Control Mechanism of GIT

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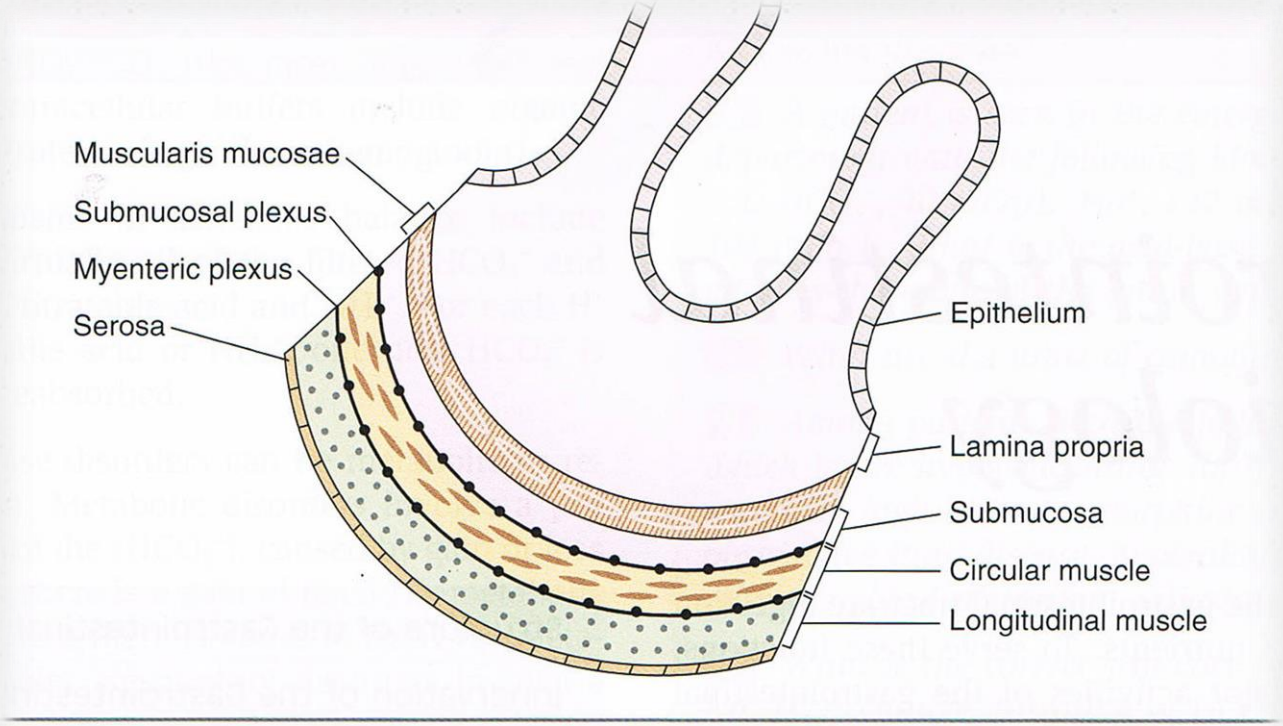
Structure of the Wall



Innervation of GIT

- ANS – Autonomic Nervous System
  - Extrinsic component
    - Sympathetic innervation
    - Parasympathetic innervation
  - Intrinsic component
    - Enteric Nervous System (ENS) ← within the plexuses ← communicates with sympathetic & parasympathetic nervous systems

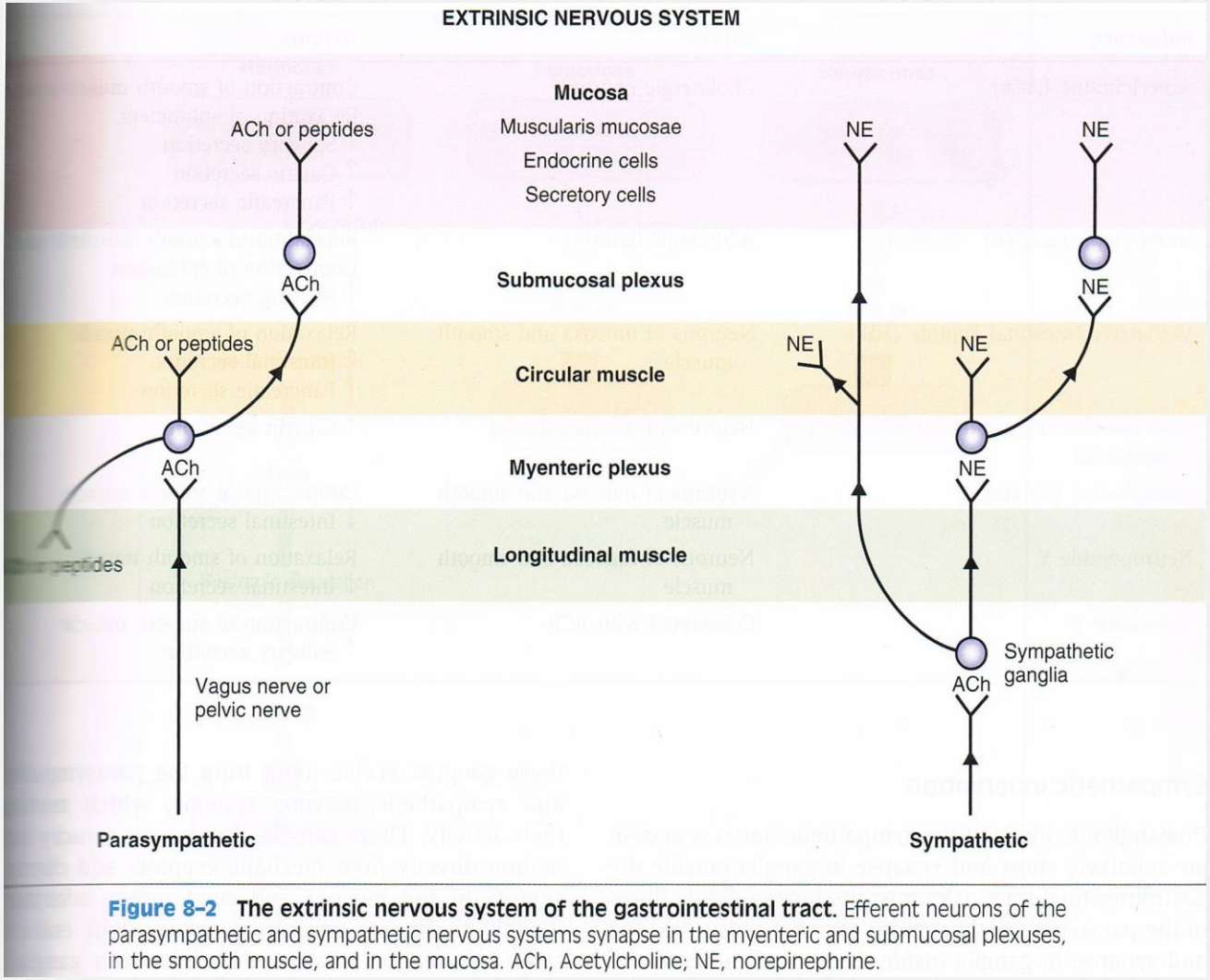


Figure 8–2 The extrinsic nervous system of the gastrointestinal tract. Efferent neurons of the parasympathetic and sympathetic nervous systems synapse in the myenteric and submucosal plexuses, in the smooth muscle, and in the mucosa. ACh, Acetylcholine; NE, norepinephrine.

Parasympathetic Innervation

- Supplied by:
  - Vagus nerve (CN X)

    Innervates the upper GIT (striated muscles Oesophagus, wall of Stomach, small intestine Ascending colon

  - Pelvic nerve

Structure of Oesophagus Wall

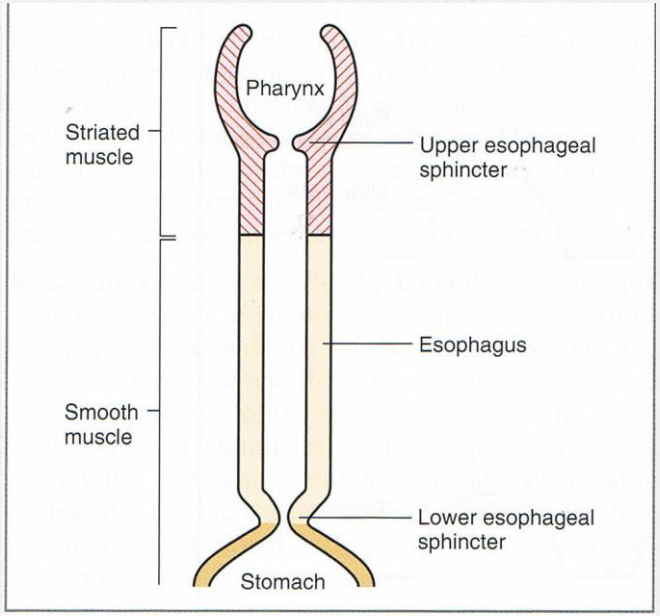


Figure 8–8 Structures of the upper gastrointestinal tract. The pharynx, upper esophageal sphincter, and upper third of the esophagus are composed of striated muscle. The lower two thirds of the esophagus and lower esophageal sphincter are composed of smooth muscle.

Cont'd

- Pelvic Nerve

  Innervates the lower GIT

  (striated muscle of external anal canal,

  Walls of transverse, descending and

  Sigmoid colons)

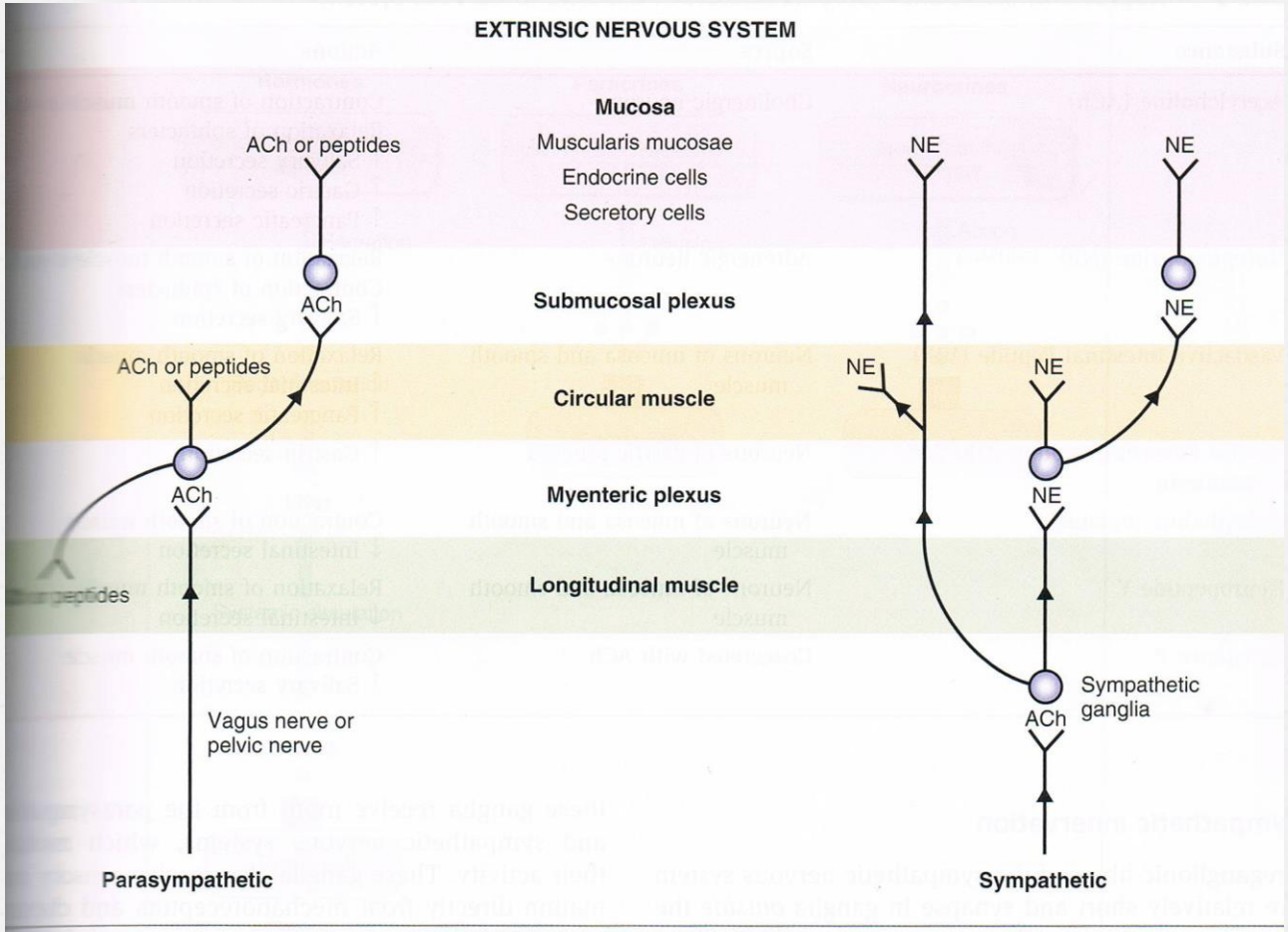
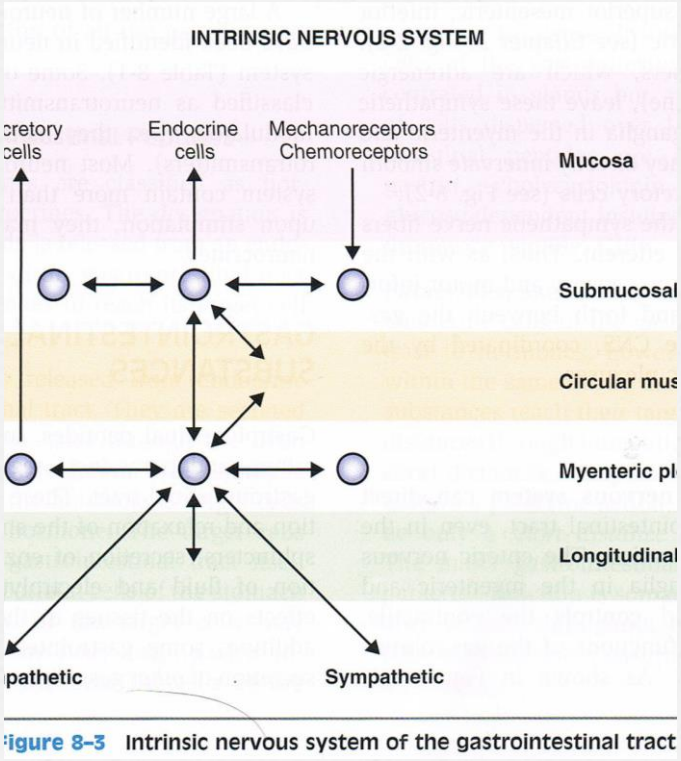
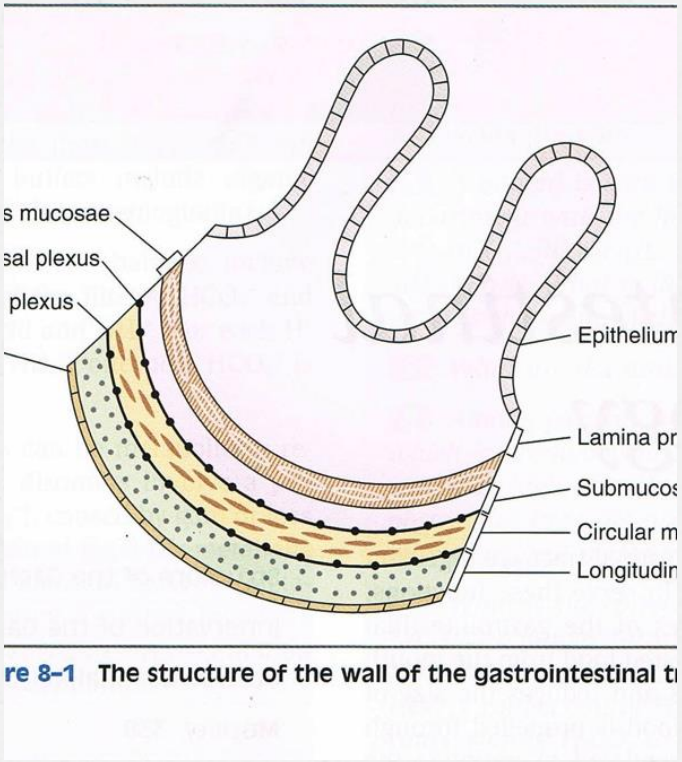


Figure 8–2 **The extrinsic nervous system of the gastrointestinal tract.** Efferent neurons of the parasympathetic and sympathetic nervous systems synapse in the myenteric and submucosal plexuses, in the smooth muscle, and in the mucosa. ACh, Acetylcholine; NE, norepinephrine.

Intrinsic Nervous System



igure 8–3 Intrinsic nervous system of the gastrointestinal tract



re 8–1 The structure of the wall of the gastrointestinal t

Enteric Nervous System (ENS)

- CAN Direct all functions of GIT
- Located in myenteric and submucosal plexuses
- Controls:
  - Contractile
  - Secretory
  - Endocrine functions

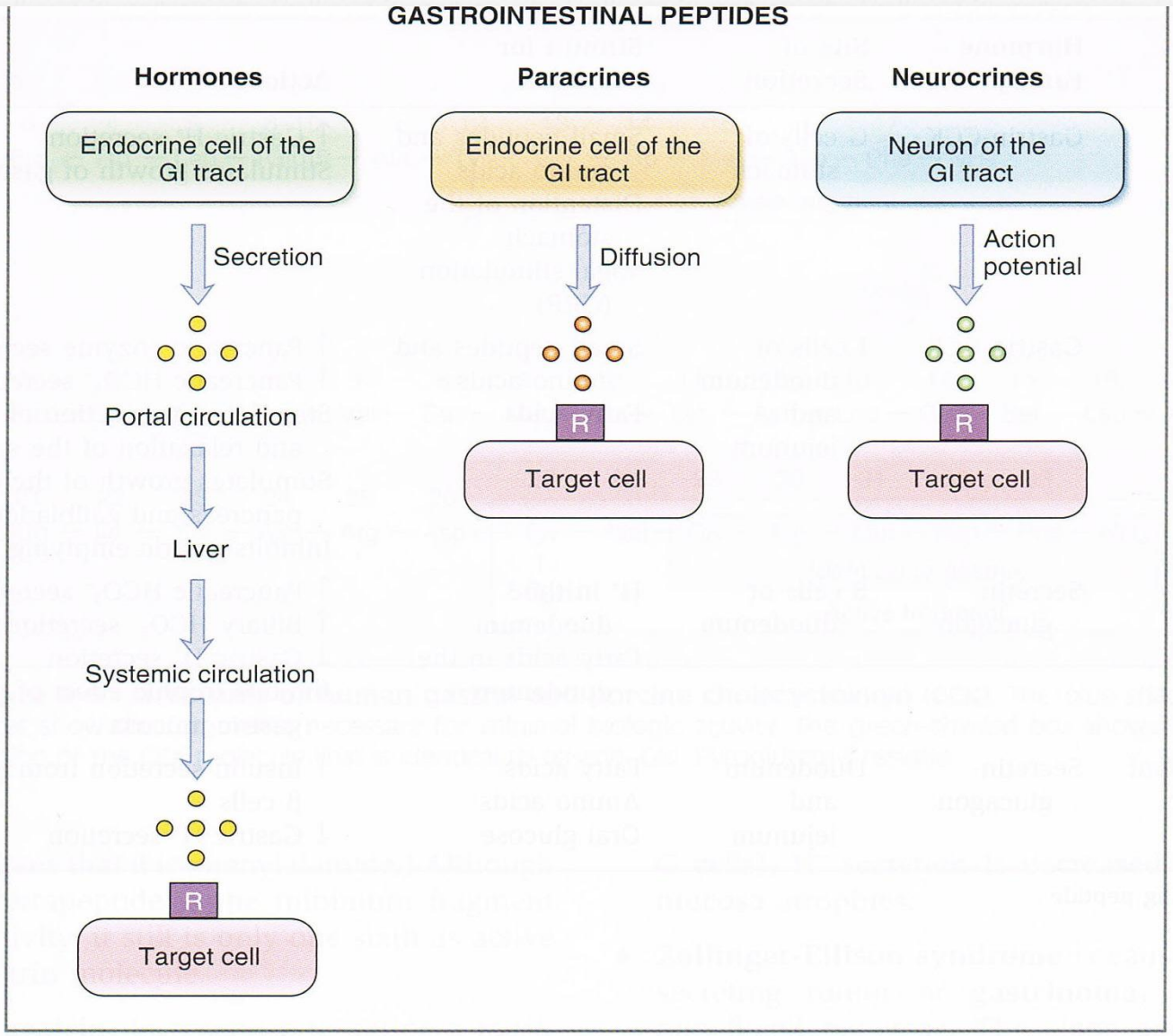
  Of GIT

Other Regulatory System

- Hormones
- Neurocrines
- Paracrines

Are peptides that regulate the function

- ✓ Contraction & Relaxation of
  - ✓ Smooth muscle wall
  - ✓ Sphincters
- ✓ Secretion of
  - ✓ Enzymes for digestion
  - ✓ Secretion of fluid and electrolytes
- ✓ Trophic (growth) effects of GI tissues
- ✓ Regulates the secretion of other GI peptides


GASTROINTESTINAL PEPTIDES
Hormones
Endocrine cell of the GI tract
Secretion
Portal circulation
Liver
Systemic circulation
R
Target cell
Paracrines
Endocrine cell of the GI tract
Diffusion
R
Target cell
Neurocrines
Neuron of the GI tract
Action potential
R
Target cell

GASTRIN Actions

- *in general*: stimulates gastric secretion & motility

1. Stimulates gastric acid secretion
2. Stimulates pepsin&intrinsic factor secretion by the stomach
3. Stimulates growth of gastric & intestinal mucosa (‘thropic action’)
4. Increase the tone of musculature of the LOS,stomach & small intestine
5. Stimulates insulin and glucagon secretion (after a protein meal)
6. Stimulates calcitonin secretion

CCK-PZ Actions

1. Contraction of gall bladder (→ cholecystokinin?)
2. Secretion of pancreatic juice rich in enzyme (→ pancreaozymin?)]
3. Augments the actions of secretin in producing an alkaline pancreatic juice
4. Increases the secretion of enterokinase from intestinal mucosa
5. Exert trophic effect on the pancreas
6. Inhibit gastric emptying
7. May enhance the motility of the small intestine and colon
8. Along with secretin, it augments the contraction of pyloric sphincter
9. Together with gastrin, stimulates glucagon secretion

SECRETIN Actions

1. Stimulates bicarbonate rich-watery alkaline pancreatic juice by increasing bicarbonate secretion of biliary tract
2. Increases bicarbonate secretion of biliary tract
3. Augments the action of CCK-PZ in producing pancreatic secretion of digestive enzymes
4. Decreases gastric acid secretion
5. May cause contraction of the pyloric sphincter
6. Increases insulin secretion; but inhibits glucagon secretion

Table 24.3 Functions of the Gastrointestinal Hormones

Site of Production	Method of Stimulation	Secretory Effects	Motility Effects
Gastrin			
Stomach and duodenum	Distention; partially digested proteins, autonomic stimulation, ingestion of alcohol or caffeine	Increases gastric secretion	Increases gastric emptying by increasing stomach motility and relaxing the pyloric sphincter
Secretin			
Duodenum	Acidity of chyme	Inhibits gastric secretion; stimulates pancreatic secretions high in bicarbonate ions; increases the rate of bile and increases intestinal secretion; mucus secretion	Decreases gastric motility
Cholecystokinin			
Intestine	Fatty acids and other lipids	Slightly inhibits gastric secretion; stimulates pancreatic secretions high in digestive enzymes; and causes contraction of the gallbladder and relaxation of the hepatopancreatic ampullar sphincter	Decreases gastric motility
Gastric Inhibitory Polypeptide			
Duodenum and proximal jejunum	Fatty acids and other lipids	Inhibits gastric secretions	Decreases gastric motility

Paracrines

- Synthesized in endocrine cells
- Do not enter the systemic circulation
- Act locally
- Reaching target cells by diffusing over short distance

- Somatostatin

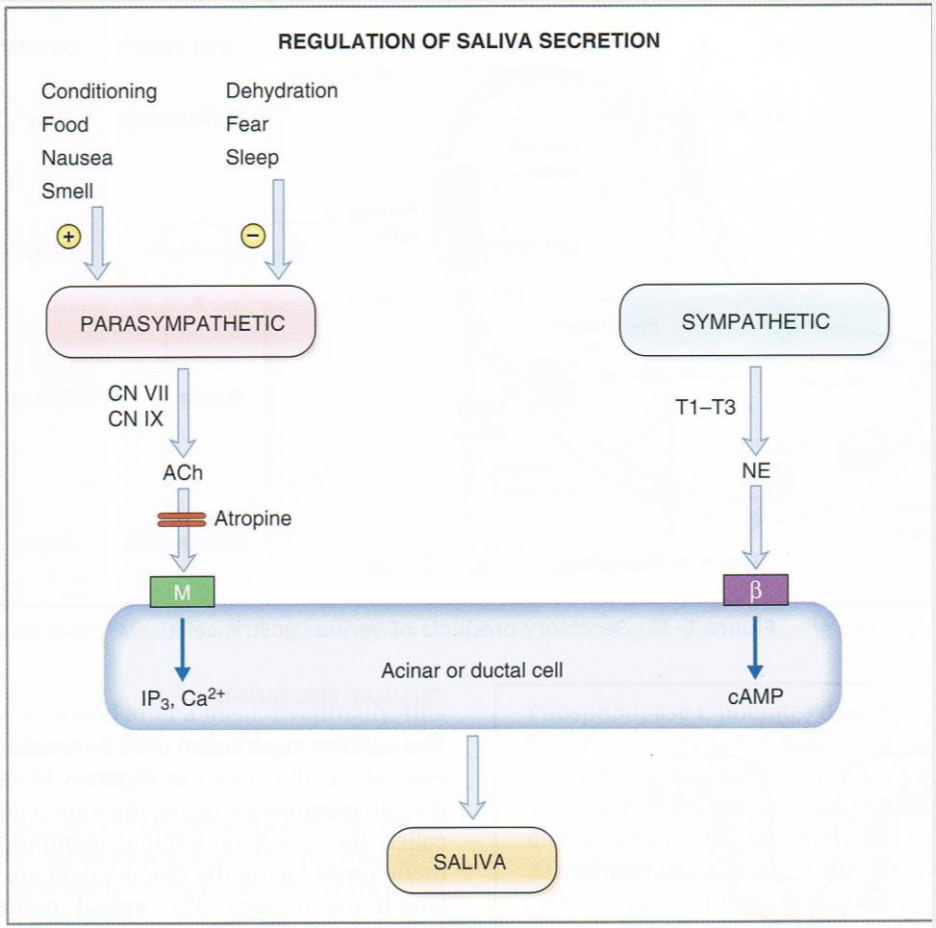
Secreted by D cells in response to decreased luminal pH

- Histamine

Secreted by endocrine-type of GI mucosa (Antrum), stimulates H+ secretion

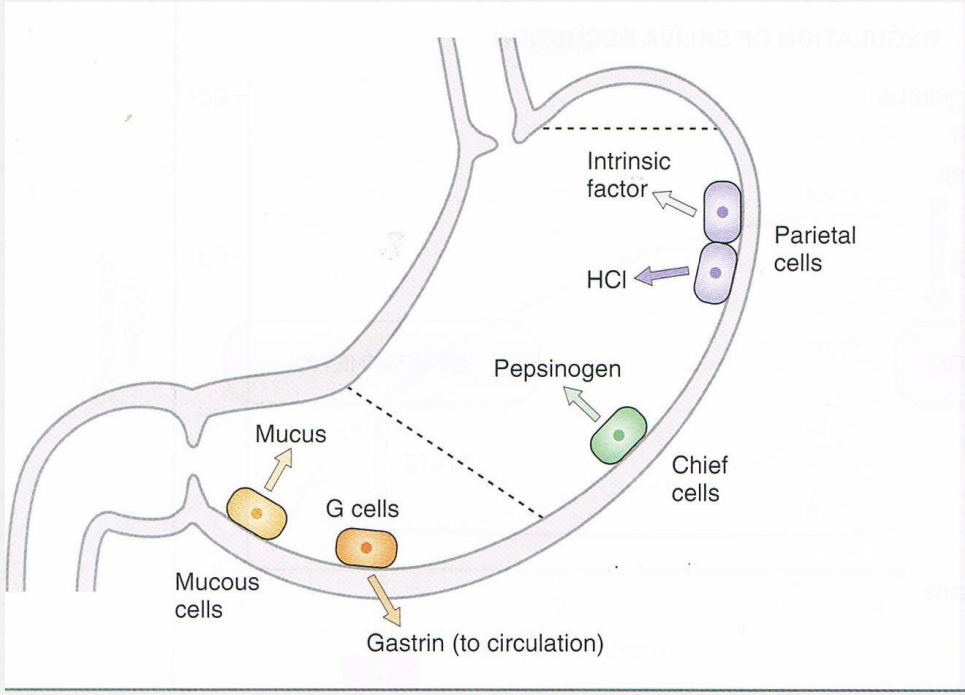
Neurocrines

- Synthesized in cell bodies of GI neurons
  - Ach
  - NE
  - Peptides: VIP GRP enkephalins, NPY, substance P



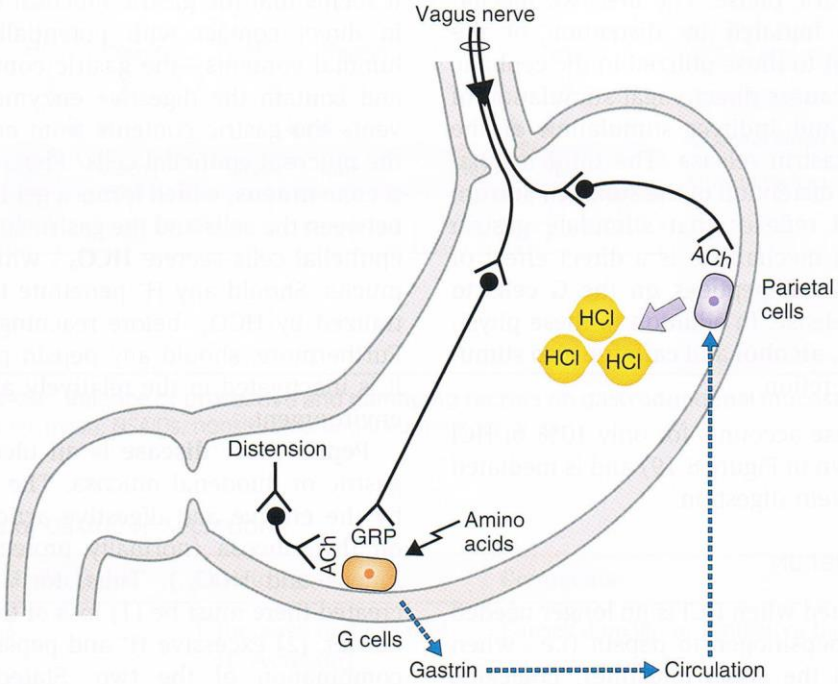
ure 8–14 Regulation of salivary secretion by the autonomic nervous system. ACh, Ac
line; β, β receptor; cAMP, cyclic adenosine monophosphate; CN, cranial nerve; M, muscarinic recep
norepinephrine; T1–T3, thoracic segments.

Products of Gastric Cells



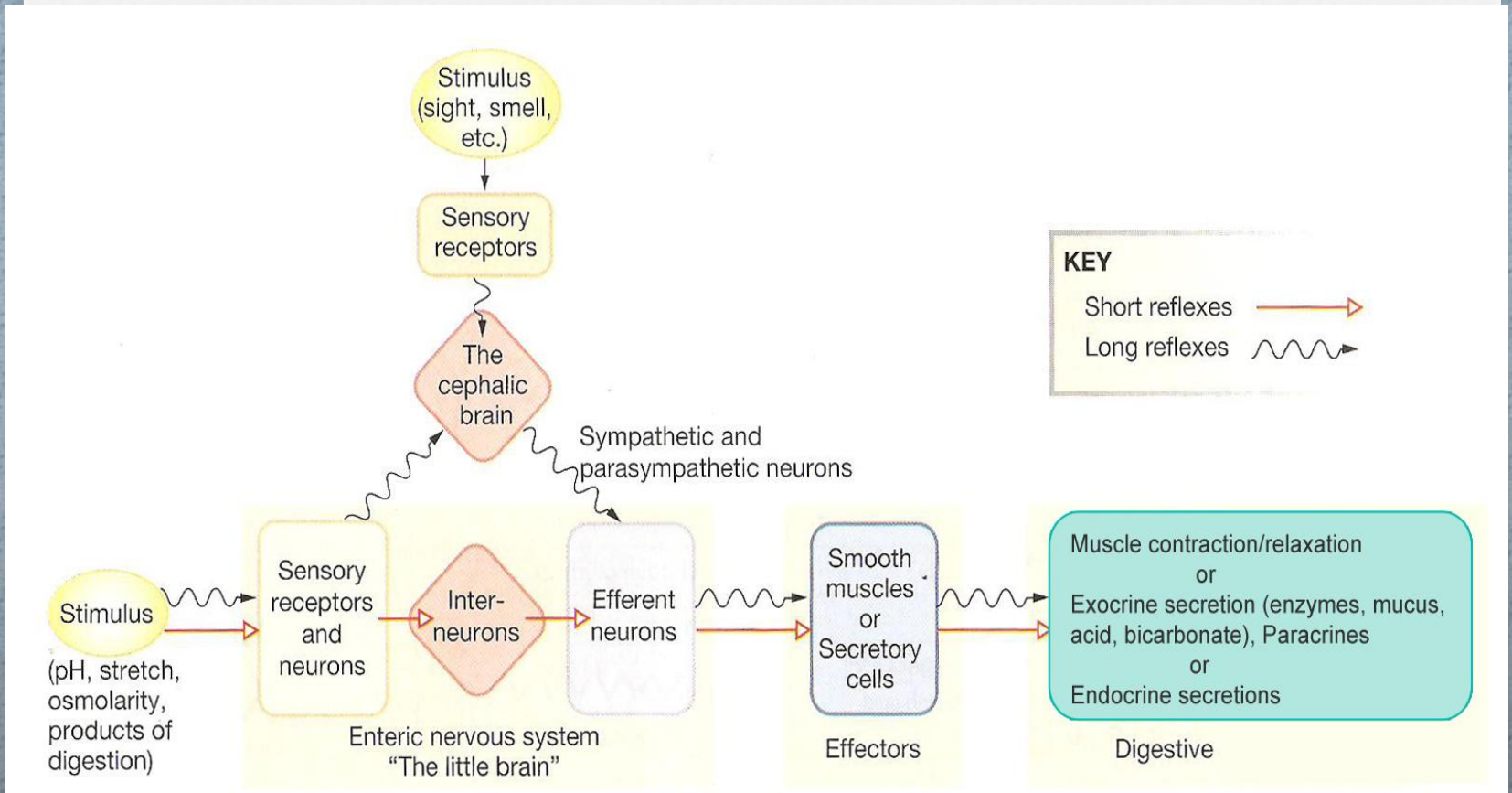
Cell Type	Location	Secretion
Parietal cells	Body	HCl Intrinsic factor
Chief cells	Body	Pepsinogen
G cells	Antrum	Gastrin
Mucous cells	Antrum	Mucus Pepsinogen

REGULATION OF HCl SECRETION



Phase	% of HCl Secretion	Stimuli	Mechanisms
Cephalic	30%	Smell, taste, conditioning	Vagus → parietal cell Vagus → gastrin → parietal cell
Gastric	60%	Distension	Vagus → parietal cell Vagus → gastrin → parietal cell
		Distension of antrum	Local reflex → gastrin → parietal cell
		Amino acids, small peptides	Gastrin → parietal cell

Figure 8–19 Regulation of HCl secretion during cephalic and gastric phases. ACh, Acetylcholine; GRP, gastrin-releasing peptide (bombesin).


Stimulus (sight, smell, etc.)
Sensory receptors
The cephalic brain
Sympathetic and parasympathetic neurons
KEY
Short reflexes
Long reflexes
Stimulus
(pH, stretch, osmolarity, products of digestion)
Sensory receptors and neurons
Inter-neurons
Efferent neurons
Enteric nervous system
"The little brain"
Smooth muscles or Secretory cells
Effectors
Muscle contraction/relaxation
or
Exocrine secretion (enzymes, mucus, acid, bicarbonate), Paracrines
or
Endocrine secretions
Digestive

Enjoy this Block!