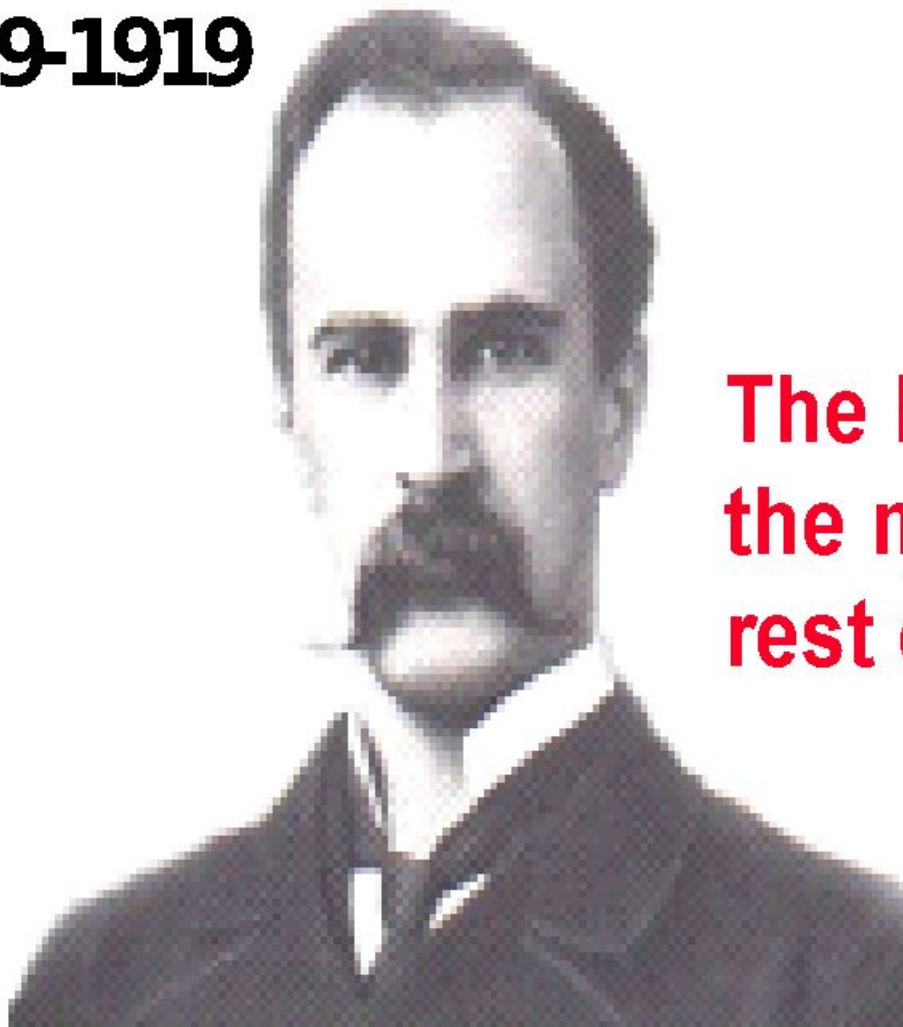


GASTROINTESTINAL SYSTEM or DIGESTIVE SYSTEM or GUT

- Figures in this ppt are from guyton, ganong, best & taylor, tortora and google images

Sir William Osler

1849-1919



**The buccal cavity is
the mirror of the
rest of the body.**

Digestive system



- **Gastrointestinal tract(GIT) + accessory organs**
- **GIT is the main portal through which body gets macronutrients, vitamins, minerals and Fluids**
- **Accessory organs-salivary glands, liver & pancreas**

GIT



- **Consists of :- mouth**
 - oropharynx**
 - esophagus**
 - stomach**
 - small intestine - duodenum**
 - jejunum**
 - ileum**

GIT

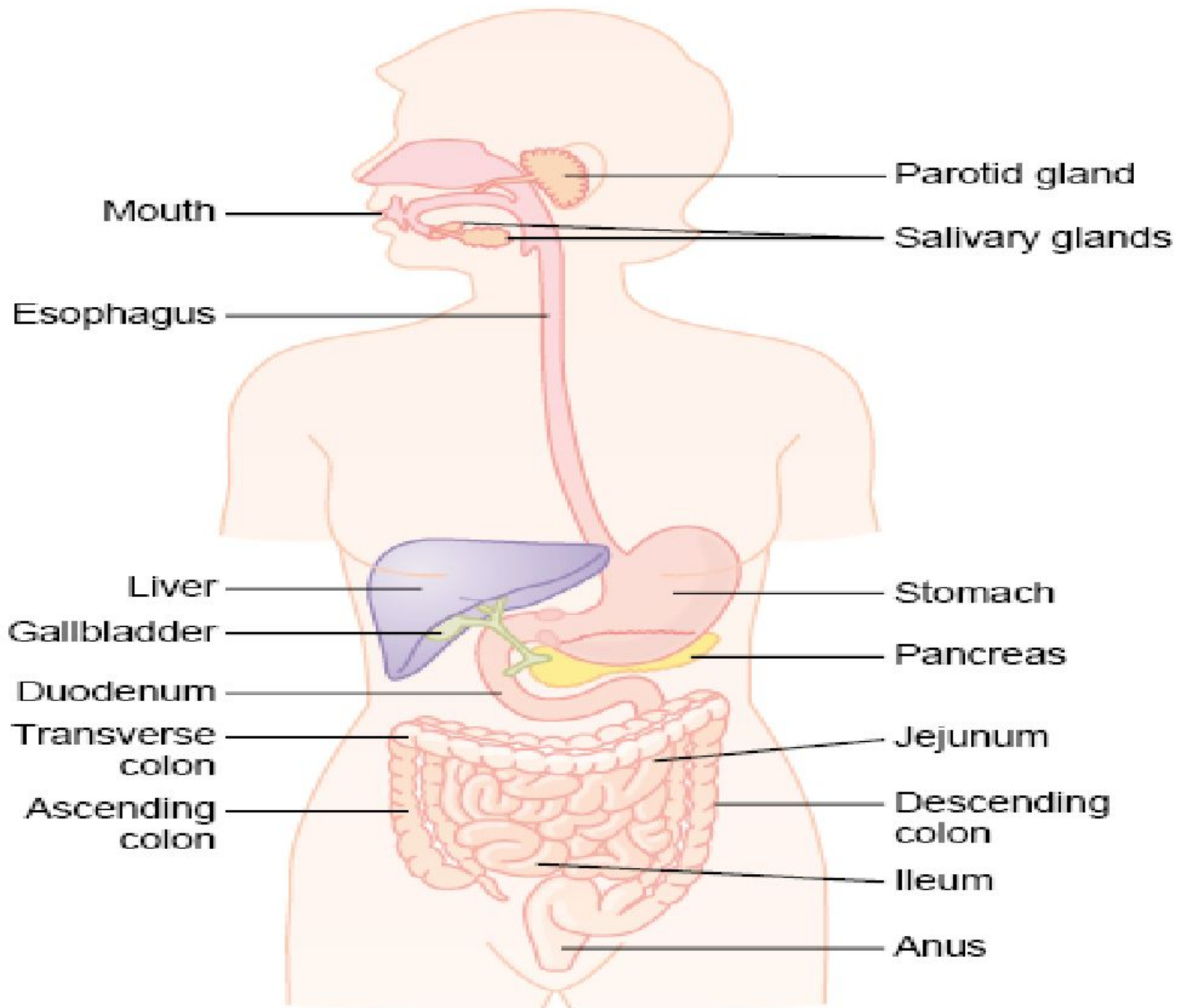
LARGE INTESTINE:

- Cecum**
- Ascending colon**
- Transverse colon**
- Descending colon**
- Sigmoid colon**
- Rectum**
- Anal canal**
- Anus**

Accessory glands



- **Salivary glands**
- **Pancreas**
- **Liver**



Processes



- The GIT breaks down food and supply, the body with water, nutrients and electrolytes needed to sustain life & removes unwanted substances.
- This is brought about by following processes:
 1. ingestion
 2. digestion
 3. absorption
 4. egestion

INGESTION



- - Placing food into the mouth
- - chewing the food into smaller pieces (mastication)
- - Moistening the food with salivary secretions
- - swallowing the food (deglutition)

DIGESTION-Mechanical & chemical



It is the breaking larger pieces into small ones & splitting of large chemical compounds into simpler substances that can be used by the body.

Starches ----- monosaccharides
(amylases)

Proteins ----- dipeptides and amino acids.
(proteases)

Fats ----- monosaccharides and FFA
(lipases, esterases)

ABSORPTION & ASIMILATION



- Simpler substances produced by digestion as well as nutrients, water and electrolytes are transported from the GIT to the circulation & through portal circulation to liver & then stored or distributed to different tissues for use & storage.

Egestion



- The undigested food particles, unabsorbed food along with various secretions and sloughed-off epithelial cells from tip of villi , constitute faeces which are voided through the anus at periodic intervals.

Functions of the GIT

1. DIGESTION & ABSORPTION OF FOOD.

the primary function of GIT.

2. EXCRETION OF WASTE MATERIALS.

3. FOOD & ELECTROLYTE BALANCE

- an adult consumes -1 kg of food

-1.5 lit of fluid /day

additional - 7 lit secreted in the form
of secretions.

Thus intestine is presented with 8.5 lit of fluid/day.

99% fluid + 90% of solids are absorbed from SI & LI along with electrolytes.

So 100ml fluid+ 100g of solids ----excreted/day.

Diarrhoea --- absorption decreases or secretion increases.

Functions of the GIT-contd



4. IMMUNITY

- GIT is open at both ends--- organisms enters easily
- MALTs or GALTs protect the body from pathogens.

MALTS - Peyer's patches

- diffuse population of immune cells.

acidic secretions of the stomach ---helps killing organisms.

.

Functions of the GIT-contd



□ **5. INTESTINAL BACTERIAL FLORA**

- -non pathogenic bacteria inhabit at intestine, form the intestinal bacterial flora
- It has many essential intestinal functions-
 - 1 - Epi. Cell permeability to electrolytes & water.
 - 2 - Synthesis & absorption of vitamins
 - 3 - Stimulation of enzymatic activity, peristalsis & mucus secretion
 - # decreased flora- impairs intestinal functions
 - # Increased flora- increases susceptibility to diarrhoea & steatorrhoea.

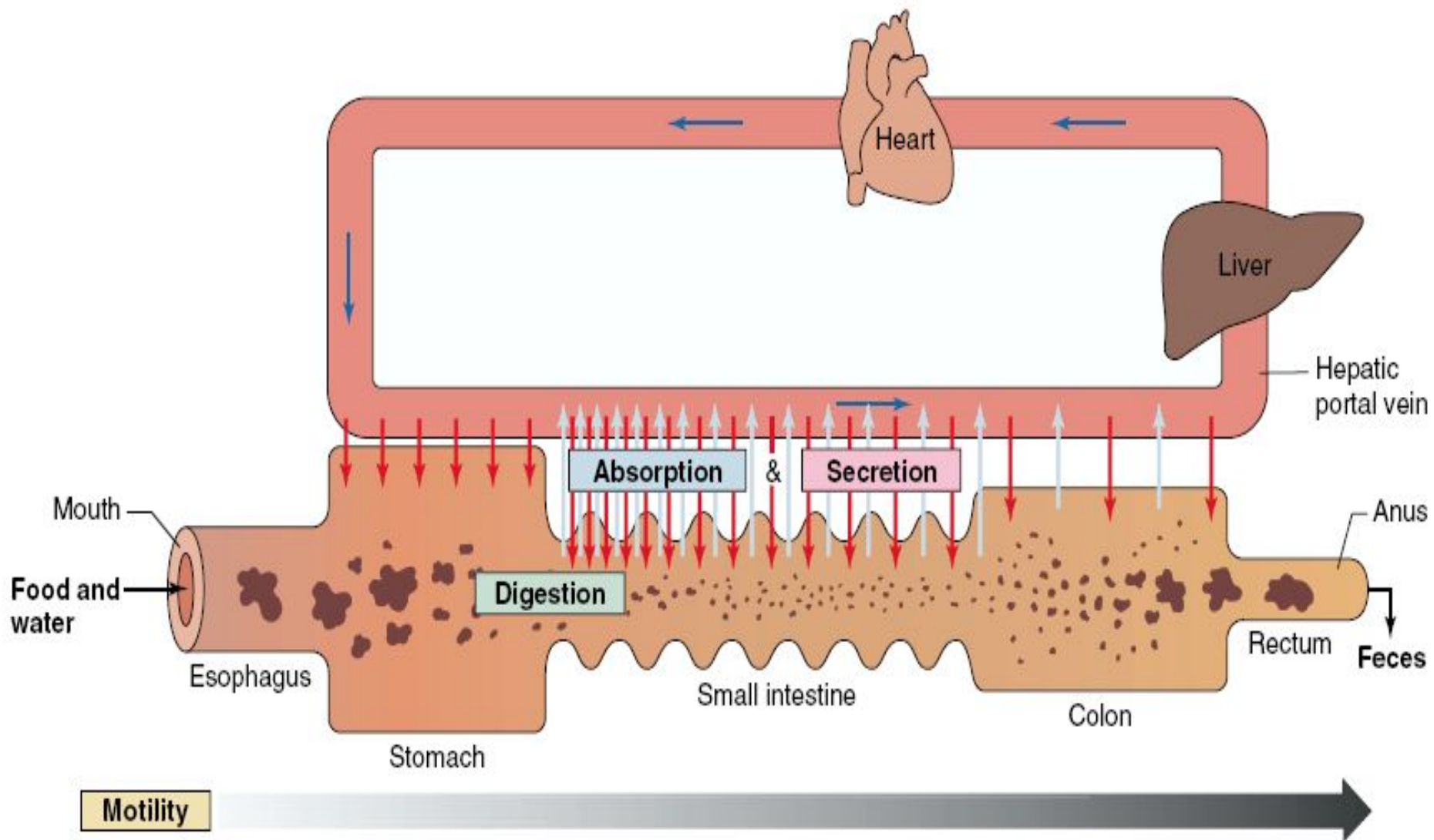


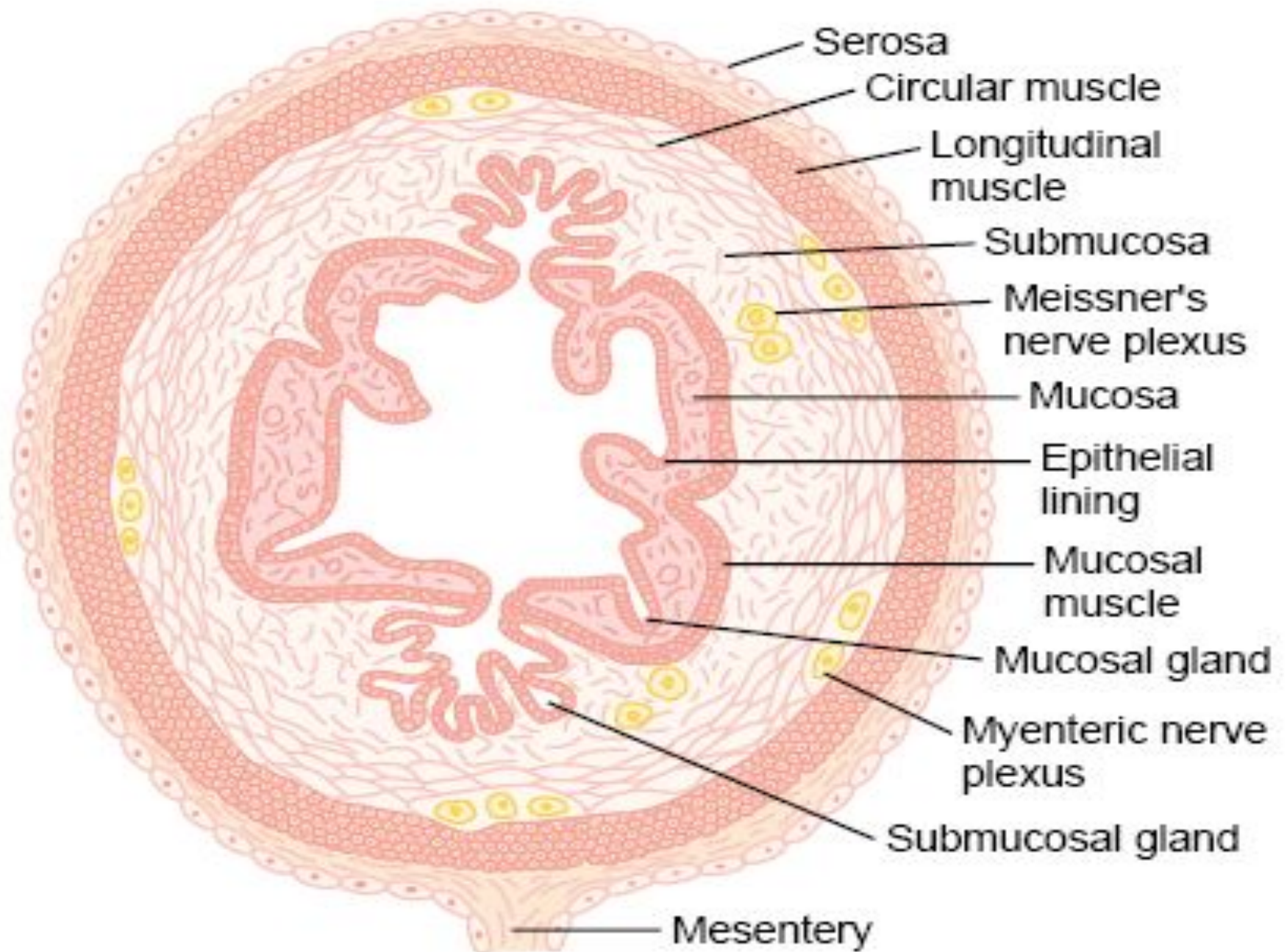
FIGURE 17-2

Four processes carried out by the gastrointestinal tract: digestion, secretion, absorption, and motility.

Organisation of structure of GIT



- From esophagus-----anus has following layers from inside outwards:
- 1. Mucous layer
- 2. Sub mucous layer
- 3. Muscle layer
- 4. Serous layer



1. Mucous layer

The lumen of GIT is lined by a mucous membrane –mucosa. It has three layers-

1. lining epithelium- in direct contact with contents of the tract

Mouth
Pharynx
esophagus
Anal canal

It is non keratinized stratified squamous epi - protective function

Stomach
intestine

Simple columnner - secretion & absorption

Rate of renewal of GI cells is rapid--- 5-7days



- **2. lamina propria-**

- Connective tissue layer containing many blood & lymphatic vessels.
- It also contains MUCOSA ASSOCIATED LYMPHOID TISSUE (MALT) – lymphoid nodules protect against infection.
- Especially present in –tonsils
 - small intestine
 - appendix
 - large intestine
- **3. muscularis mucosae** - thin layer of smooth muscle fibers throws the mucous mem into many small folds & increases surface area for digestion & absorption

2. Sub mucous layer



- It is highly vascular .
- Consists of loose connective tissue, blood vessels and lymphatics.
- Contain the **sub mucous plexus or**
- **meissner's plexus-** controls
- movements of mucosa and blood flow

3. Muscular layer



- Mouth, pharynx, up to middle part of esophagus- **skeletal muscle**– produces voluntary swallowing.
- External anal sphincter- **skeletal muscle** -voluntary control of defecation.
- Rest of GI tract consists of **smooth muscles** arranged in two layers:
 - Outer longitudinal
 - Inner circular
- Both help in local mixing and forward propulsion of the contents of GIT.
- It contains **myenteric or auerbach's plexus**

4. Serous layer



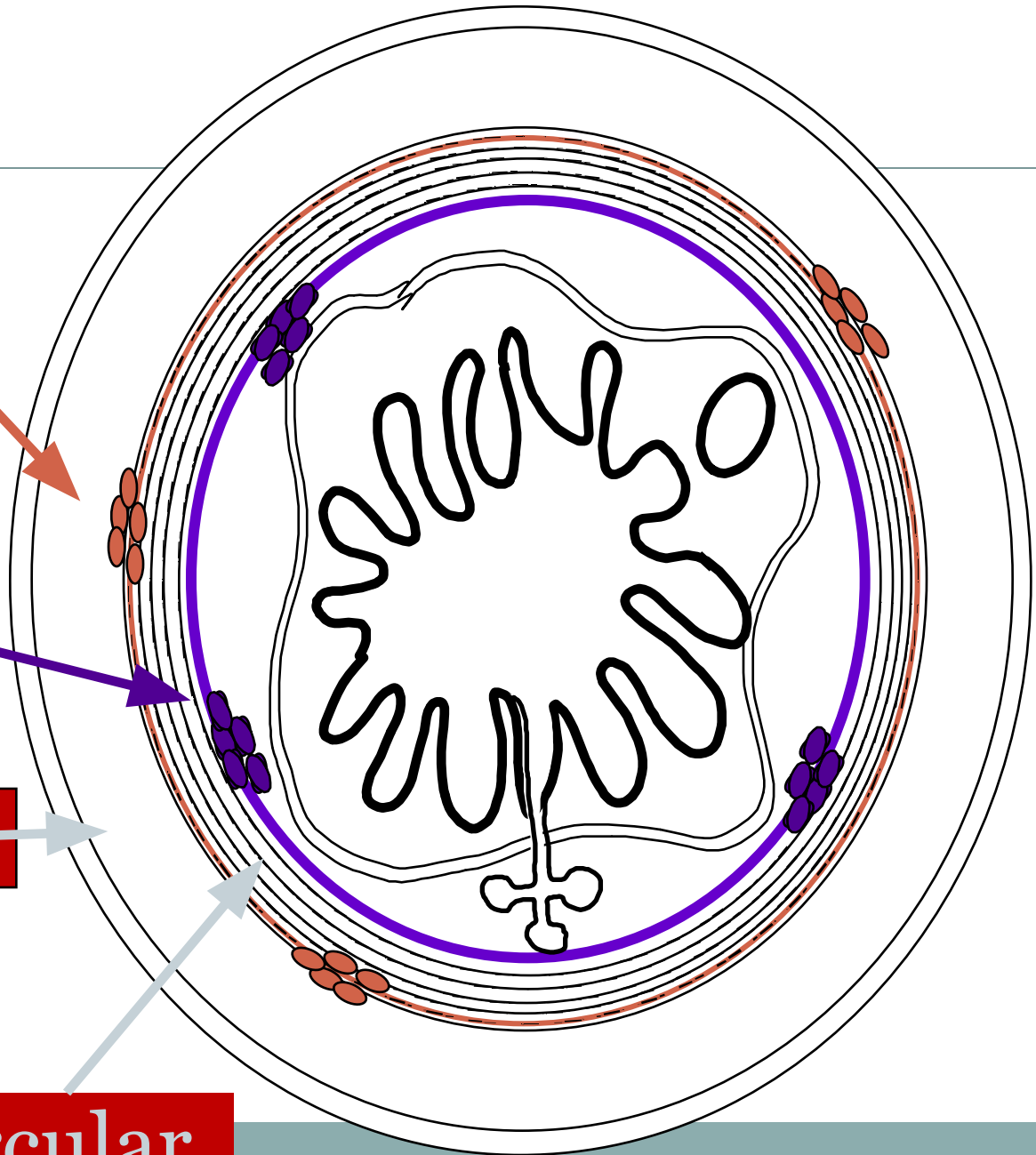
- Helps in attachment of the gut to the surrounding structures.

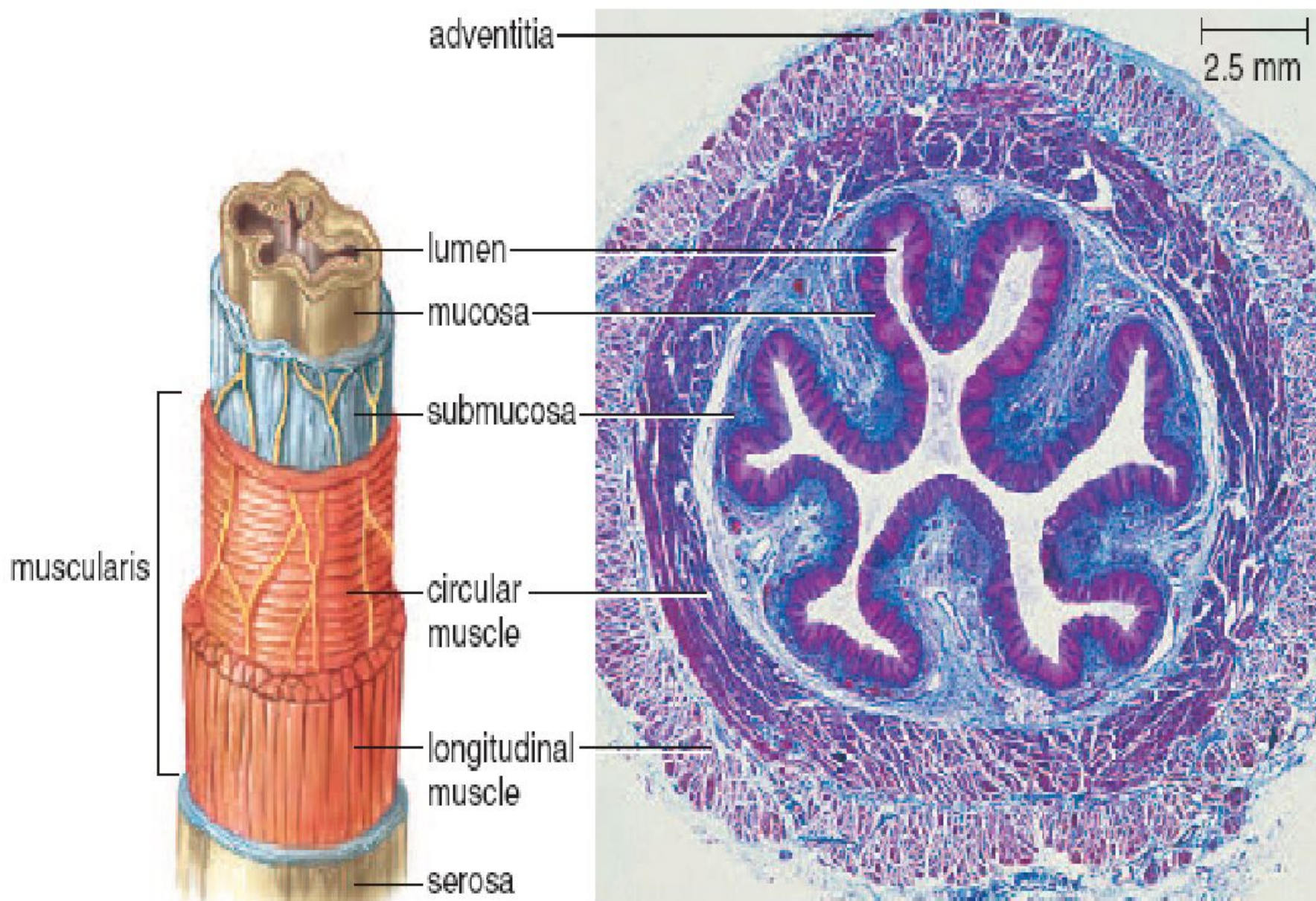
**Myenteric
plexus
(Auerbach's)**

**Submucosal
plexus
(Meissner's)**

Longitudinal

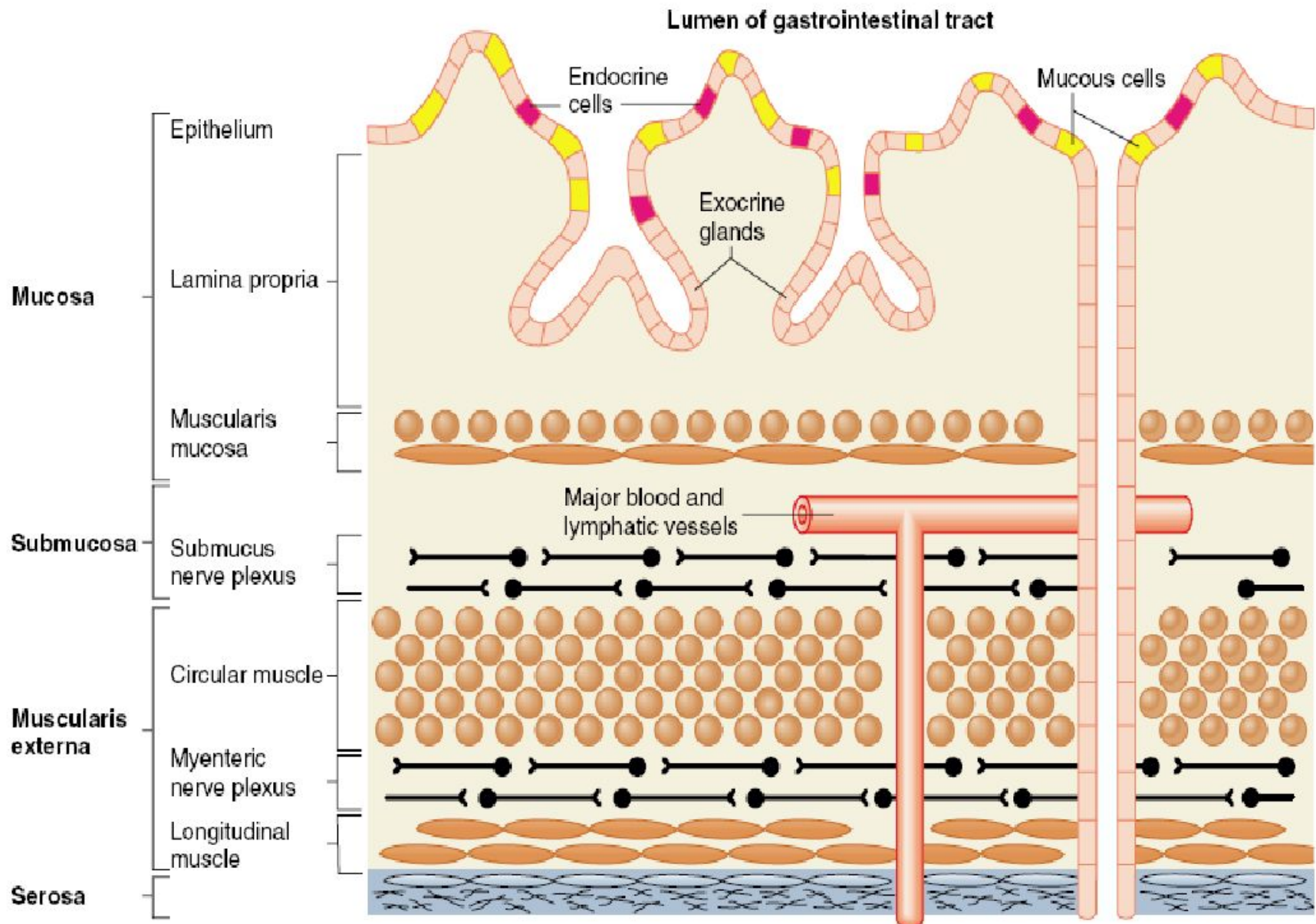
• circular





a.

b.



Innervations of GIT



- There are two major networks of nervous system that innervate the GIT:
 - INTRINSIC – Enteric nervous system
 - EXTRINSIC – from ANS

Innervation of the GI tract

1. Intrinsic nerve plexuses

Located

in the submucosa (submucosal or Meissner's plexus) and between circular and longitudinal muscle layers (myenteric or Auerbach's plexus)

Control

Motility - Myenteric plexus

Secretion - Submucosal plexus

through release of neurotransmitters

Excitatory - Acetylcholine, Substance P

Inhibitory - VIP, nitric oxide

Excitatory - Acetylcholine

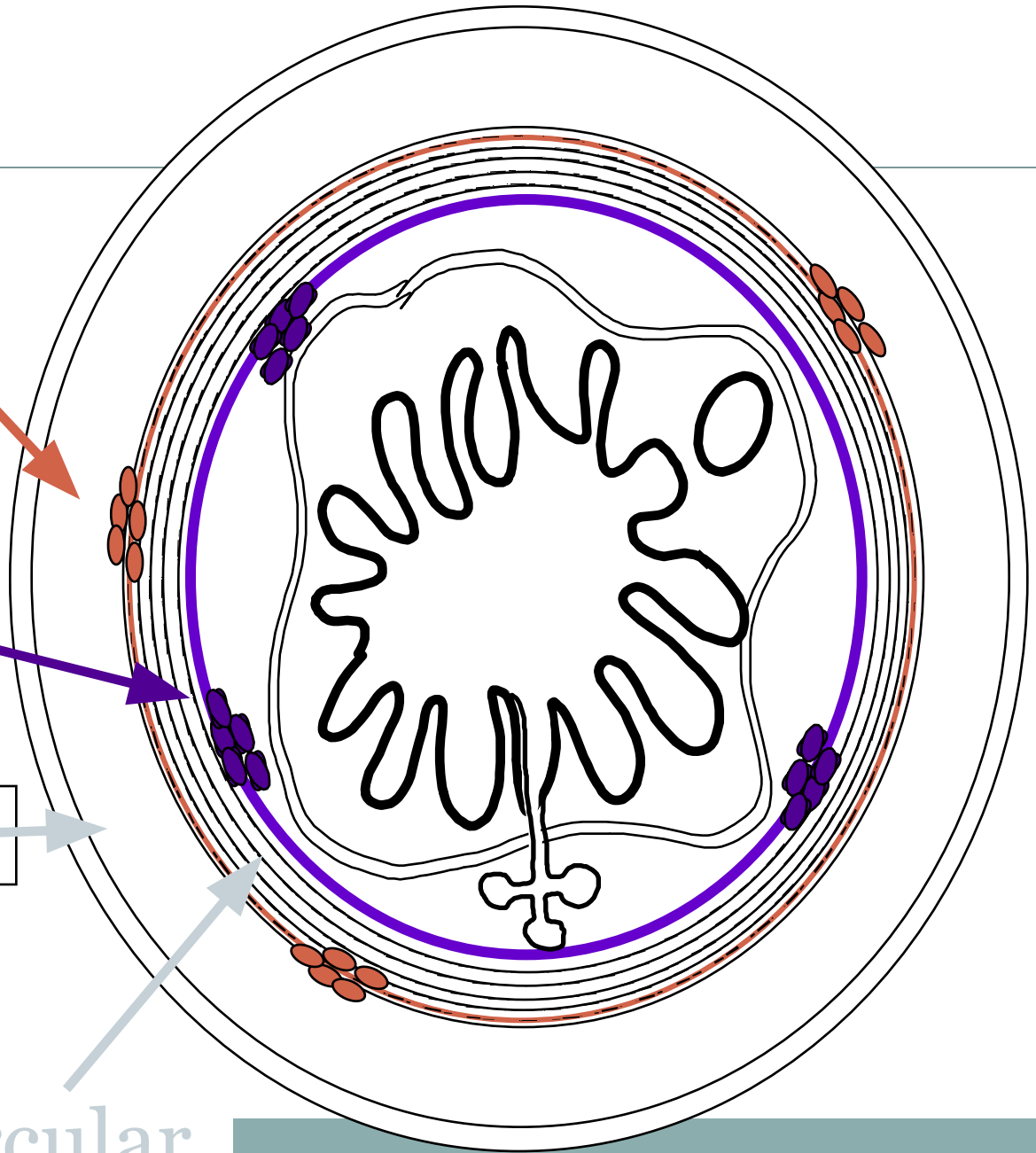
A diagram consisting of three yellow arrows pointing from the text blocks on the left to the neurotransmitter lists on the right. The top arrow points from 'Motility - Myenteric plexus' to 'Excitatory - Acetylcholine, Substance P'. The middle arrow points from 'Motility - Myenteric plexus' to 'Inhibitory - VIP, nitric oxide'. The bottom arrow points from 'Secretion - Submucosal plexus' to 'Excitatory - Acetylcholine'.

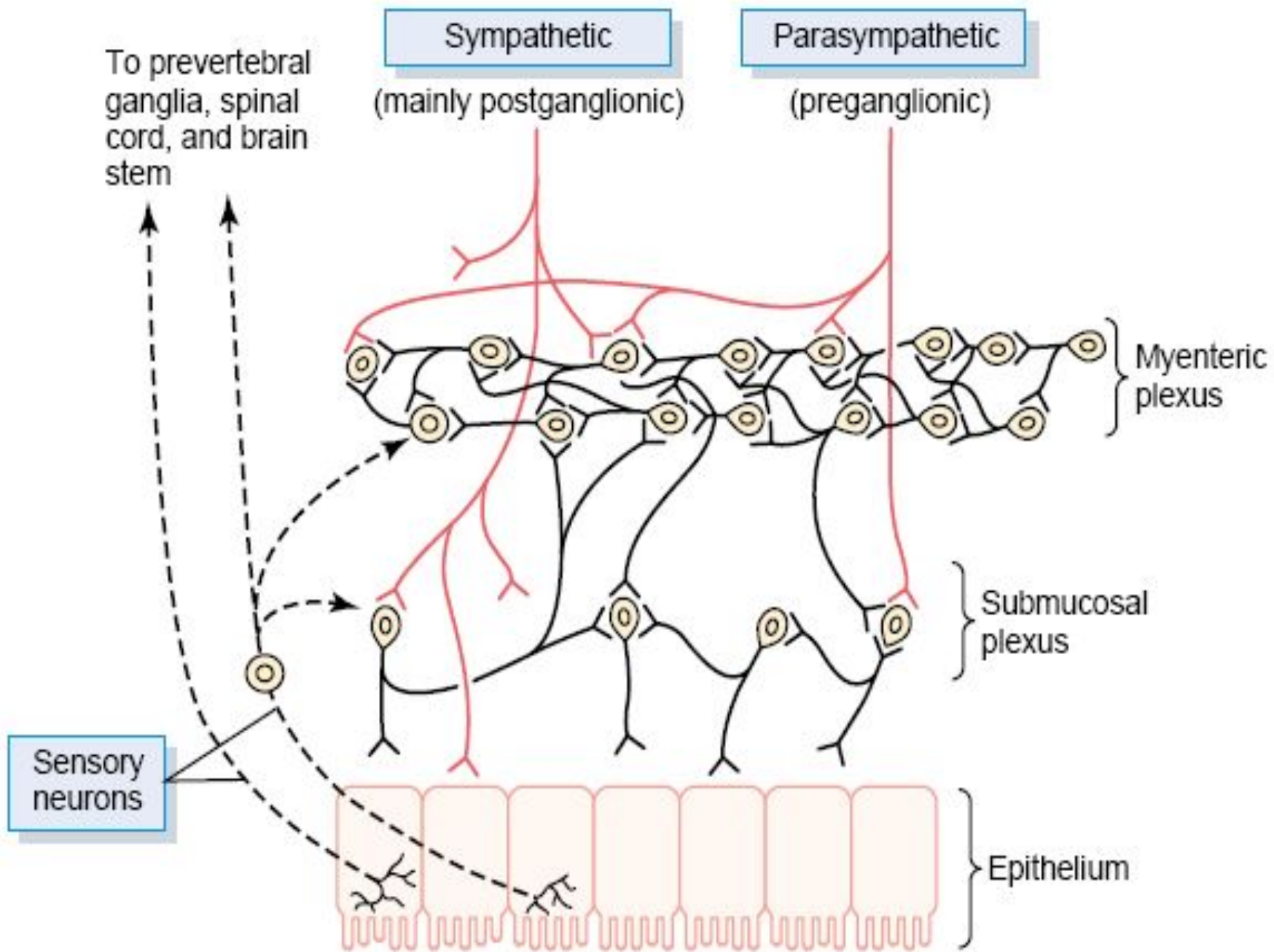
**Myenteric
plexus
(Auerbach's)**

**Submucosal
plexus
(Meissner's)**

Longitudinal

● circular





Parasympathetic innervation

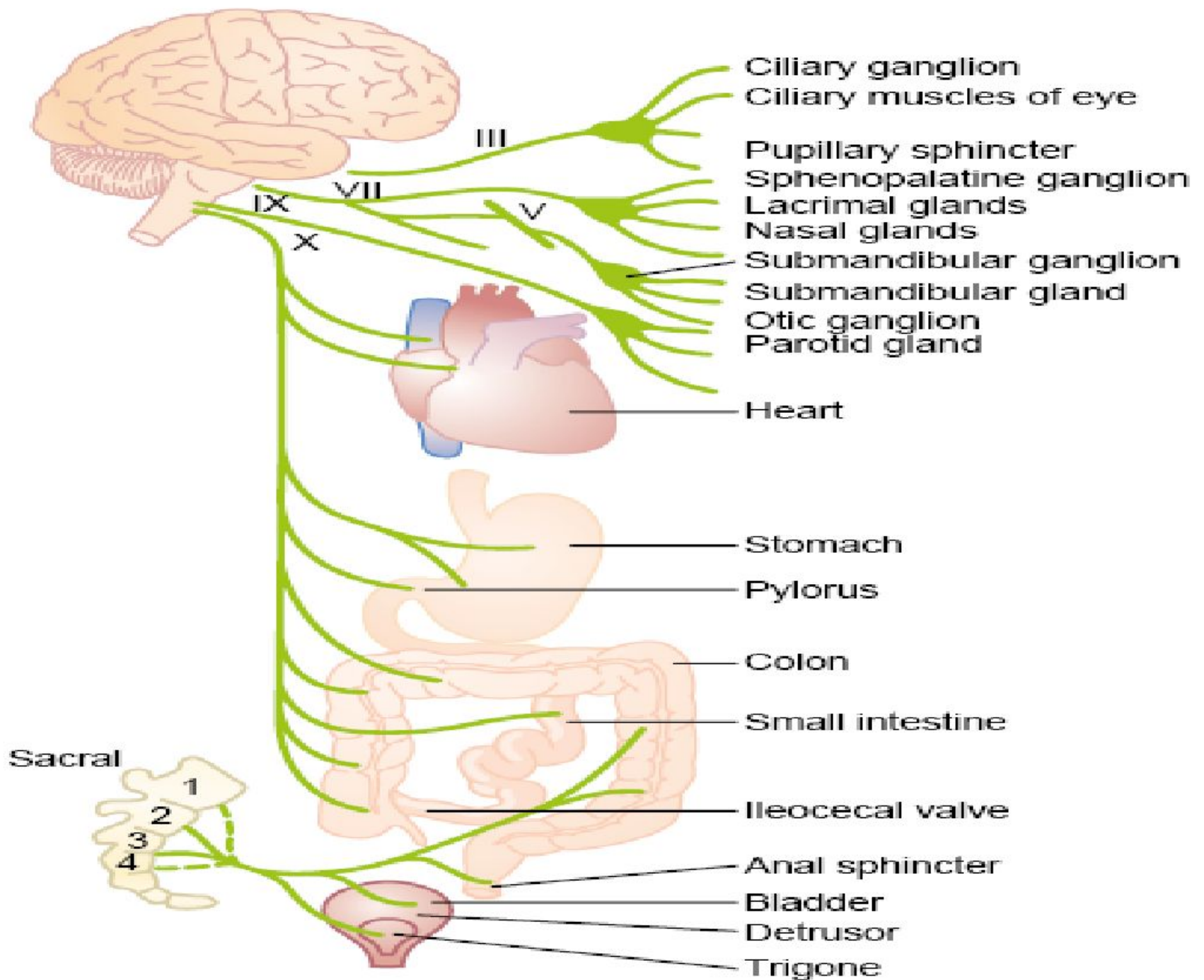


- It is divided into – cranial division
- - sacral division.
- **CRANIAL** : arises from medulla
- mouth & pharyngeal region are carried by 7th & 8TH cranial nerves.
- Esophagus, stomach, pancreas & up to first half of the LI----- are carried by vagus nerve.
- **SACRAL** : from S2,S3,S4 segment of spinal cord.
- Through pelvic nerves supply the distal half of the LI.

Innervation of the GI tract

Parasympathetic innervation

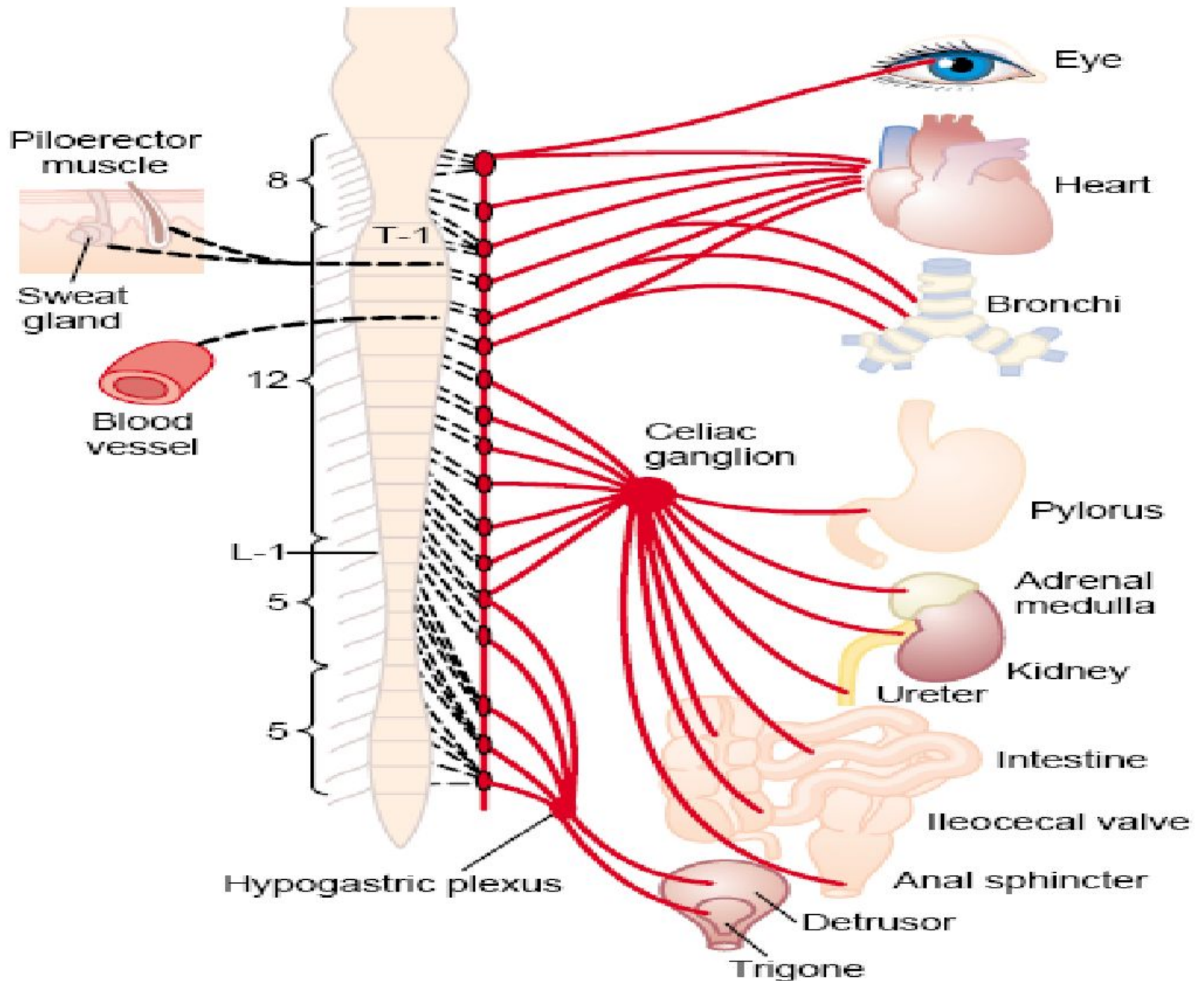
- via preganglionic fibres in vagus and pelvic nerves
- synapse on ganglionic neurons in enteric nervous system
- excitatory through release of **acetylcholine**
 - sigmoid, rectal & anal regions are better supplied with this & have function in the defecation reflex.





□ Sympathetic nervous system

- Originate from lateral horns of spinal cord b/n T5 –L2 regions.
- -Pre ganglionic fibres enter the sympathetic chain & then to the ganglia.
- inhibitory through release of noradrenaline
- postganglionic fibres from coeliac, superior and inferior mesenteric ganglia. & end on neurons in ENS.



Parasympathetic n.s

Sympathetic n.s.

Vagal nuclei
Sacral spinal cord

CNS

Preganglionic fibres

Preganglionic fibres

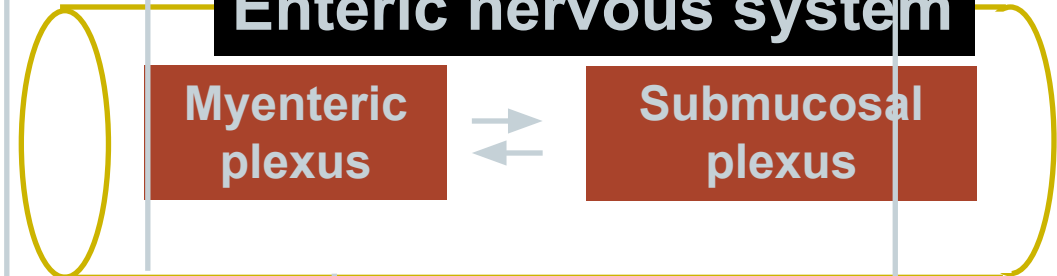
Sympathetic ganglia

Postganglionic fibres

Enteric nervous system

Myenteric plexus

Submucosal plexus



Smooth muscle

Secretory cells

Endocrine cells

Blood vessels





THANK YOU