

QUIZ/TEST REVIEW NOTES
SECTION 1 CEPHALIC PHASE OF DIGESTION
DIGESTIVE SYSTEM CHAPTER 21

I. DIGESTION OVERVIEW

a. Digestion involves four fundamental processes with different parts of the system implementing at least one or more of these functions

1. Digestion

- Is the chemical and mechanical breakdown of foods into smaller units that can be taken across the intestinal epithelium into the body

2. Secretion

- Refers to both transepithelial transfer of water and ions from the ECF to the digestive tract lumen and the release of substances synthesized by GI epithelia cells

3. Absorption

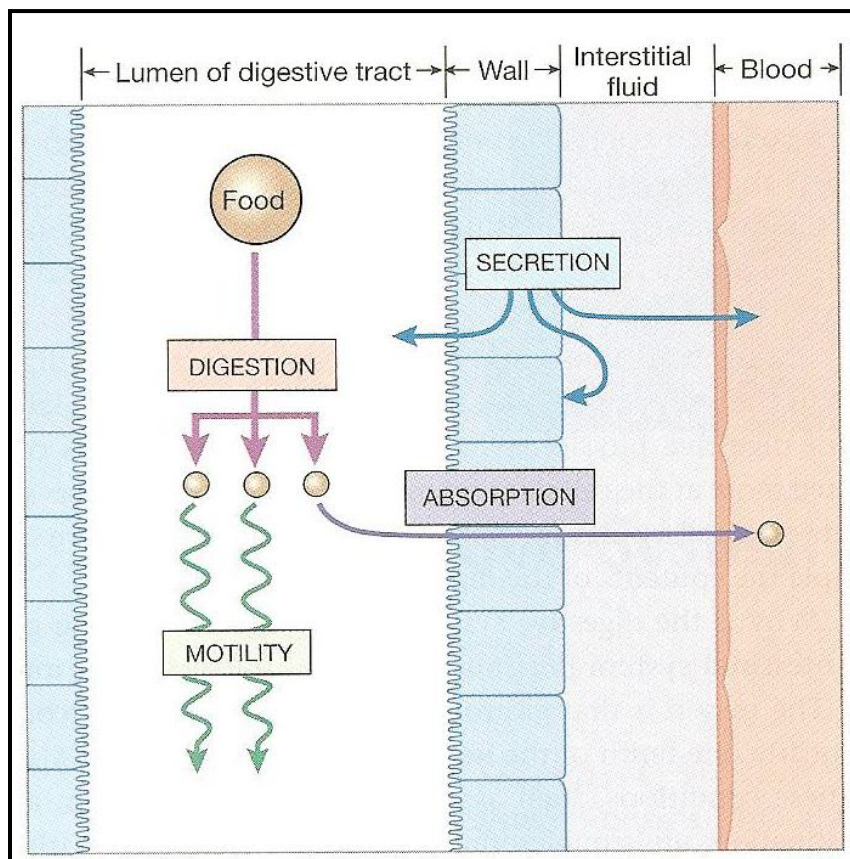
- Active or passive transfer of substances form the lumen of the GI tract to the extracellular fluid

4. Motility

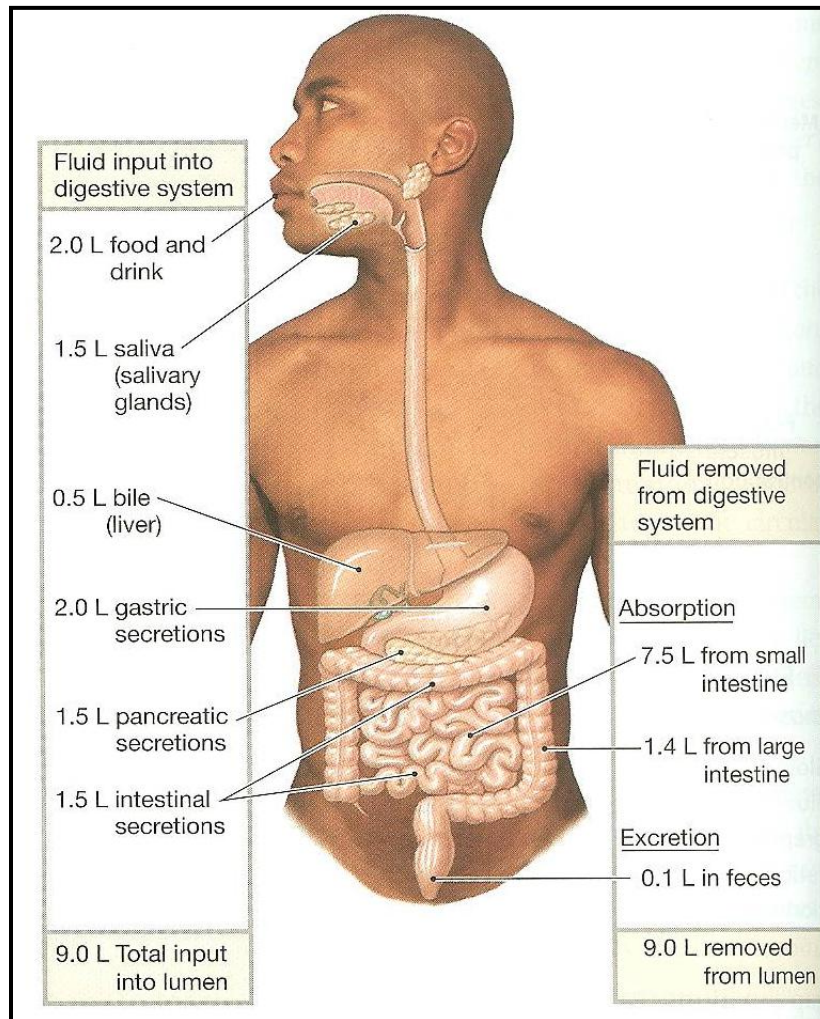
- Movement of material in the GI tract as a result of muscle contraction

Learning Objectives:

- Describe the processes of digestion, secretion and motility that occur during the cephalic phase of digestion
- Describe neural controls of cephalic phase of digestion
- Describe processes of digestion of carbohydrates and fats in the mouth
- Identify components and function of saliva
- Describe feed forward controls of secretion and motility



- Mass balance: Matching input with output; is achieved through physiological processes of motility, absorption, secretion, and digestion



b. Digestion must be carefully controlled and coordinated

1. Cephalic phase

- The long reflexes that begin in the brain to create a feedforward response; anticipatory stimuli and stimulus of food in the oral cavity that activate neurons in the medulla oblongata that signals salivary glands through the Vagus nerve to the enteric nervous system;

2. Gastric phase

- When food enters the stomach and stimuli in gastric lumen initiate series of short reflexes; distension of the stomach and the presence of peptides or amino acids in the lumen activate endocrine cells and enteric neurons

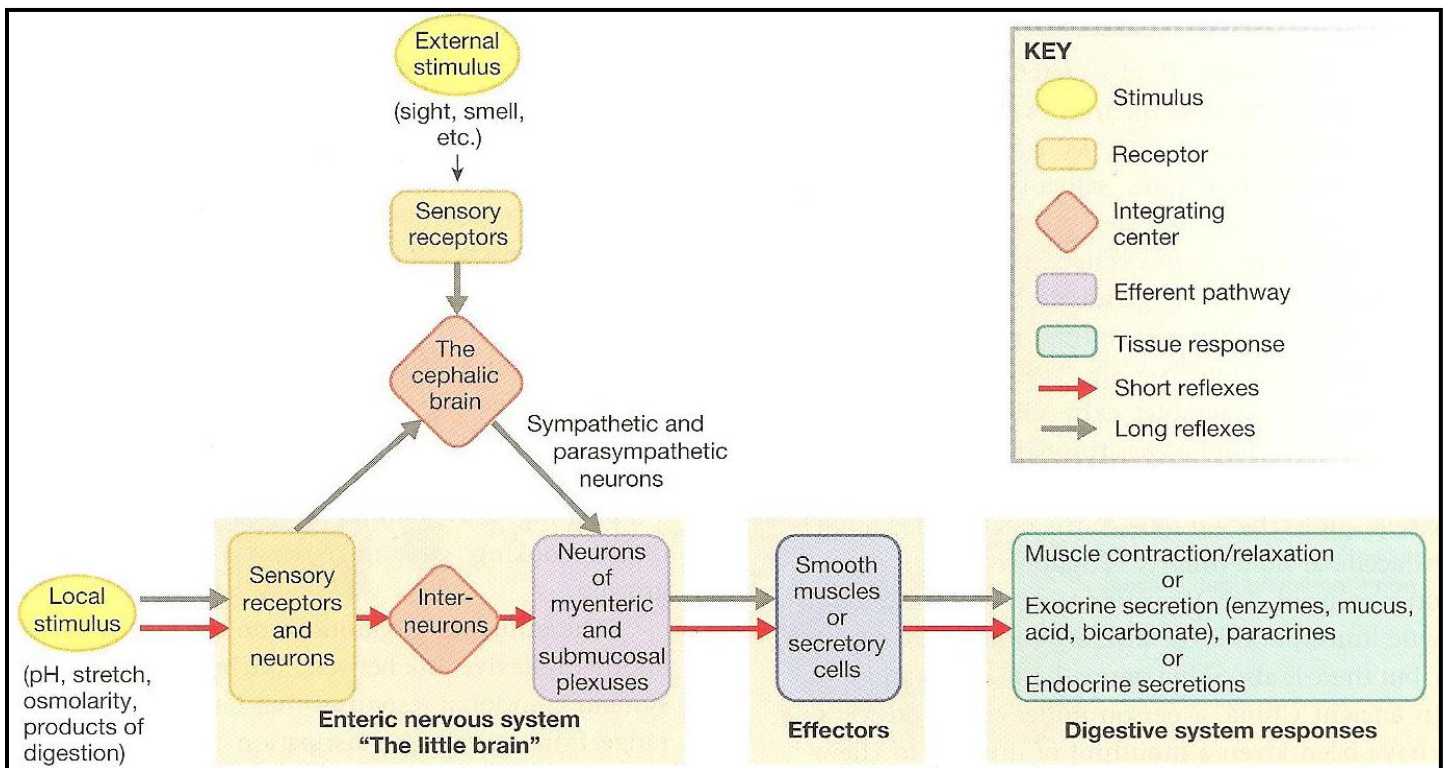
3. Intestinal phase

- Once chyme enters the small intestine; initiation of this phase triggers a series of reflexes that feed back to regulate the delivery rate of chyme from the stomach, and feed forward to promote digestion, motility, and utilization of nutrients

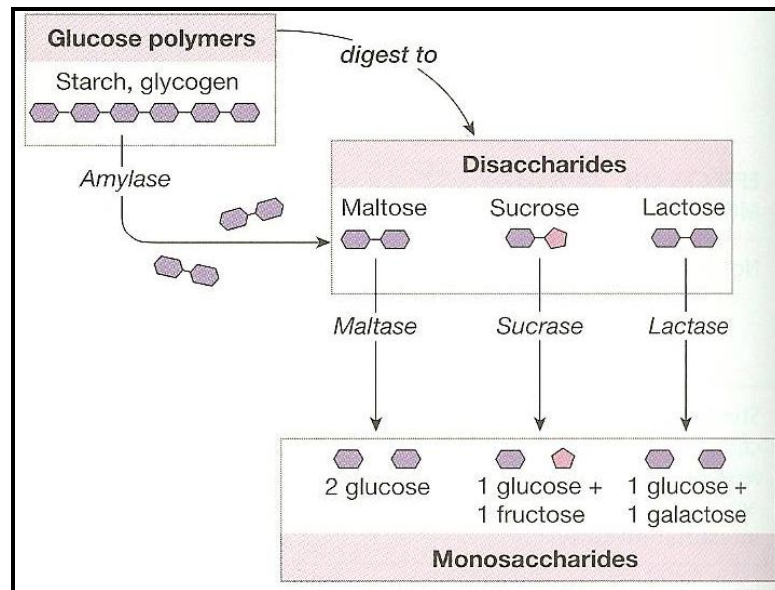
II. CEPHALIC PHASE

a. Mastication breaks apart food and mixes it with saliva

1. Conditioned stimuli initiate feedforward/autonomic control of salivation
 - Begins with long reflexes that begin in the brain that create a feedforward response of digestion (cephalic)
 - Medulla sends efferent signal through autonomic neurons to salivary glands, and through Vagus nerve to enteric nervous system
 - Vagus nerve alerts the stomach, intestine, and accessory glandular organs to begin secretion and increase motility in anticipation of food
2. Salivation is under autonomic regulation
 - a) Integration center and efferent pathway
 - b) Sympathetic effects
 - Sympathetic inhibition
 - Vasoconstriction
 - c) Parasympathetic effects
 - Parasympathetic stimulation
 - Dilation
 - Innervated by Vagus Nerve; acting as a anticipatory response



- d) Glands
 - (1) Sublingual [under tongue]
 - (2) Submandibular [under mandible]
 - (3) Parotid [near mandible hinge/near zygomatic]
3. Saliva contains
 - a) Water and Electrolytes
 - b) Mucin
 - c) Salivary amylase
 - Breaks down starch to disaccharides, eventually to monosaccharide's (glucose)

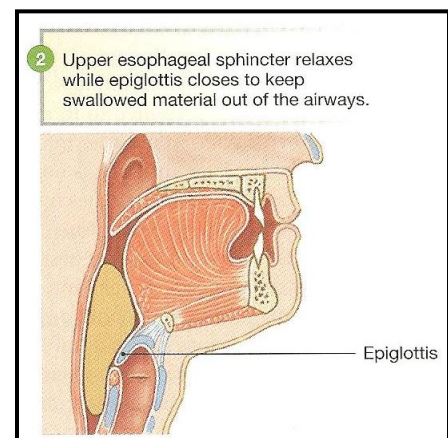
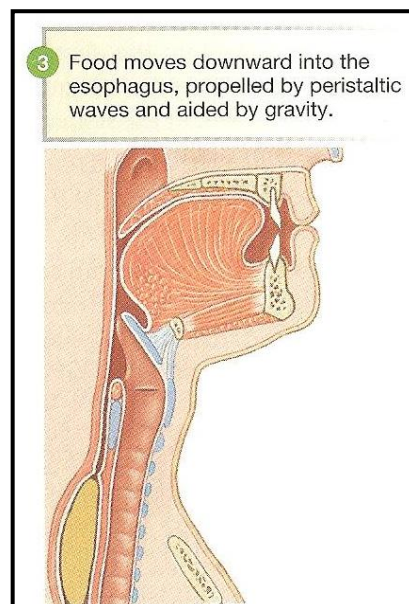
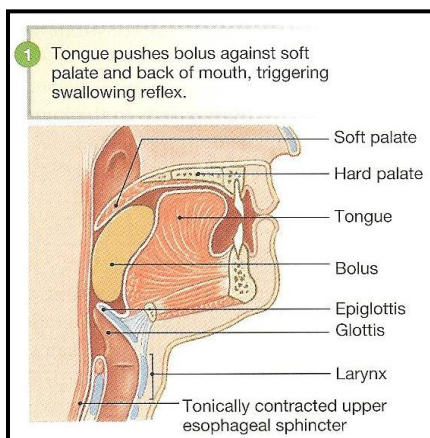


- d) Lysozyme and Cyanide-based compounds
 - Contains enzymes that break apart harmful bacteria
- e) Lingual Lipase
 - Breaks down fat
- f) Calcium
 - Decrease concentration gradient
- g) Bicarbonate
 - Acting as buffer; neutralizes pH levels

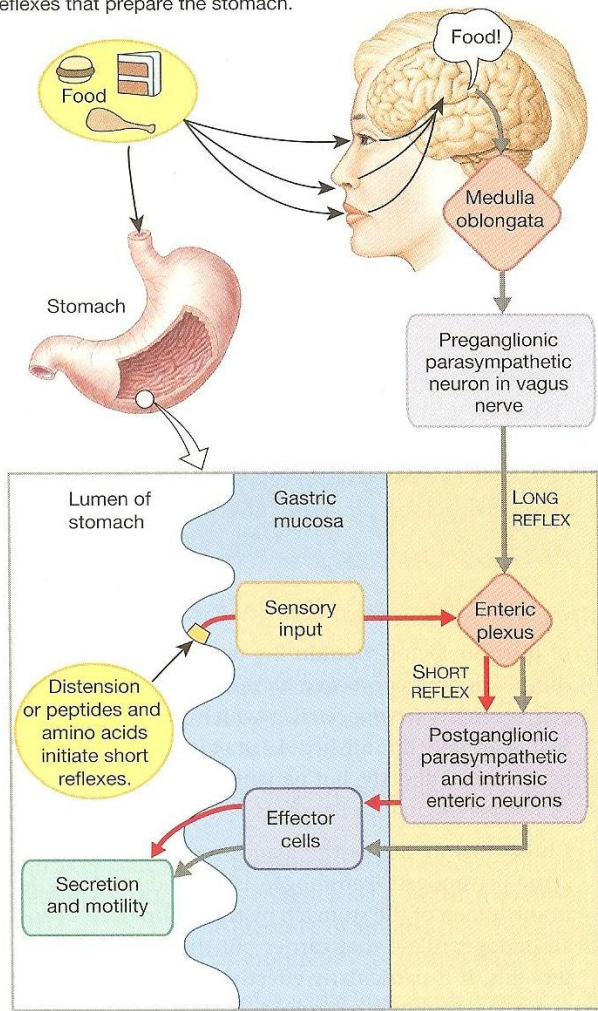
b. Long feedforward reflexes prepare stomach for arrival of bolus

1. Long reflux

- Integrated in the CNS
- Any digestive reflex that is integrated in the CNS
- Include feedforward reflexes, emotional reflexes, cephalic reflexes
 - Smooth muscle and glands of GI tract are under autonomic control
 - Parasympathetic neurons of the GI tract varied mostly in Vagus nerve are excitatory and enhance GI functions
 - Sympathetic neurons of the GI tract usually inhibit GI function



The sight, smell, taste, and thought of food initiate long reflexes that prepare the stomach.

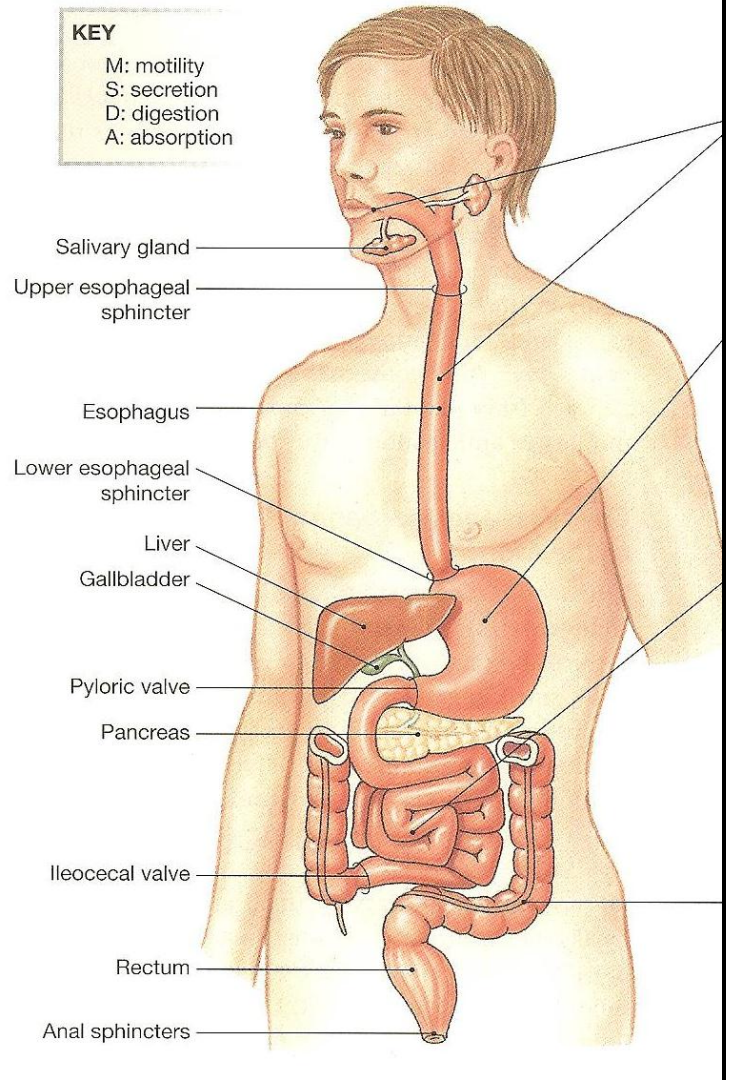


KEY

- Stimulus
- Receptor
- Afferent pathway
- Integrating center
- Efferent pathway
- Effector
- Tissue response
- Short reflex
- Long reflex

KEY

- M: motility
- S: secretion
- D: digestion
- A: absorption



Summary of Motility, Secretion, Digestion, and Absorption

	Oral Cavity/Esophagus	Stomach	Small Intestine	Large Intestine
Motility	Swallowing and chewing	Peristaltic mixing and propulsion	Mixing and propulsion primary by segmentation	Segmental mixing; mass movement for propulsion
Digestion	Carbohydrates, fats (minimal)	Proteins, fats	Carbohydrates, fats, polypeptides, nucleic acids	None (except by bacteria)
Secretion	Saliva (salivary glands), lipase	HCL (parietal cells); pepsinogen and gastric lipase (chief cells); mucus and HCO_3^- (surface mucous cells); gastrin (g cells); histamine (ECL cells)	Enzymes; HCO_3^- and enzymes (pancreas); bile (liver); mucus (goblet cells); hormones: CCK, secretin, GIP, and other hormones	Mucus (goblet cells)
Absorption	None	Lipid-soluble substances such as alcohol and aspirin	Peptides by active transport; amino acids, glucose, and fructose by secondary active transport; fats by simple diffusion; water by osmosis; ions, minerals, and vitamins by active transport	Ions, water, minerals, vitamins, and small organic molecules produced by bacteria