

Corticospinal tract

Pyramid pathway : trunk & limbs

Corticospinal tract

➤ Upper motor neuron:

Cerebral cortex

Internal capsule

Ant. Surface medulla (pyramid)

80-90% cross midline(pyramid decussation)

=

Lat. corticospinal

10-20% not cross midline

=

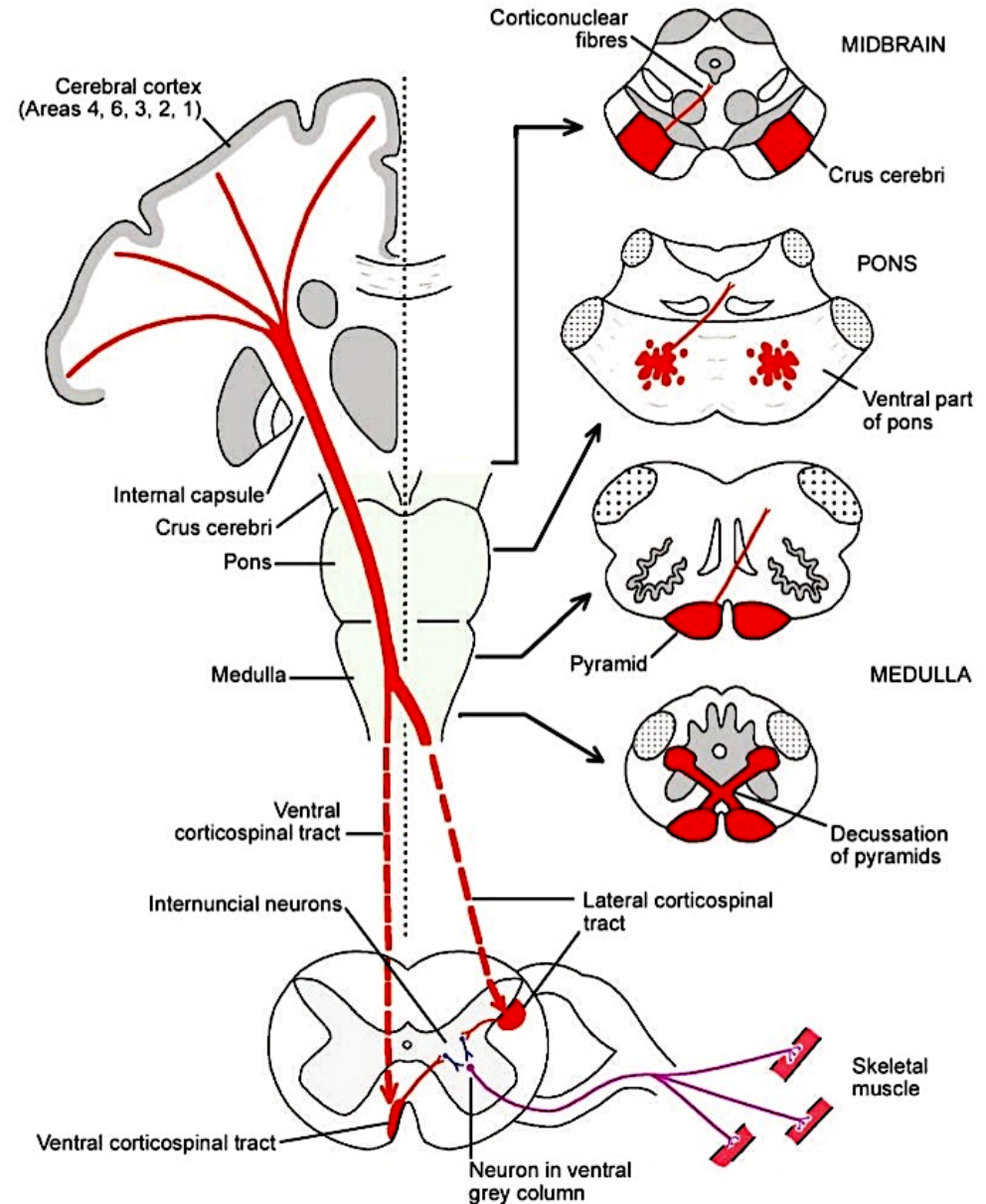
Ant. Corticospinal

➤ Lower motor neuron:

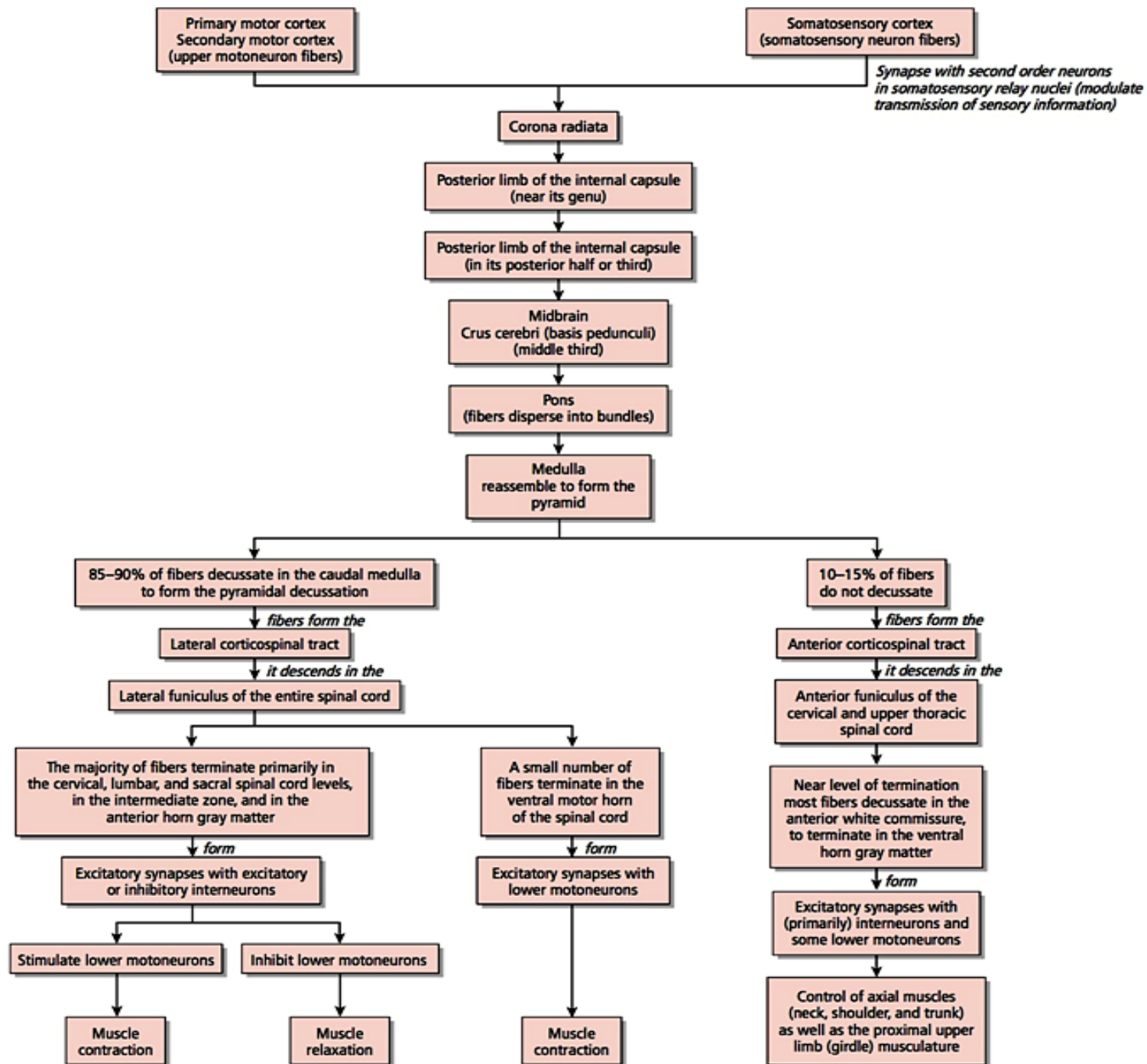
Spinal nucleus

Function:

Speed & delicacy of voluntary movement



50.3: Scheme to show the course of the corticospinal tracts



Extrapyramidal pathways

Rubrospinal

Vestibulospinal

Tectospinal

Reticulospinal

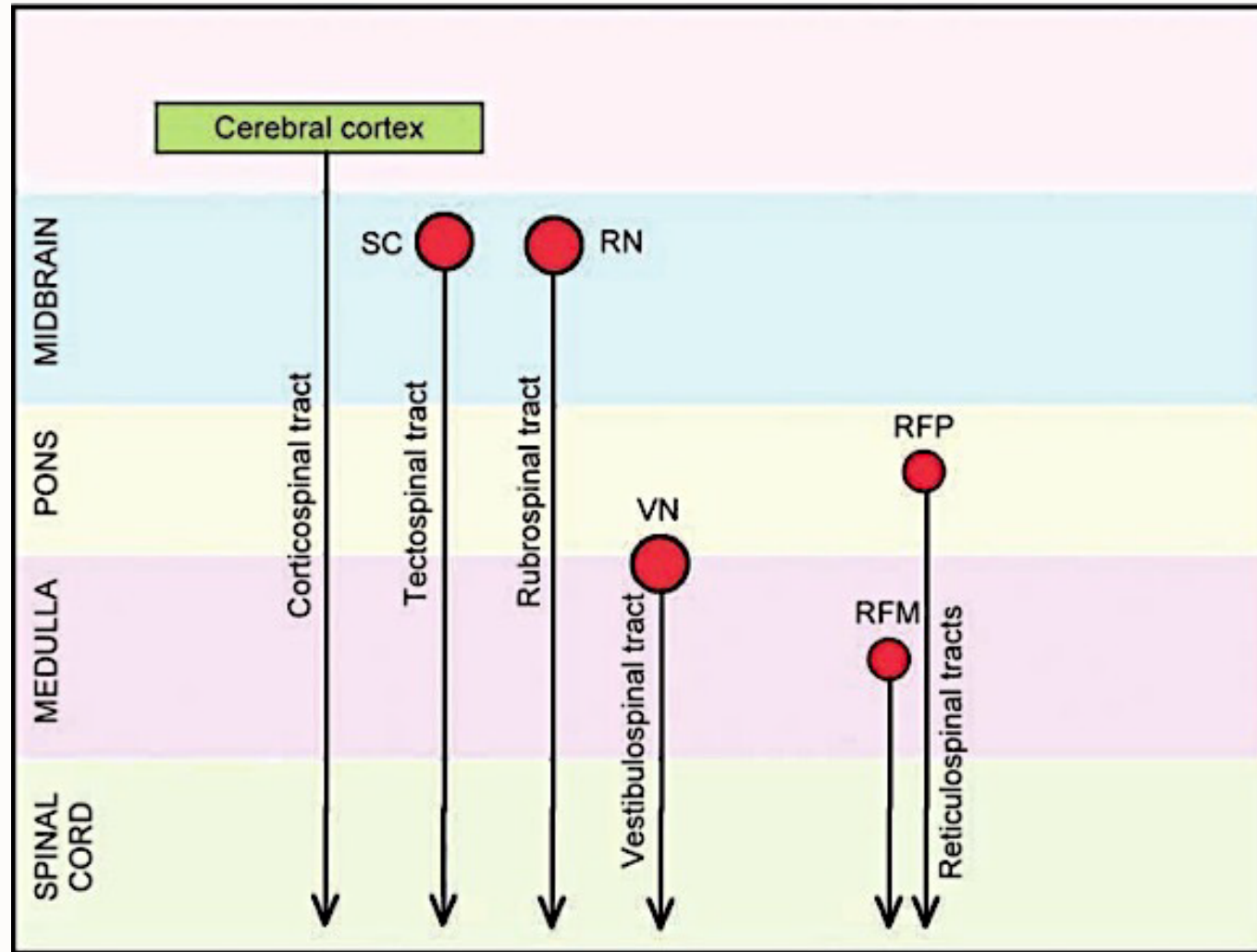
olivospinal

Extrapyramidal pathways:

1st order neuron= cerebral cortex

2nd order neuron= subcortical center

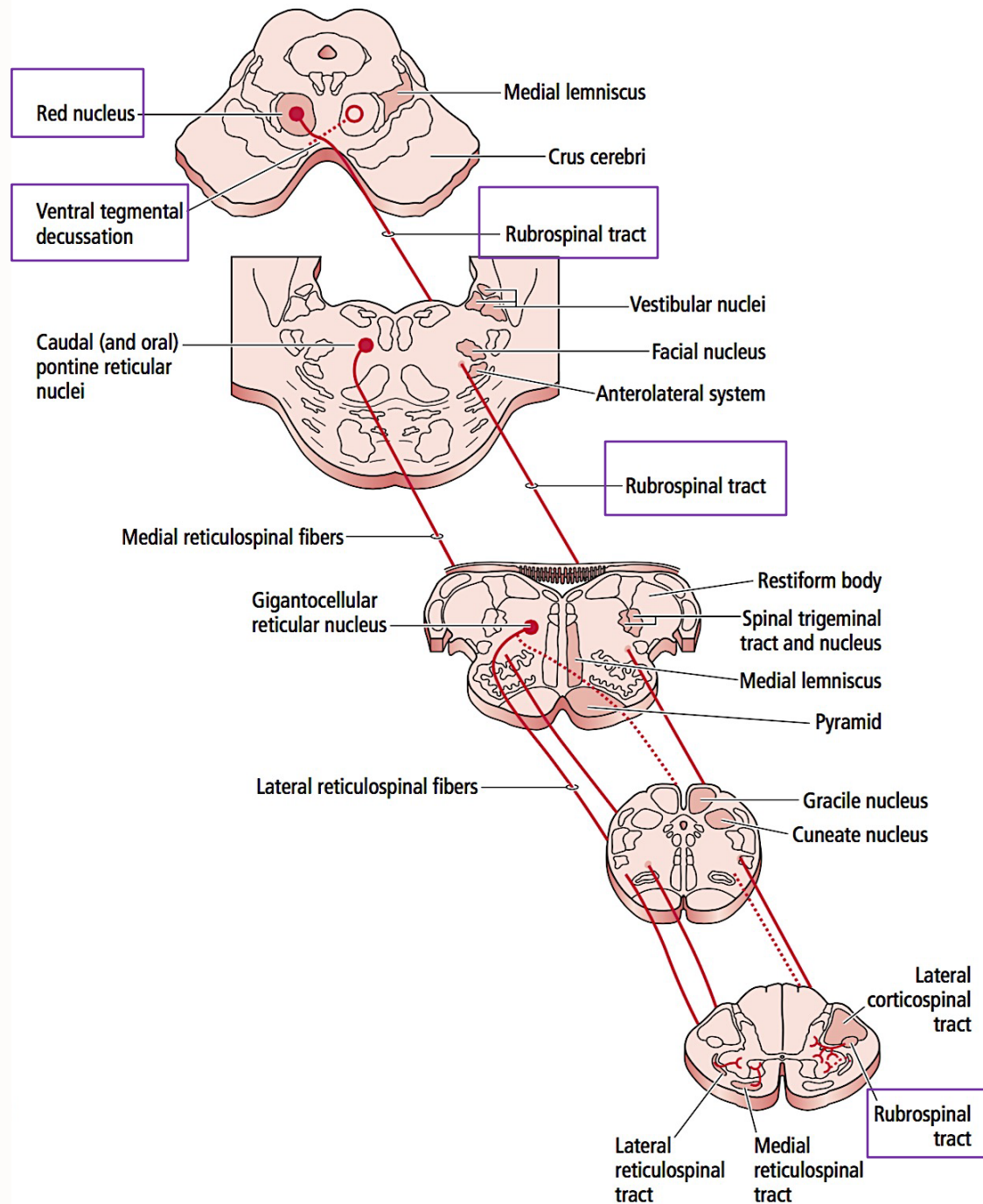
3rd order neuron= cranial & spinal nucleus

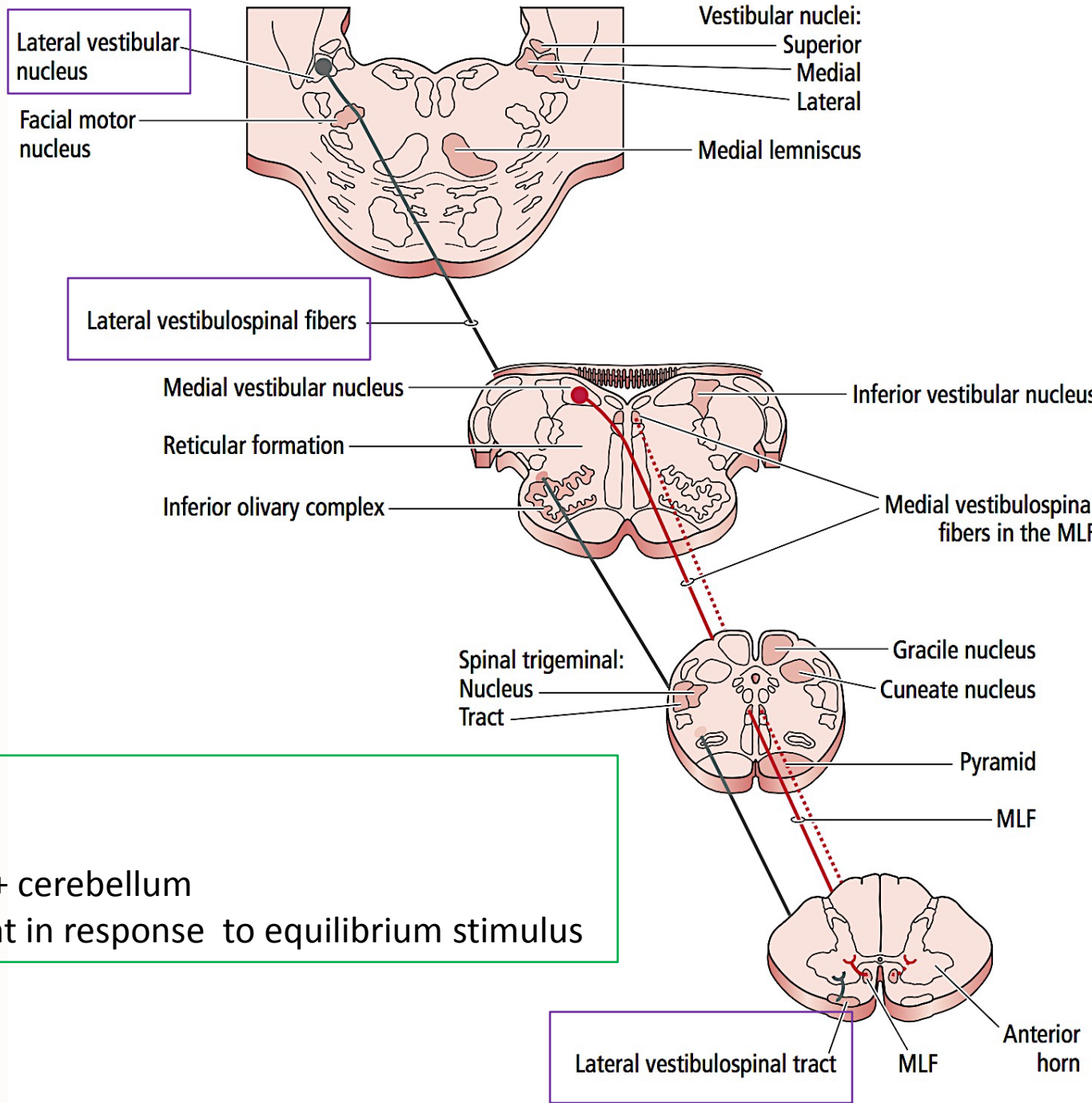


Rubrospinal tract

Coordinator pathway for the effect of Cerebral & cerebellar cortex on motor neuron In spinal cord

Suppress extensor muscles activity
Facilitated flexor muscles activity





Vestibulospinal tract:

Afferent fibers: inner ear + cerebellum

Control of body movement in response to equilibrium stimulus

Tectospinal tract

sup. & inf. colliculus

cross midline

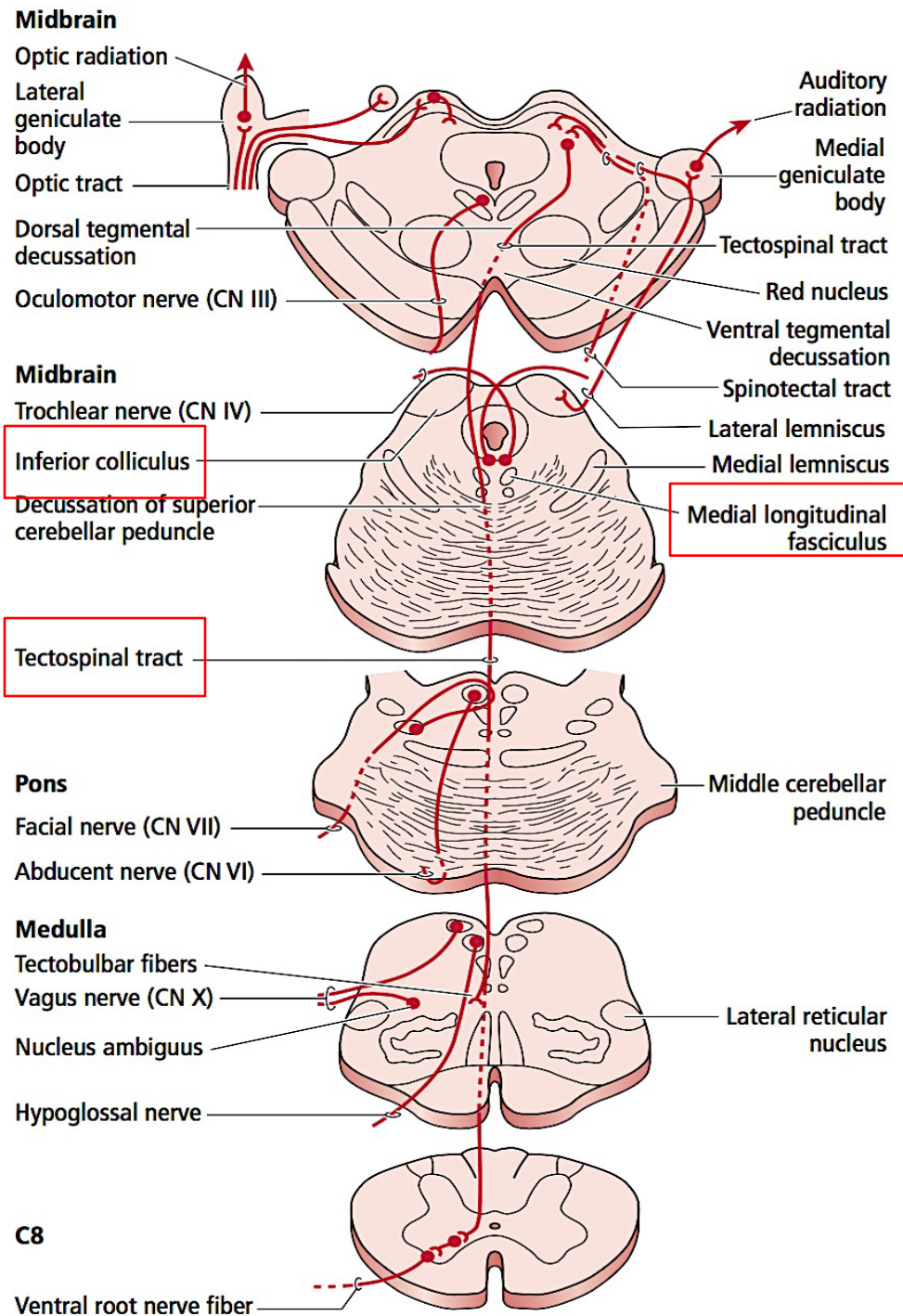
MLF

ant. cord of spinal cord

Ant. Horn of sup.
cervical segments

Function:

Visual & auditory pathway & reflex



Reticulospinal tract

RF of pons & medulla

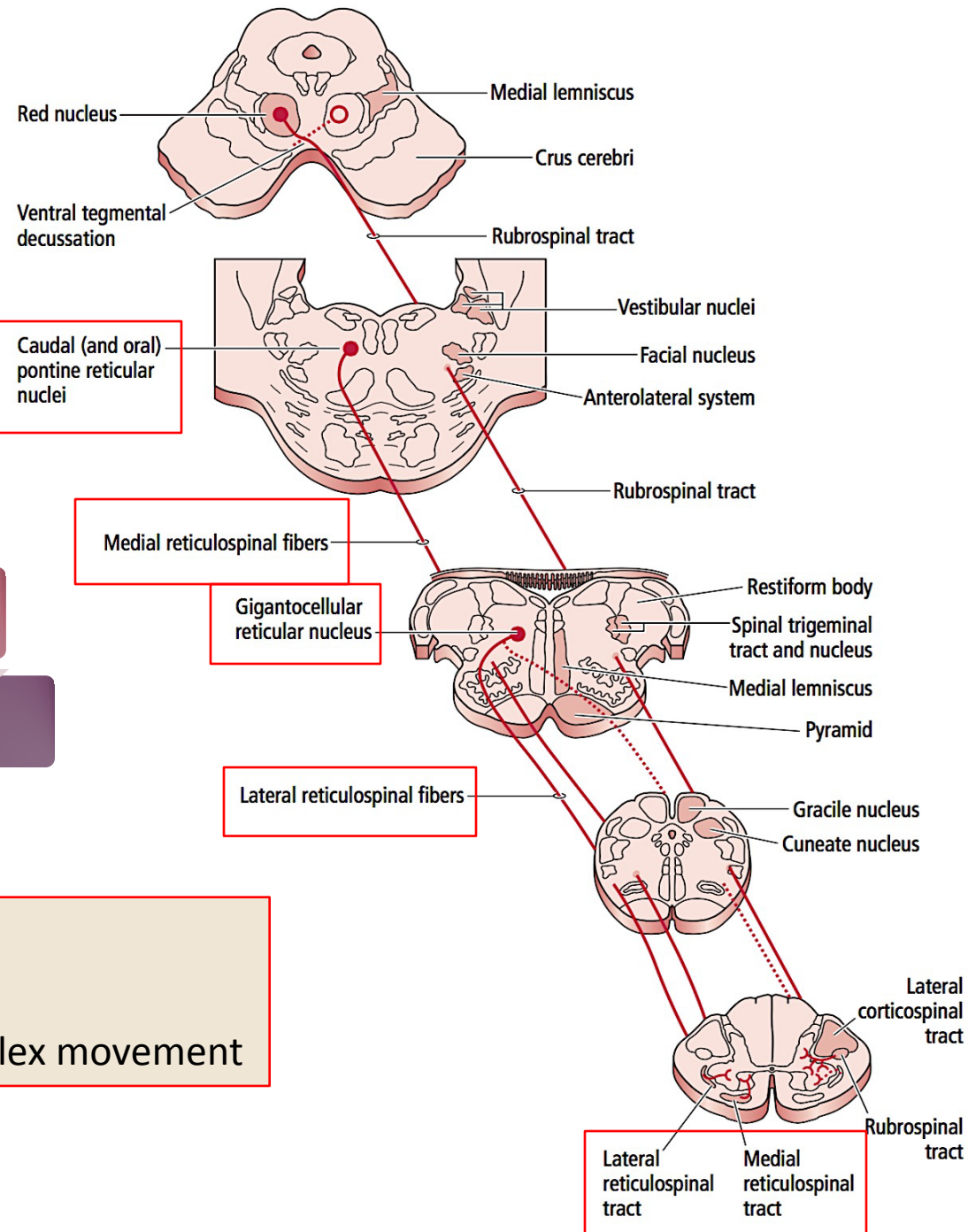
cross midline / without cross

ant. & lat. spinal column

ant. horn of spinal cord

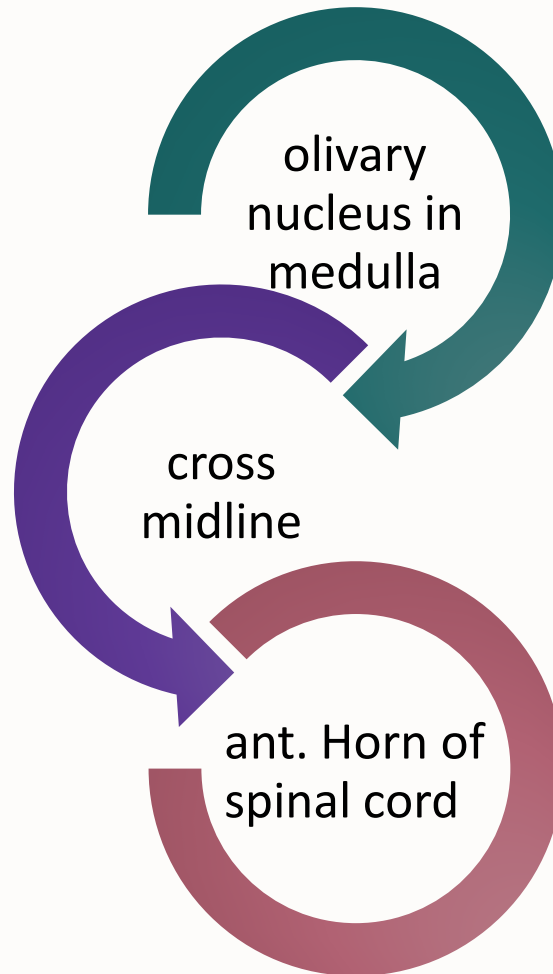
Function:

Activated or suppress voluntary & reflex movement



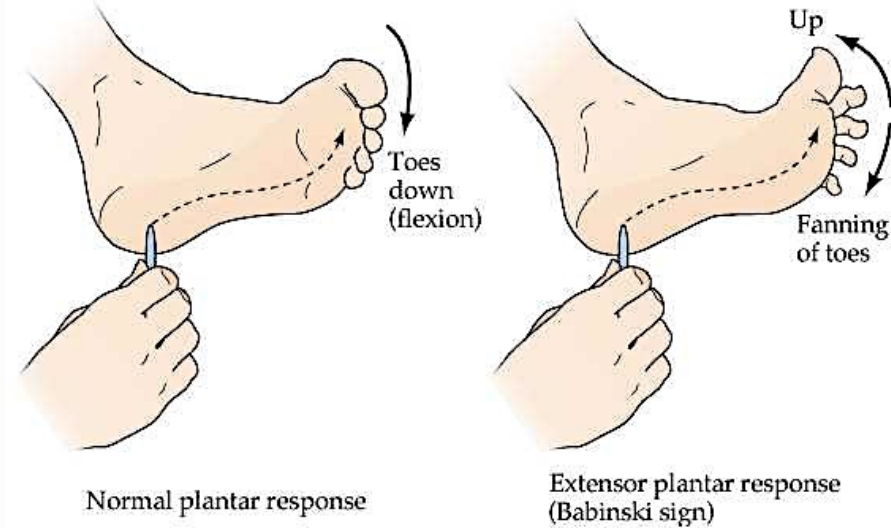
Olivospinal tract

Function: motor learning



Upper motor neuron lesions:

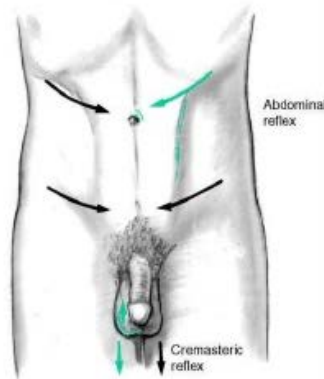
Palsy
Espasticity
Suppress of reflexes (babinski / cremasteric)
Dystonia



(abdominal reflex,
Cremasteric reflex)



Abdominal Reflex



Cremastic Reflex

Lower motor neuron lesions :

Palsy
Flaccid
Normal reflexes (babinski / cremastric)

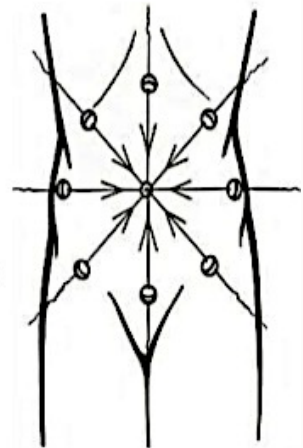
CREMASTERIC REFLEX



- ▶ The cremasteric reflex is a reflex in human males.
- ▶ The cremasteric reflex is dependent upon the nerve roots L1 and L2
- ▶ This reflex is elicited by lightly stroking the superior and medial part of the thigh in a downward direction. The normal response is a contraction of the cremaster muscle that pulls up the scrotum and testis on the side stroked.
- ▶ Upper and lower motor neurone disorders can cause an absence of the cremasteric reflex.

B. Abdominal reflexes

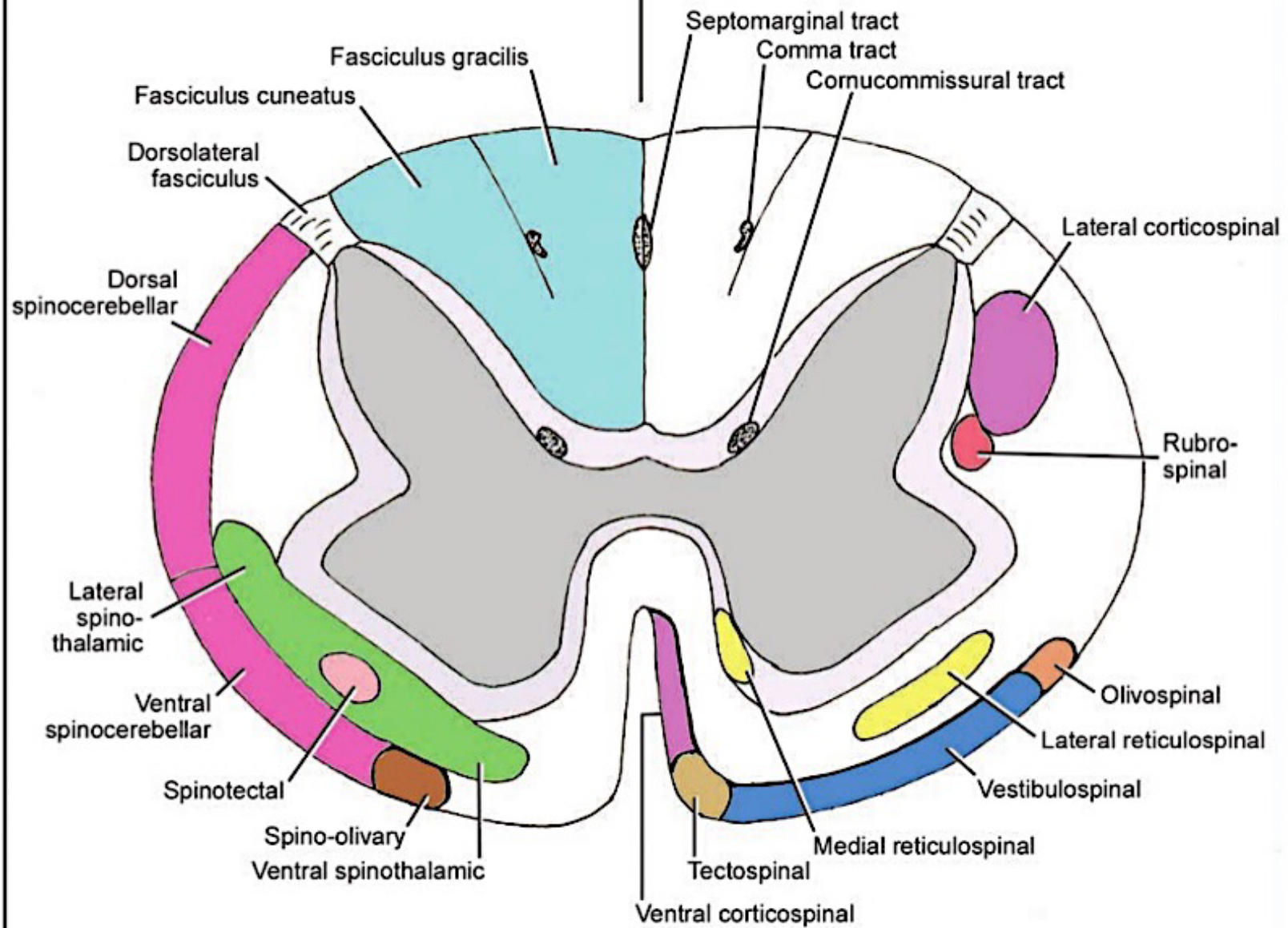
- The patient should be supine and relaxed.
- Use an orange stick and stroke briskly but lightly in a medial direction across the upper and lower quadrant of the abdomen.
- The normal responses is contraction of the underlying muscle with the umbilicus moving laterally and up or down depending upon the quadrant tested.



ASCENDING TRACTS

DESCENDING TRACTS

Some propriospinal tracts



50.2: Simplified scheme to show the positions of the main ascending and descending tracts present in the spinal cord

Association pathways:

Coloration of different parts of
cerebrum & spinal cord & cerebellum & brain stem

MLF

Autonomic nervous system

Sympathetic
pathway

Parasympathetic
pathway

—

Autonomic nervous system:

Visceral Afferent = unipolar neuron / cell body located in dorsal root ganglion & cranial nerve ganglion (*the same as somatic afferent*)

Visceral efferent =

Preganglionic neuron / cell body located in motor nucleus of sympathetic & parasympathetic in lat. Spinal horn or brain stem

Postganglionic neuron / cell body located in sympathetic & parasympathetic ganglion

Sympathetic pathway parts:

Visceral afferent = the same as somatic afferent

Visceral efferent = have 5 parts

➤ **Sympathetic control center =**

Upper center / diencephalon (hypothalamus)

Lower center = lat. Horn of T1-L2

➤ **Preganglionic fibers**

➤ **Sympathetic ganglion (sympathetic chain)**

➤ Paravertebral ganglion = around vertebral column / 22-24 pair / C1-C3 / T1-T12 / L1-L4 / S1-S5 / Impar ganglion

➤ Prevertebral ganglion = around great vessels

➤ **Postganglionic fibers** = terminated in target organ

➤ **White & gray communicants** = association of paravertebral ganglion with ant.

Root of spinal cord

➤ White communicant = Preganglionic fibers

➤ Gray communicants = Postganglionic fibers

Cranial

Thoracic

Lumbar

Sacral

Sympathetic trunk

Celiac ganglion

Superior mesenteric ganglion

Inferior mesenteric ganglion

Eye: dilator of pupil

Blood vessels of the head

Salivary glands

Glands of nasal and oral cavities

Heart

Bronchial tree

Liver, gall bladder

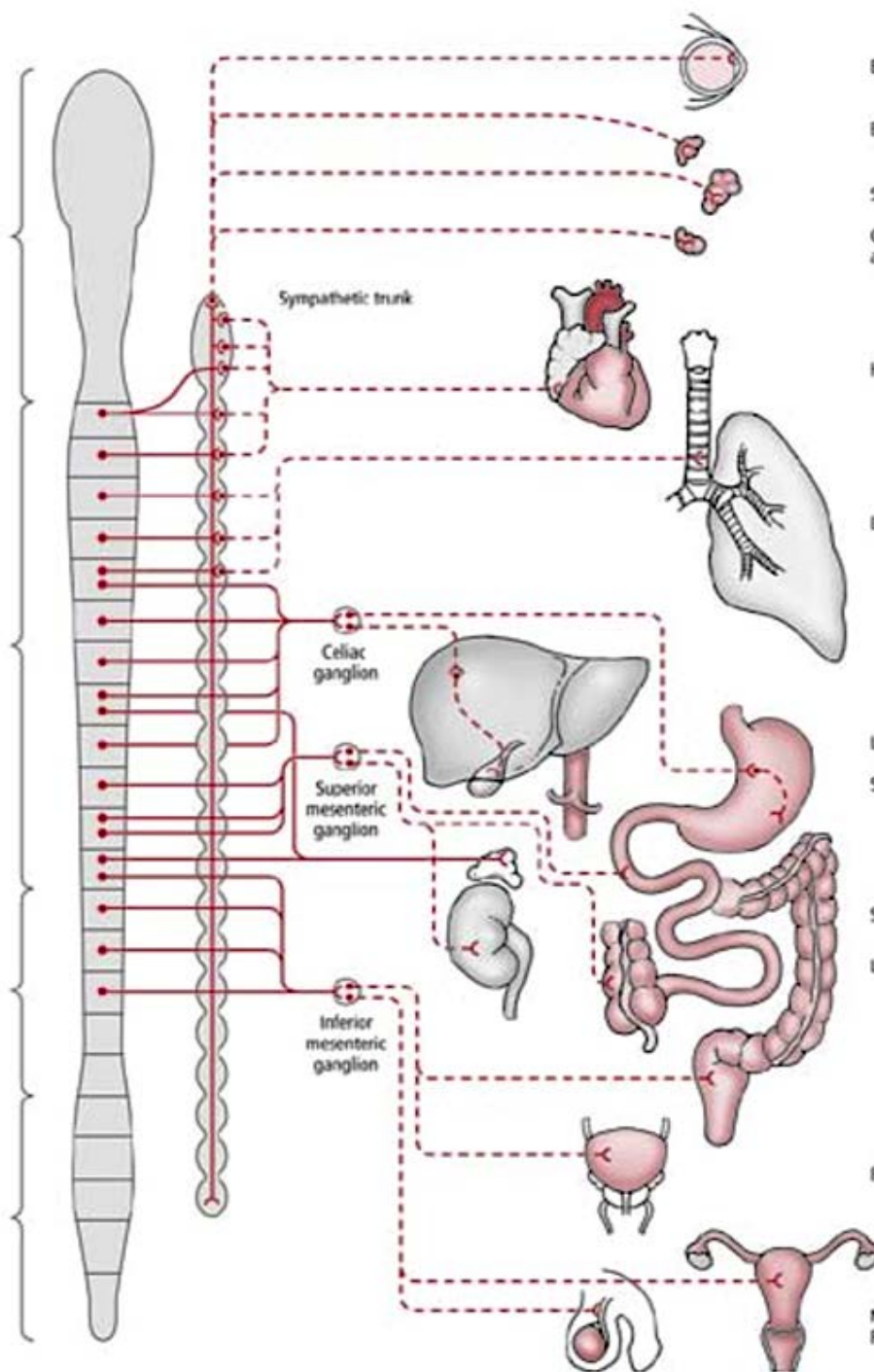
Stomach

Small intestine

Large intestine

Bladder, prostate

Male: ductus deferens
Female: uterus



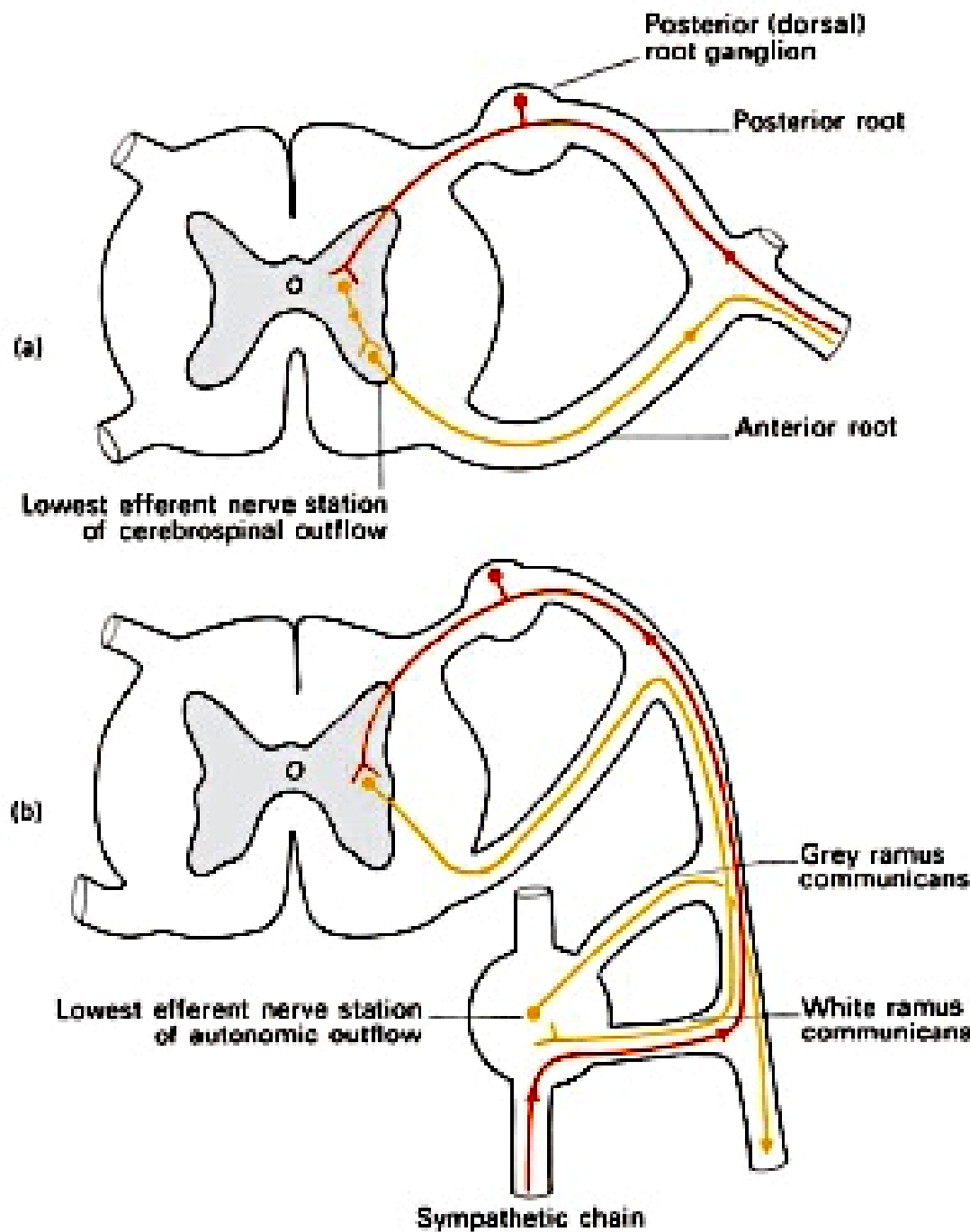
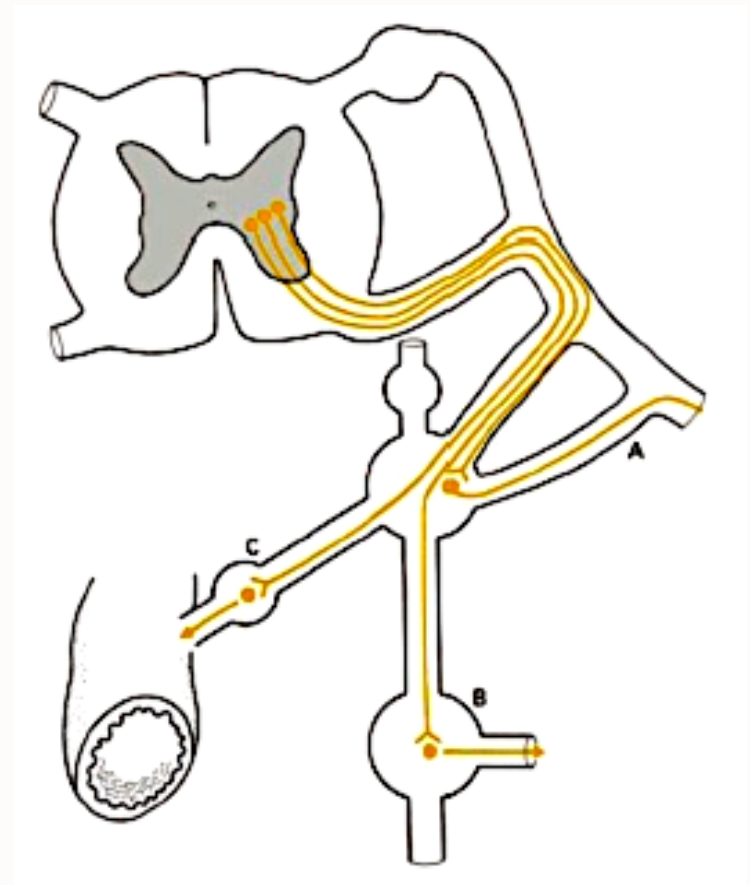
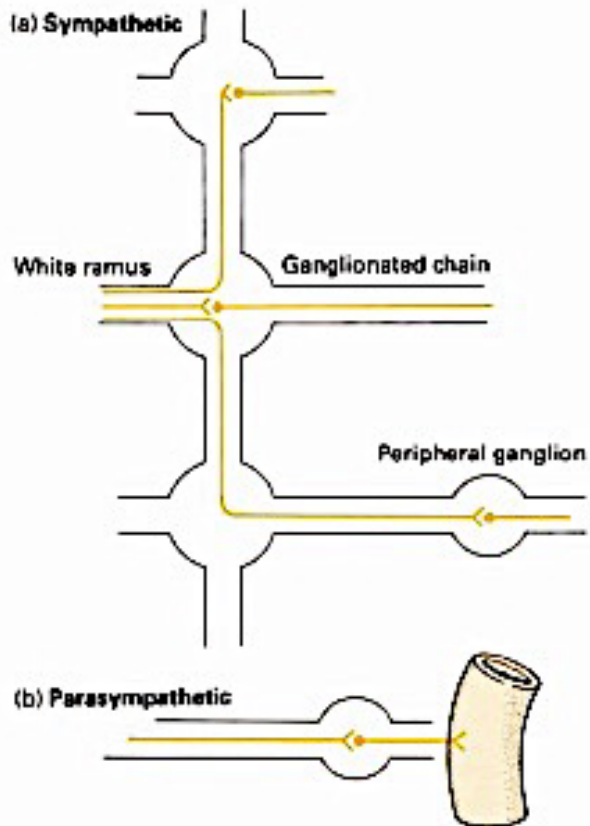


Fig. 275 The essential difference between the cerebrospinal and autonomic outflows: (a) the cerebrospinal system has its lowest efferent nerve cell stations within the c.n.s.; (b) the autonomic system has its lowest efferent cell stations in a peripheral ganglion (here illustrated by a typical sympathetic nerve ganglion). Red, afferent pathway; yellow, efferent pathway.

➤ Note:

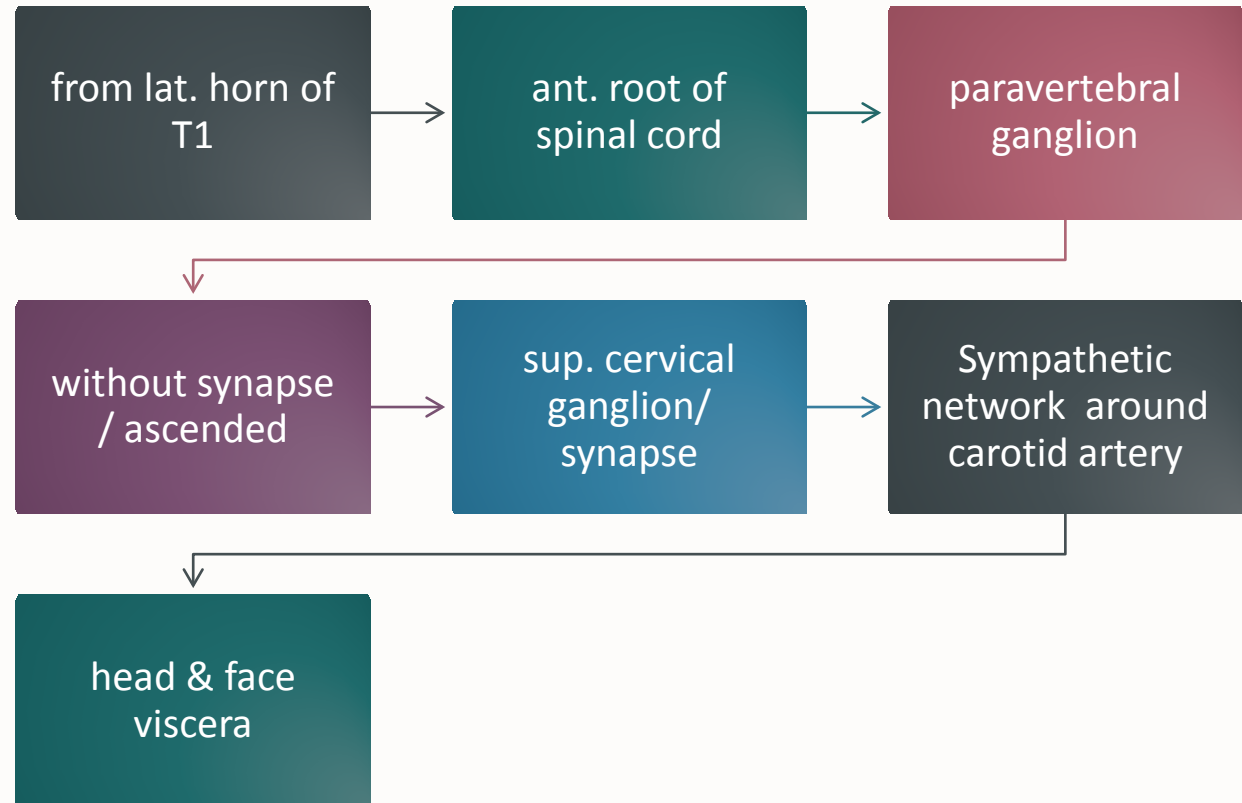
Preganglionic fibers have 3 pathways:

- 1. Synapse in paravertebral sympathetic ganglion*
- 2. Synapse in lower & upper paravertebral sympathetic ganglion*
- 3. Synapse in Prevertebral sympathetic ganglion*



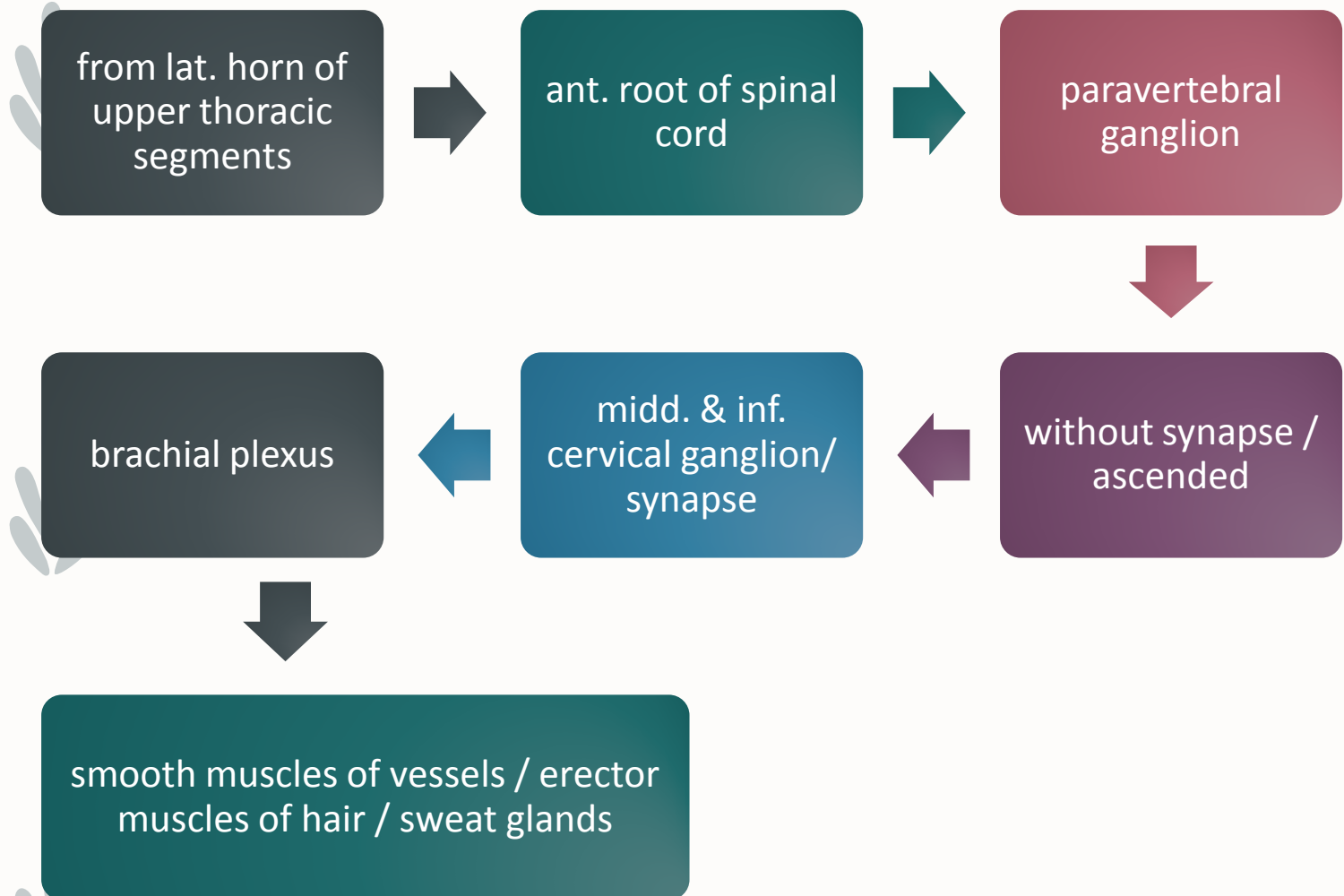
Sympathetic pathways in body

Head & face



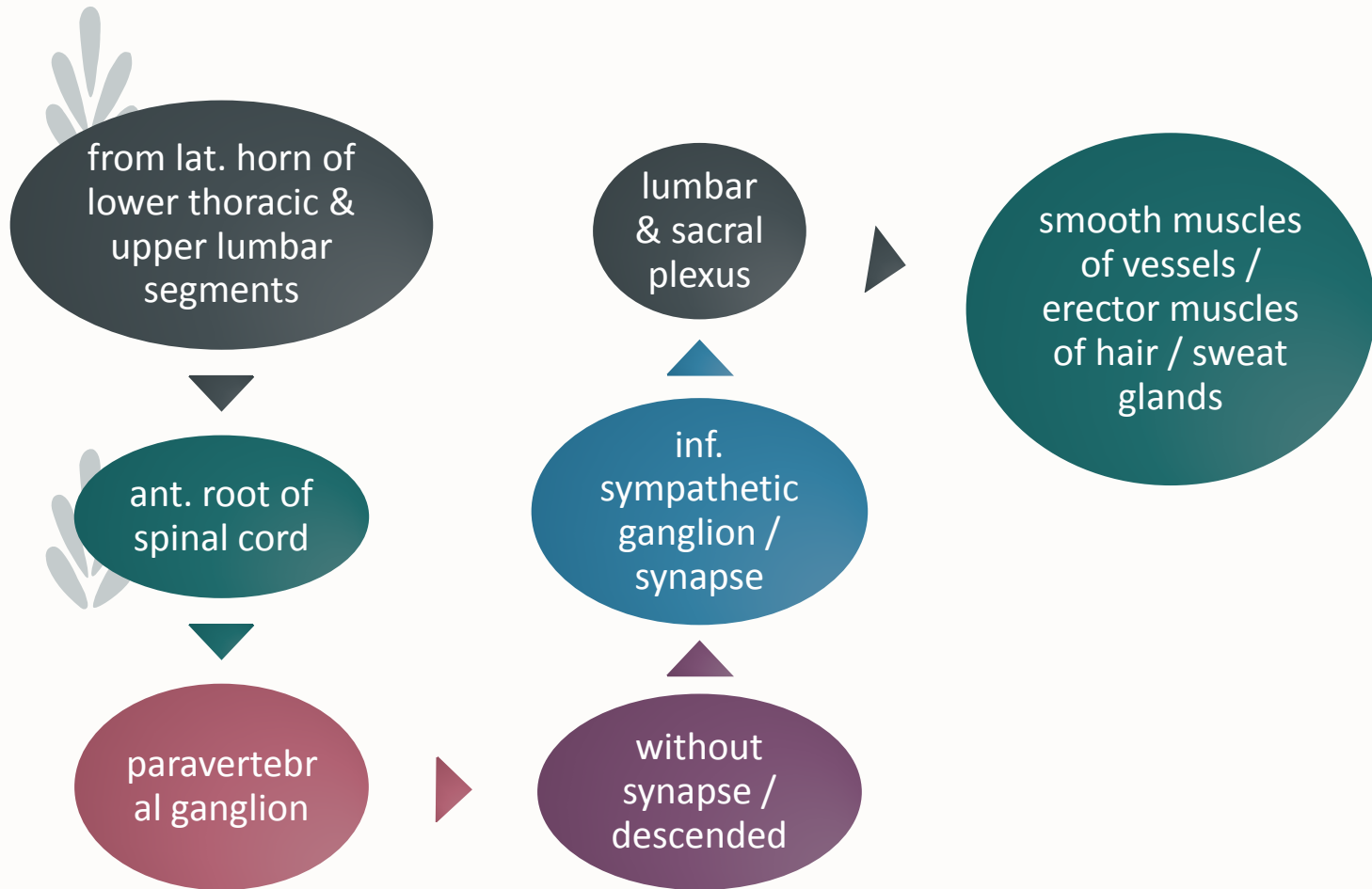
Sympathetic pathways in body

Upper limb



Sympathetic pathways in body

Lower limb



Sympathetic pathways in body

Trunk

trunk in T1-L2
level

ant. root of spinal
cord

paravertebral
ganglion / synapse

trunk in upper &
lower T1-L2 level

ant. root of spinal cord

paravertebral ganglion

without synapse / descended
or ascended

sympathetic ganglion /
synapse

Sympathetic pathways in body

Thoracic viscera

from lat.
horn of T1-
T5

ant. root of
spinal cord

paravertebr
al ganglion
/ synapse

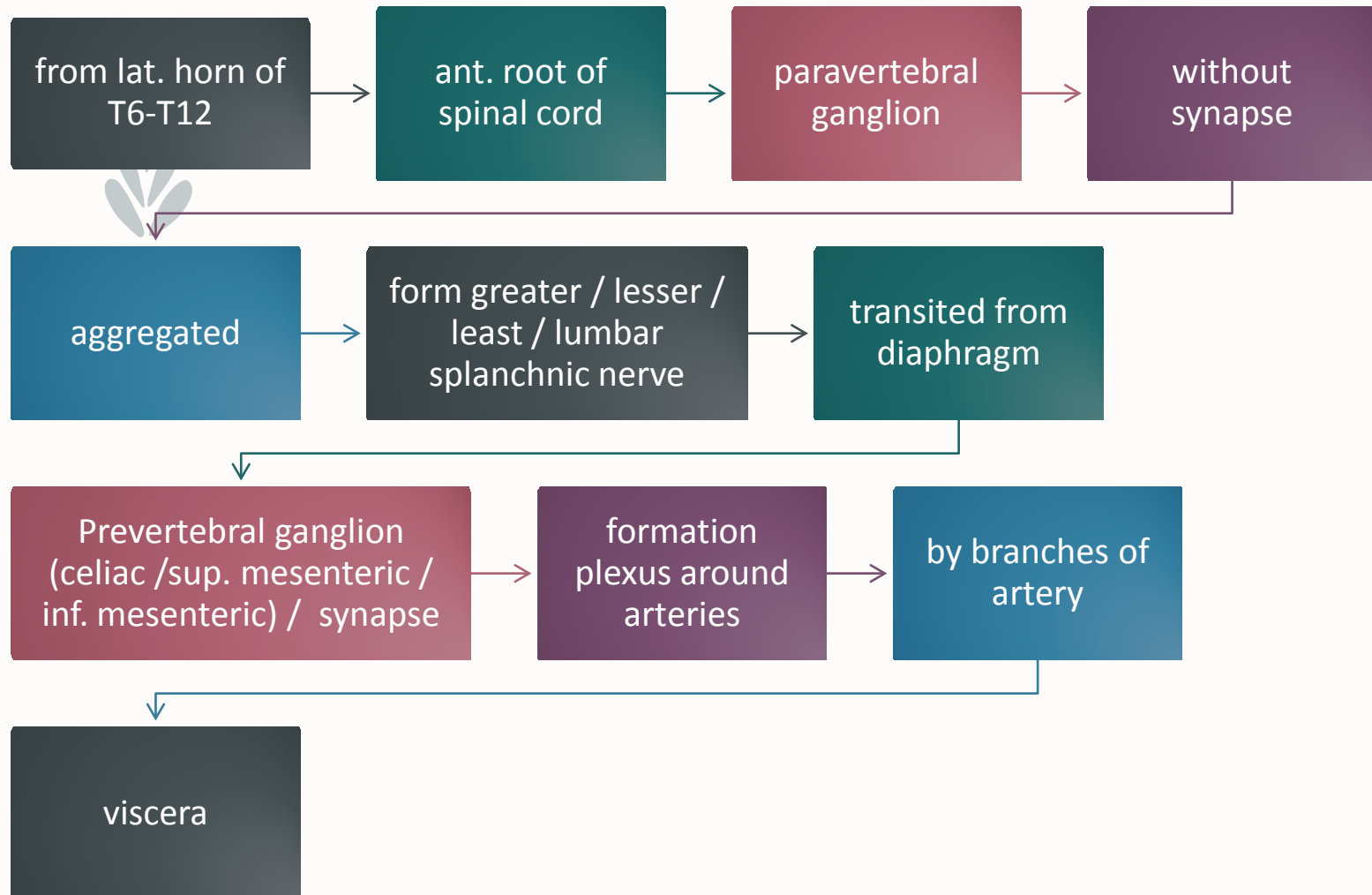
formation
of cardiac
&
pulmonary
plexus

by
branches of
vessels

terminate
in viscera

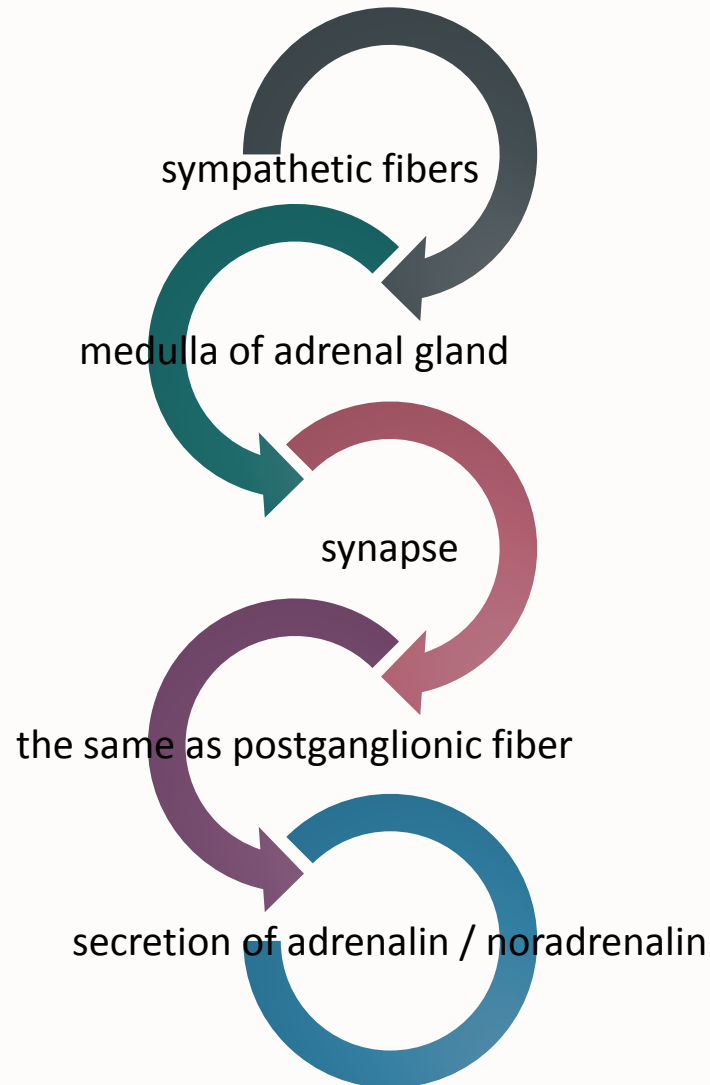
Sympathetic pathways in body

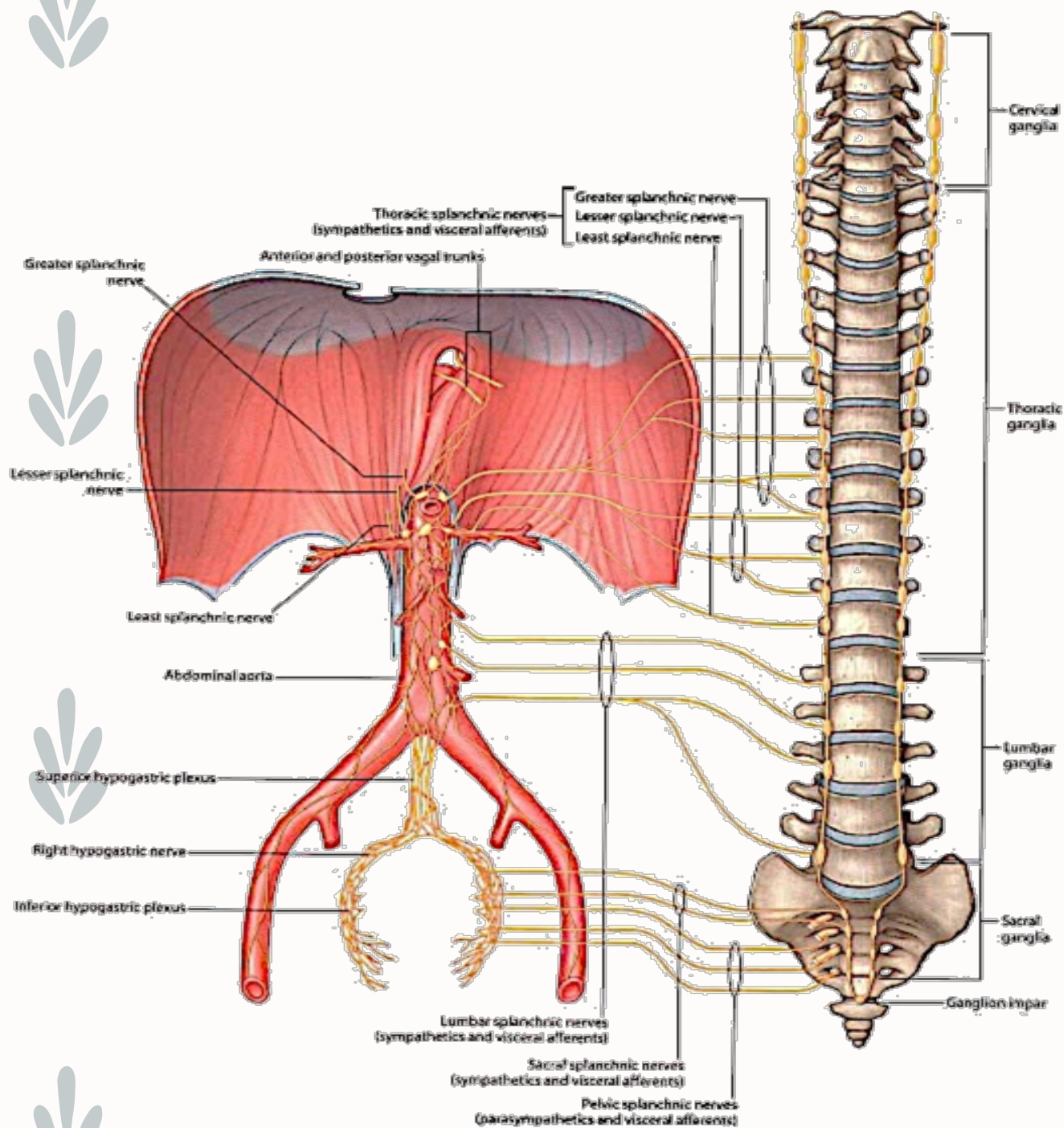
Abdomen & pelvic viscera

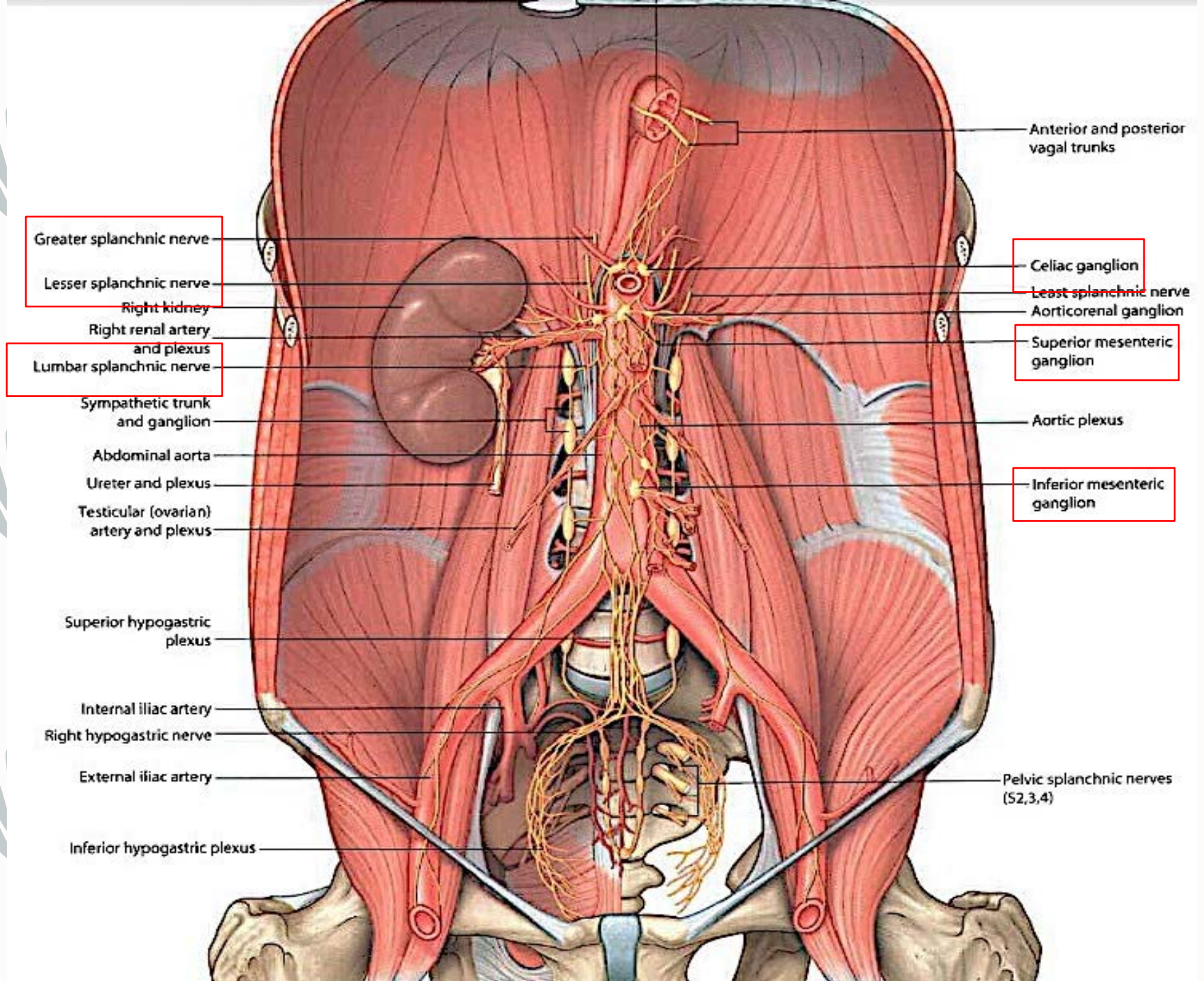


Sympathetic pathways in body

Suprarenal gland







Autonomic nervous system:

Visceral Afferent = unipolar neuron / cell body located in dorsal root ganglion & cranial nerve sensory ganglion (*the same as somatic afferent*)

Visceral efferent =

Preganglionic neuron / cell body located in motor nucleus of sympathetic & parasympathetic

Postganglionic neuron / cell body located in sympathetic & parasympathetic ganglion

Table 9.1 ● Functions of the sympathetic nervous system.

Organ/structure innervated	Function
Eccrine sweat glands of skin	Release of sweat
Arrector pili muscle	Contraction
Blood vessels of skeletal muscle	Dilation
Blood vessels of skin/mucous membranes	Vasoconstriction
Blood vessels of abdominal viscera	Vasoconstriction
Coronary arteries	No effect
Sinoatrial node of heart	Accelerates heart beat
Ventricular myocardium	Increases force of contraction
Alimentary canal	Reduces peristalsis; contraction of sphincters
Iris	Dilates pupils
Levator palpebrae superioris	Contraction of smooth muscles opens upper eyelids
Ductus deferens	Increases peristaltic movements carrying spermatozoa
Bronchial smooth muscle	Relaxation of smooth muscle causes easier breathing
Suprarenal medulla	Releases epinephrine

Sympathetic pathway function: (fight & flight)

↑ heart rate

Vasoconstriction

↑ BP

blood Shift to brain / heart / skeletal muscles

Dilation of pupils

Suppress smooth muscles of bronchi / intestine / bladder

Sphincters closed

Autonomic nervous system:

Visceral Afferent =

unipolar neuron / cell body located in dorsal root ganglion & cranial nerve ganglion (the same as somatic afferent)

Visceral efferent =

Preganglionic neuron / cell body located in motor nucleus of sympathetic & parasympathetic

Postganglionic neuron / cell body located in sympathetic & parasympathetic ganglion

Parasympathetic
pathway

ParaSympathetic pathway parts:

Visceral afferent = the same as somatic afferent

Visceral efferent = have 4 parts

➤ ***ParaSympathetic control center =***

Upper center / diencephalon (hypothalamus)

Lower center = lat. Horn of S2-S4 / brain stem (parasympathetic nucleus of cranial nerve 3 / 7 / 9/ 10)

Edinger-Westphal / sup. Salivary – lacrimal / inf. Salivary / dorsal

➤ ***Preganglionic fibers (cranial / sacral)***

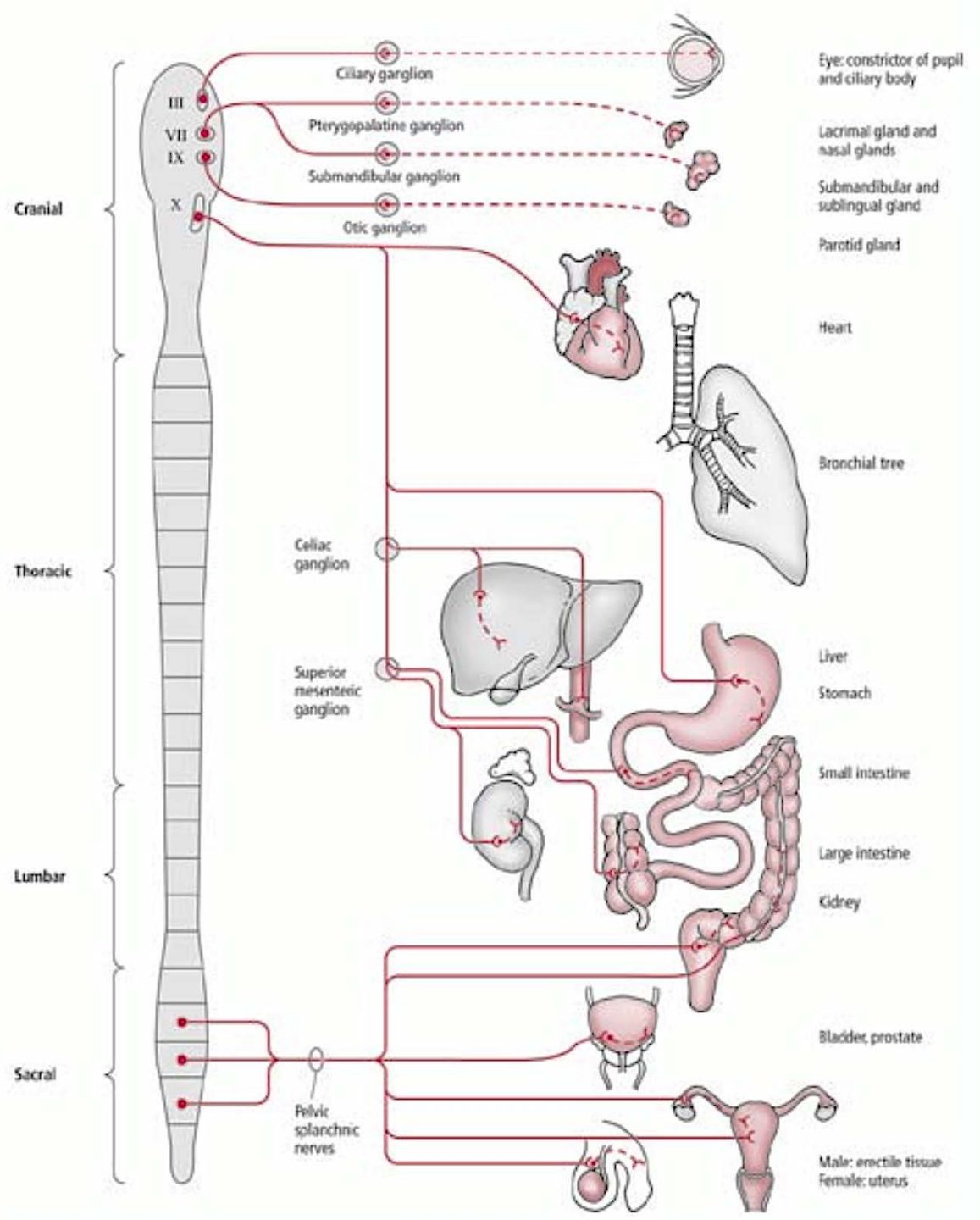
➤ ***Sympathetic ganglion (sympathetic chain)***

➤ Ciliary ganglion / 3

➤ Pterygopalatine & submandibular ganglion / 7

➤ Otic ganglion / 9

➤ ***Postganglionic fibers*** = terminated in target organ



Parasympathetic Pathway In Body

Oculomotor nerve

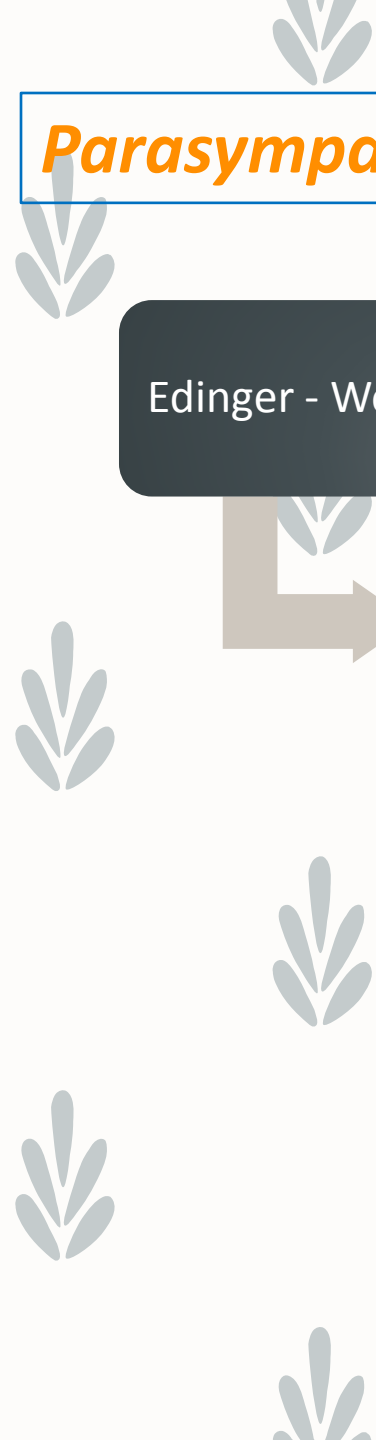
Edinger - Westphal

ciliary ganglion /
synapse

short ciliary nerve

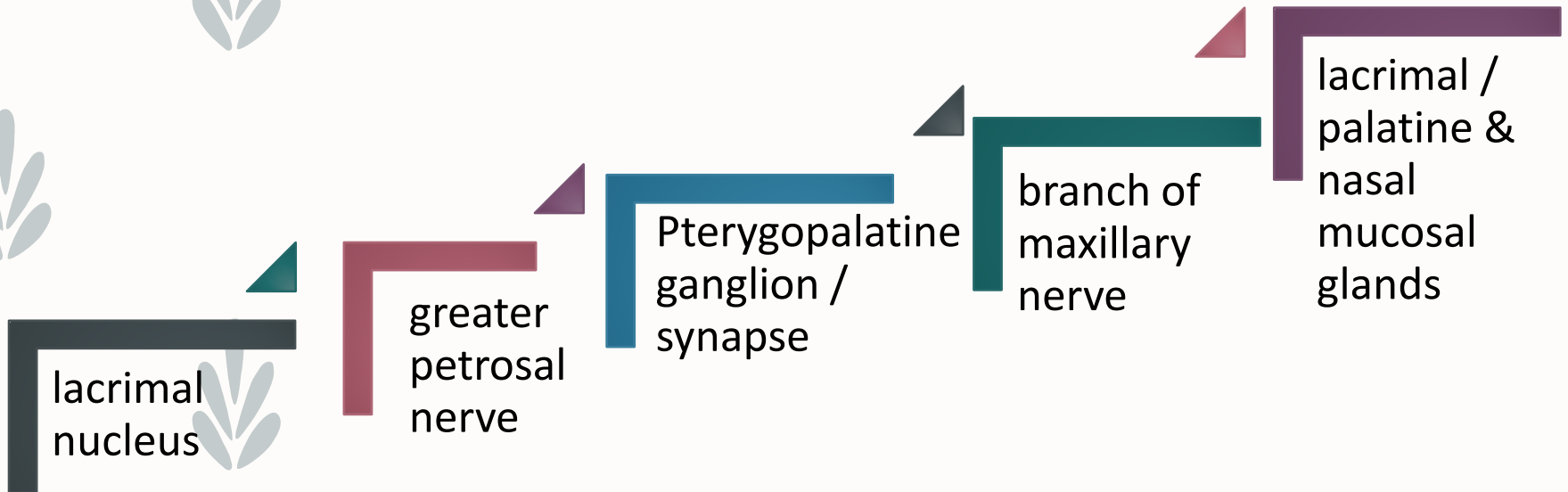
sphincter pupillae
muscle/ ciliary body

pupillary constriction /
thickening of lens



Parasympathetic Pathway In Body

Facial nerve



Parasympathetic Pathway In Body

Facial nerve

Sup. Salivary nucleus

cordatympani nerve

lingual nerve

submandibular ganglion / synapse

sublingual / submandibular glands

Parasympathetic Pathway In Body

Glossopharyngeal nerve

inf. salivary nucleus

tympanic nerve

tympanic cavity

lesser petrosal
nerve

otic ganglion /
synapse

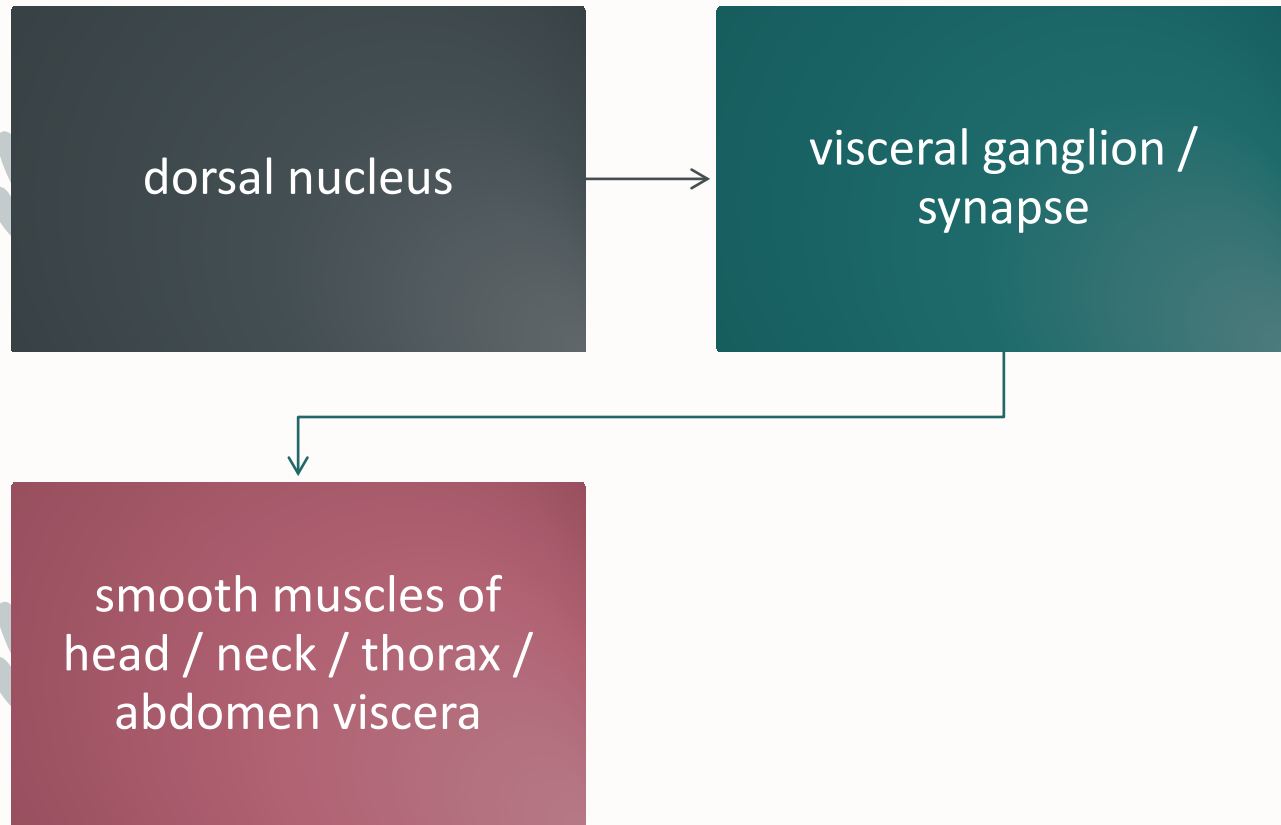
auriculotemporal

parotid
gland



Parasympathetic Pathway In Body

Vagus nerve



Parasympathetic Pathway In Body

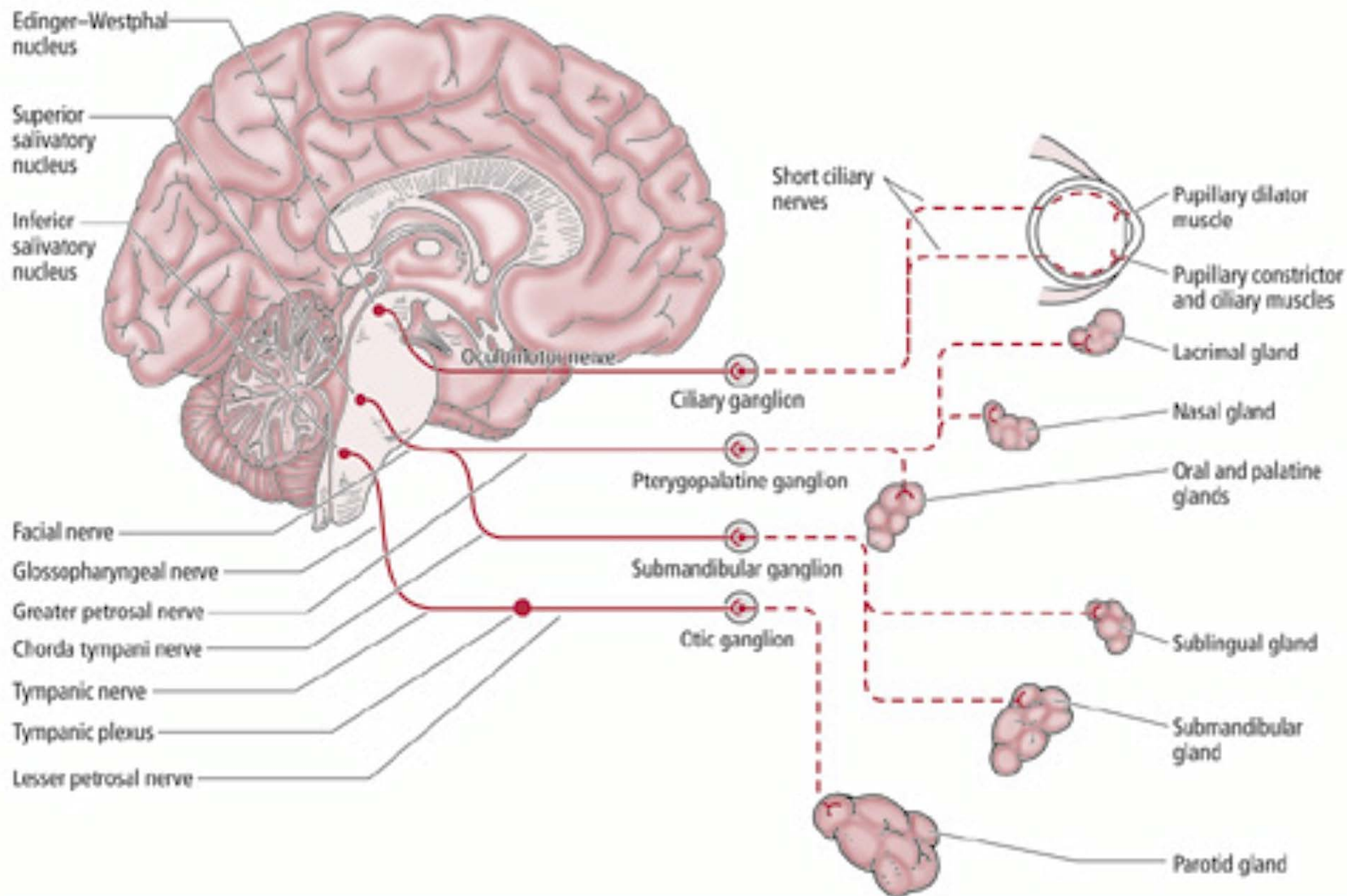
Lat. Horn of S2-S4

lat. horn of
S2-S4

pelvic
splanchnic
nerve

visceral
parasympath
etic ganglion

pelvic viscera
/ after lf.
colic flexure



Autonomic nervous system:

Visceral Afferent = unipolar neuron / cell body located in dorsal root ganglion(sacral nerve & cranial nerve sensory ganglion (3/7/9/10)(**the same as somatic afferent**))

Visceral efferent =

Preganglionic neuron / cell body located in motor nucleus of sympathetic & parasympathetic

Postganglionic neuron / cell body located in sympathetic & parasympathetic ganglion

Parasympathetic pathway functions: (rest)

↓ HR

Vasodilation

Pupillary constriction

↑ secretion of glands

↑ peristaltic motion

Sphincter opened

Bladder constriction

Organ/structure innervated	Function
Iris	Constricts pupils (miosis)
Ciliary muscles	Contracts to relax suspensory ligaments of the lens (near vision)
Lacrimal glands	Facilitates flow of tears
Salivary glands	Facilitates flow of serous secretion
Sinoatrial node of heart	Decreases rate of heart beat
Blood vessels	Usually has little effect
Bronchial smooth muscle	Bronchoconstriction
Glands of conducting portion of respiratory system	Facilitates secretion
Peristalsis of alimentary canal	Stimulates peristalsis
Sphincter muscles	Relaxes sphincter muscles (inhibitory function)
Intrinsic glands of the alimentary canal	Facilitates secretion
Pancreas	Facilitates secretion
Gall bladder	Facilitates release of bile
Penis and clitoris	Stimulates erection

Table 9.2 • Functions of the parasympathetic nervous system.



Horner's syndrome:

Pupillary constriction (miosis)

Ptosis

Enophthalmos

Vasodilation

Ahydrosis in neck & face



Raynods disease:

To treat vasoconstriction in upper limb

Diminished pain

Removed satellite ganglion (inf. Cervical ganglion)

