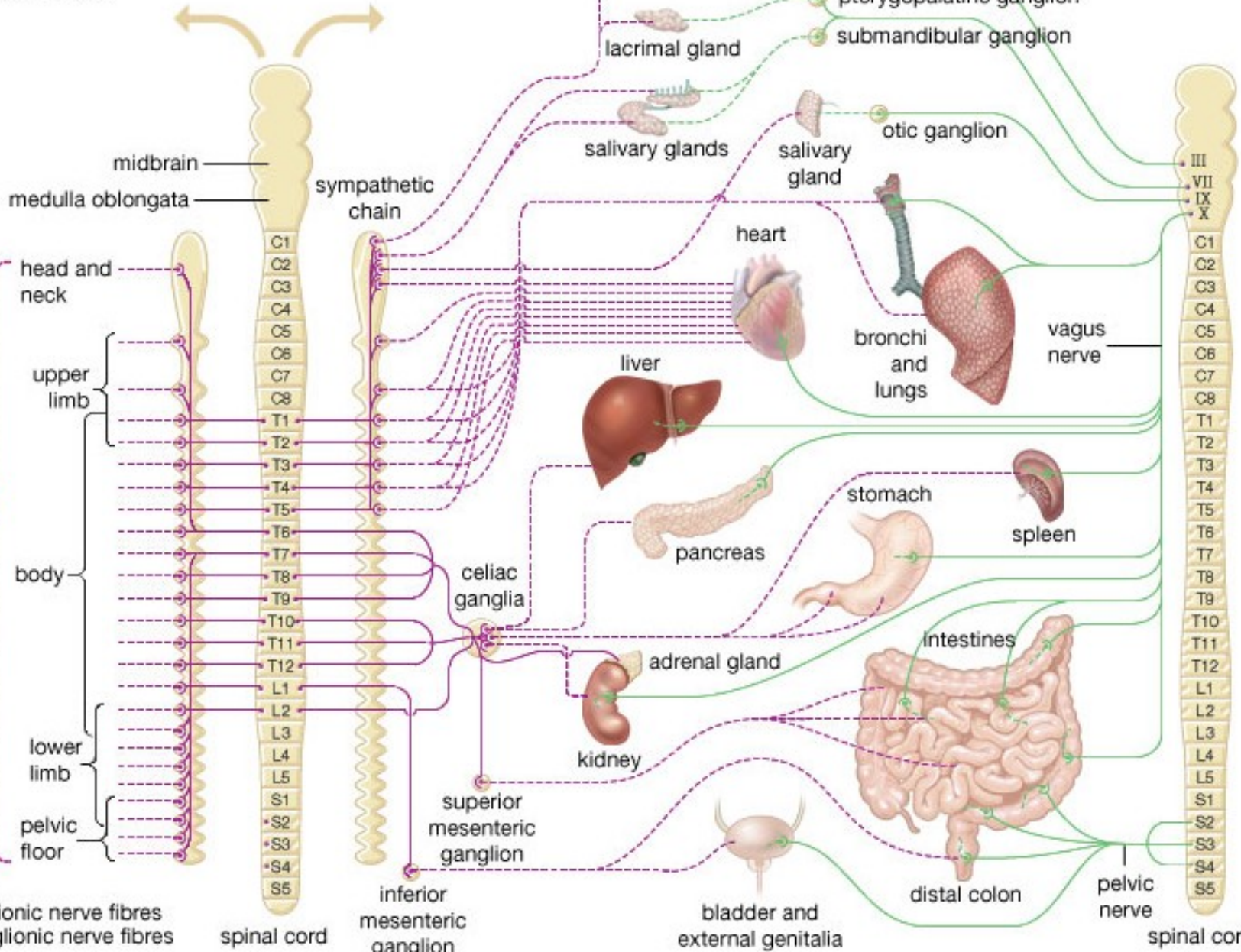
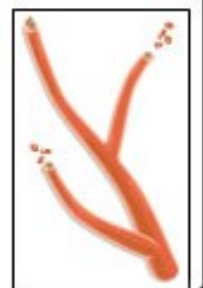
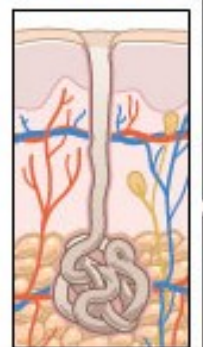
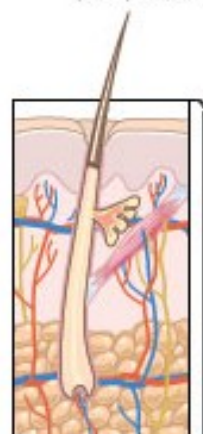


Sympathetic nervous system

Parasympathetic nervous system

sympathetic outflow to smooth muscle of hair follicles, sweat glands, and peripheral blood vessels

sympathetic outflow to organs of the head and trunk



● ○ ganglion
 — preganglionic nerve fibres
 - - - postganglionic nerve fibres

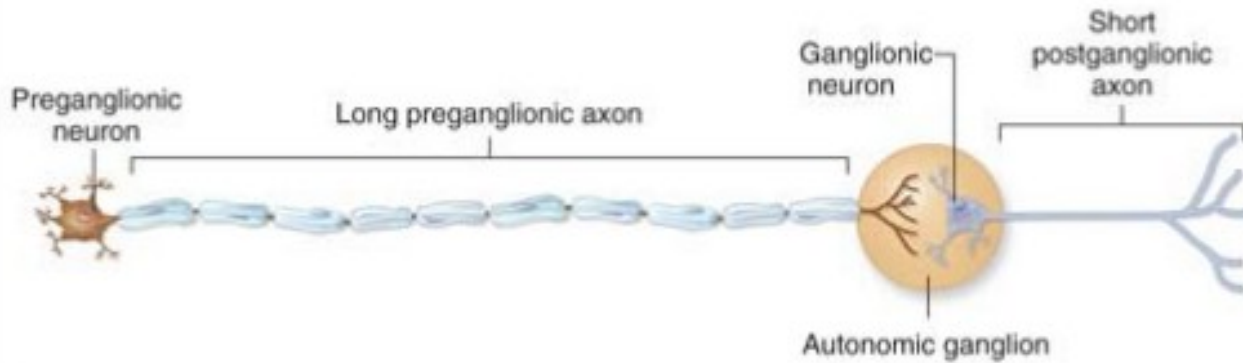
spinal cord

inferior mesenteric ganglion

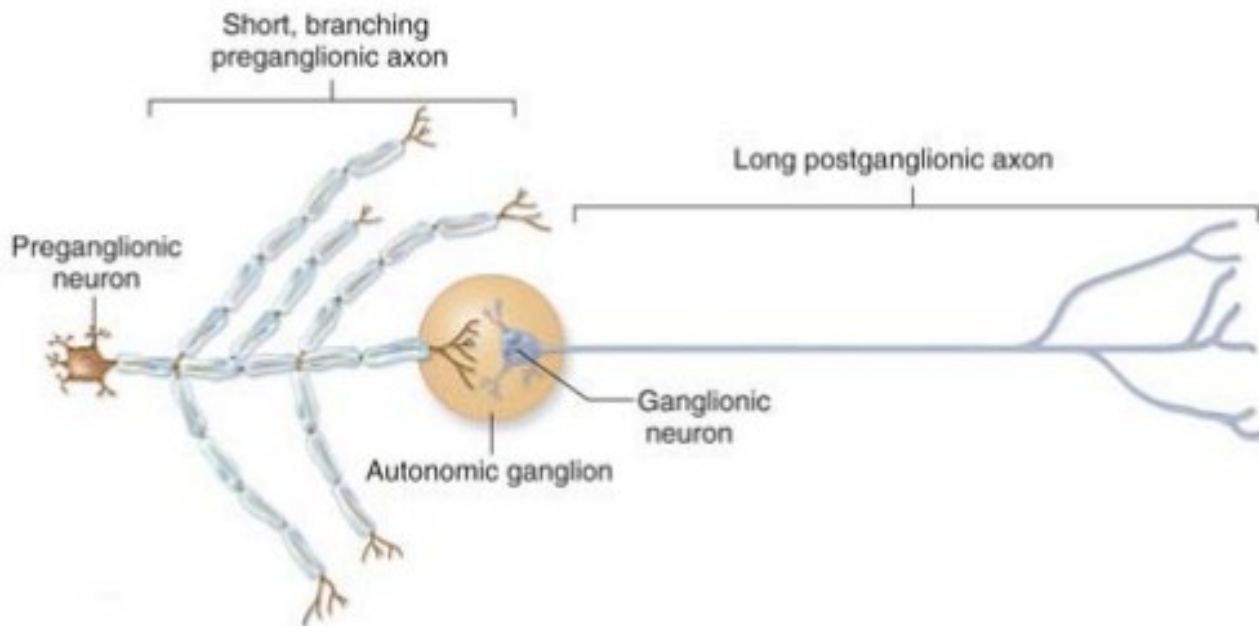
bladder and external genitalia

spinal cord

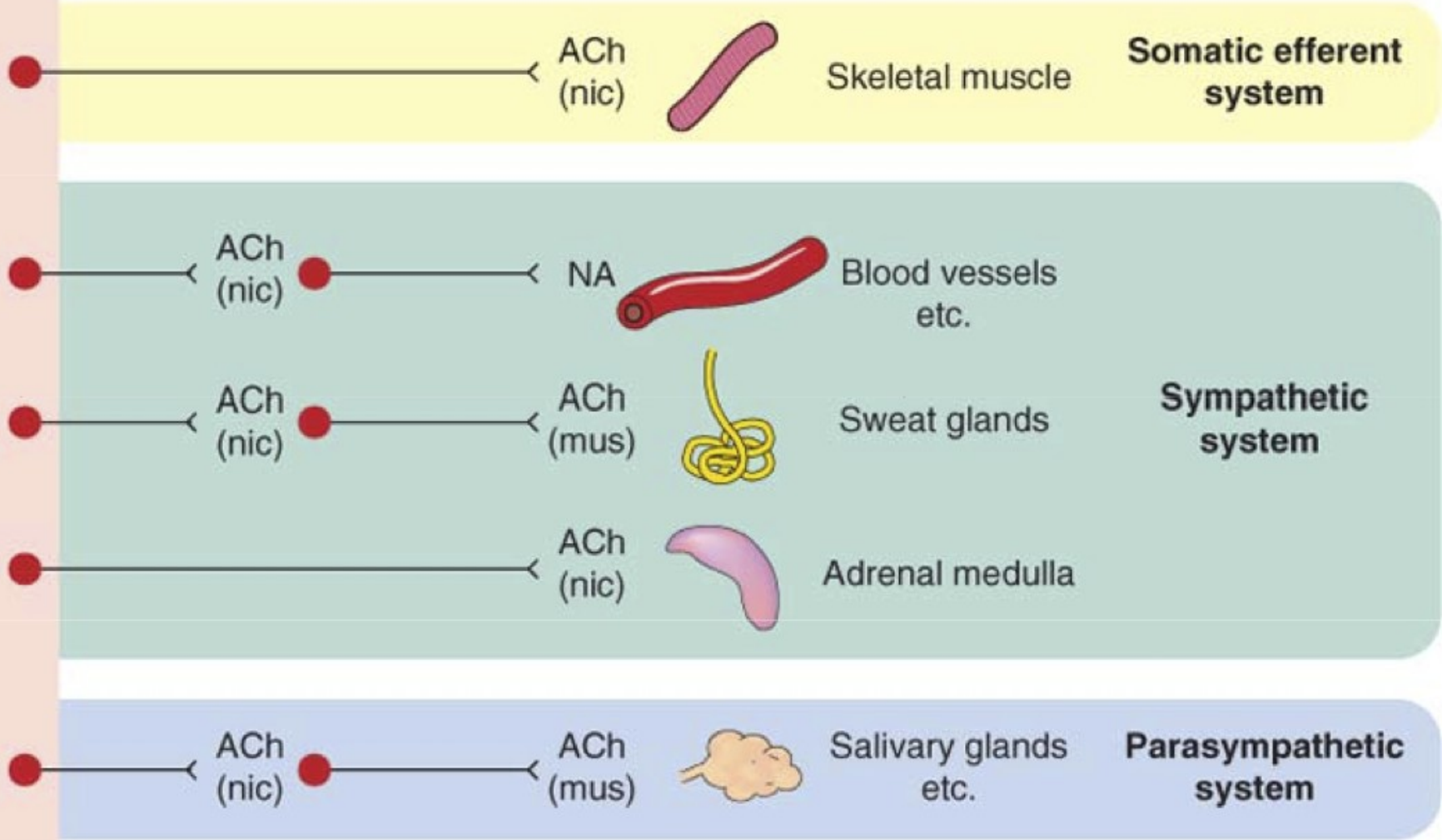
Parasympathetic Division



Sympathetic Division



CENTRAL NERVOUS SYSTEM



AUTONOMIC NERVOUS SYSTEM

□ sympathetic NS

- ncl. intermediolateralis in T1 - L2 segments of spinal cord = *thoracolumbar system*
- paravertebral ganglia (tr. sympathicus) and prevertebral ganglia
- neurotransmitters
 - pregangl. - acetylcholine
 - postgangl. - norepinephrin (ex. sweat glands and piloerector muscle)

□ parasympathetic NS

- parasympathetic nuclei of CN III, VII, IX, X
- segments S2 - S4 = *craniosacral system*
- ganglia near the target organ
- neurotransmitter acetylcholine

Sympathetic system

Catabolic reaction (activities that are mobilized during emergency and stress situations, “fight, fright and flight” responses)

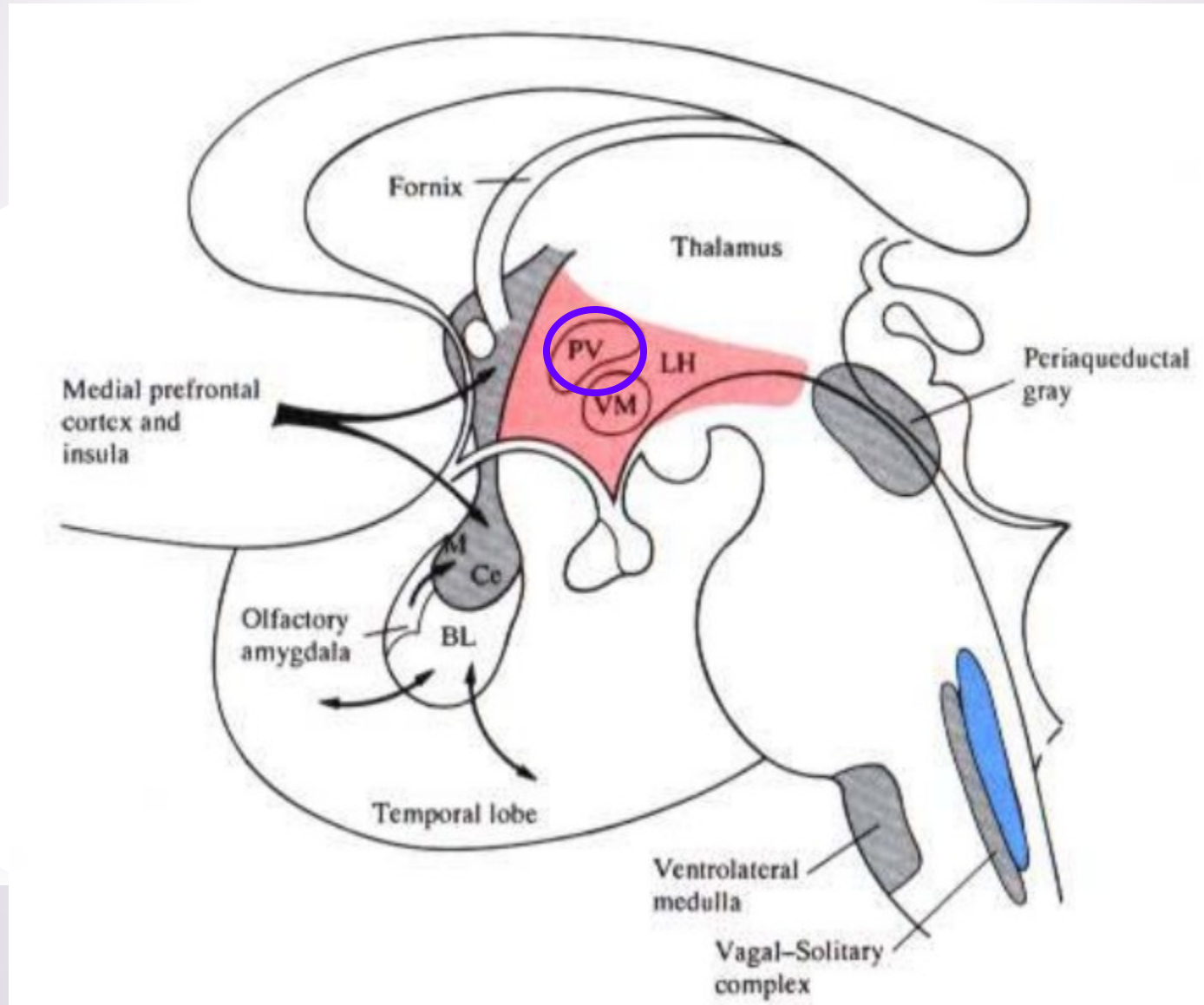
Parasympathetic system

Anabolic reactions (activities associated with conservation and restoration of body resources, “rest and digest” responses)

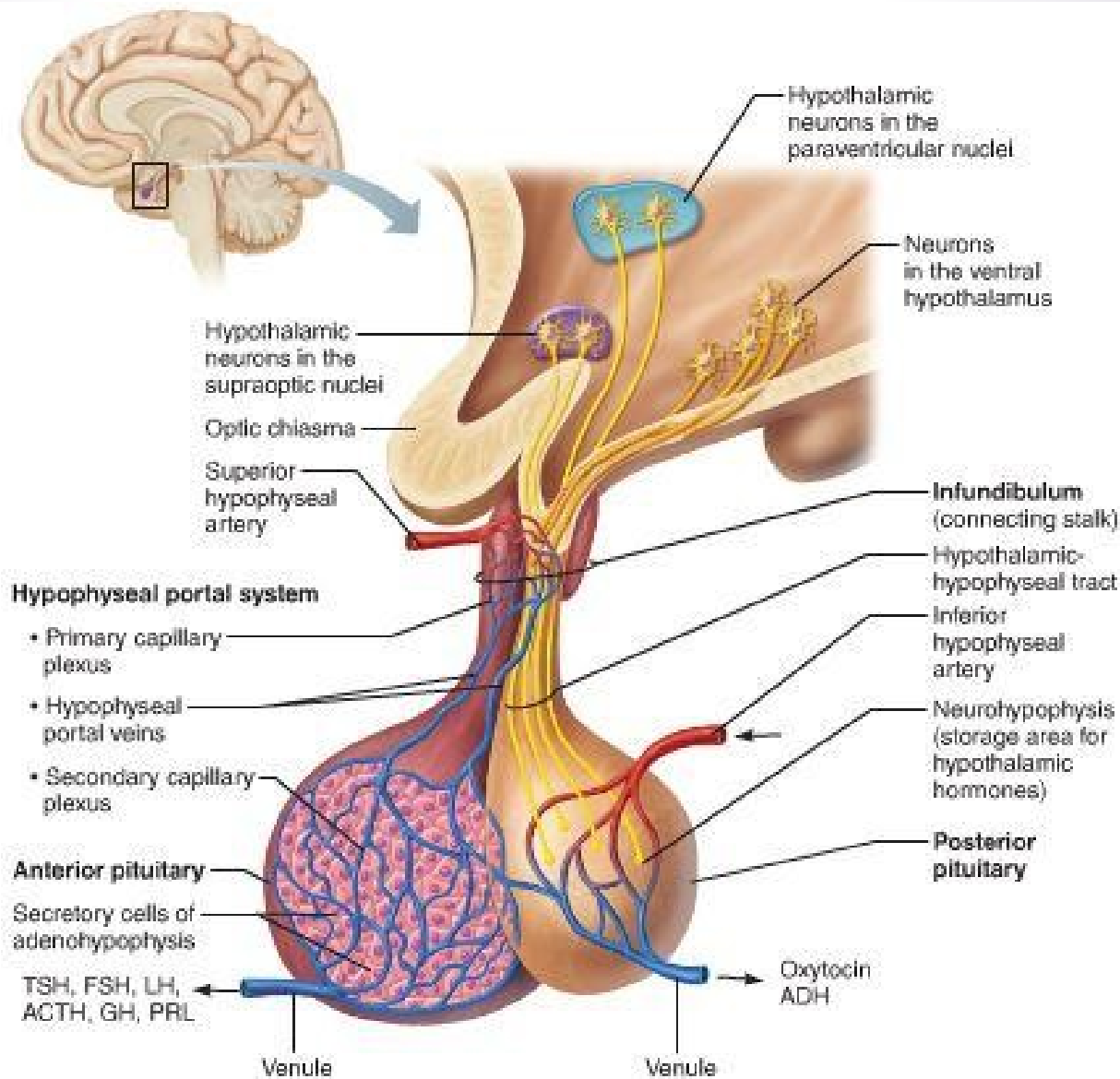
FUNCTIONS OF THE AUTONOMIC NERVOUS SYSTEM

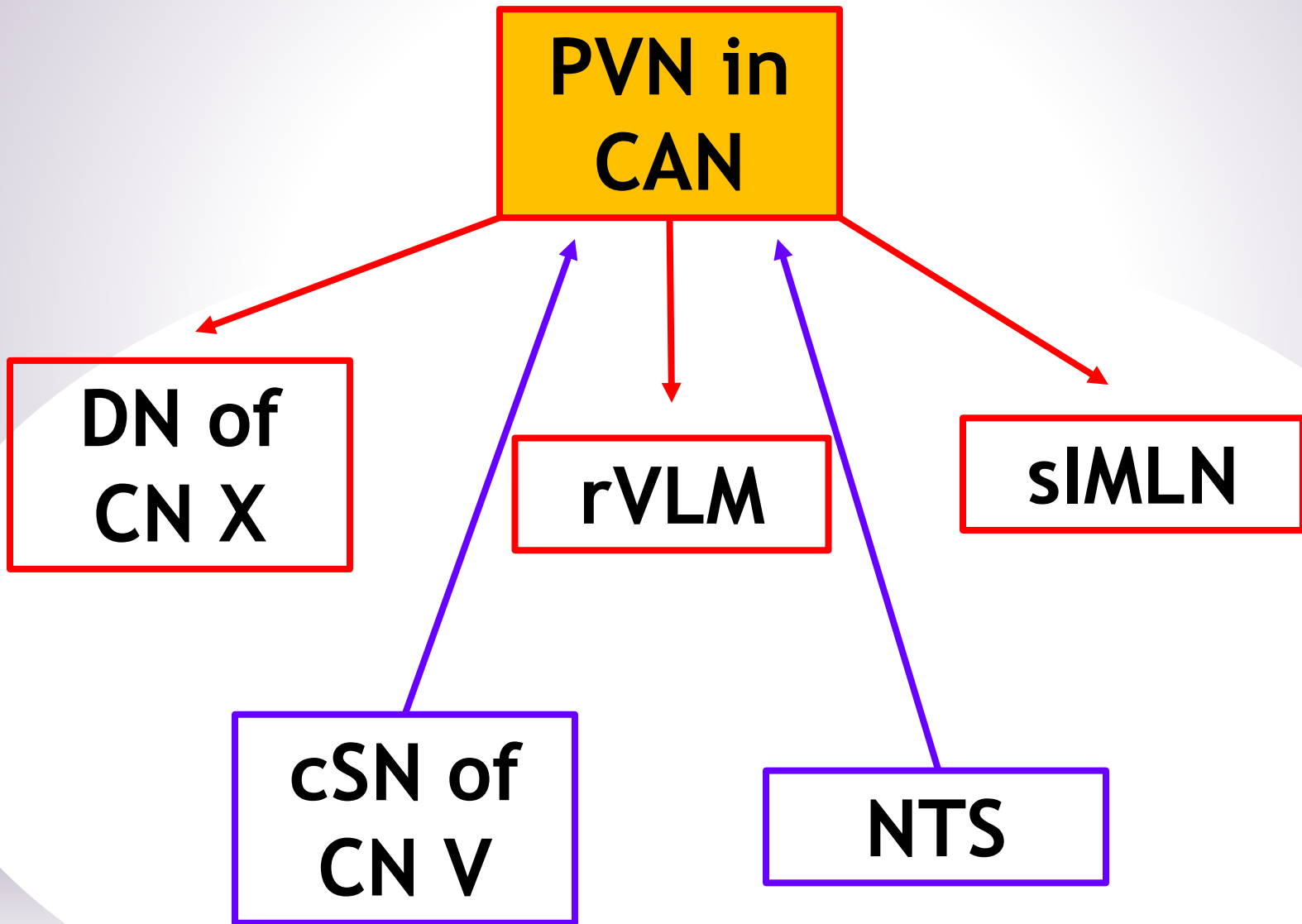
<u>SYMPATHETIC RESPONSE</u>	<u>ORGAN</u>	<u>PARASYMPATHETIC RESPONSE</u>
Increase rate	HEART	Decrease rate (to normal)
Dilate	BRONCHIOLES (Smooth muscle)	Constrict (to normal)
Pupils dilate	IRIS	Pupils constrict (to normal)
Decrease secretion	SALIVARY GLANDS	Increase secretion (to normal)
Decrease peristalsis	STOMACH & INTESTINES (Smooth muscle)	Increase peristalsis for normal digestion
Decrease secretion	STOMACH & INTESTINES (Glands)	Increase secretion for normal digestion
Contracts to prevent defecation	INTERNAL ANAL SPHINCTER	Relaxes to permit defecation
Relaxes to prevent urination	URINARY BLADDER	Contracts for normal urination

Central autonomic network (CAN)



Paraventricular nucleus





Other hypothalamic nuclei in CAN:

Dorsomedial nucleus

Posterior hypothalamic nucleus

Mammillary nucleus

Lateral hypothalamic area - cardiovascular control, control of feeding, satiety and insulin release

Extrahypothalamic structures in CAN:

Control of symp. outflow

Locus coeruleus

Rostral and caudal VLM

Raphe nuclei

Control of parasymp. outflow

Central ncl. of amygdala

Dorsal ncl. of CN X

Raphe nuclei

PAG

Parabrachial ncl.

Limbic cortex - control of both
autonomic outflows

Cingulate c.

Orbitofrontal c.

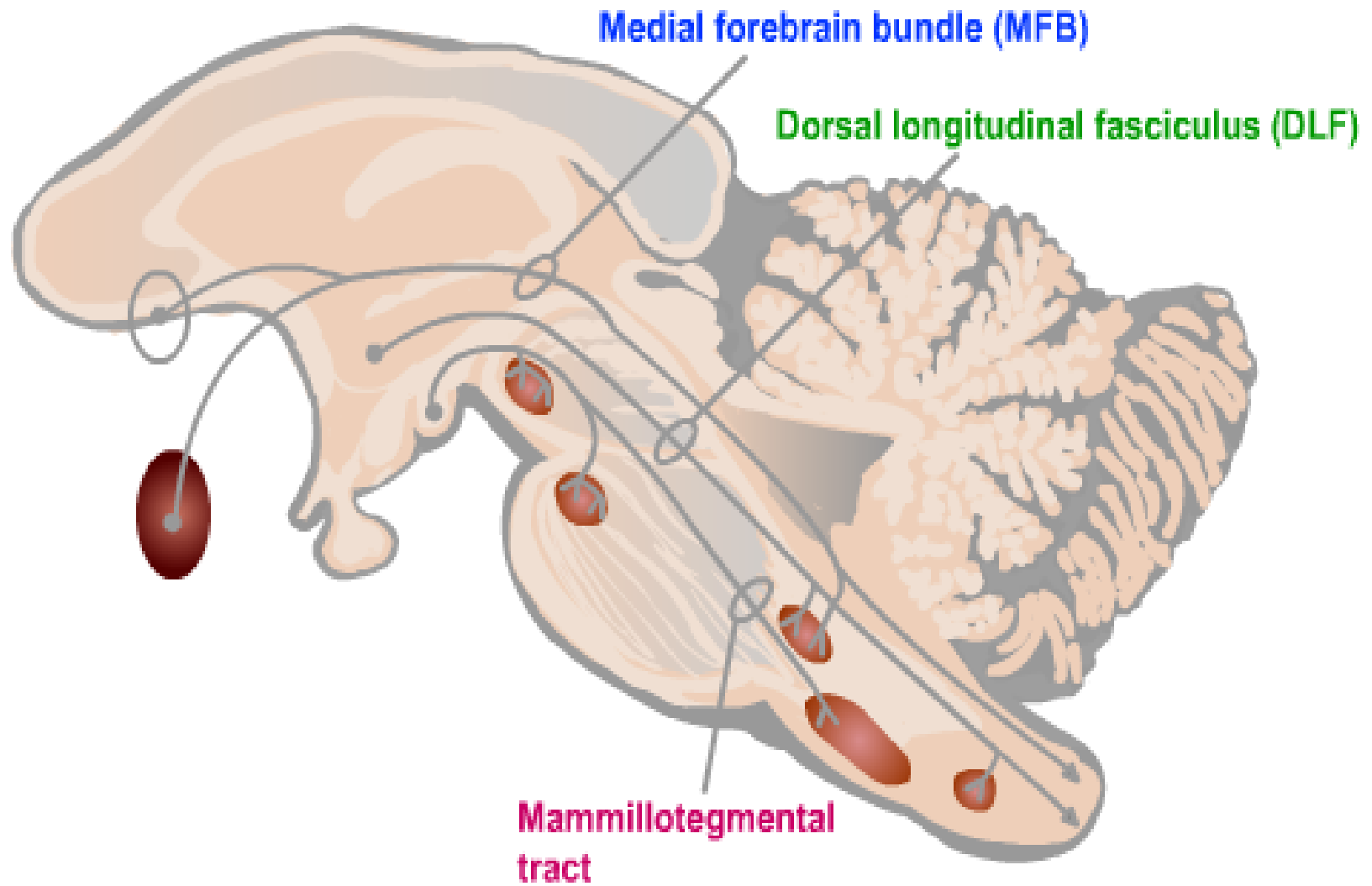
Insula

Rhinal c.

Hippocampus

Descendent modulatory pathways

- ❑ fasciculus longitudinalis dorsalis (FLD)
- ❑ fasciculus telencephalicus medialis (medial forebrain bundle MFB)
- ❑ tr. mammillotegmentalis



Hypothalamus

Nuclei of the anterior part

- ncl. paraventricularis
- stimulation of parasympathetic system

Stimulation of the anterior part of hypothalamus

- miosis
- decrease in heart rate and blood pressure
- dilation of cutaneous arteries
- increase in peristalsis and secretion in the GIT

Hypothalamus

Nuclei of the posterior part

- ncl. mammillaris and hypothalamicus post.
- stimulation of sympathetic system

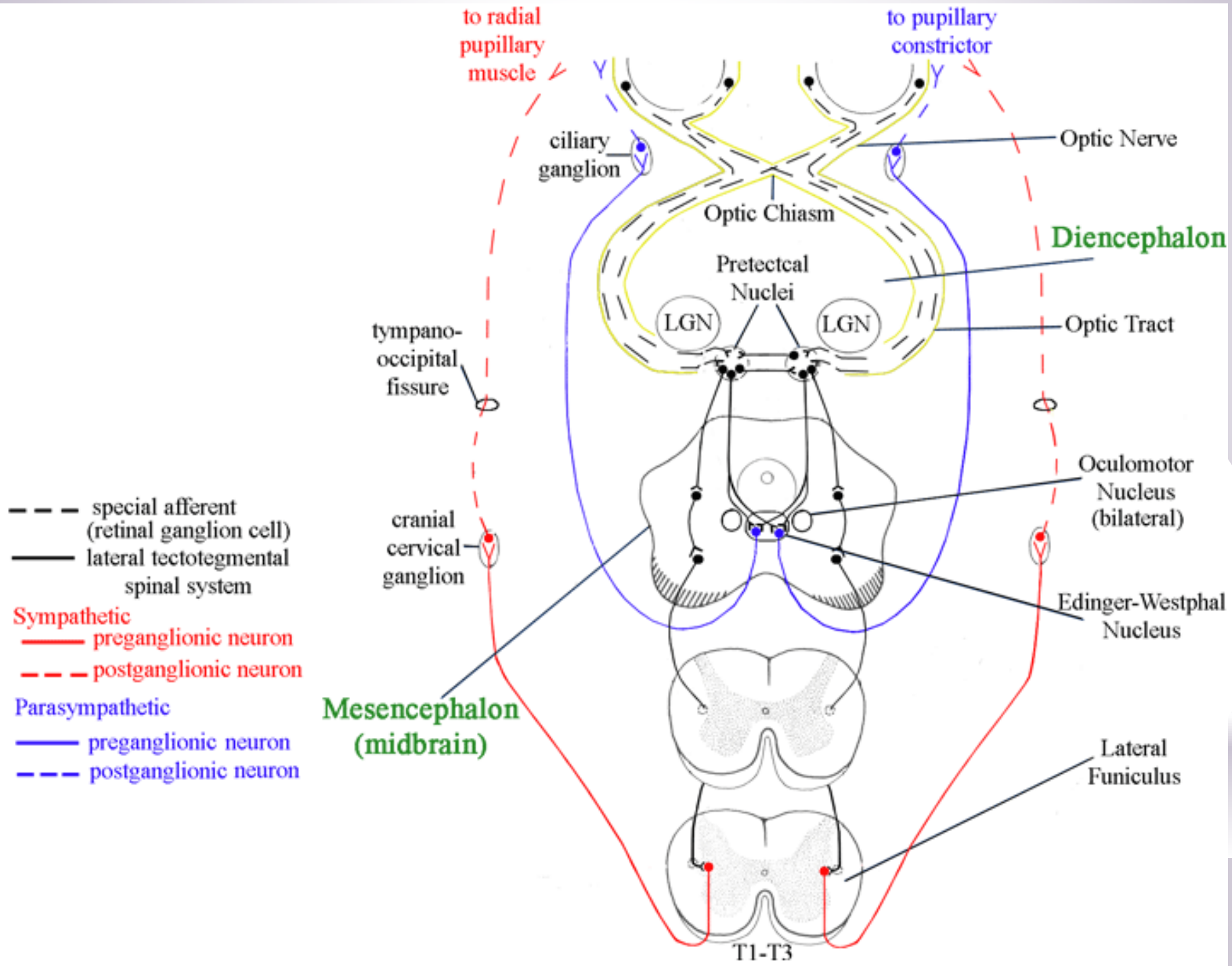
Stimulation of the posterior part of hypothalamus

- mydriasis
- increase in heart rate and blood pressure
- constriction of cutaneous arteries
- decrease in peristalsis and secretion in the GIT
- erection of hairs

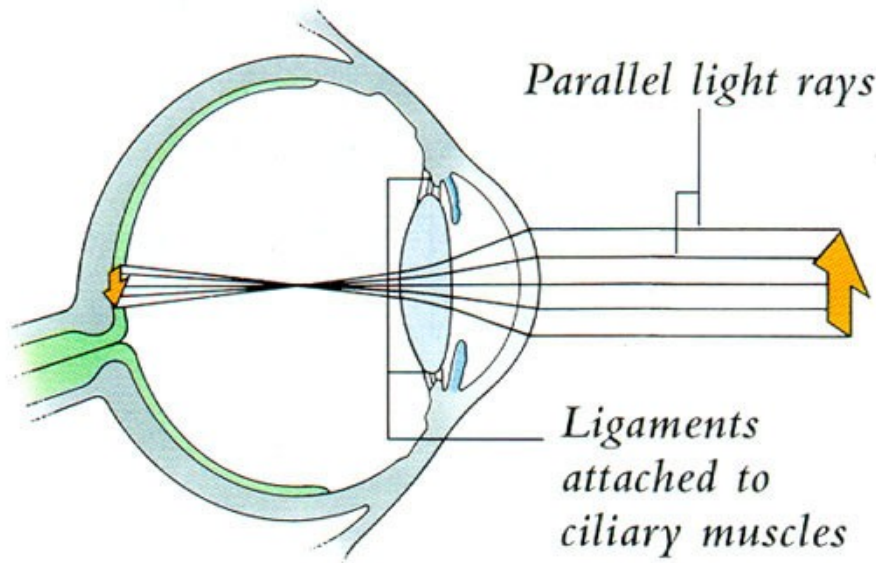
PUPILARY LIGHT REFLEX

- ❑ a reflex that controls the diameter of the pupil, in response to the intensity of light (luminance) that falls on the retina of the eye
- ❑ **mydriasis:** dilation of the pupil
- ❑ **miosis:** constriction of the pupil



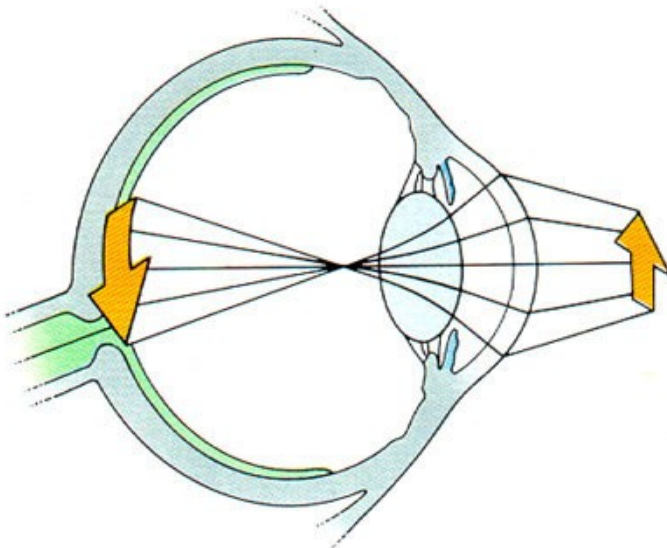


ACCOMMODATION



Distant objects

To focus on objects in the distance, the ciliary muscles relax and the lens flattens and thins. Light rays are slightly refracted (bent) by the lens.

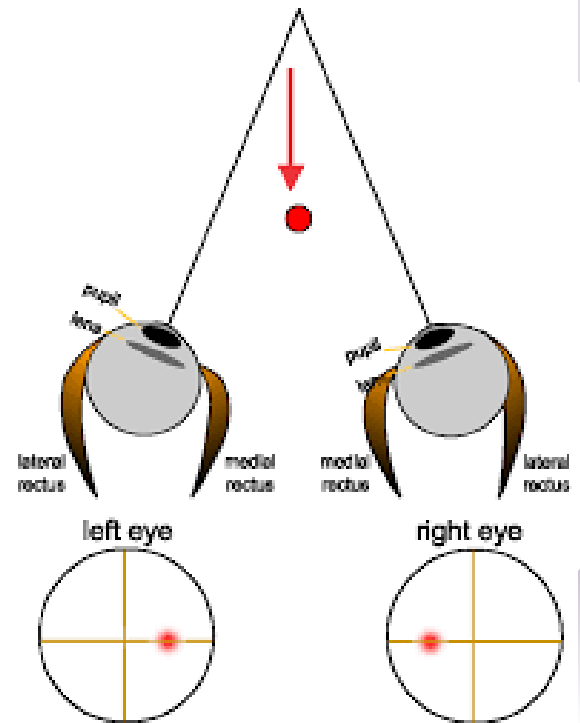


Nearby objects

To view objects that are nearby, the ciliary muscles contract and the lens becomes more rounded. The point at which the image of a close object becomes blurred is called the near point of vision; it occurs when the lens reaches its maximum curvature.

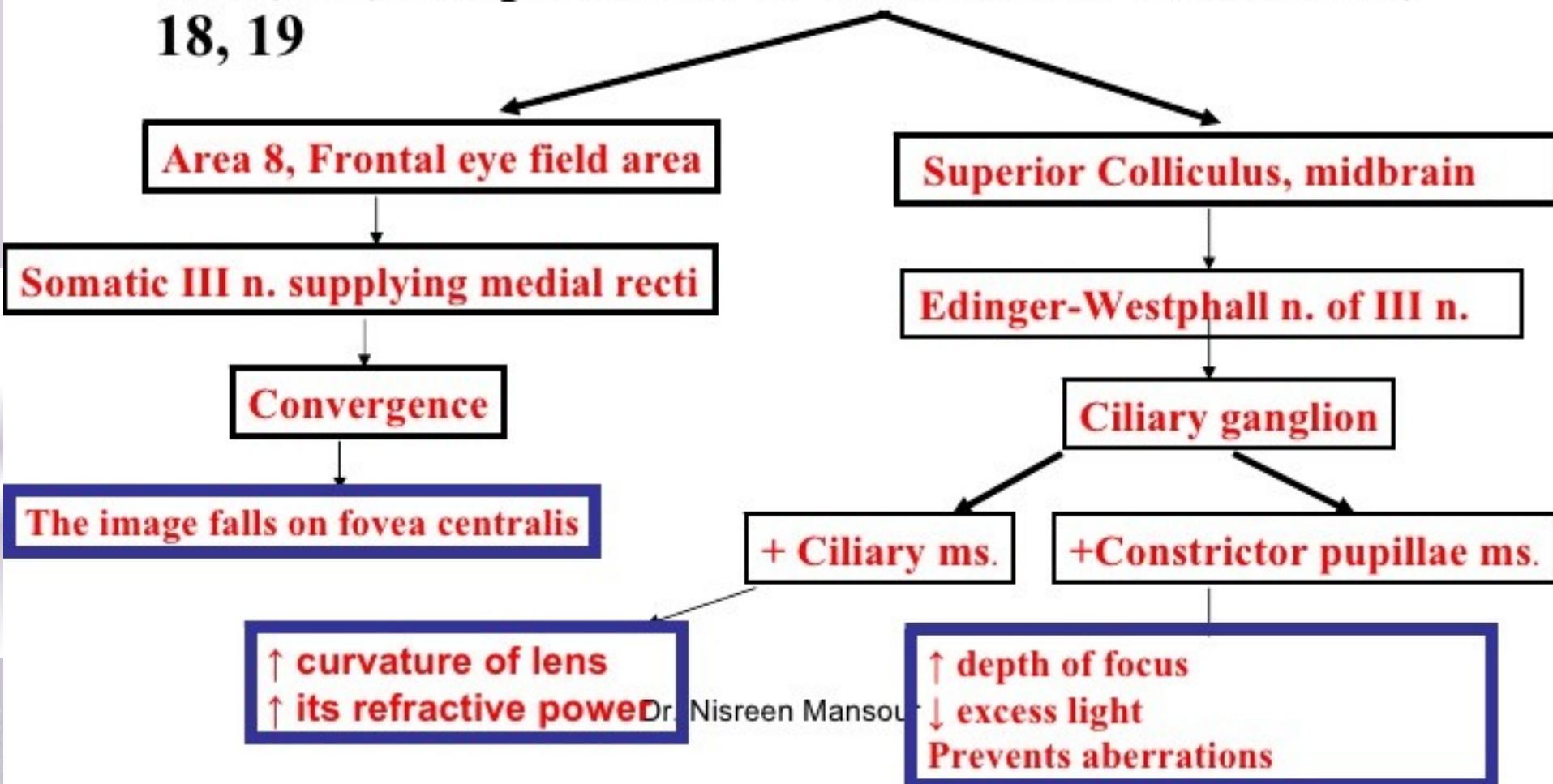
Near reflex triad: convergence

- accommodation of the lens
- pupillary constriction



• Pathway of Accommodation reflex:

Blurred retinal image → retinal nervous elements → optic nerve → optic chiasma → optic tract → LGB (thalamus) → optic radiation → primary visual area; 17; occipital lobe & association visual area; 18, 19



Illustrations were copied from:

**Neuroscience Online, the Open-Access Neuroscience
Electronic Textbook**

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