Autonomic Nervous System

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The Parasympathetic nervous System

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- It is the part of the autonomic nervous system, which deals with the anabolic activities and lead to conservation of body energy. It is also called the **Cranio-sacral outflow** secondary to its origin.

- **Parasympathetic is divided into two main types**

Parasympathetic cranial outflow

- **Parasympathetic fibers are found in the cranial nerves III «occulomotor», VII «facial», IX «glossopharyngeal» and X «vagus»**

Parasympathetic Sacral outflow

- **Parasympathetic fibers arised from LHCs of sacral 2,3 &4 segments of the spinal cord.**

Occluolomotor nerve (III)

- **arise** From the Edinger-Westphal nucleus in the midbrain

- The preganglionic fibers relay in the ciliary ganglion.

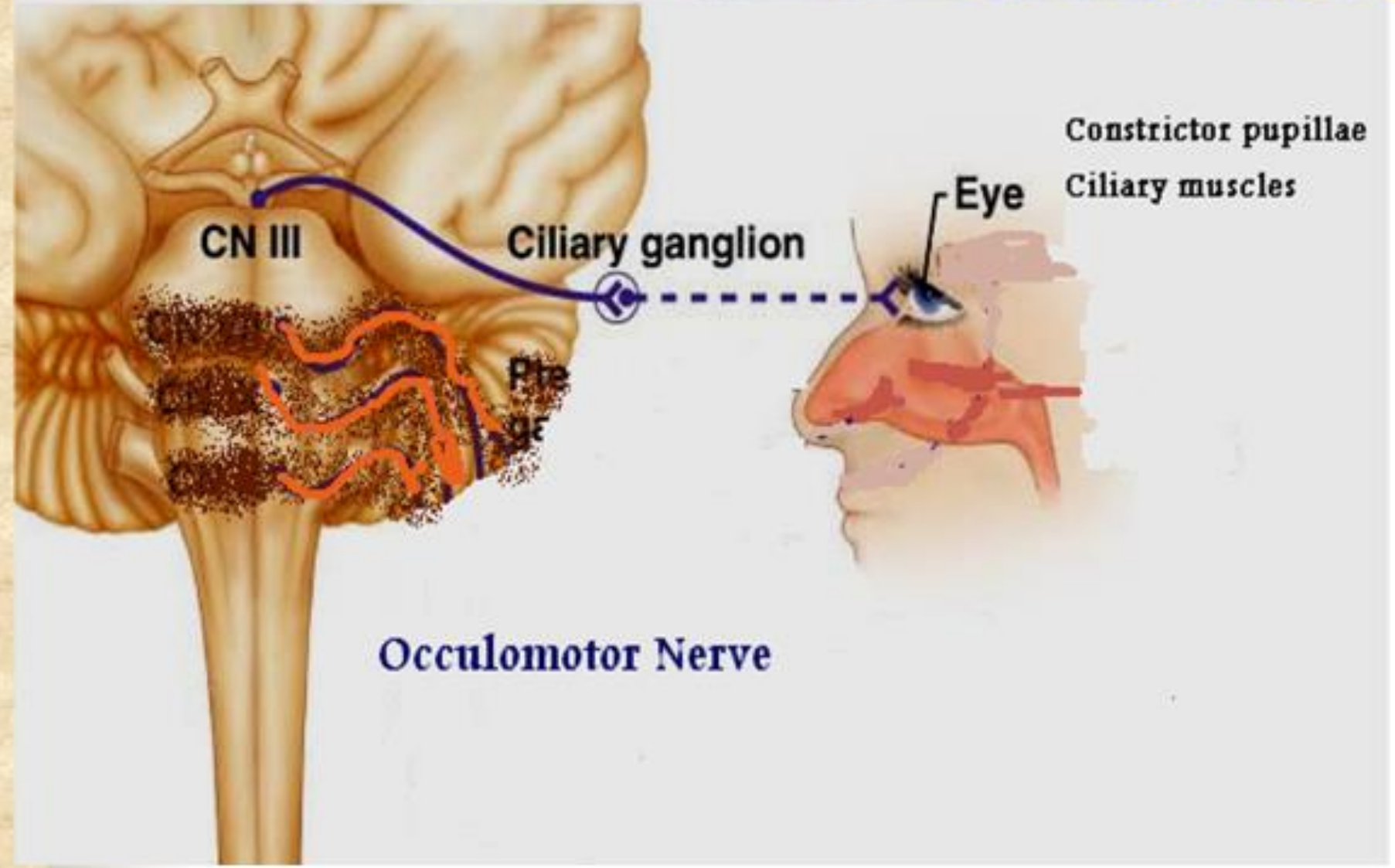
- The postganglionic fibers run in the short ciliary nerves. These fibers produce:

a) Contraction of the constrictor pupillae

→ narrowing of the pupil. (miosis).

b) Contraction of the ciliary muscle:

→ relaxation of suspensory ligaments, causing increased power of the lens which is very useful in near vision accommodation.


Constrictor pupillae
Ciliary muscles
Eye
CN III
Ciliary ganglion
Occulomotor Nerve

facial nerve (VII)

- **Supply : the lacrimal, nasal and submaxillary salivary glands.**

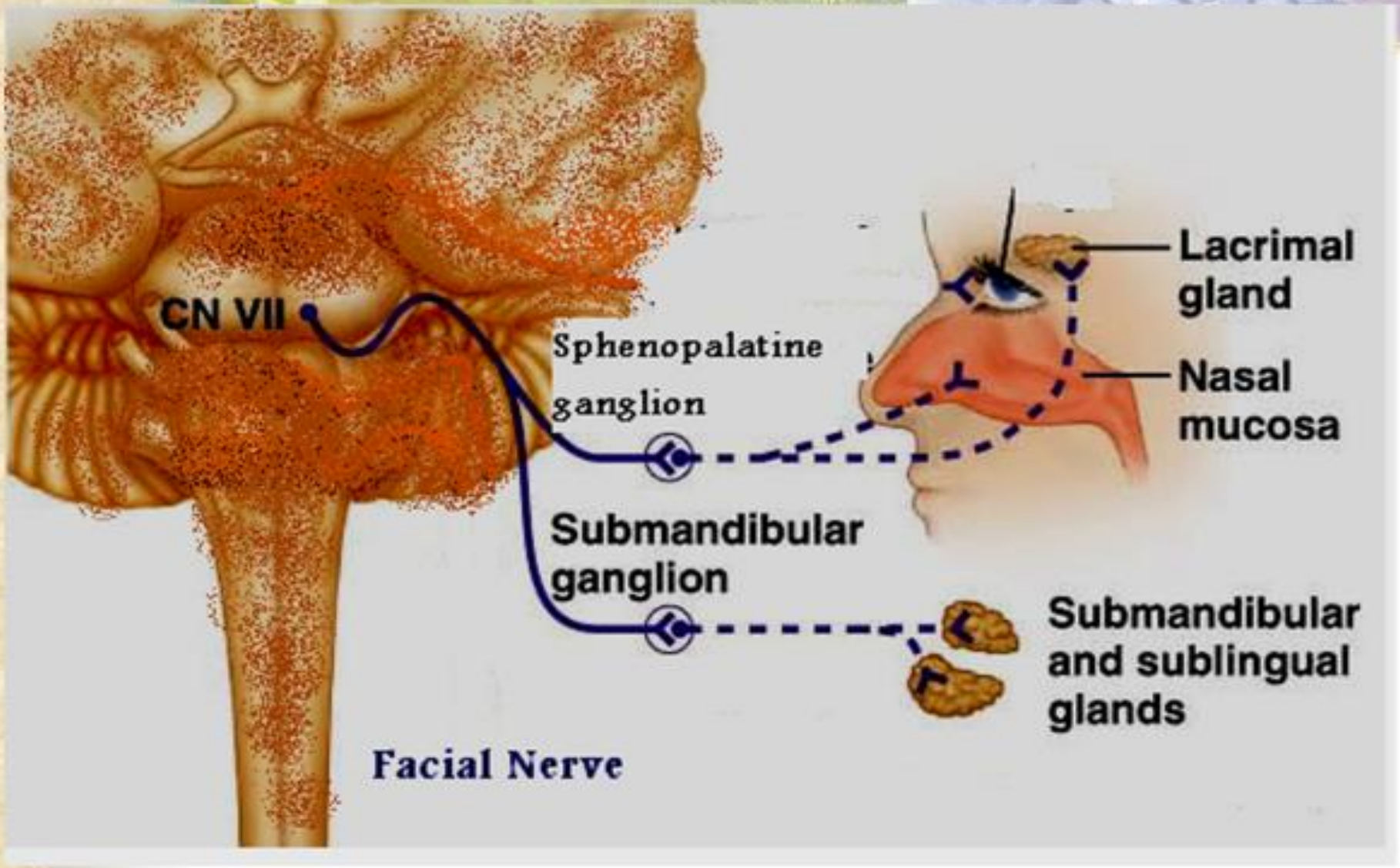
Preganglionic fibers: arise from the Superior salivary nucleus in pons.

- **Relay : Fibers that supply the lacrimal and nasal glands relay in The Sphenopalatine ganglion (collateral).**

Fibers that supply the submaxillary gland relay in the Submandibular ganglion (collateral).

Functions:

- **These fibers supply the salivary glands and produce True secretion (Large in volume, less in enzymes and watery) also produce vasodilatation.**


CN VII
Sphenopalatine
ganglion
Submandibular
ganglion
Lacrimal
gland
Nasal
mucosa
Submandibular
and sublingual
glands
Facial Nerve

The glosso-pharyngeal (IX)

- **Supply the parotid salivary gland**
  - **Preganglionic fibers**

    arise from the inferior salivary nucleus (in medulla)

    relay in the otic ganglion (collateral)

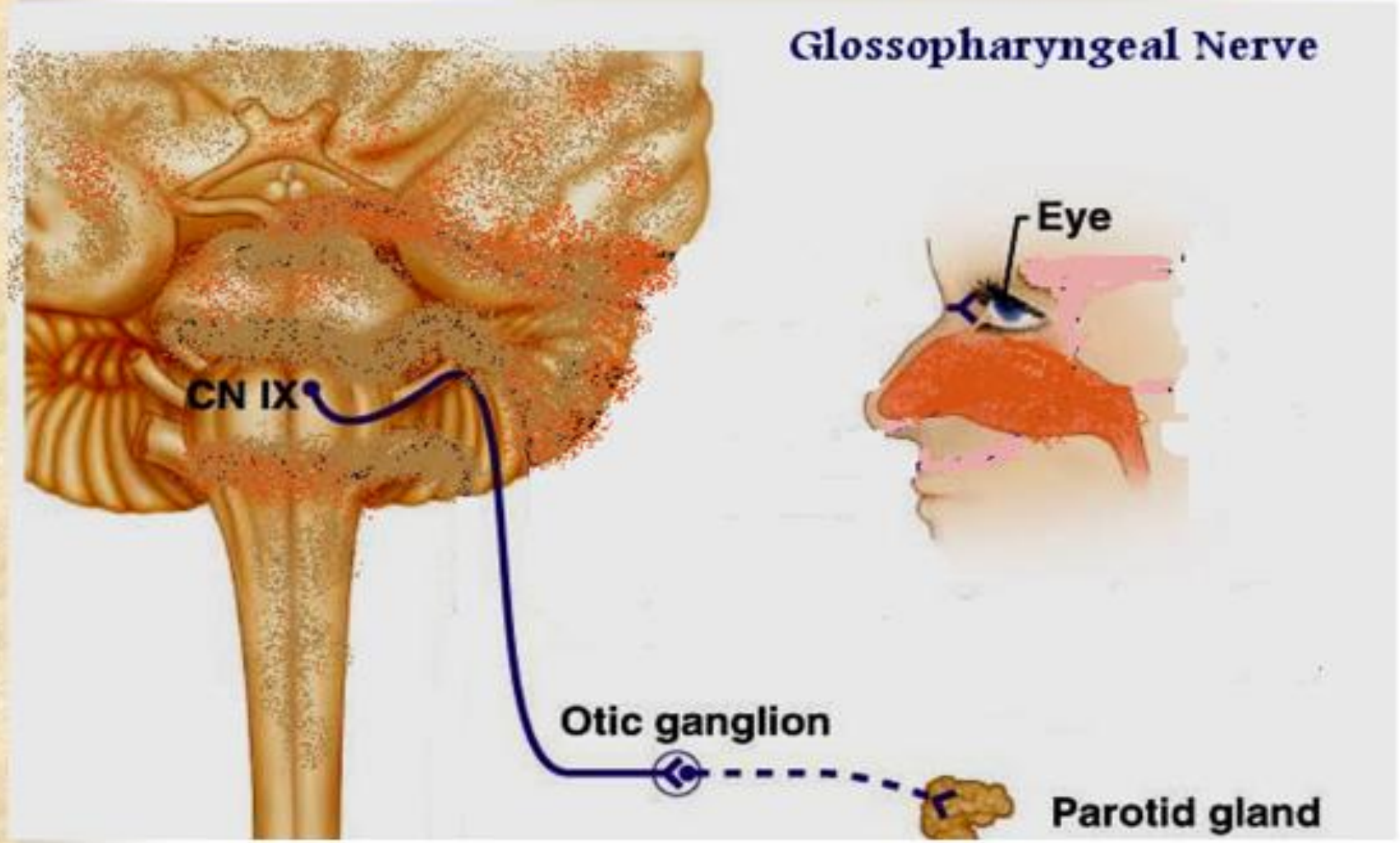
- **Postganglionic fibers**

  supply the parotid (largest) salivary gland.

  Functions:

  a) **True secretion (Large in volume, less in enzymes and watery)**
  b) **Vasodilatation.**

So, nerve supply to salivary glands arise from facial nerve (to submaxillary and sublingual glands) and from glosso-pharyngeal nerve (to parotid gland)


Glossopharyngeal Nerve
Eye
CN IX
Otic ganglion
Parotid gland

-The vagus nerve (X)

Arise from the vagal nucleus in medulla oblongata

- **The preganglionic fibers relay in terminal ganglia situated in the organs supplied**

From the terminal ganglia short postganglionic fibers arise and pass to supply the organs.

The vagus nerve have the following functions:

1-Inhibition of all properties of atrial cardiac muscle.

N.B Ventricles receive very few vagal parasympathetic efferent fibers. (this is called *the ventricular vagal escape phenomenon*)

2- Decrease of the coronary blood flow and O2 consumption of the heart

(indirect v.c in coronary due to the increased O2 concentration & decreased metabolic activity.

- **Constriction** of the bronchi and bronchioles **(Bronchoconstriction)**
- **Increased secretion** from bronchial glands.
- **VD** of blood vessel. This leads to **narrowing of air passages**.

- **Motor** to **GIT wall** (contraction).

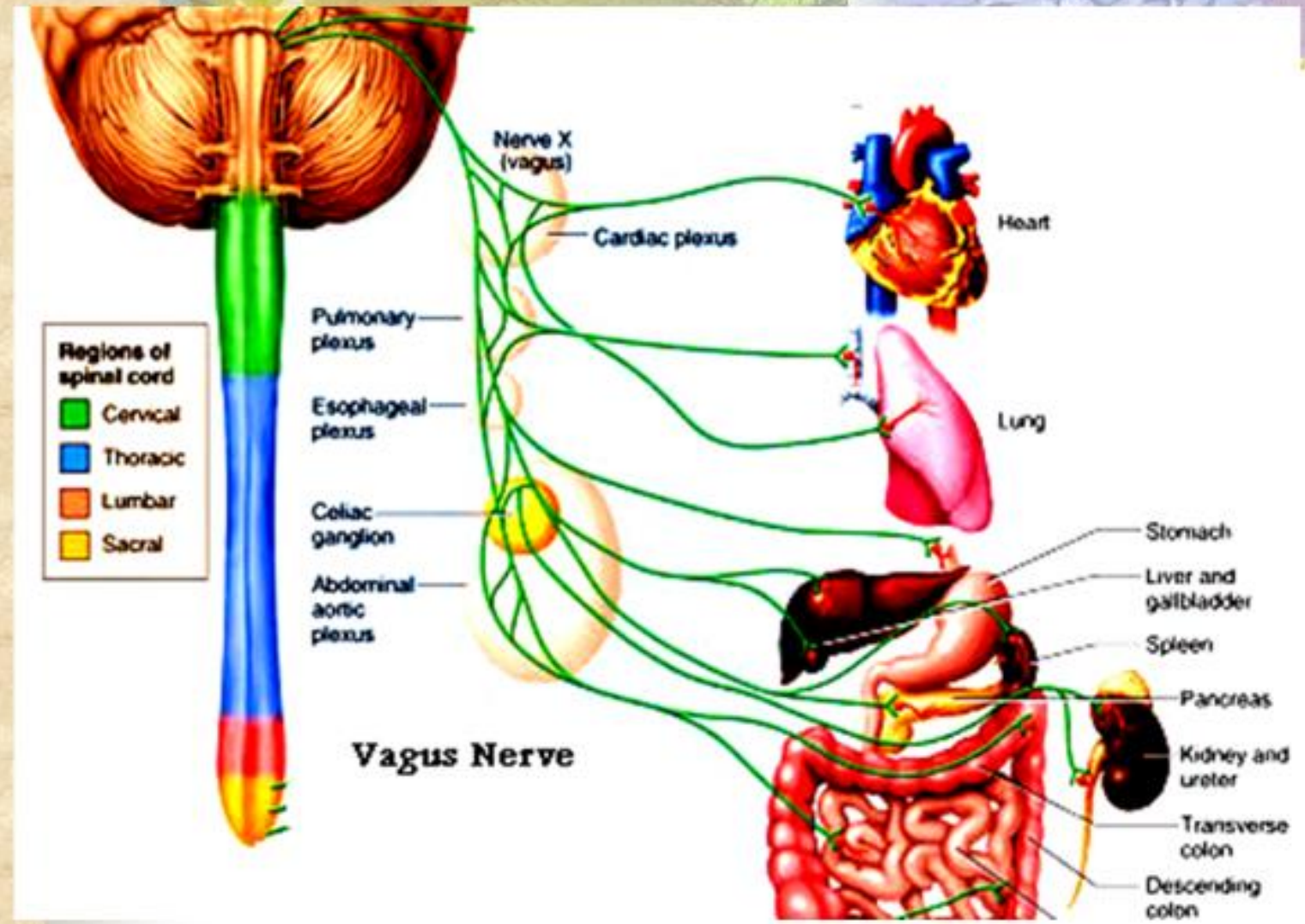
oesophagus, stomach, small intestine and proximal part of large intestine.

but inhibitory to sphincters leading to rapid evacuation of food.

- (↑) Secretory to **digestive glands** of stomach, pancreas and liver enhancing (↑) **insulin** hormone release.

- **Motor (↑)to gall bladder and inhibitory to sphincter of Oddi** .

- **Vasodilatation** to the **splanchnic** vessels.


Nerve X
(vagus)
Cardiac plexus
Heart
Pulmonary
plexus
Lung
Esophageal
plexus
Celiac
ganglion
Abdominal
aortic
plexus
Regions of
spinal cord
Cervical
Thoracic
Lumbar
Sacral
Stomach
Liver and
gallbladder
Spleen
Pancreas
Kidney and
ureter
Transverse
colon
Descending
colon
Vagus Nerve

Parasympathetic sacral outflow

- The sacral parasympathetic fibers **arise from L.H.C of 2, 3, and 4th sacral** segments of the spinal cord

- They run as preganglionic fibers in the **pelvic sacral nerve** or the **nervi erigentes** to relay in **terminal ganglia** in the organs they supply.

- The sacral parasympathetic fibers supply :

* the rest of the digestive tract that is **the descending colon, the rectum the anal canal.**
* The urinary bladder
* the **blood vessels** of the external genitals.

This Sacral flow have the following functions:-

- **Defecation**

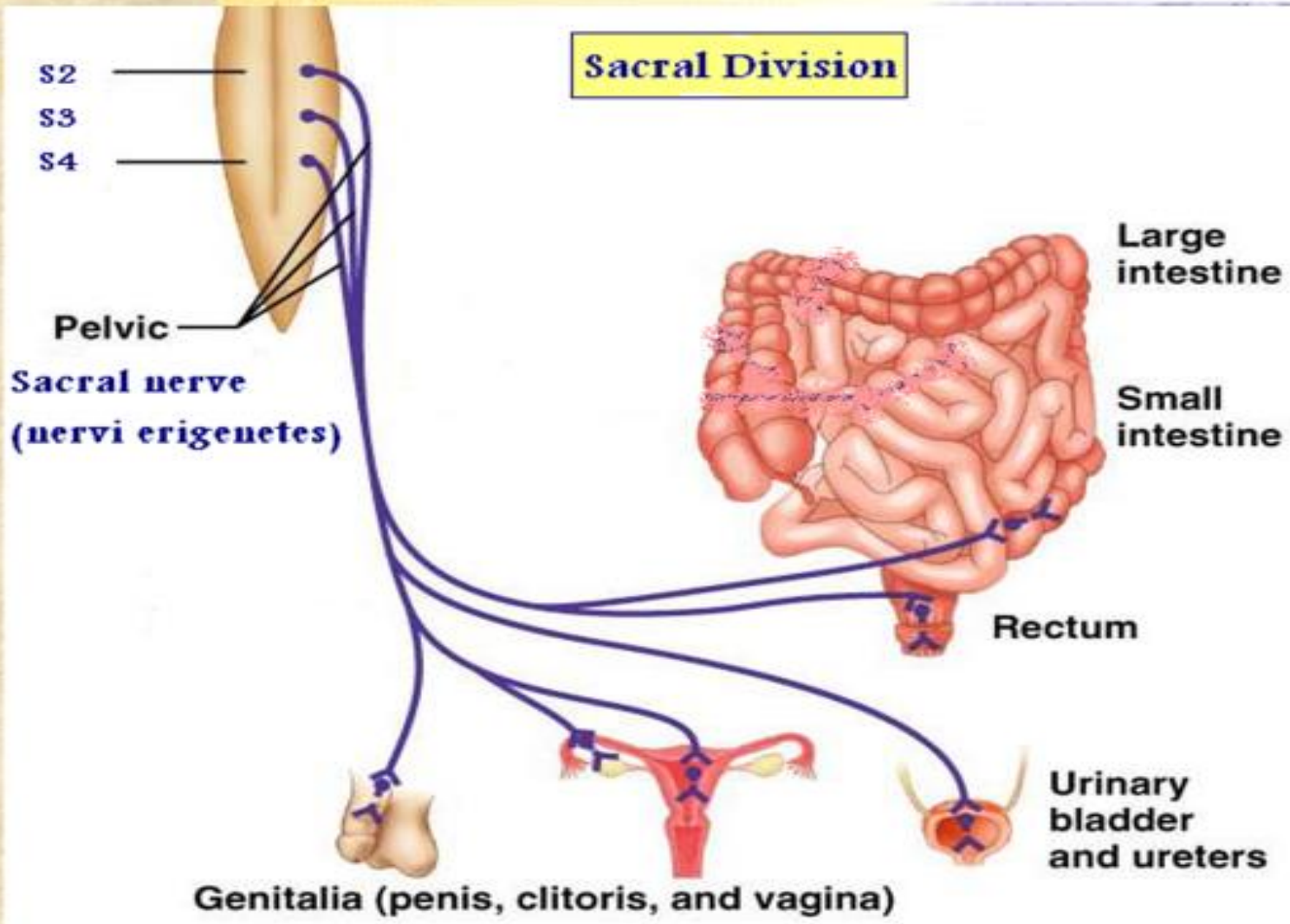
  contraction of the wall of the rectum and relaxation of internal rectal sphincter.

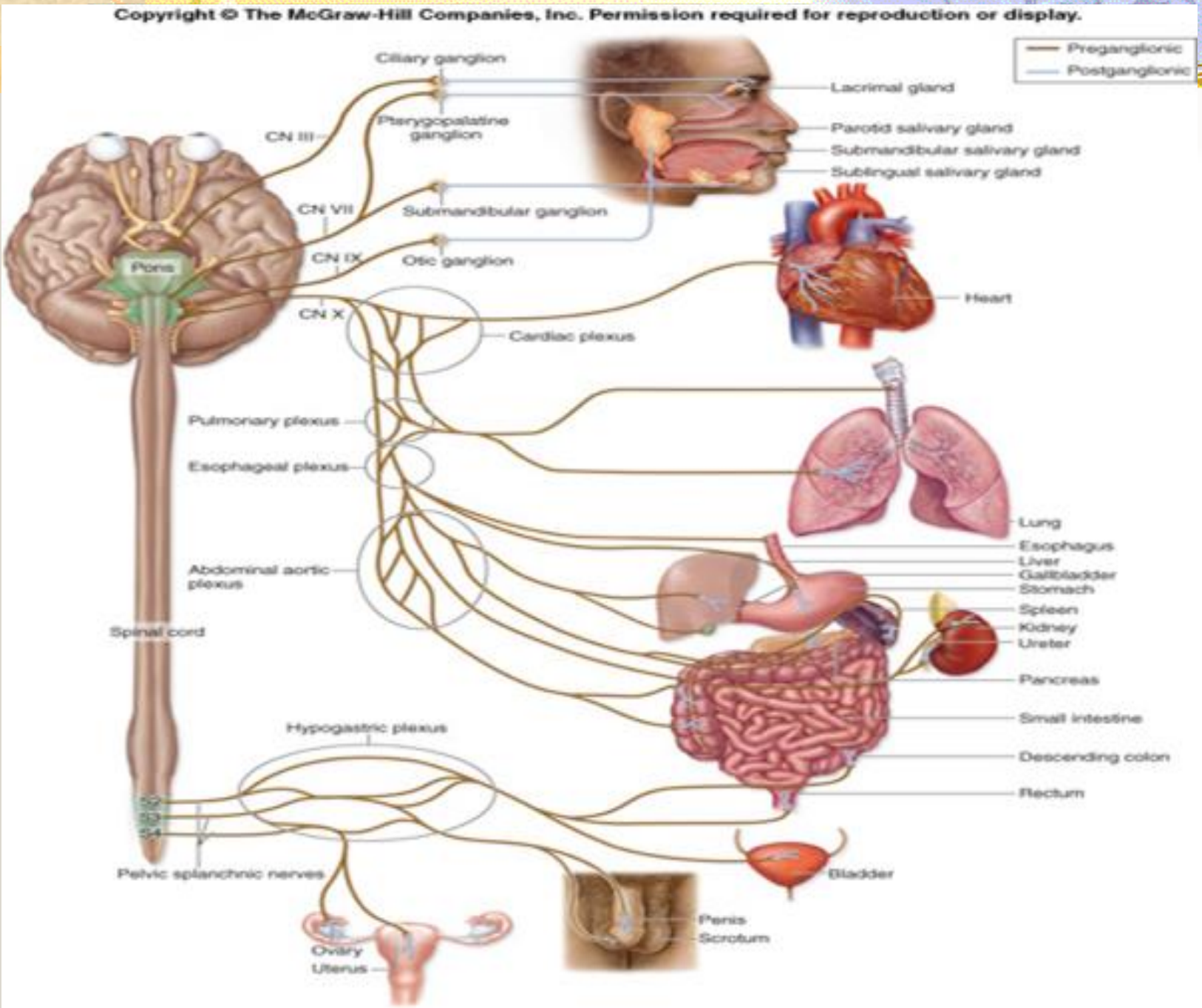
- **Micturition**

  contraction of the wall of the bladder and relaxation of the internal uretheral sphincter.

- **Erection**

  vasodilatation of the blood vessels of the erectile tissue of the penis in the male and clitoris in the female.


Sacral Division
S2
S3
S4
Pelvic
Sacral nerve
(nervi erigenetes)
Large intestine
Small intestine
Rectum
Urinary bladder and ureters
Genitalia (penis, clitoris, and vagina)



Parasympathetic tone

*a) Vagal tone to the **heart***

- Decreases the rhythm of the SAN from **110** to only **70** beats / minute.
- This greatly spares excess energy & effort in the heart.

*b) Vagal tone to the **gastrointestinal tract***

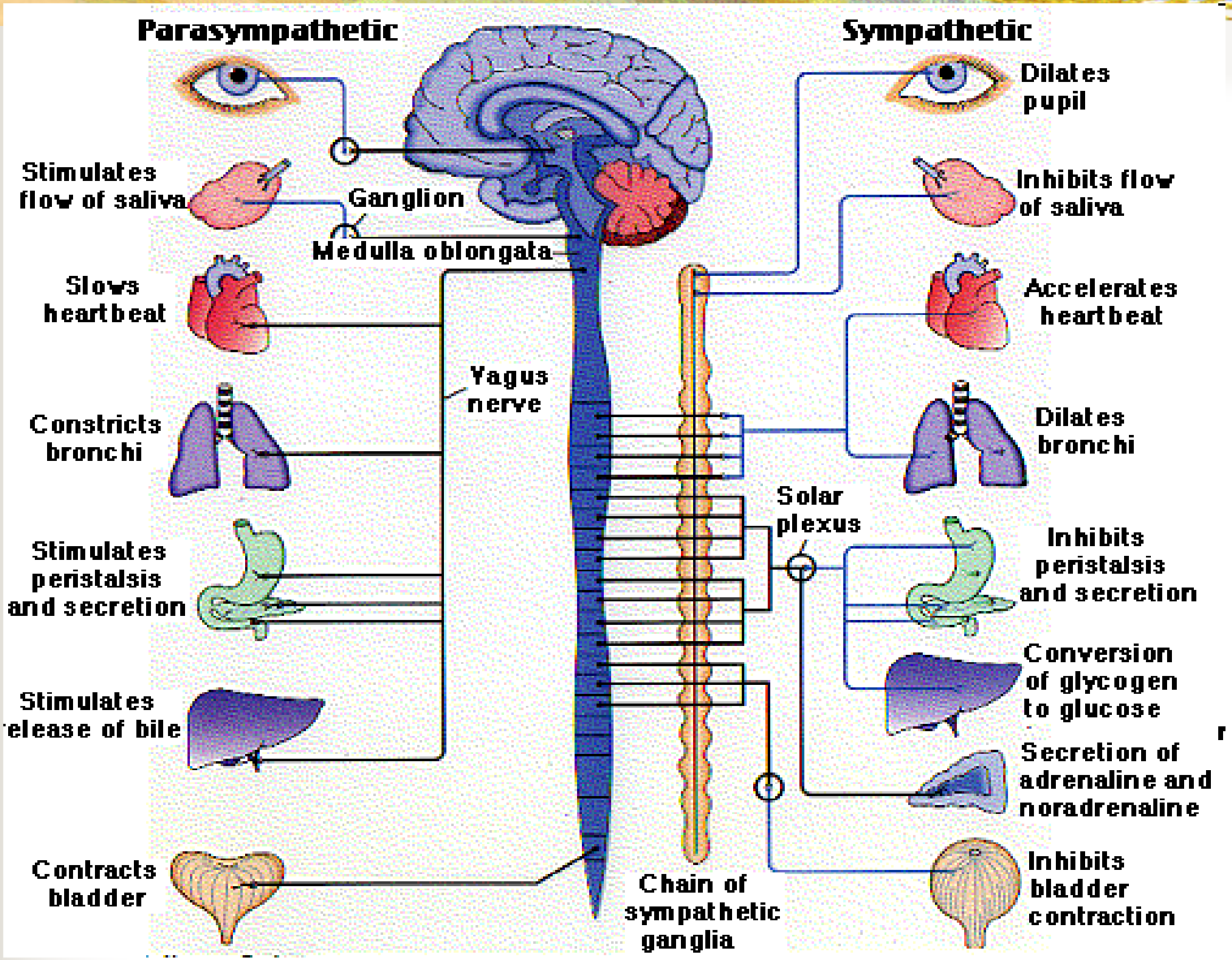
- Prevents GIT distention and maintain basal amount of secretion.
- This is very important to complete the digestive process.

*c) Vagal tone to the **bronchi***

- Maintains constant distribution of air during ventilation.
- Protects the bronchial wall during cough.

N.B. *Many structures are supplied by* ***one system only****:*

- ***Sympathetic:*** **S**kin, **S**uprarenal medulla, **S**weat glands, **S**keletal muscle blood vessels, **S**pleen, ventricles, **dilator** pupillae muscle.
- ***Parasympathetic:*** constrictor pupillae muscle.


Parasympathetic
Sympathetic
Dilates pupil
Stimulates flow of saliva
Ganglion
Medulla oblongata
Inhibits flow of saliva
Slows heartbeat
Accelerates heartbeat
Yagus nerve
Constricts bronchi
Dilates bronchi
Solar plexus
Stimulates peristalsis and secretion
Inhibits peristalsis and secretion
Conversion of glycogen to glucose
Stimulates release of bile
Secretion of adrenaline and noradrenaline
Contracts bladder
Chain of sympathetic ganglia
Inhibits bladder contraction


Thanks