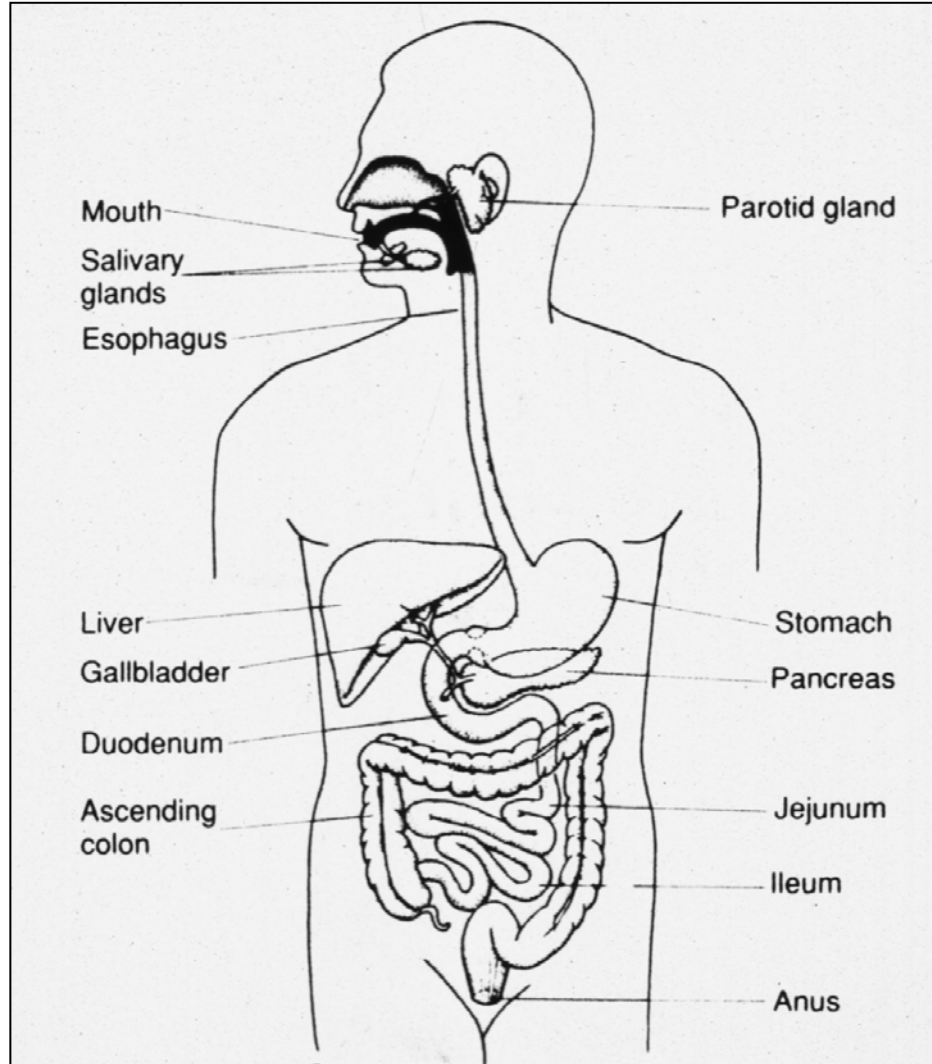


Overview of Gastrointestinal Function

George N. DeMartino, Ph.D.

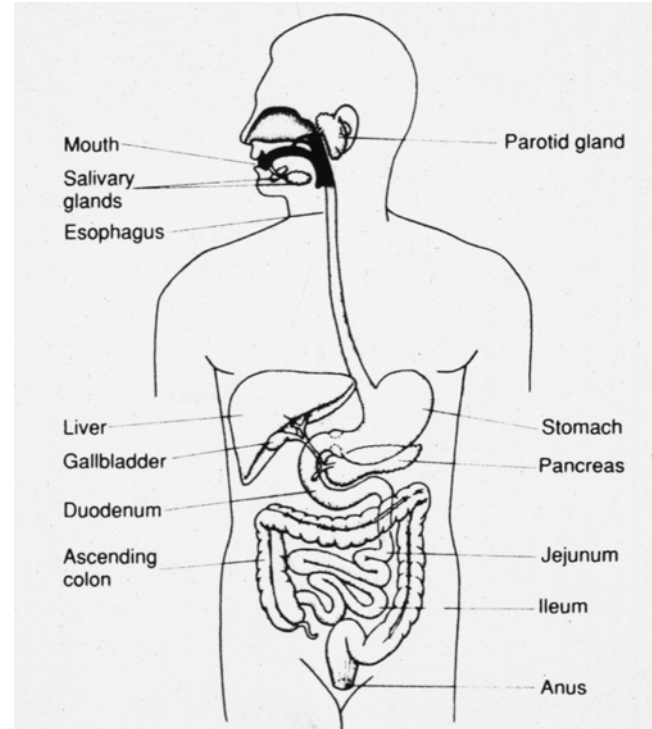
**Department of Physiology
University of Texas Southwestern Medical Center
Dallas, TX 75390**

The gastrointestinal system



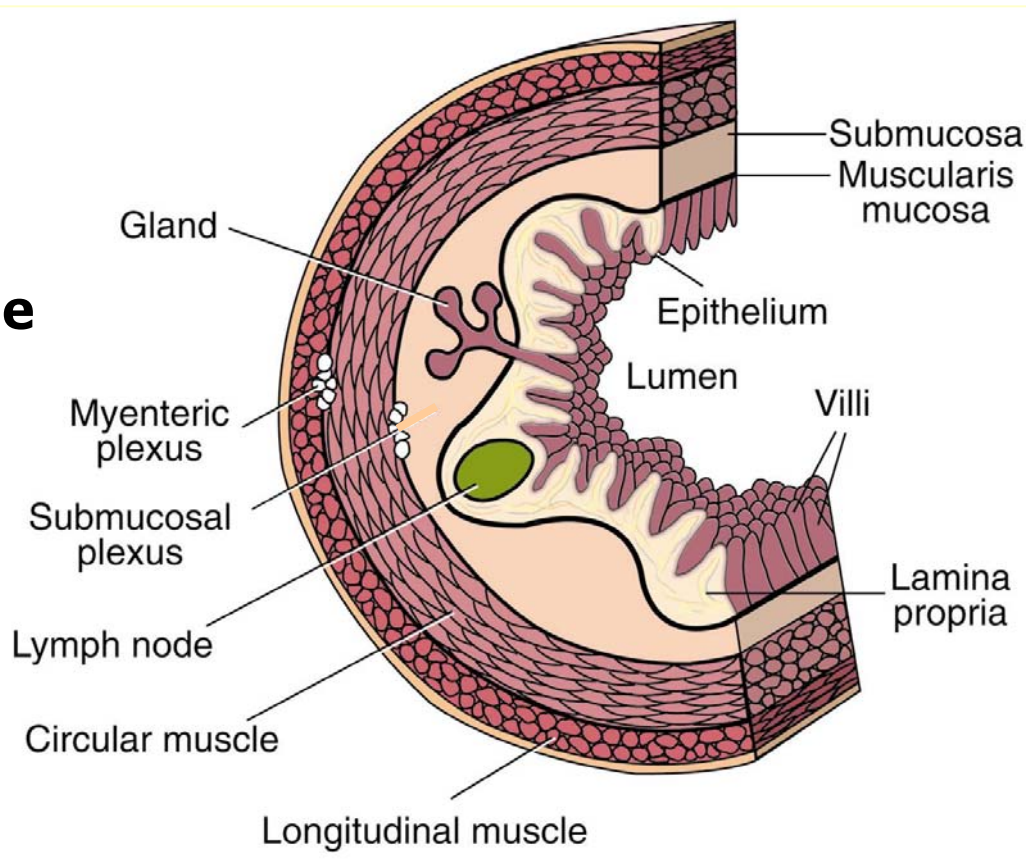
Functions of the gastrointestinal system

- **Digestion**
- **Absorption**
- **Secretion**
- **Motility**
- **Immune surveillance and tolerance**



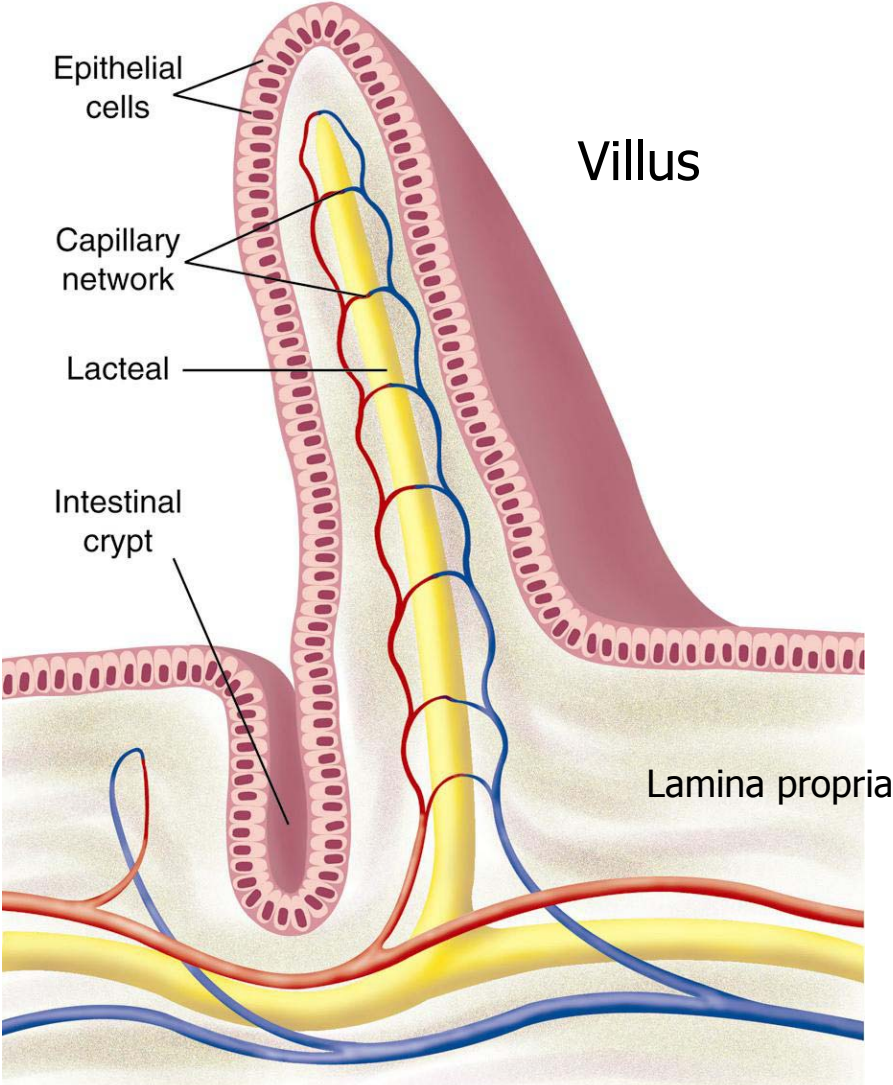
Histology of the GI tract

**Blood
or
Serosal Side**

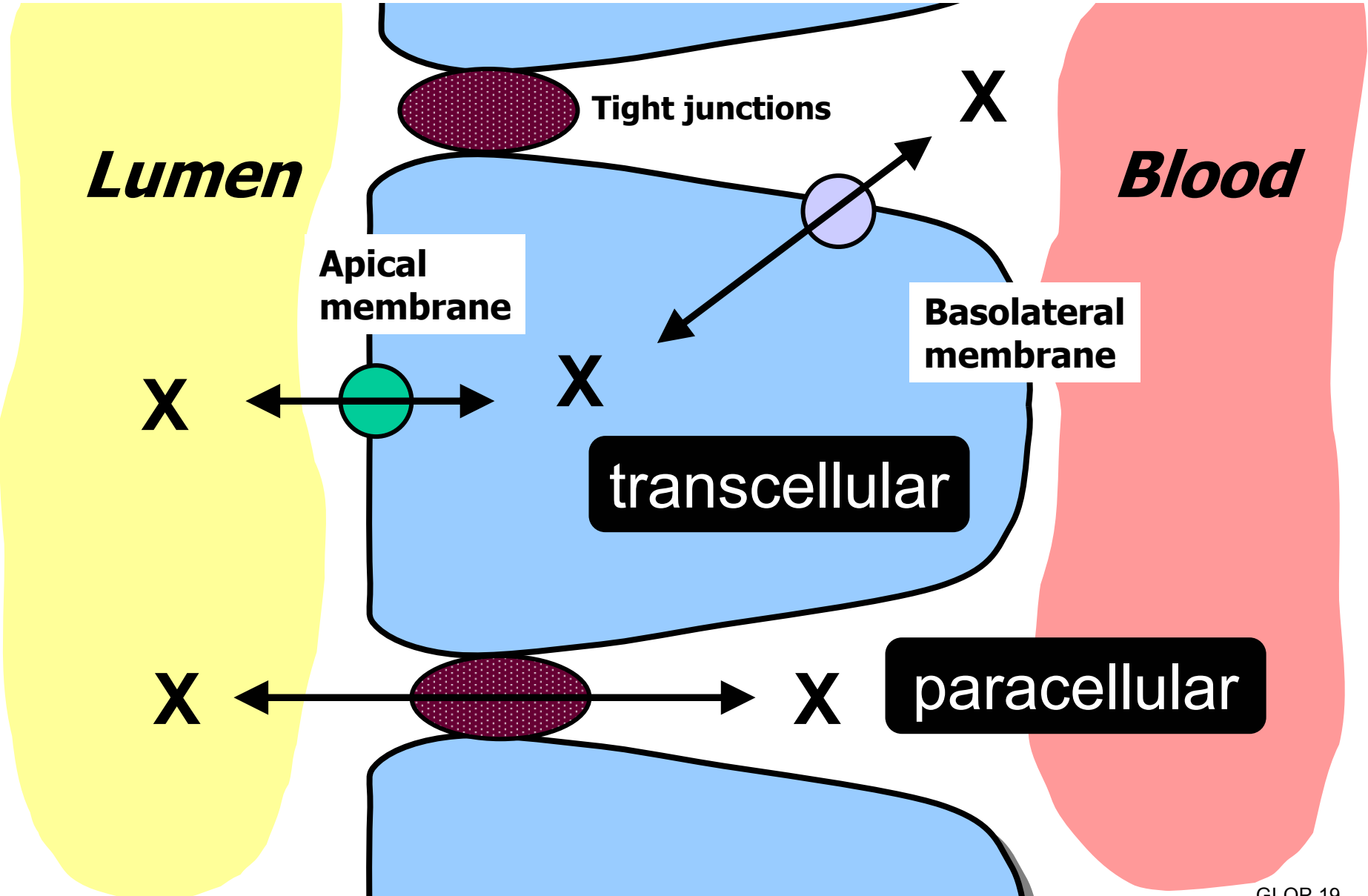


**Luminal
or
Mucosal Side**

Structure of a villus

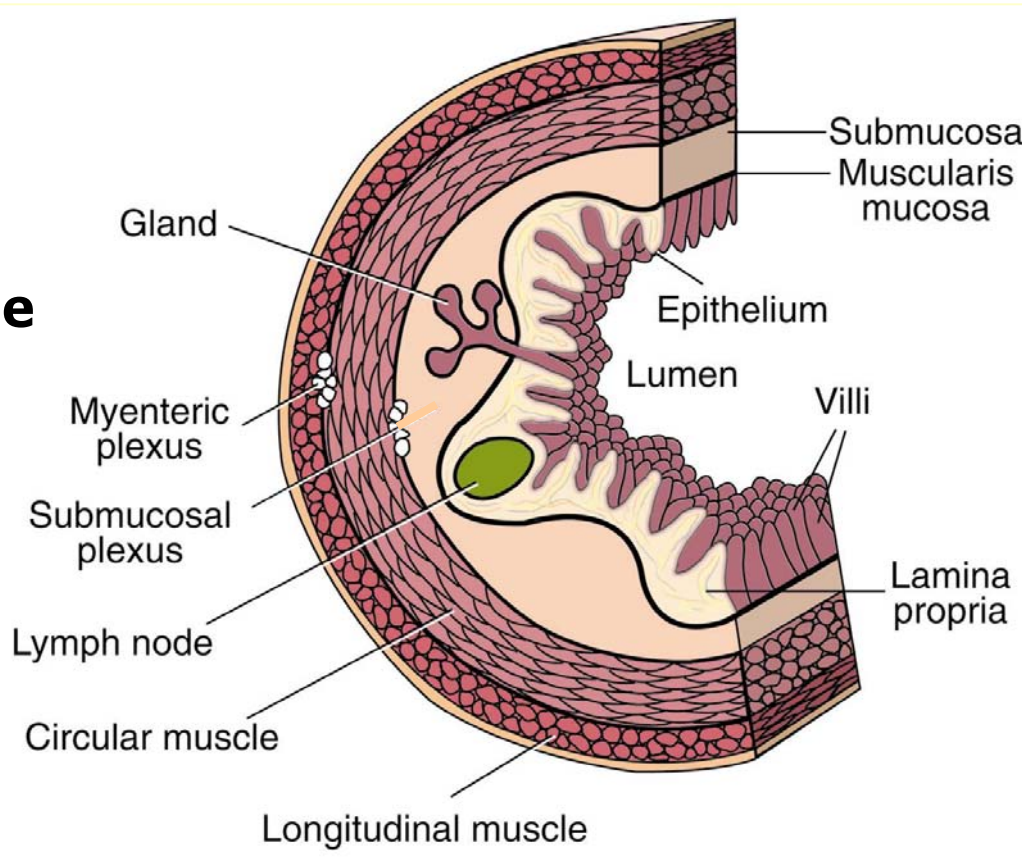


Movement of substances across the epithelial layer



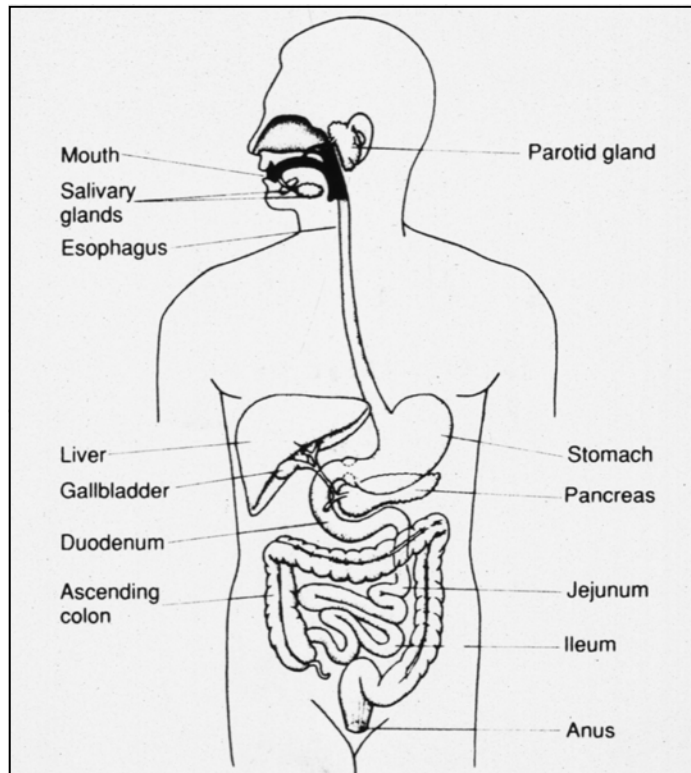
Histology of the GI tract

**Blood
or
Serosal Side**



**Luminal
or
Mucosal Side**

Motility in the gastrointestinal system



- **Propulsion**
net movement by peristalsis
- **Mixing**
for digestion and absorption
- **Separation**
sphincters
- **Storage**
decreased pressure

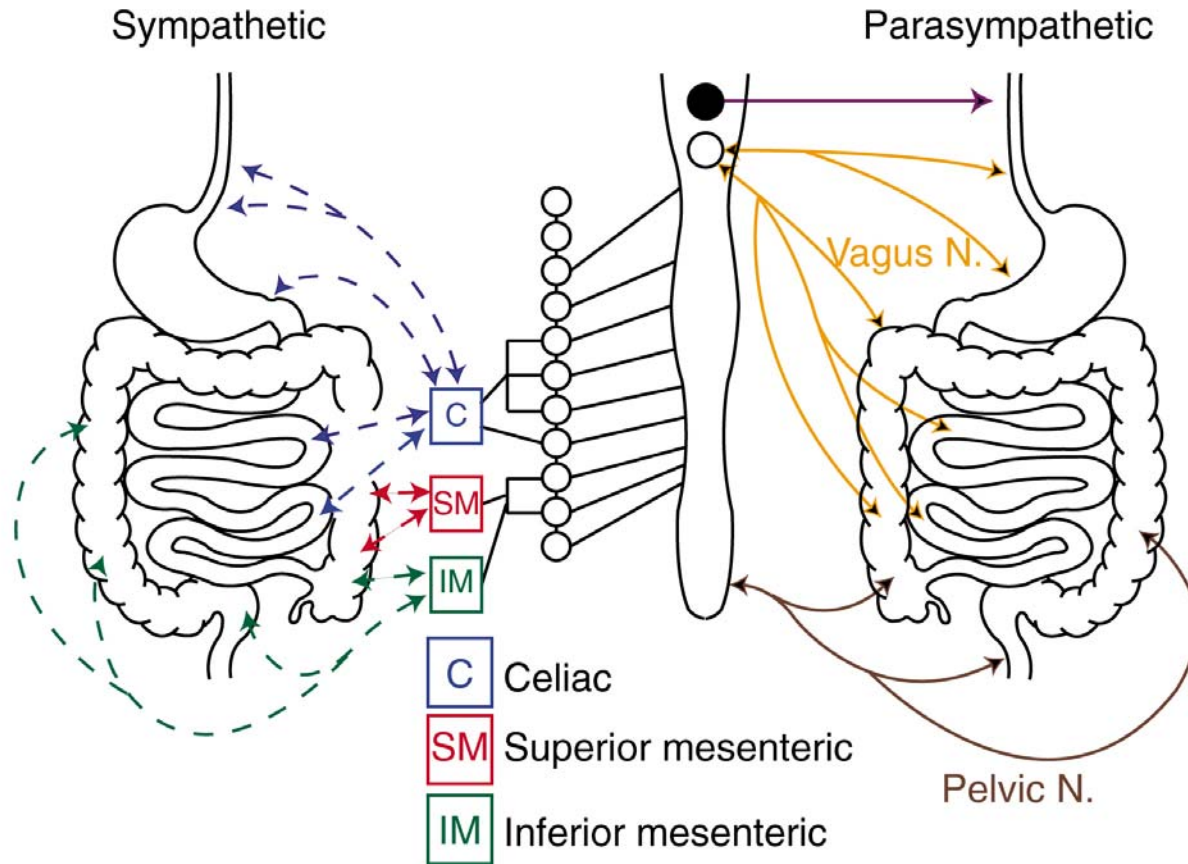
Intercellular signaling in the gastrointestinal system

- **Neural**
- **Hormonal**
- **Paracrine**

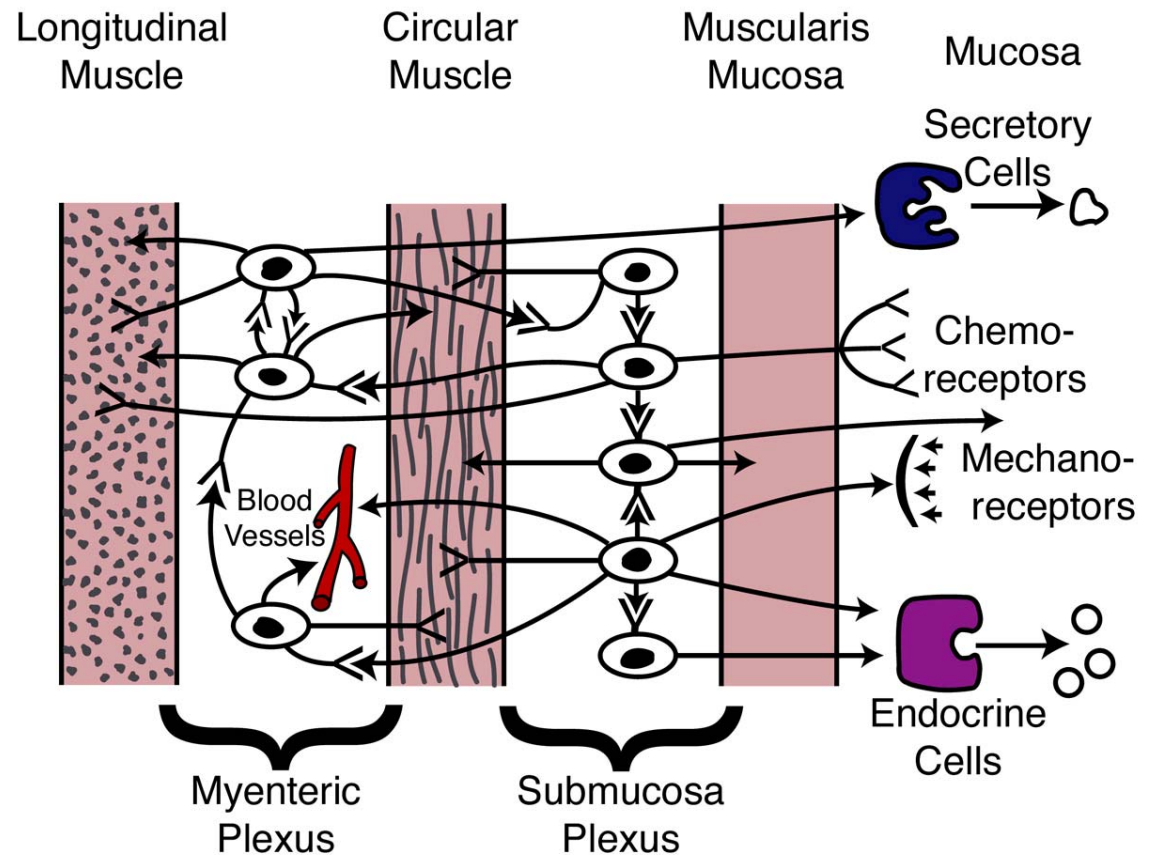
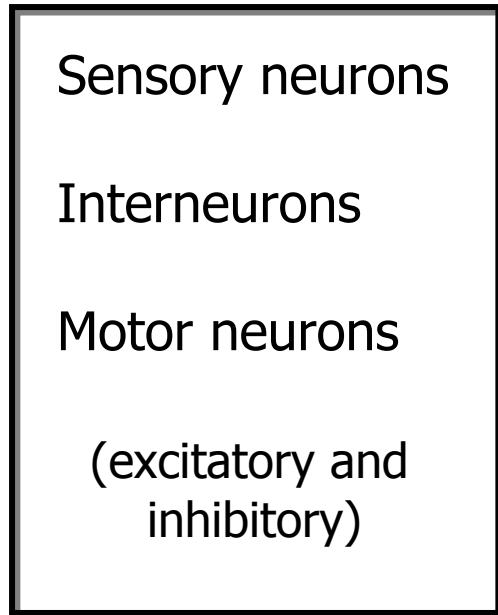
Neural control of the GI system

- **Extrinsic nervous system**
autonomic central nervous system
- **Intrinsic (enteric) nervous system**
entirely within the GI system

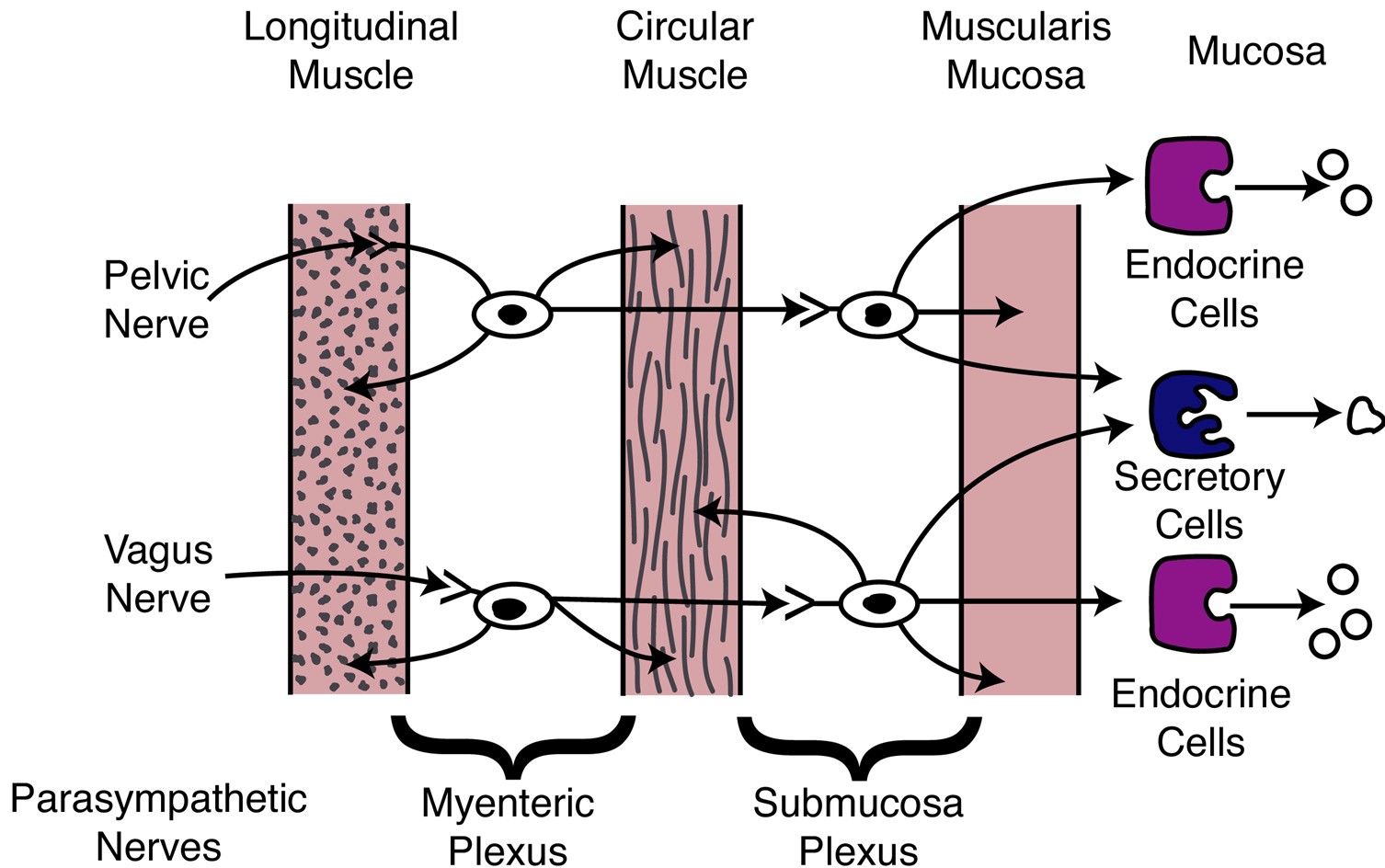
The extrinsic nervous system



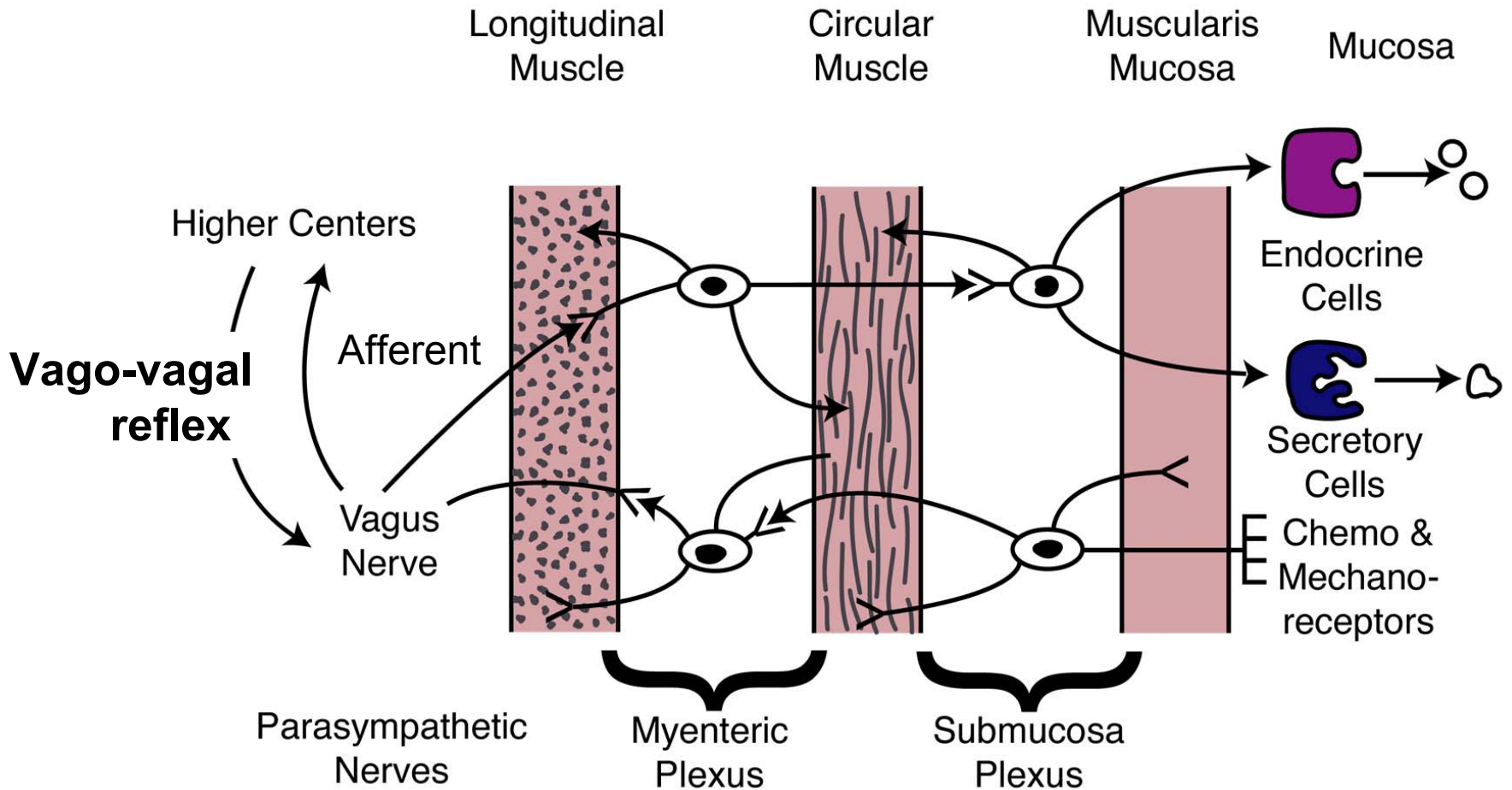
The intrinsic nervous system forms complete functional circuits



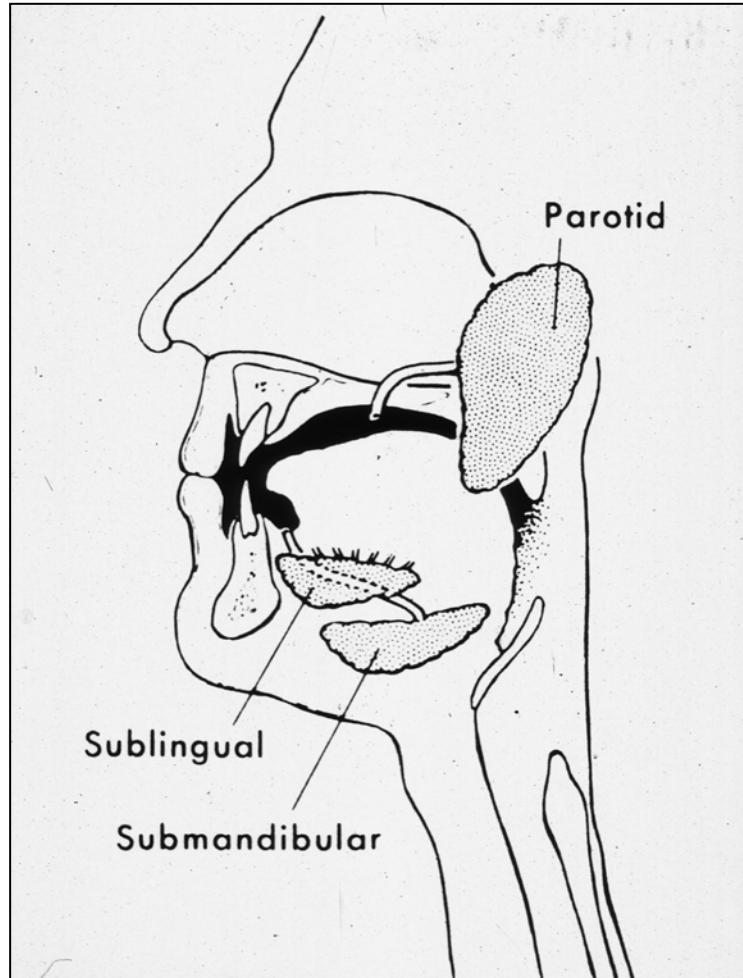
Parasympathetic nerves regulate functions of the intrinsic nervous system



Reflex control of gastrointestinal functions



Salivary Glands



Composition of Saliva

- **Proteins**

α -amylase *lactoferrin*

lipase *RNase*

lysozyme *et al*

mucus

- **Electrolyte solution**

water

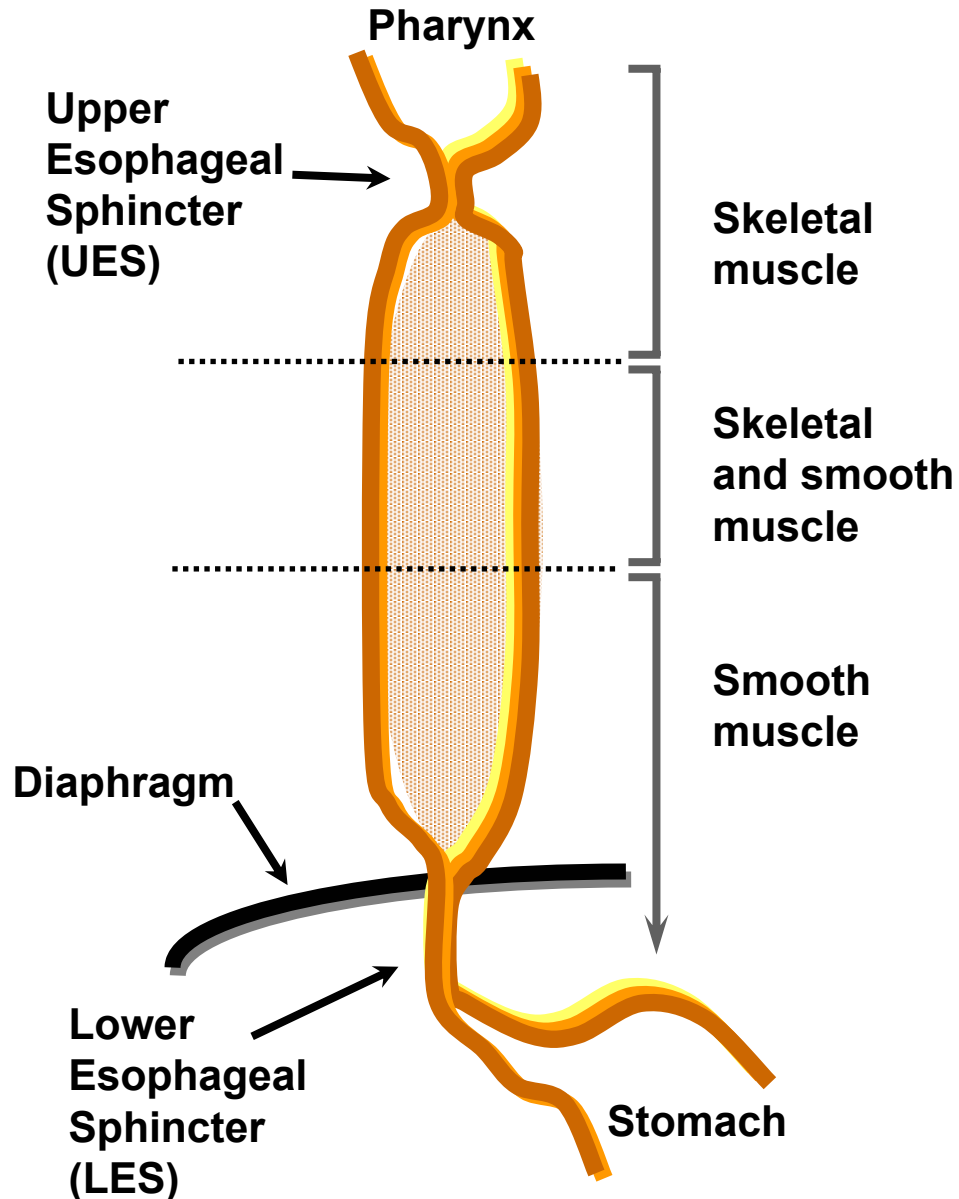
Na^+ , K^+

HCO_3^-

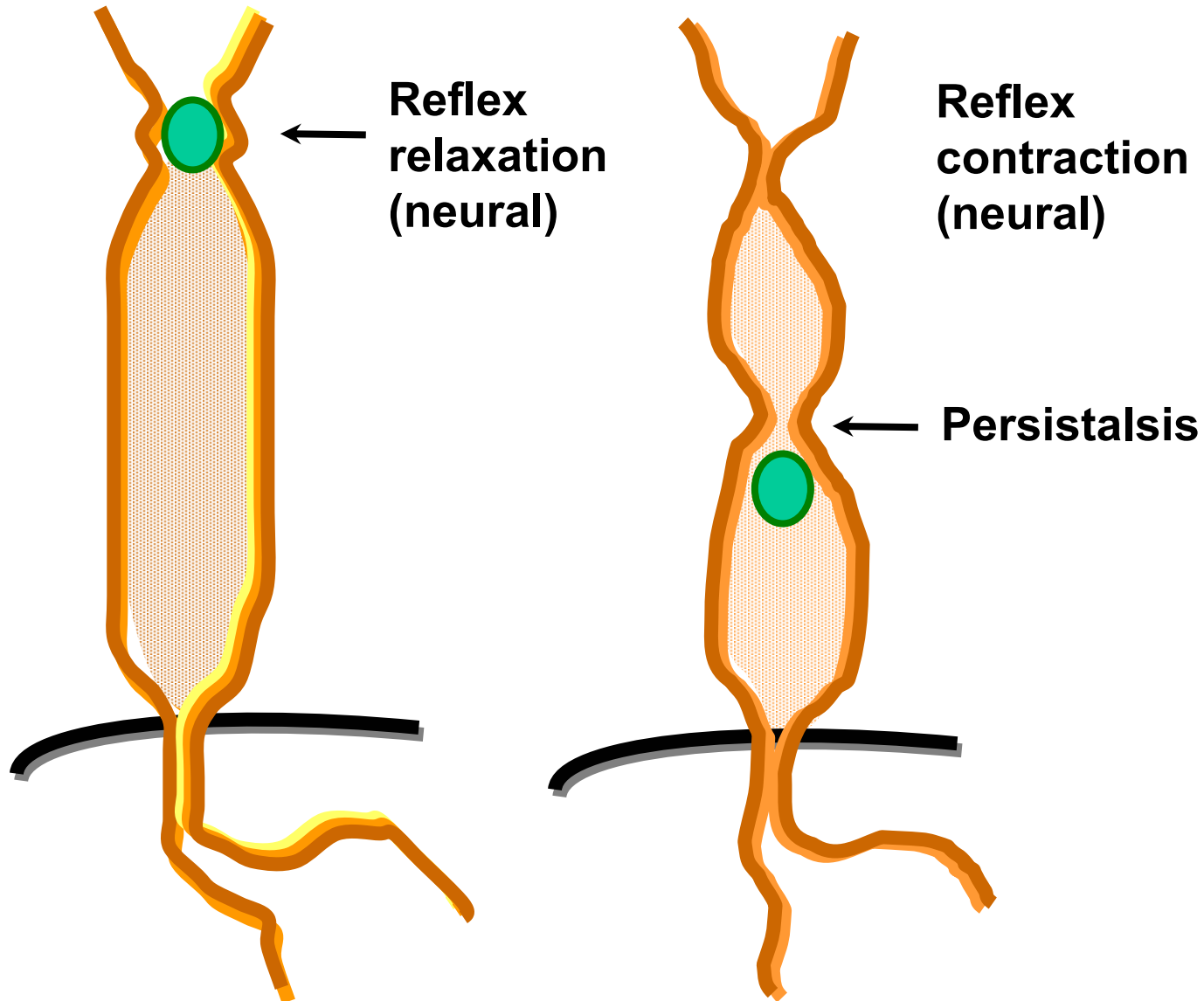
Functions of saliva

- **Oral protection**
buffering of hot, cold, acid, base
- **Oral hygiene**
bacteriostatic
- **Lubrication**
swallowing
- **Digestion**
carbohydrates and lipids

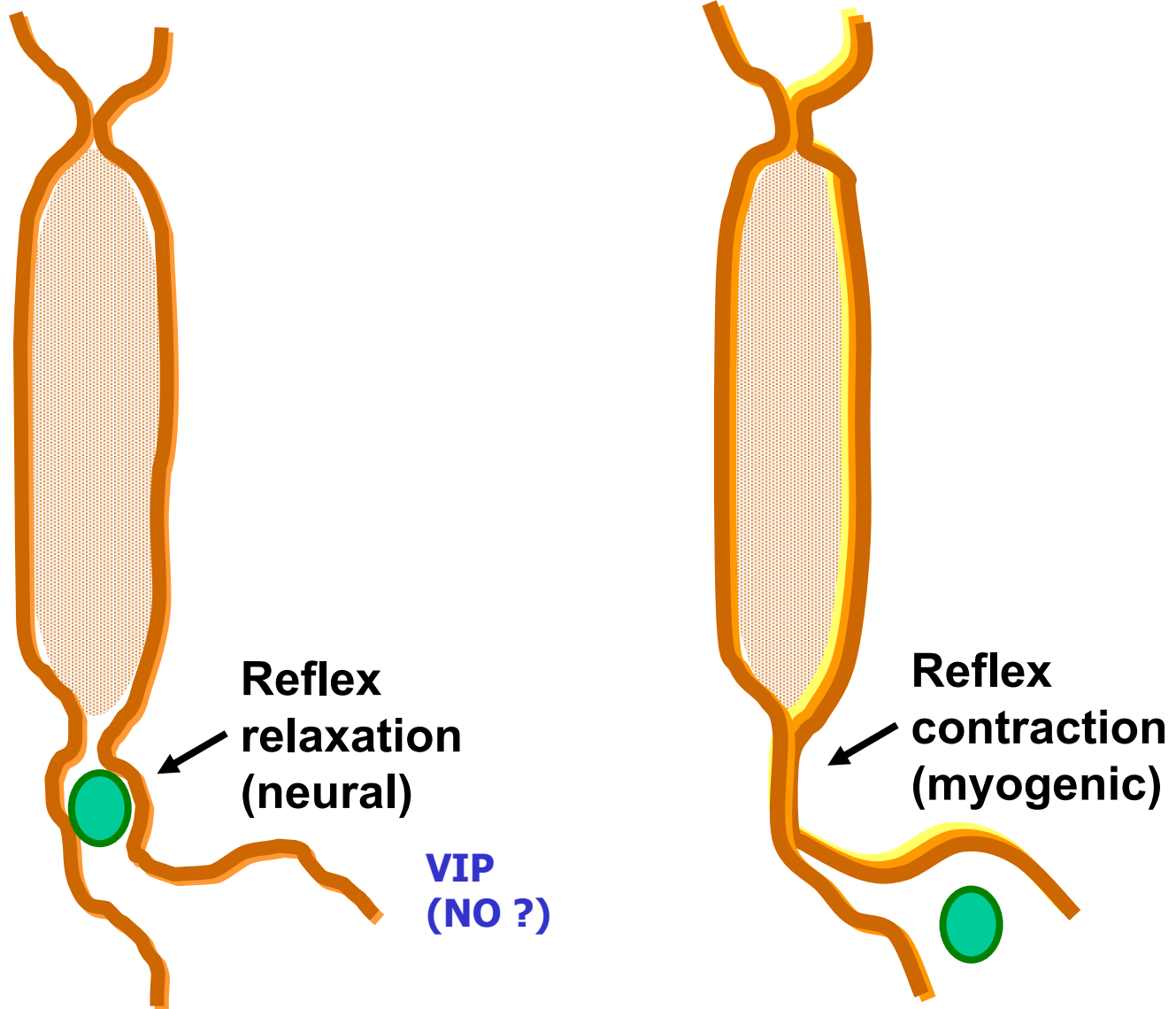
Structure of the esophagus



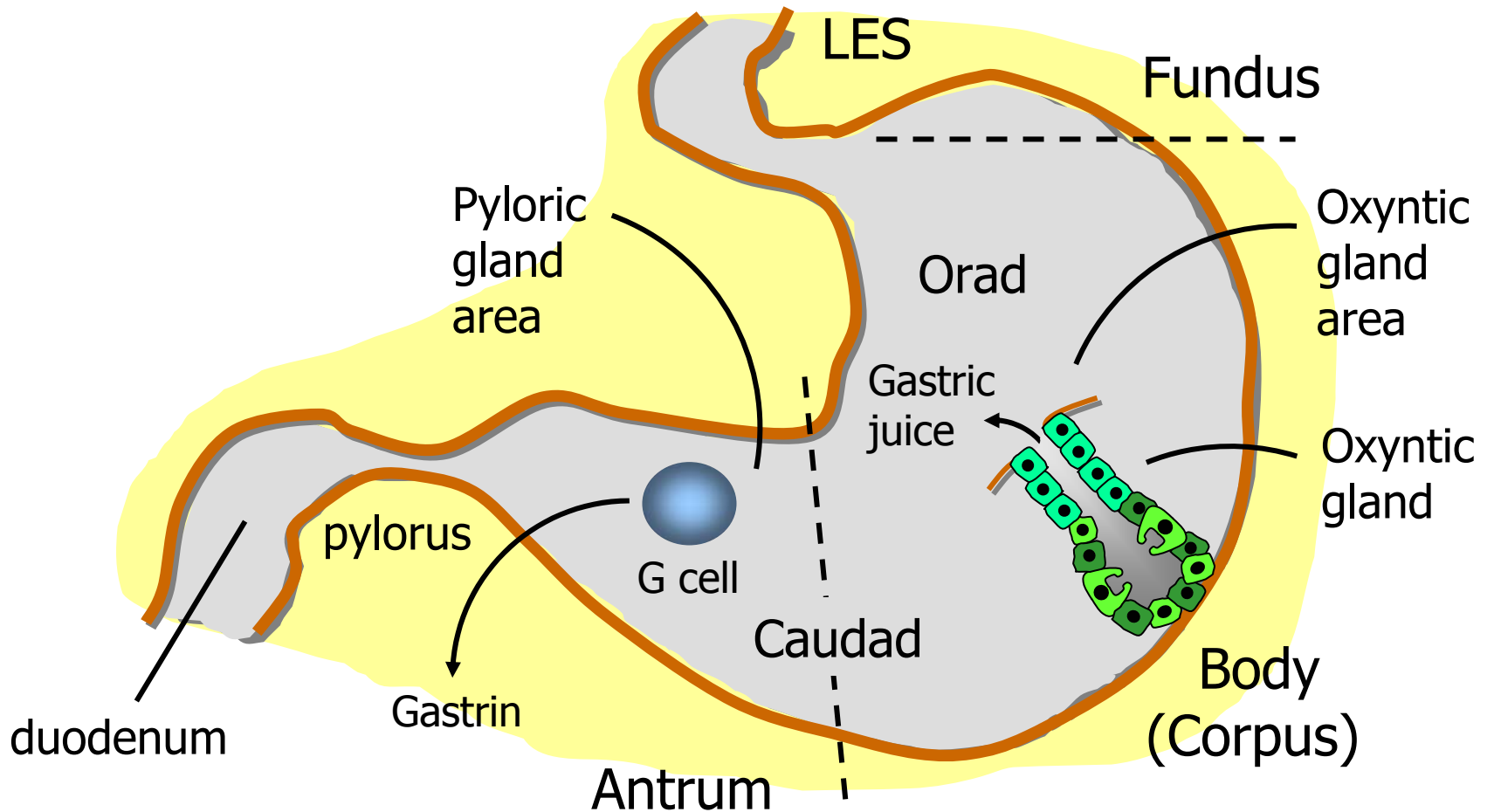
Regulation of the UES during a swallow



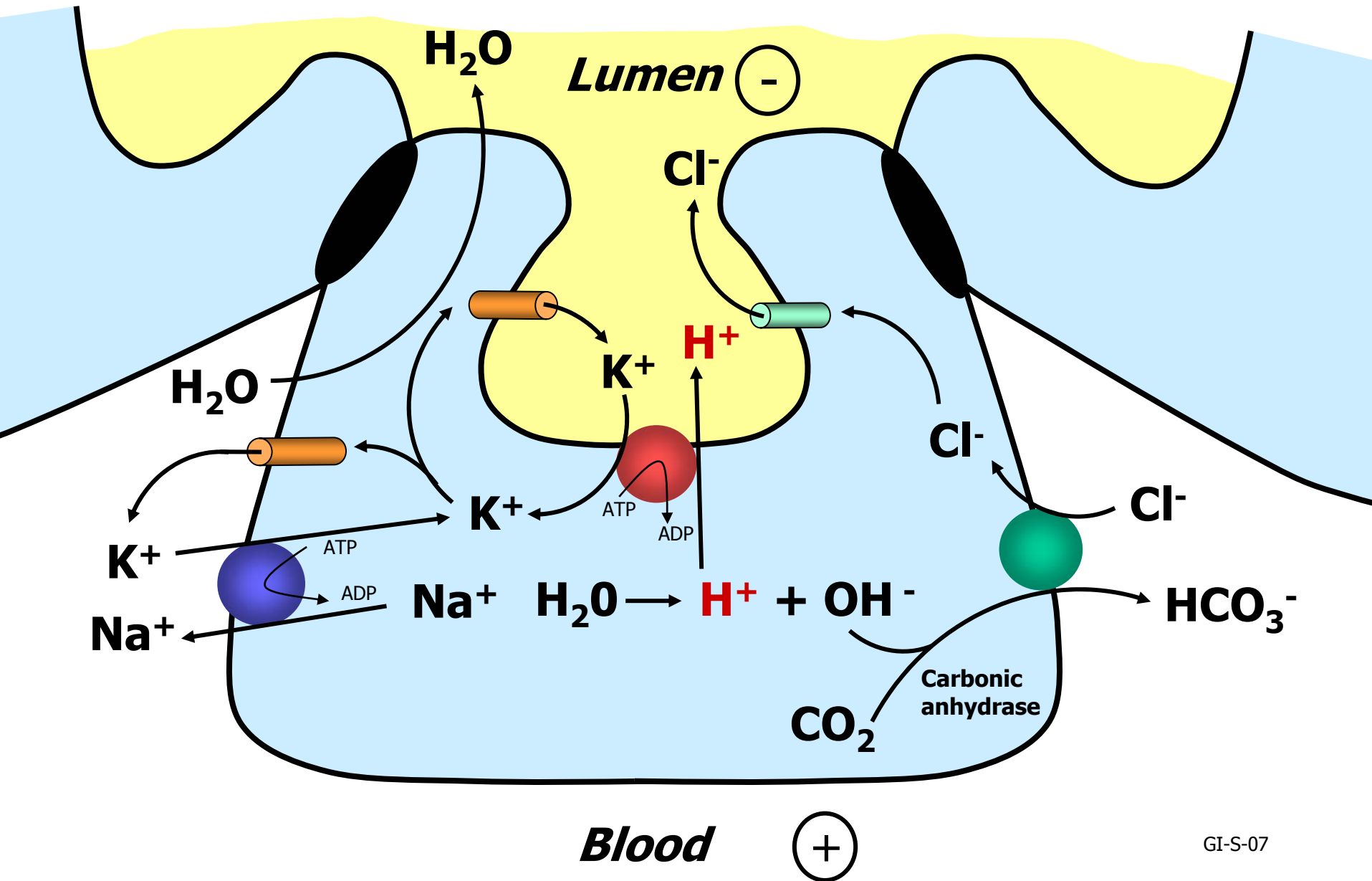
Regulation of the UES during a swallow



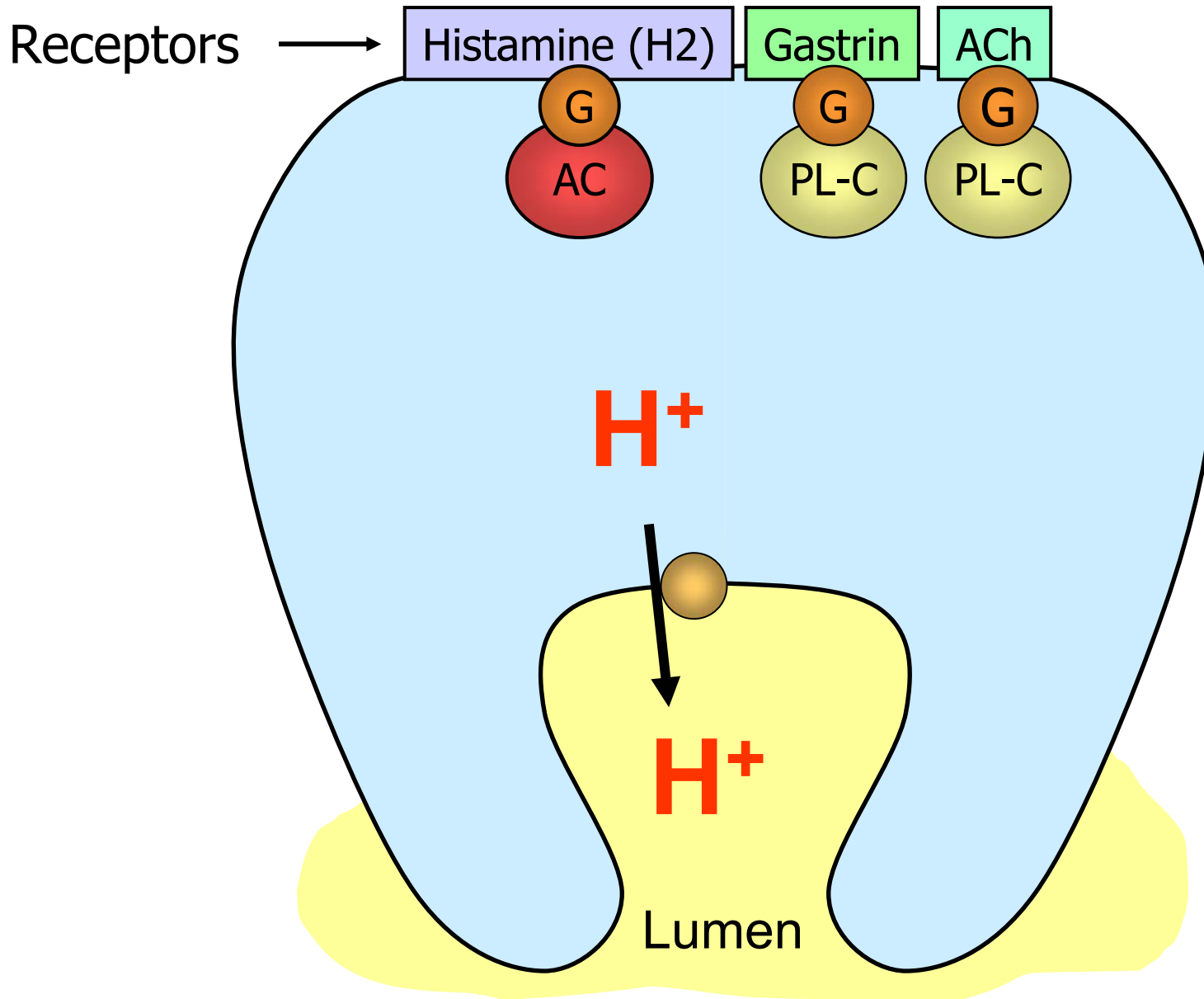
Anatomical and functional divisions of the stomach



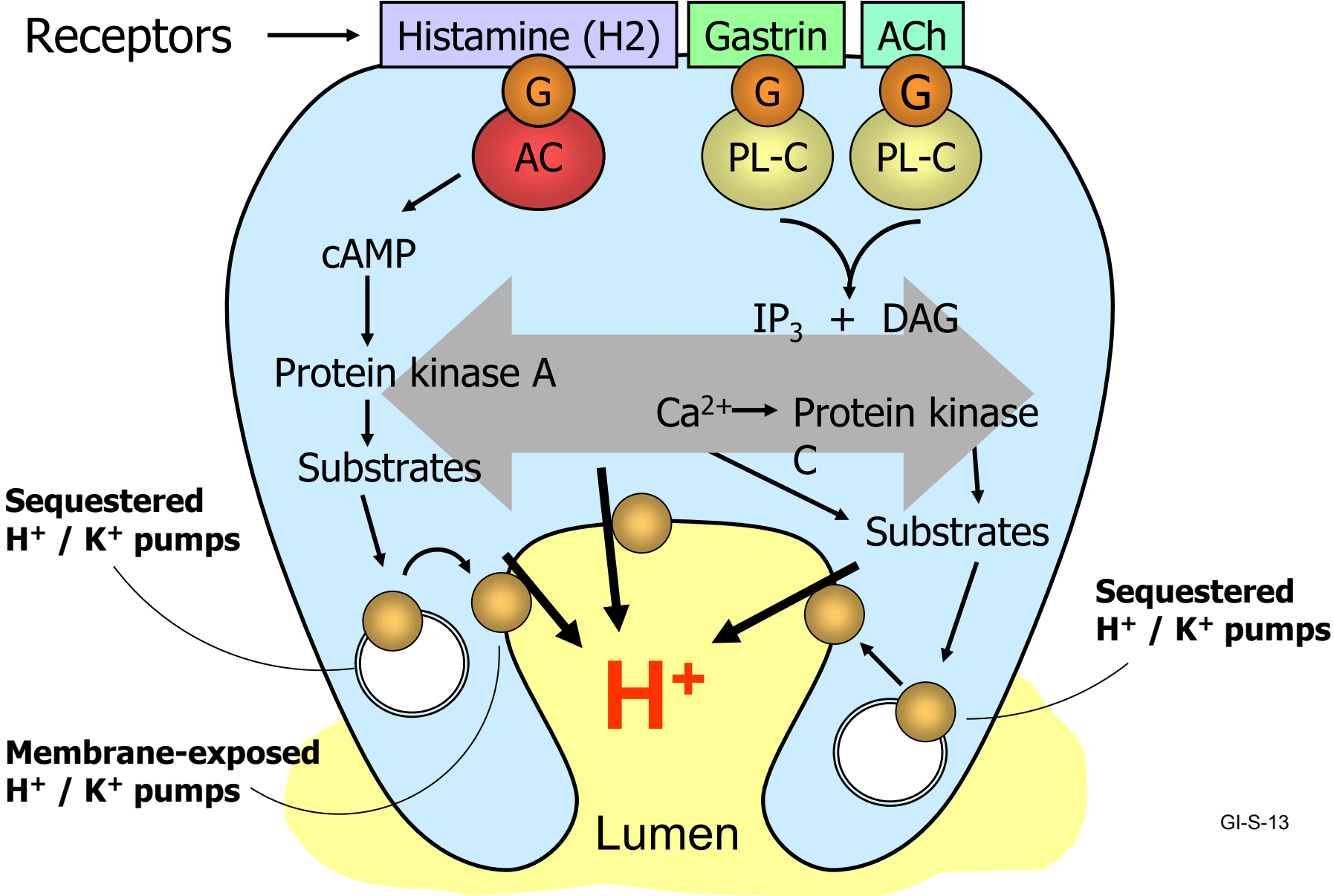
Mechanism of acid secretion by the parietal cell



Stimulation of acid secretion in parietal cells

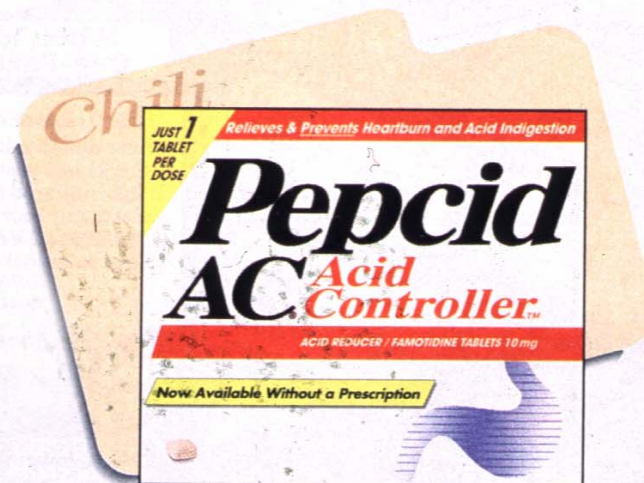


Stimulation of acid secretion in parietal cells





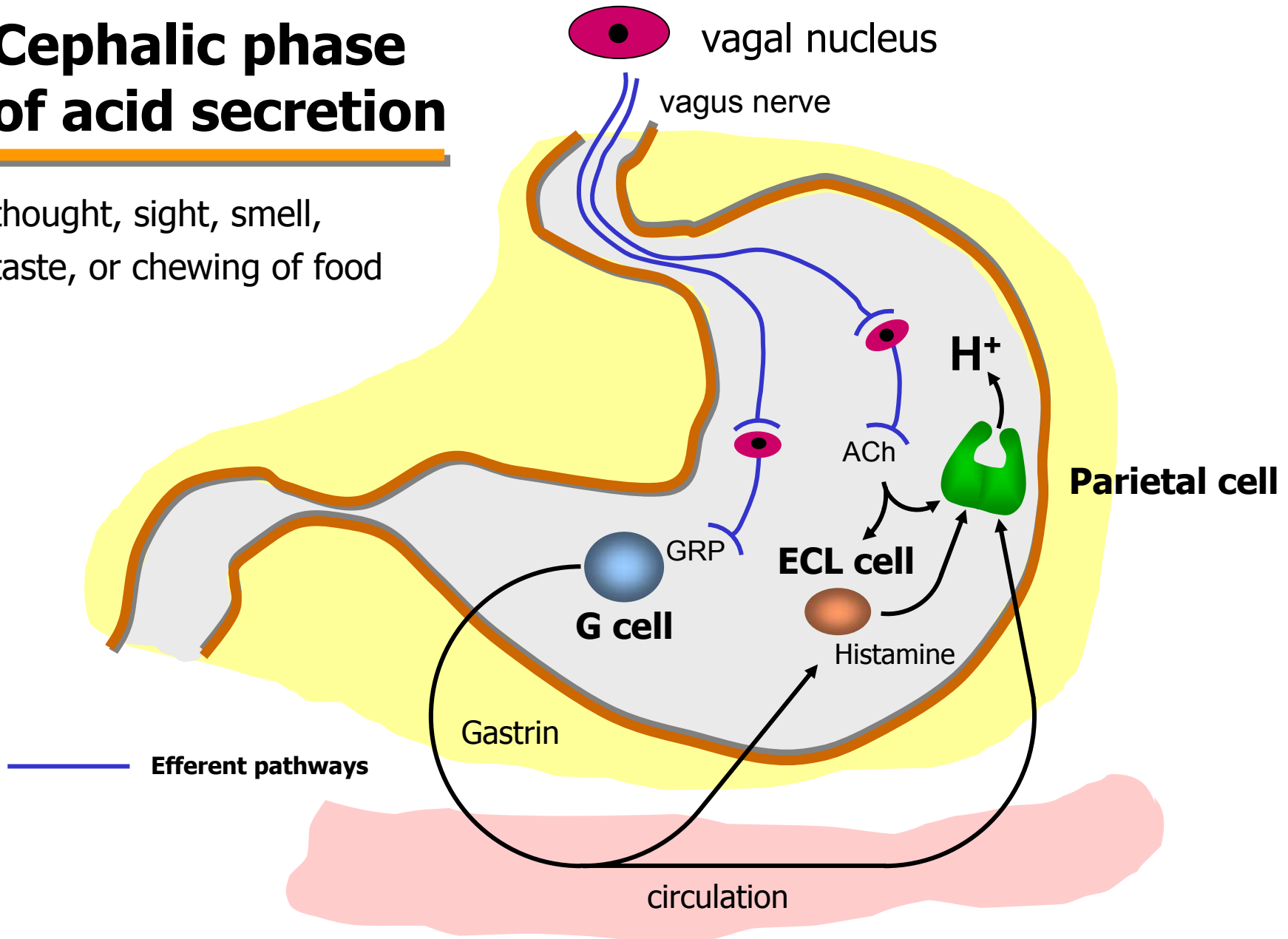
A Simple Recipe For Heartburn-Free Chili



Take Pepcid AC[®] first
and you can be heartburn-free

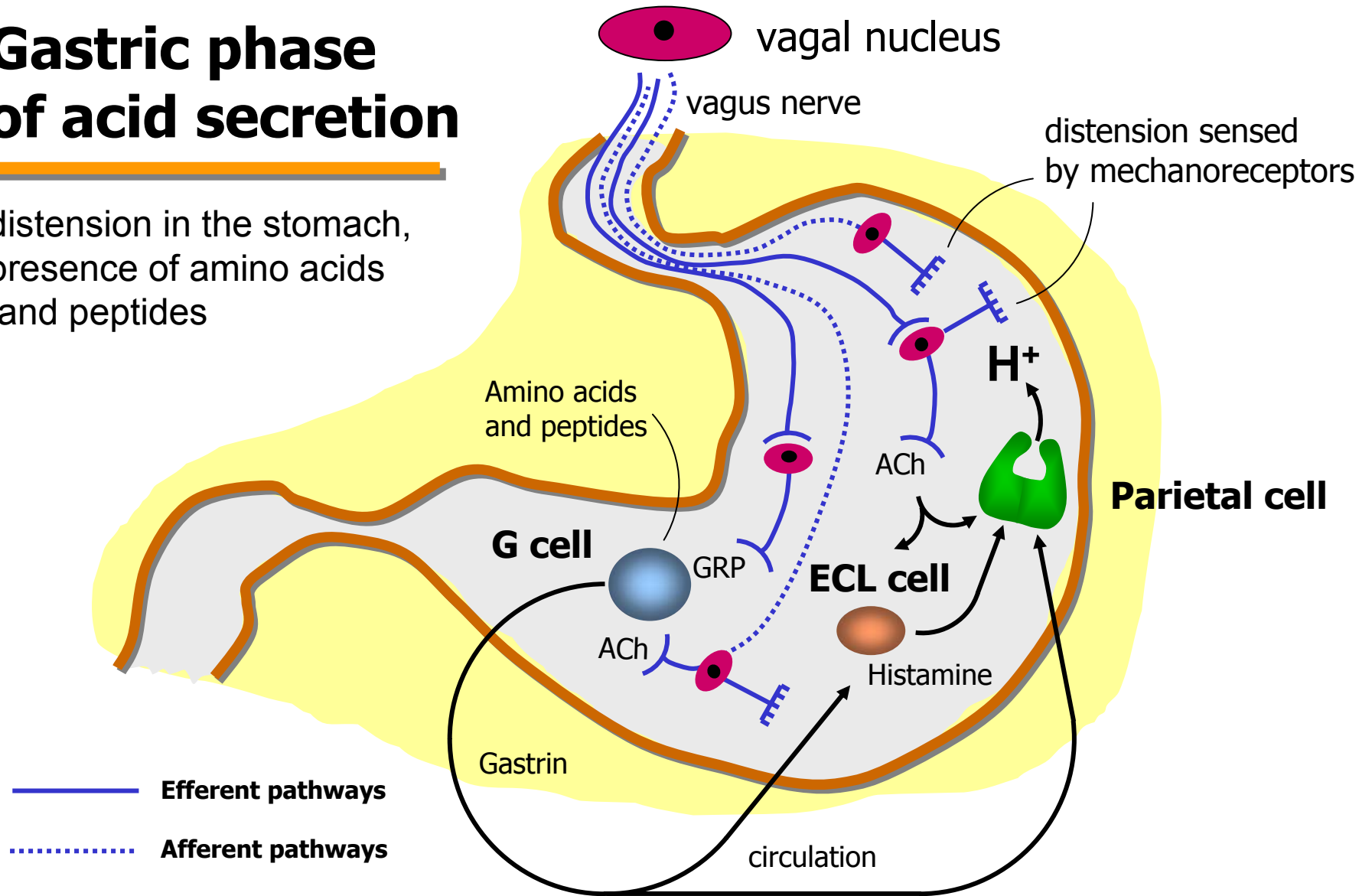
Cephalic phase of acid secretion

thought, sight, smell, taste, or chewing of food

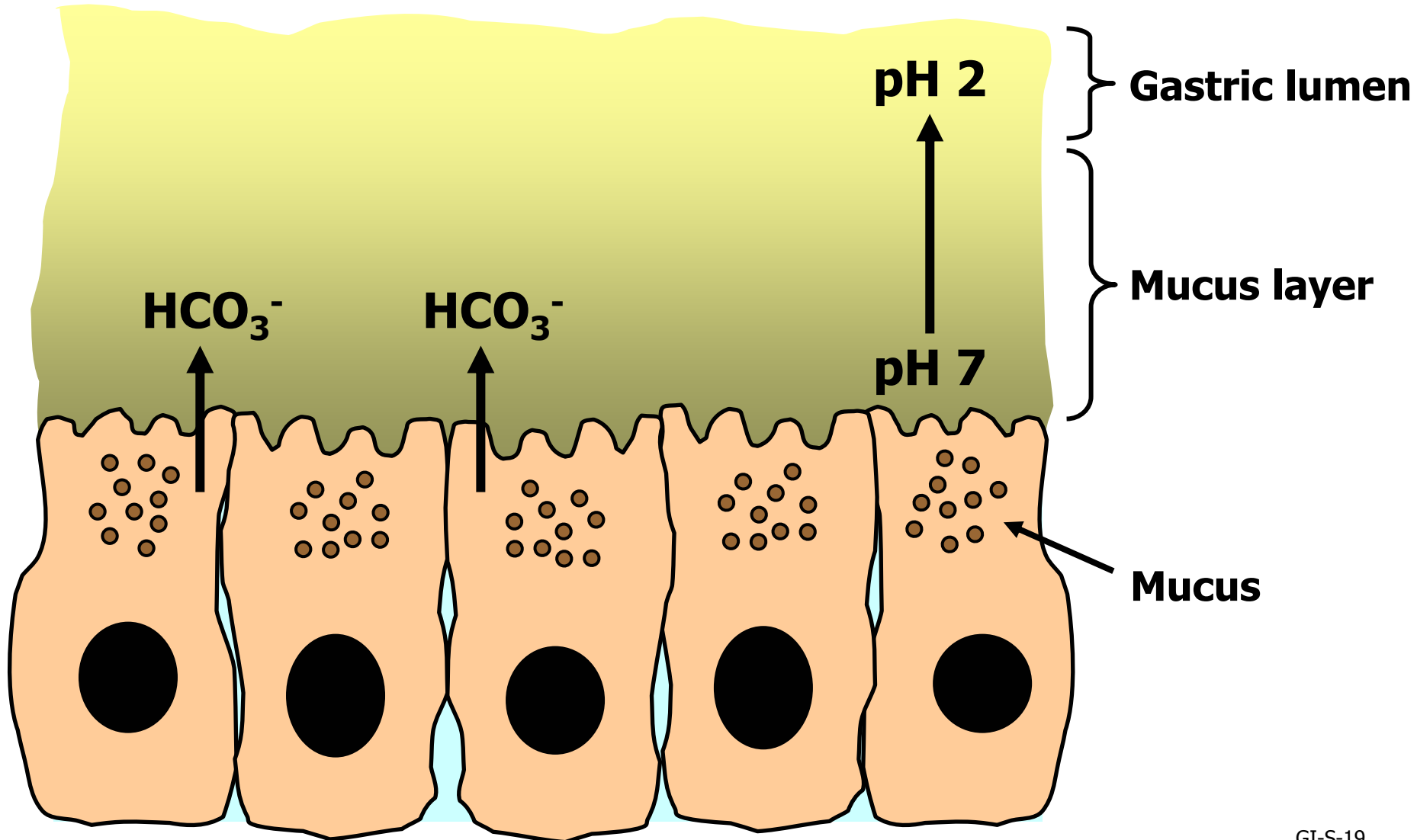


Gastric phase of acid secretion

distension in the stomach,
presence of amino acids
and peptides



Protection of the epithelial lining of the stomach



Motility in the stomach

- **Reservoir**

storage without increased pressure

- **Grinding and mixing**

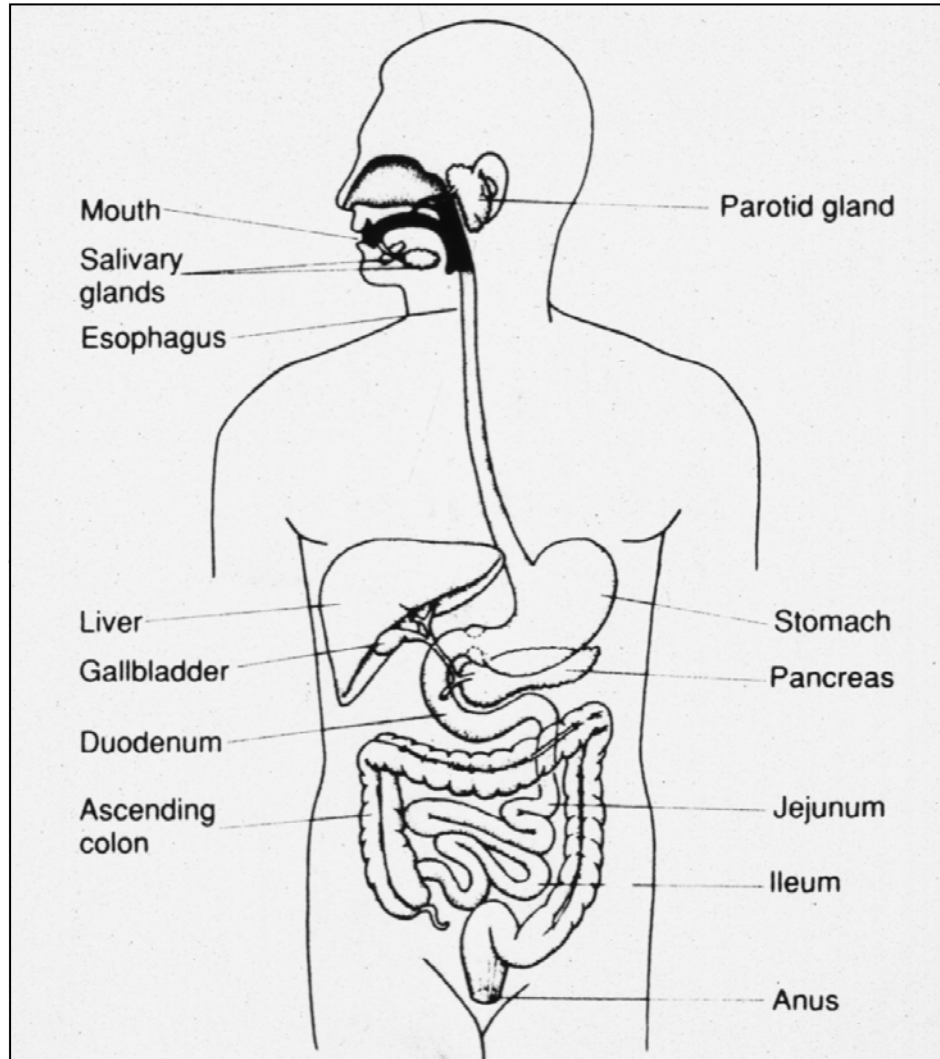
mechanical disruption for digestion and absorption

- **Regulated pumping**

optimal delivery to duodenum



The gastrointestinal system



Small Intestine

Digestion
Absorption
Secretion
Motility

Pancreatic Secretion

Aqueous Component (ductule cells)

- water
- bicarbonate

Function: acid neutralization

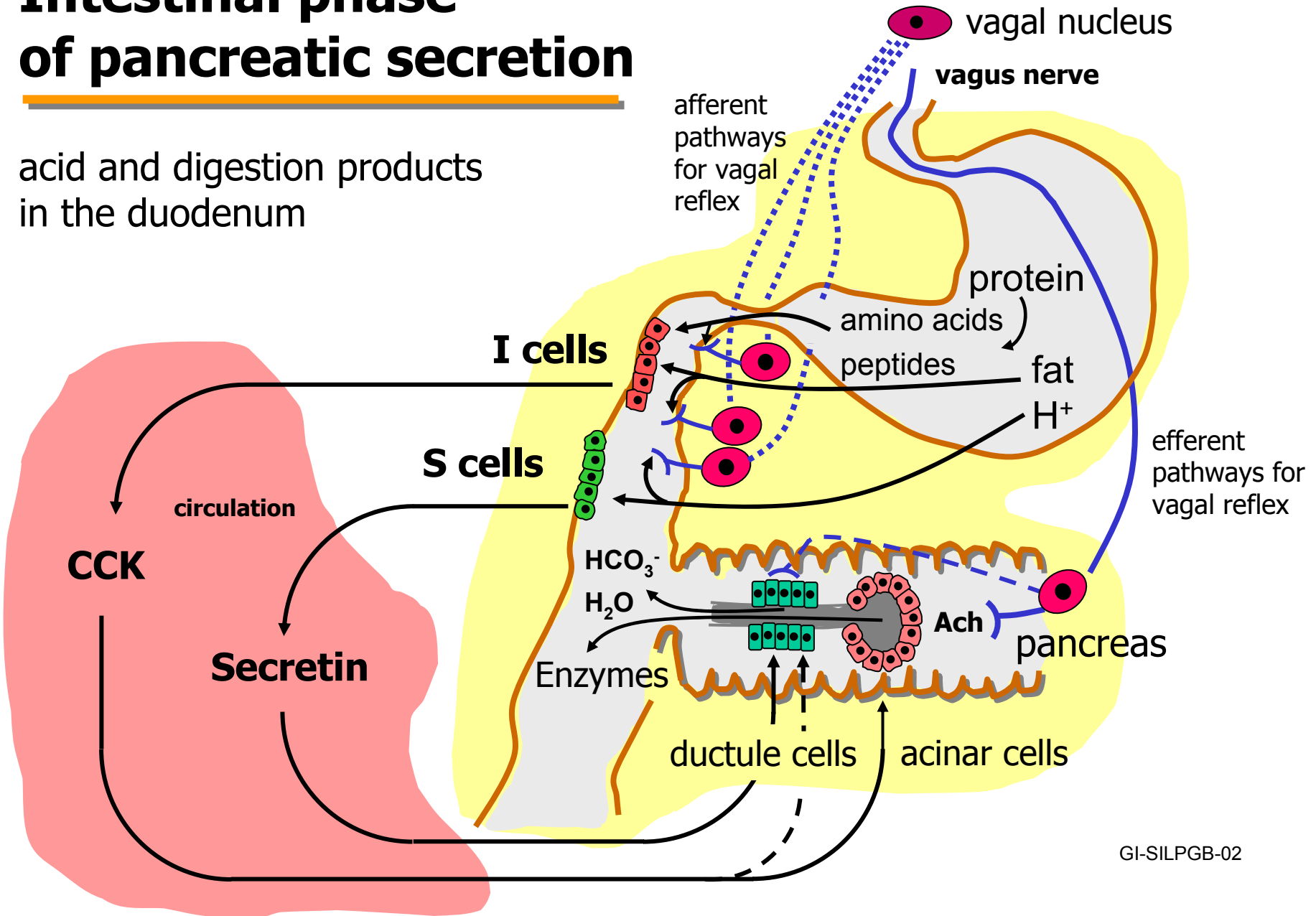
Enzymatic Component (acinar cells)

- proteases
- lipases
- saccharidases

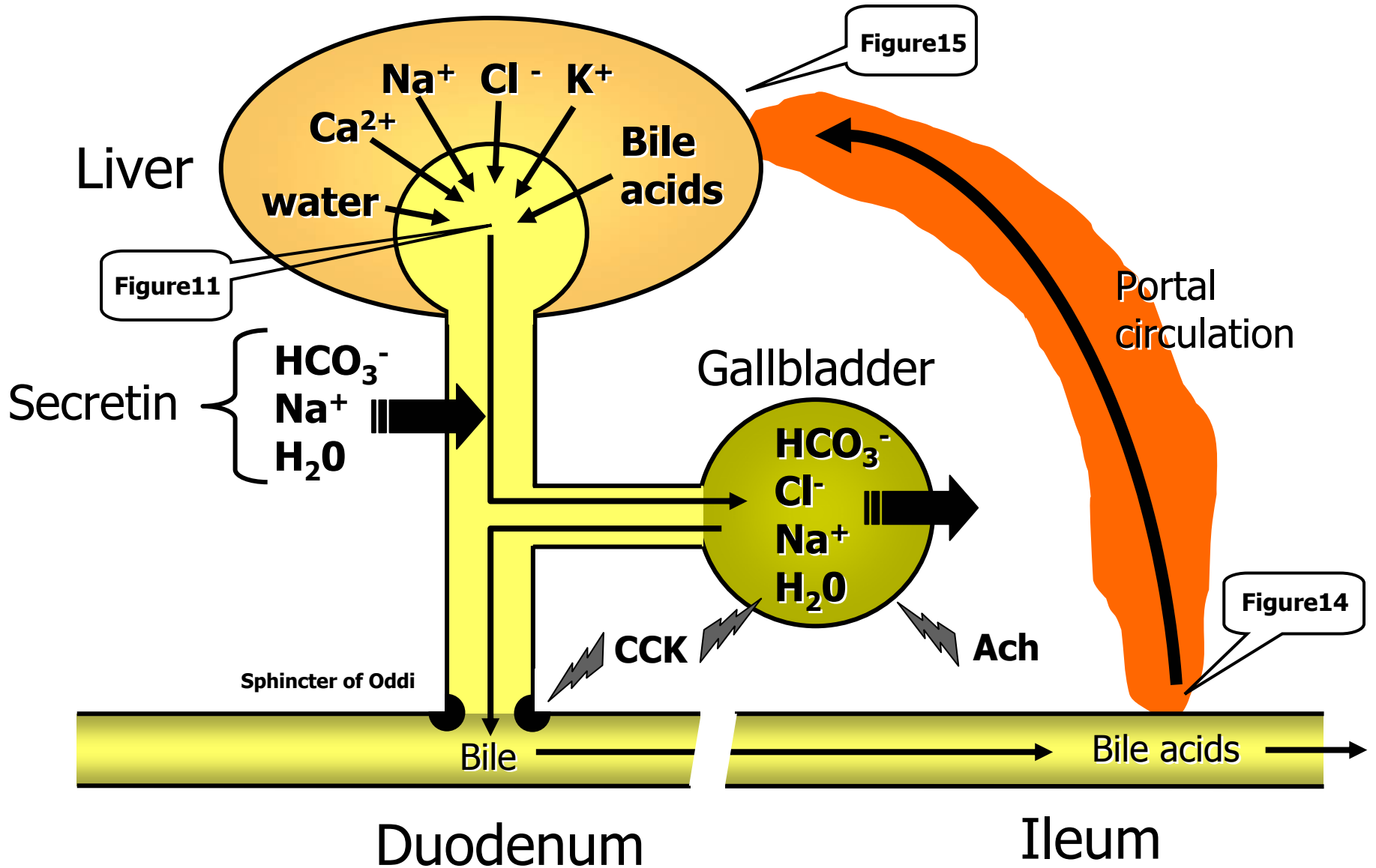
Function: digestion

Intestinal phase of pancreatic secretion

acid and digestion products
in the duodenum



Secretion from the liver and gallbladder



Functions of Bile

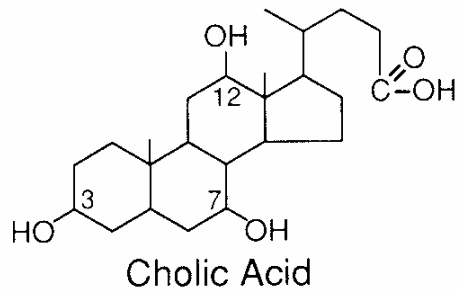
- **Emulsification** of dietary lipids
required for lipid digestion
- **Solubilization** of lipid digestion products
required for lipid absorption
- **Excretion** of waste products
bilirubin and cholesterol

Organic components of bile

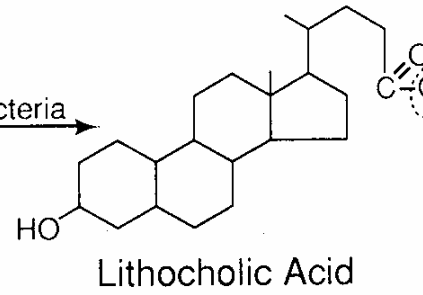
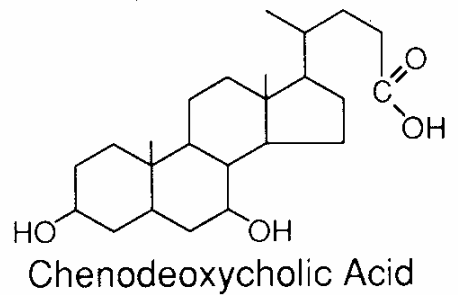
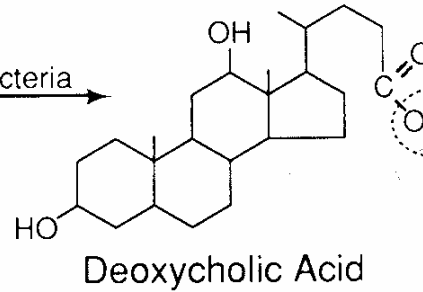
- **Bile acids / bile salts** **70%**
- **Phospholipids** **20%**
- **Cholesterol** **5%**
- **Bilirubin** **1%**
- **Everything else** **4%**

Components of bile

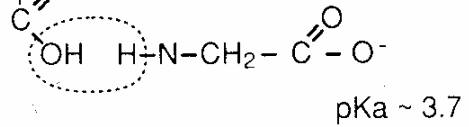
Primary Bile Acids



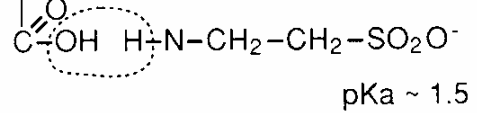
Secondary Bile Acids



Bile Salts

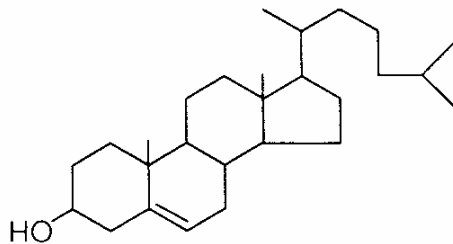


Glycine

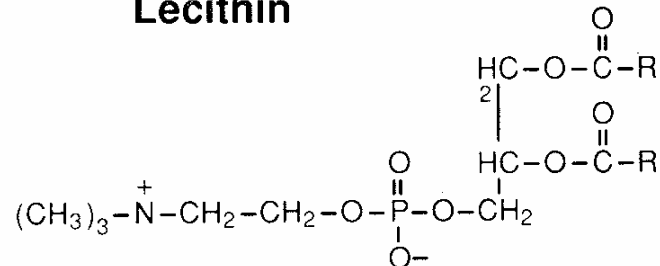


Taurine

Cholesterol

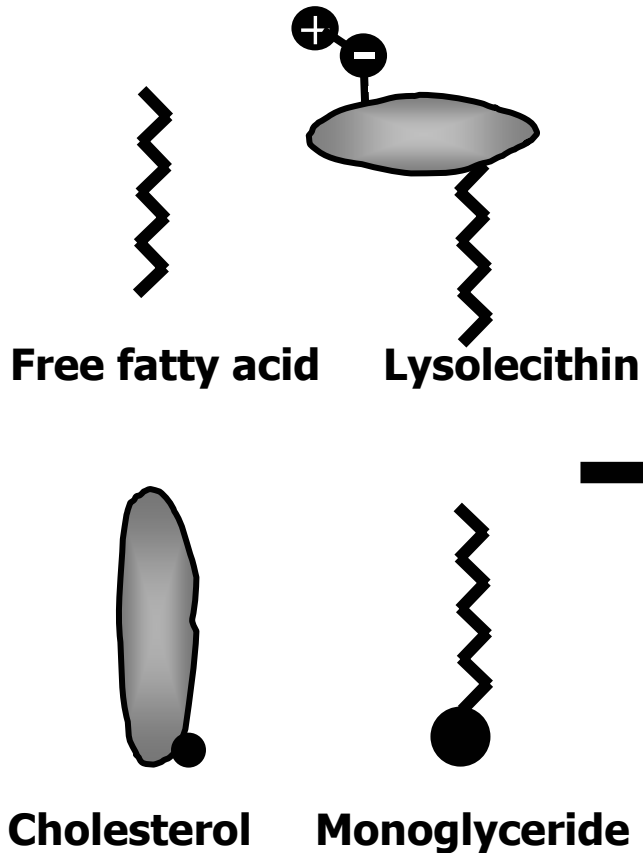


Lecithin

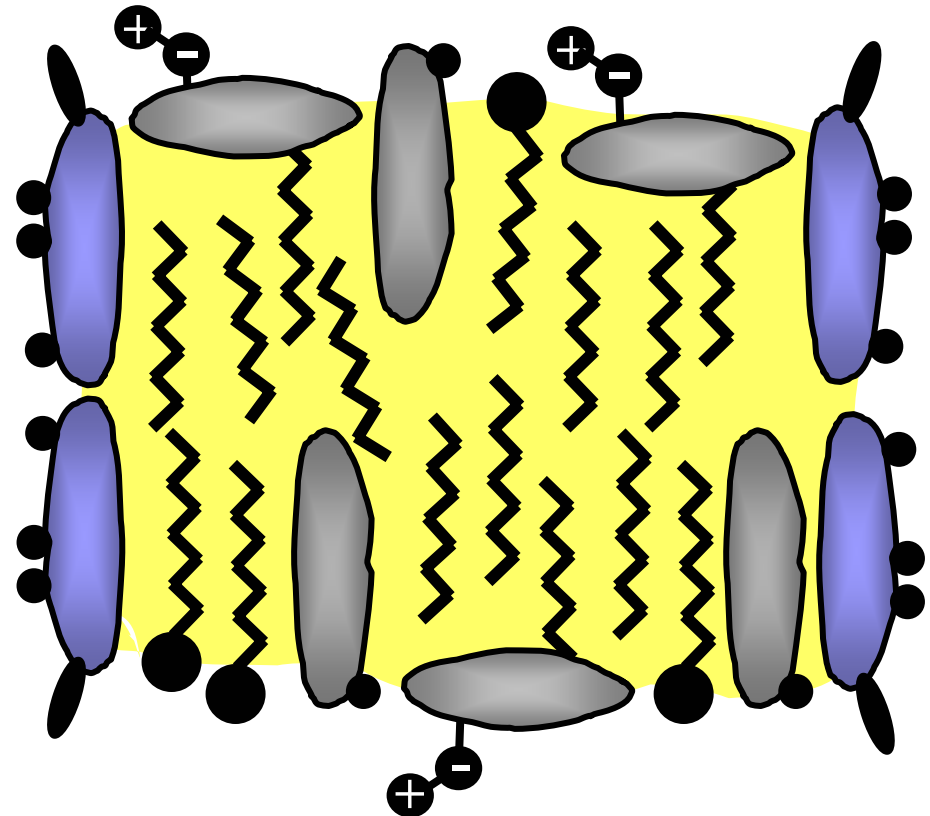


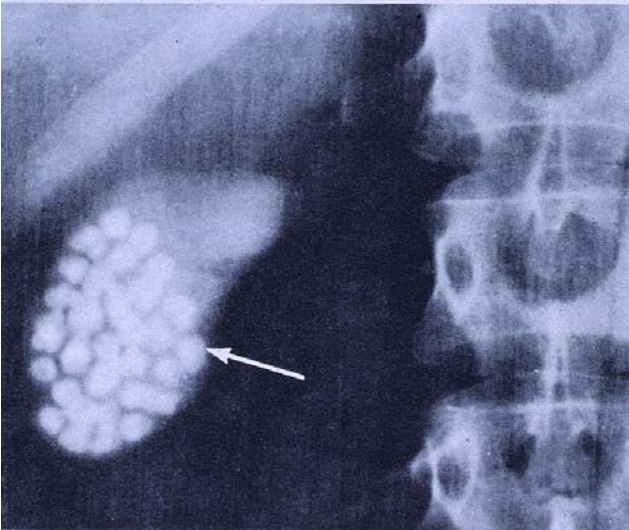
Bile acids package products of lipid digestion into mixed micelles for absorption

Products of lipid digestion



Mixed micelle





Digestion and absorption in the small intestine

Proteins

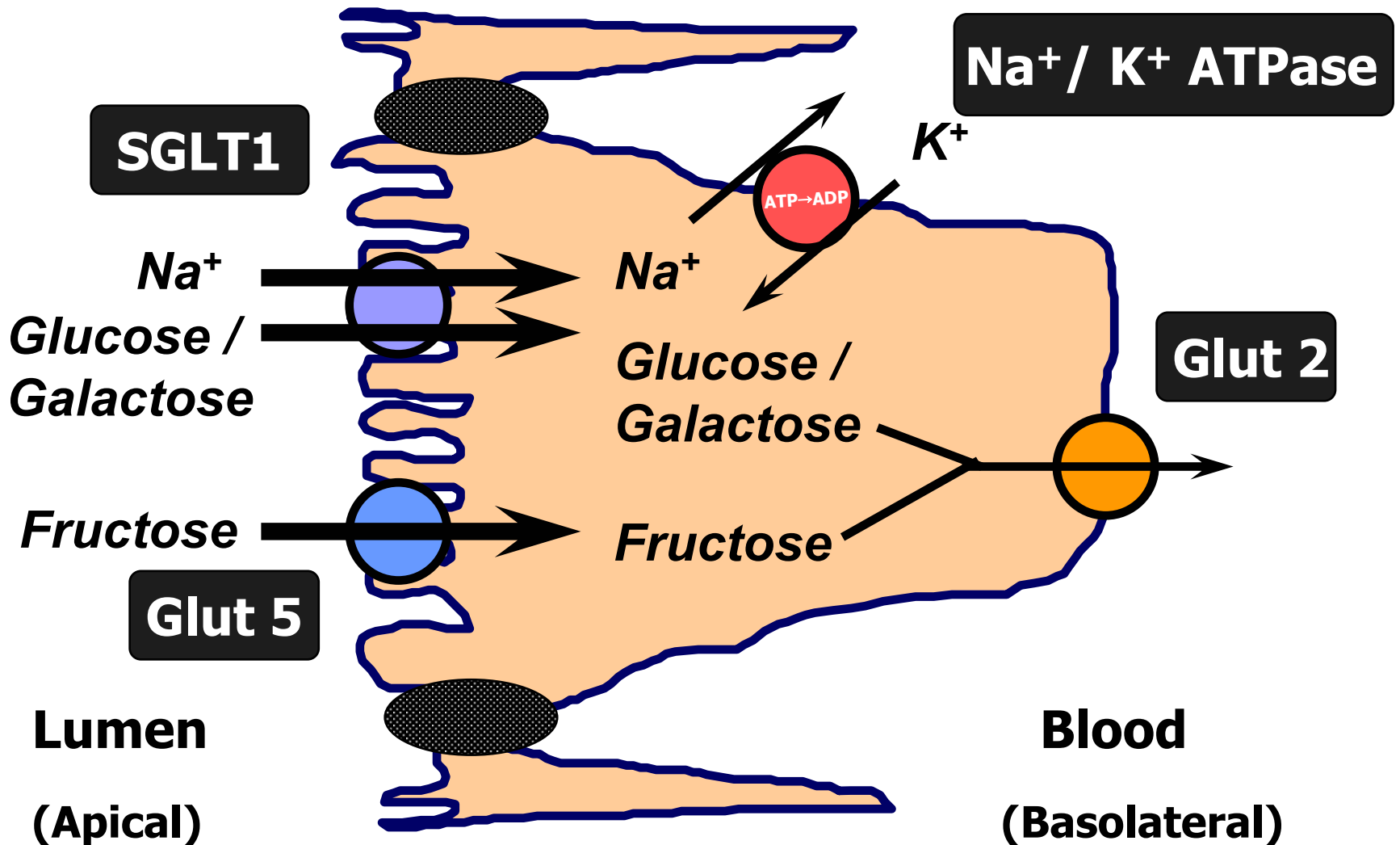
- degradation to amino acids and peptides
- combined action of luminal and membrane-bound proteases
- absorption by multiple transporters

Carbohydrates

- degradation to monosaccharides
- combined action of luminal and membrane-bound proteases
- absorption by several transporters

Lipids

Absorption of monosaccharides in the small intestine



Lactaid[®]

DIETARY SUPPLEMENT

Ultra[®]

*Just 1
Caplet Per
Serving*

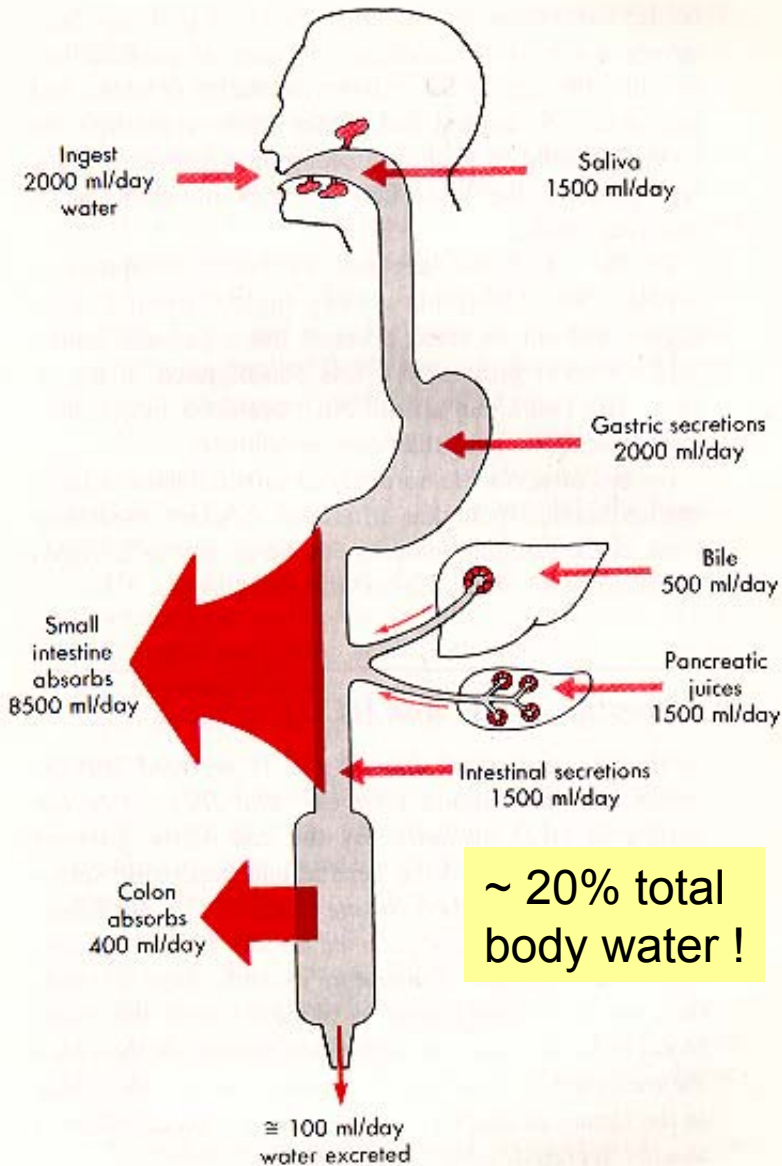


Works naturally to make dairy
foods easy to digest.

32 Caplets 32 Single-Serve Packets



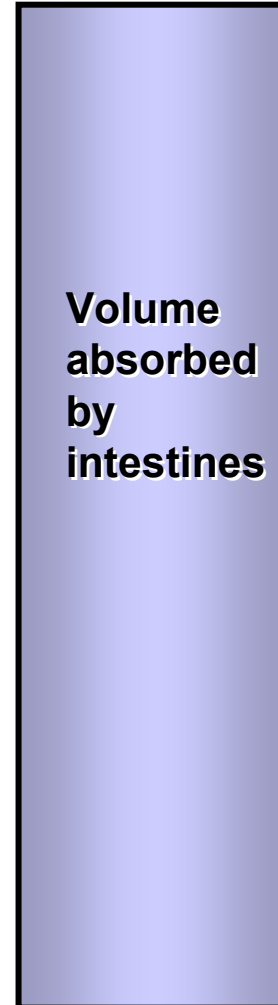
Fluid balance in the GI tract



9000 ml



8900 ml



100 ml

Volume excreted



Important Principle

**The absorption of water
is dependent on and
proportional to
the absorption of solutes**

Bad things happen when solutes are not absorbed

