

DIGESTION & ABSORPTION

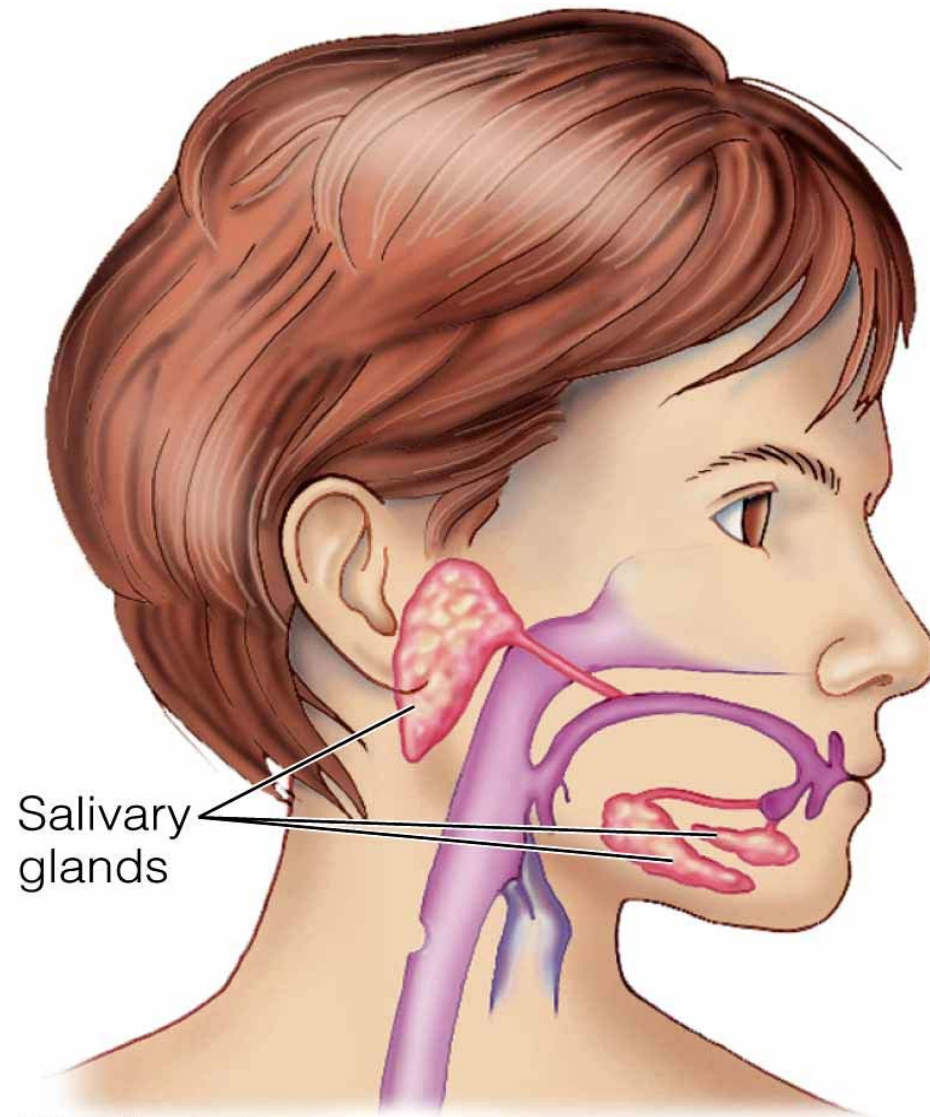
Digestion

- Digestion – The process of changing food into simple components which the body can absorb
- Digestive tract or Gastrointestinal tract- where digestion & absorption take place
- Mouth->esophagus->stomach->small intestine->large intestine

Digestion

- Mouth – ingestion of food; chewing (mastication) & swallowing
 1. Bolus – portion of food swallowed at one time
 2. Saliva - water, salts, enzymes, mucus secreted by salivary glands to:
 - a. Moisten food & aids swallowing
 - b. Begins carbohydrate digestion

Secretions of Digestion



Digestion

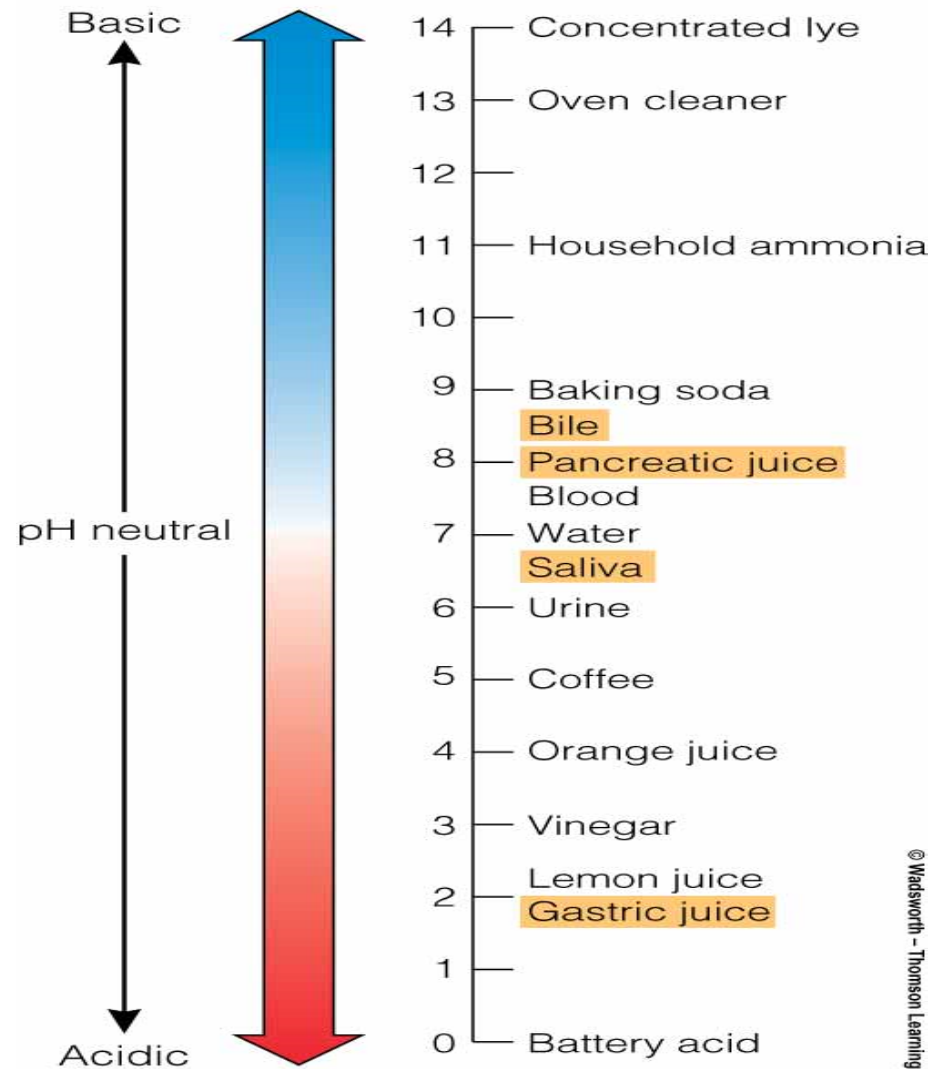
- Esophagus – connects mouth to stomach
 1. Epiglottis – closes airway
 2. Bolus moved along by peristalsis
 3. Cardiac sphincter – keeps food from backing up into esophagus

Digestion

- Stomach – collecting & churning
 1. Gastric glands secrete: gastric juice (water, enzymes, hydrochloric acid) that kills most bacteria and begins protein digestion and mucus to protect lining
 2. Chyme – semi-liquid mass of partially digested food
 3. Pyloric sphincter – regulates passage of chyme into small intestine

Secretions of Digestion

pH's of common substances:



Digestion

- Small Intestine – 3 segments:
 1. Duodenum – opening from common bile duct
secretes fluids from:
 - a. Liver & Gallbladder – bile emulsifies fat
 - b. Pancreas – amylase break down
carbohydrate, sodium bicarbonate
neutralizes the acidic chyme and lipase
 2. Jejunum
 3. Ileum
 - a. Ileocecal valve – sphincter that regulates
passage of chyme into large intestine

Digestion

- Large intestine (colon) - reabsorbing & eliminating
 1. Fermentation of undigested residues by bacteria occurs
 2. Terminates at rectum, where water some minerals are absorbed
 3. Anus – sphincter that controls defecation (excretion of fiber residue, wastes and some water)

Digestion

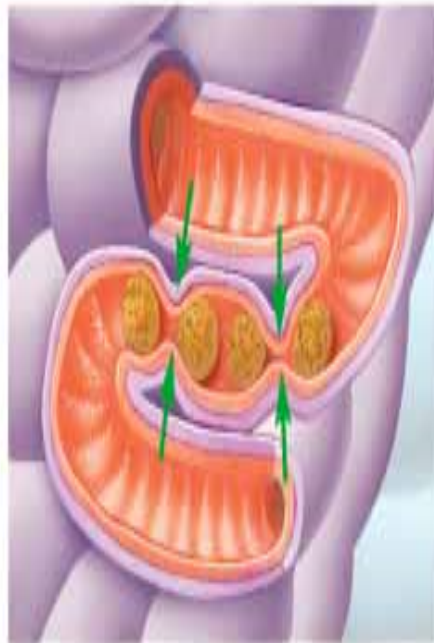
- Muscular action helps to propel liquefied food through the G.I. tract by:
 1. Peristalsis – muscular contractions that push contents forward
 2. Segmentation – inward squeezing for greater mixing of secretions
 3. Sphincter contractions

Segmentation

SEGMENTATION



Circular muscles contract, creating segments within the intestine.



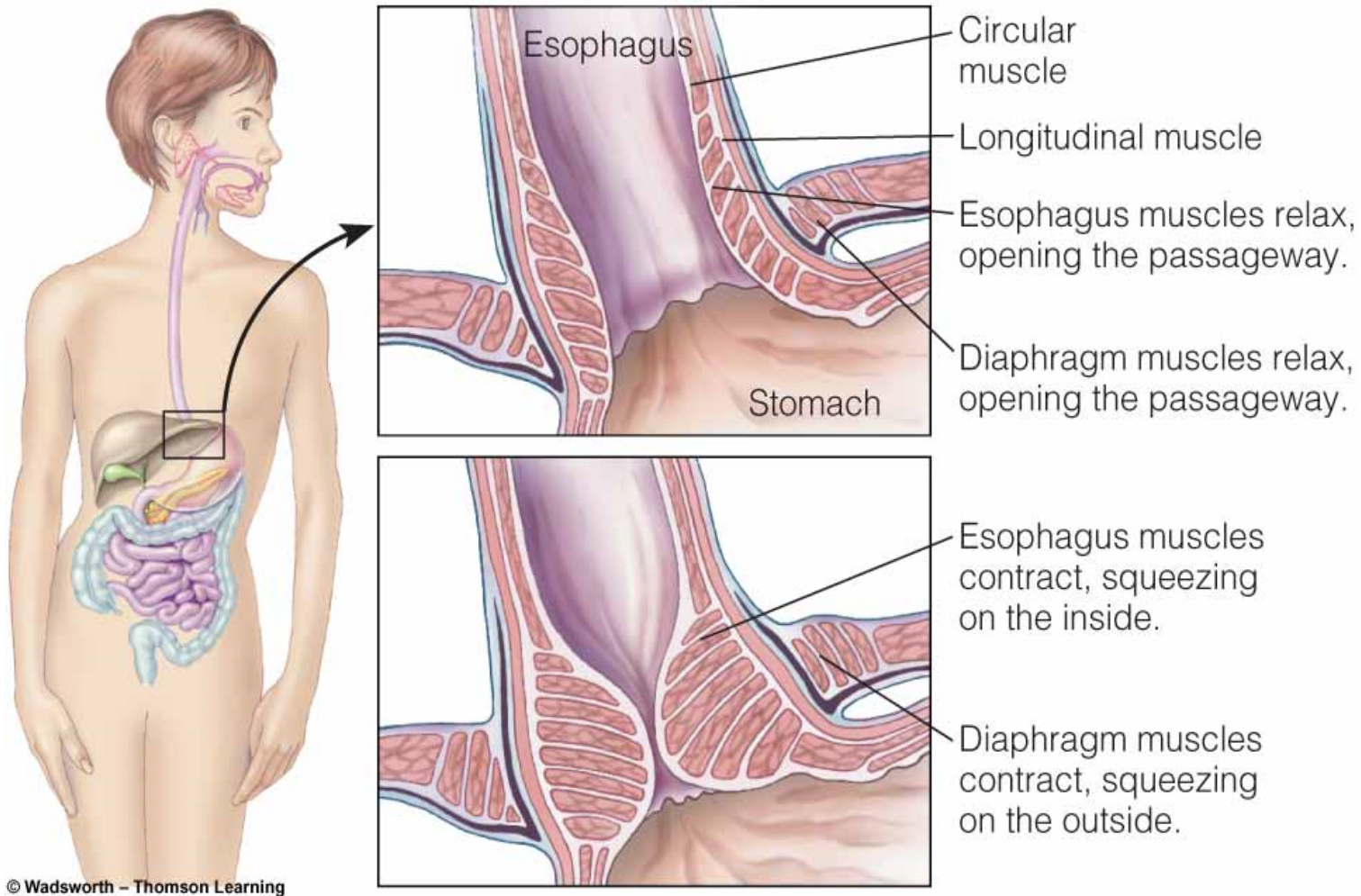
As each set of circular muscles relaxes and contracts, the chyme is broken up and mixed with digestive juices.



These alternating contractions, occurring 12 to 16 times per minute, continue to mix the chyme and bring the nutrients into contact with the intestinal lining for absorption.

Sphincter Contractions

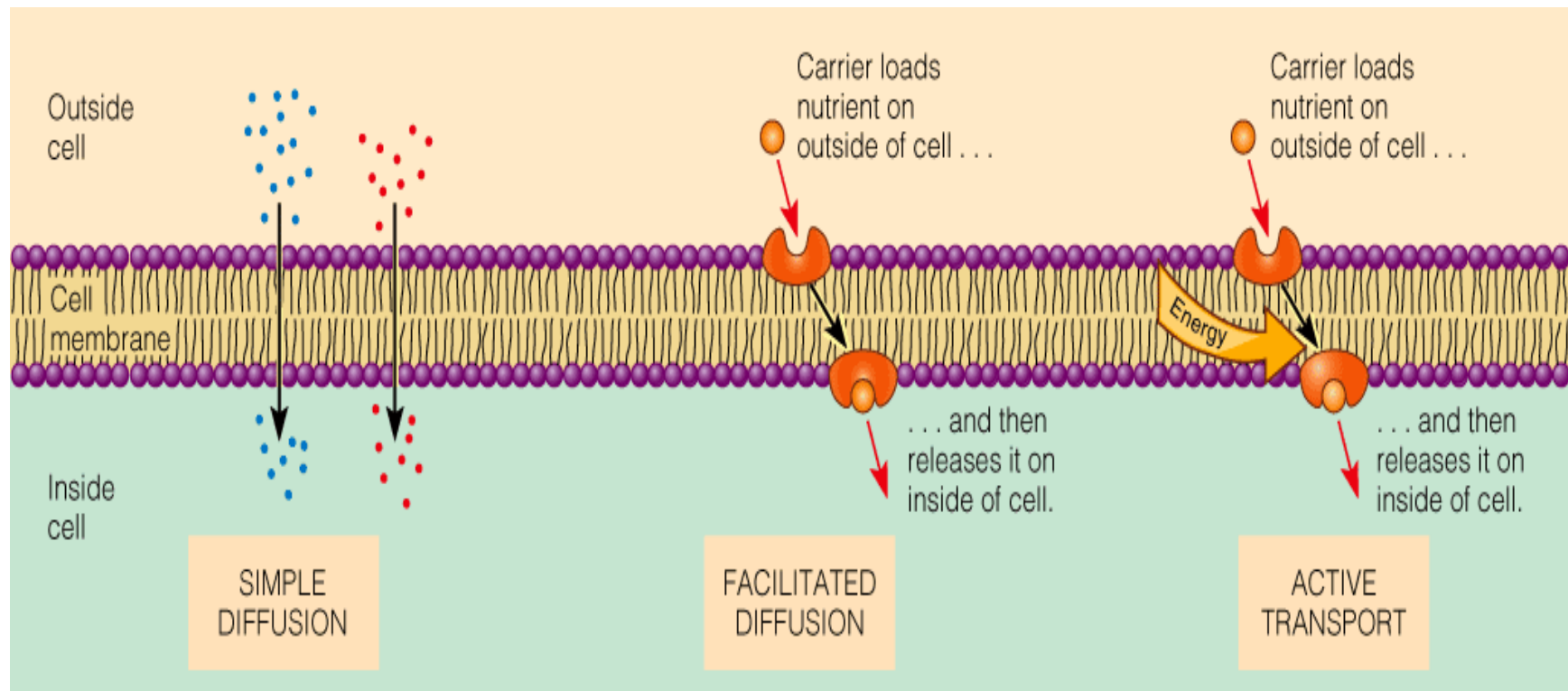
When the circular muscles of a sphincter contract, the passage closes; when they relax, the passage opens.



Absorption & Transport

- End-products of digestion:
 1. CHO >>> Monosaccharides
 2. Fats >>> Glycerol + fatty acids
 3. Proteins >>> Amino acids
 4. Vitamins, minerals & water – no breakdown

Absorption



Some nutrients (such as water and small lipids) are absorbed by simple diffusion. They cross into intestinal cells freely.

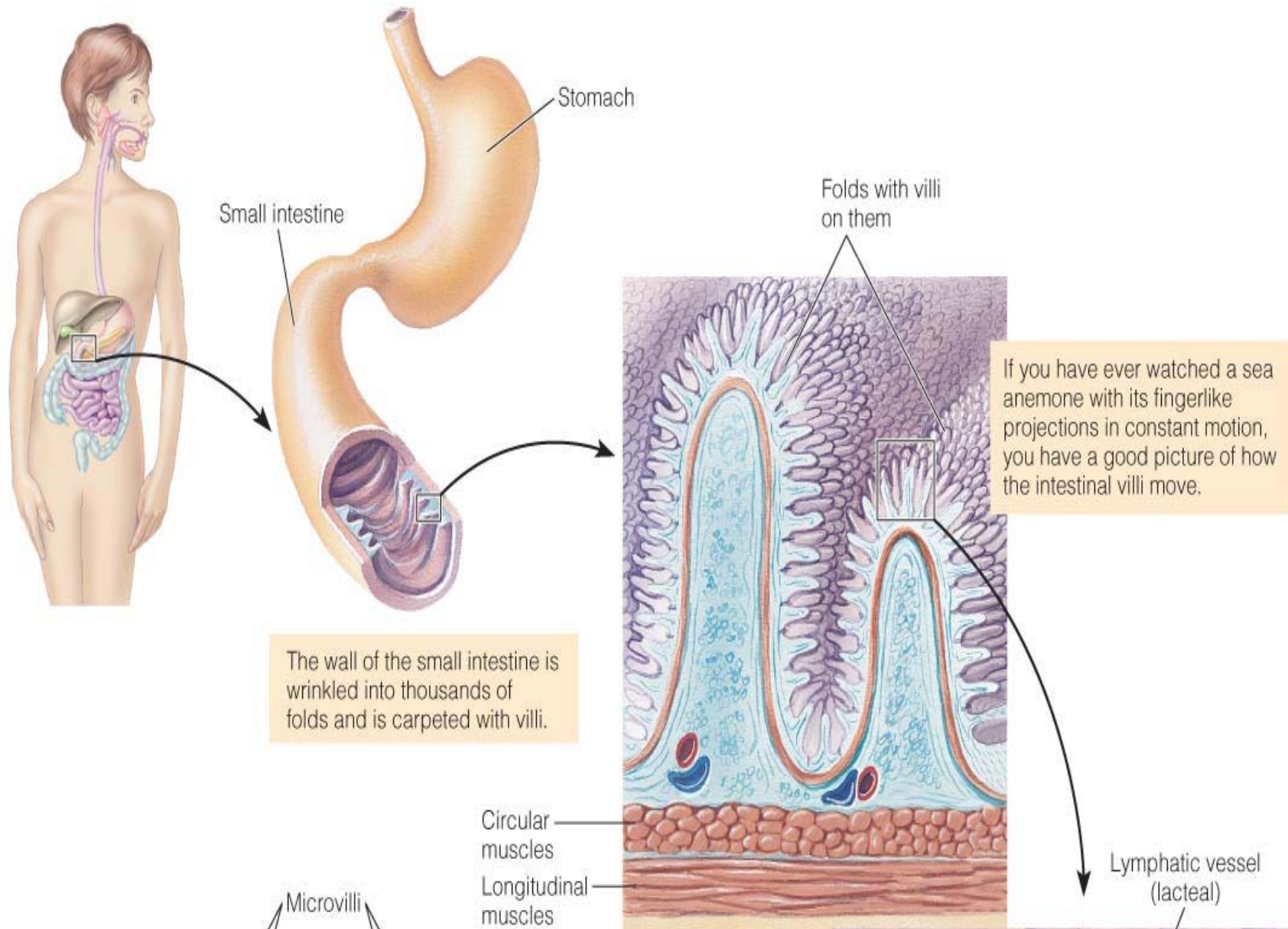
Some nutrients (such as the water-soluble vitamins) are absorbed by facilitated diffusion. They need a specific carrier to transport them from one side of the cell membrane to the other. (Alternatively, facilitated diffusion may occur when the carrier changes the cell membrane in such a way that the nutrients can pass through.)

Some nutrients (such as glucose and amino acids) must be absorbed actively. These nutrients move against a concentration gradient, which requires energy.

Absorption & Transport

- Absorption occurs in the small intestine
 1. Wall of small intestine covered with 100s of folds
 2. Each fold covered with 1000s of villi
 3. Each villi contains 100s of microvilli

The Small Intestine Villa



Absorption & Transport

- Absorbed nutrients enter either the:
 1. Vascular system – water-soluble nutrients (monosaccharides, amino acids, water-soluble vitamins, minerals, water) enter the blood via the portal vein for transport to the liver

Absorption & Transport

2. Lymph system – fat-soluble nutrients (lipids, fat-soluble vitamins) enter here, eventually entering the blood near the heart
3. Transport of lipids – since fats are insoluble in water, they must be packaged for transport as lipoproteins (triglyceride, phospholipid, protein, cholesterol)

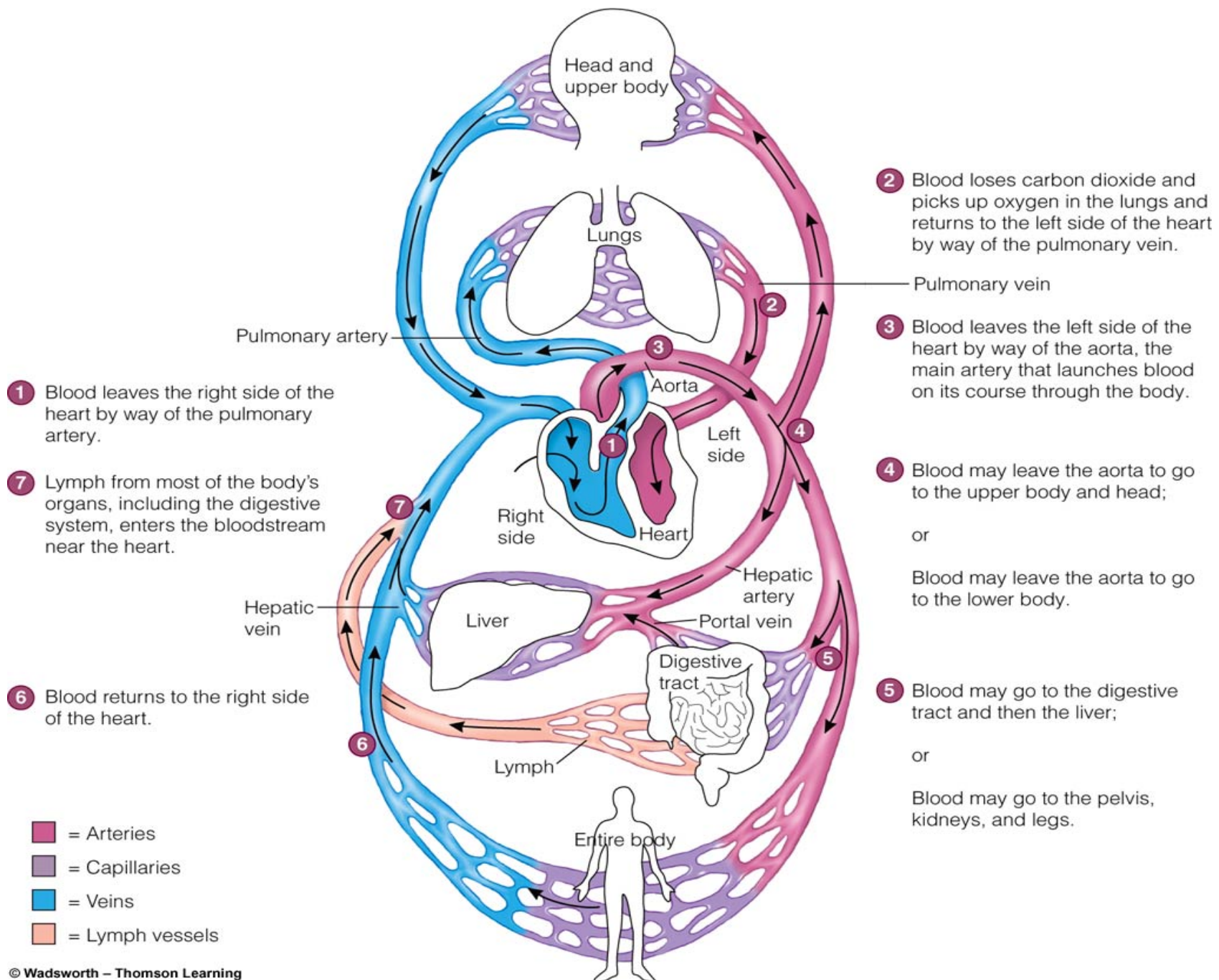
Absorption & Transport

4 basic types of lipoprotein:

1. Chylomicrons – very, very low density (85% triglyceride); absorbed from small intestine into lymph & circulated to cells where some of lipid material is picked off & remnants return to liver
2. VLDL – very low density lipoprotein (50% triglyceride); made by liver & travels to cells

Absorption & Transport

3. LDL – low density lipoprotein (50% cholesterol); remains of VLDL; high levels increase risk of heart attack
4. HDL – high density lipoprotein (50% protein); removes cholesterol from blood for return to liver; high levels decrease risk of heart attack



Upper GI Problems

Dysphagia – difficulty swallowing with tendency to choke/aspirate

1. Foods that are soft texture & smooth consistency critical to avoid aspiration (i.e. pudding consistency or pureed)
2. Thickened liquids using commercial thickeners are easier to swallow
3. Tube feeding into duodenum may be indicated

Upper GI Problems

Reflux esophagitis (“heartburn”) which often occurs due to a hiatal hernia and

Gastritis (inflammation of stomach lining) and

Peptic Ulcers (erosions of the lining of stomach or duodenum) require a **bland diet** to reduce gastric secretions and eliminate foods that cause pain or discomfort

1. Avoid chocolate, garlic/onions, caffeine, spicy & fatty foods, mint, alcohol
2. Small meals with fluids between meals
3. Antacids & acid controllers

Digestive Problems

Delayed Gastric Emptying – may be delayed temporarily following surgery or chronically due to Diabetes Mellitus

1. Low fiber, low fat speeds gastric emptying

Constipation – prevent with a high fiber diet and treat by drinking plenty of fluids including prune juice, get regular exercise & add laxatives (hydrophilic colloids), as needed

Digestive Problems

Diarrhea/dehydration – treat underlying cause and replace fluids & electrolytes to prevent dehydration

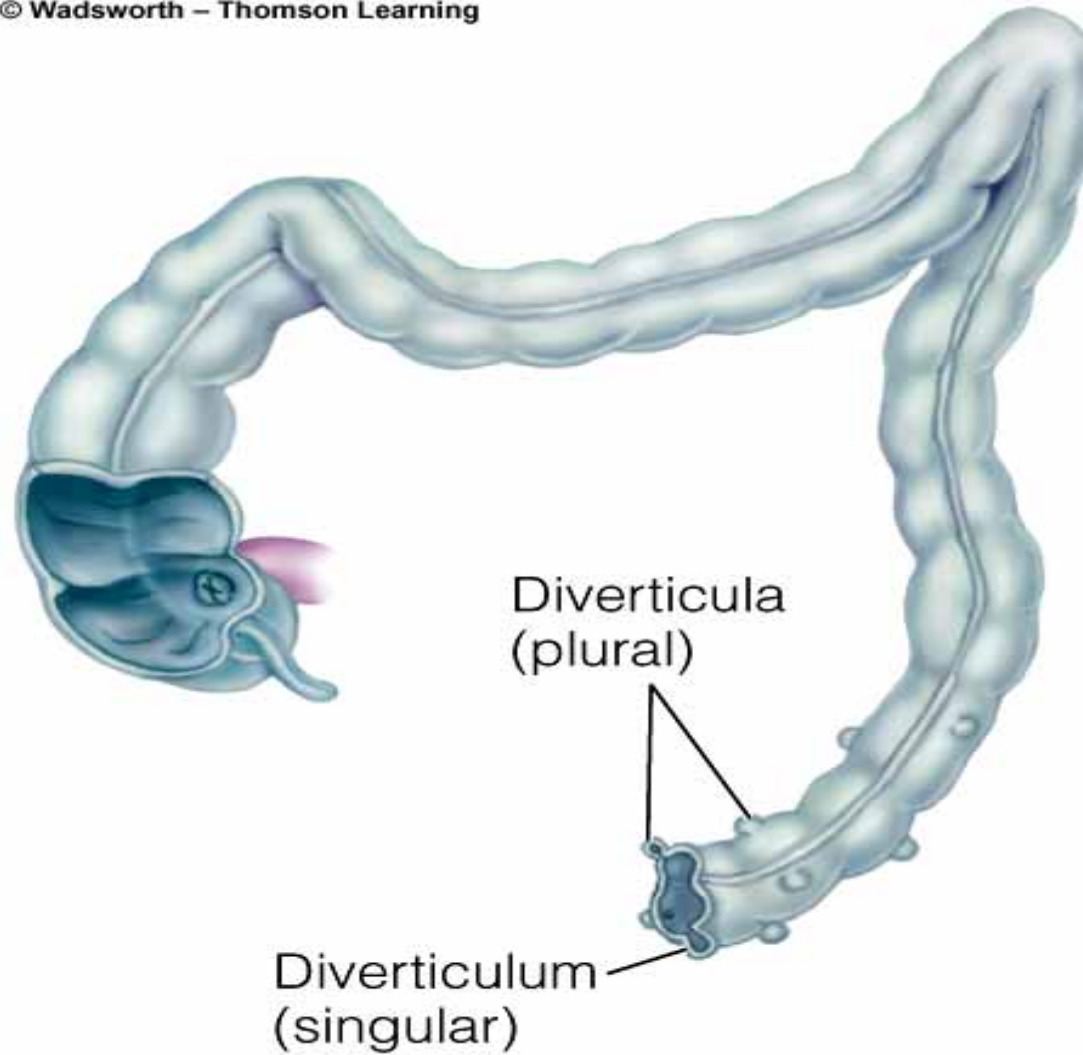
1. Mild cases use juices, sports drinks, caffeine-free sodas, tea, broth, oral rehydration formulas (e.g. Pedialyte)

Diverticular Disease

1. Avoid nuts, seeds, hulls (e.g. okra, strawberries, popcorn) which may get trapped & cause diverticulitis

Diverticula in the Colon

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Malabsorption Syndromes

Dumping Syndrome

Carbohydrate malabsorption that occurs due to removal of pyloric sphincter from partial gastrectomy causing osmotic diarrhea

1. Symptoms include weakness, dizziness, rapid heartbeat, diarrhea, abdominal pain
2. Avoid concentrated sweets, drink fluids between meals, eat small, frequent meals

Malabsorption Syndromes

Lactose Intolerance

Carbohydrate malabsorption due to a lack of the enzyme lactase that splits lactose into glucose + galactose

1. Incidence assoc. with aging, certain ethnic groups, and G.I. disease or surgery
2. Symptoms include cramping, distention, diarrhea after consuming products containing milk or lactose
3. Lactose-Restricted Diet or enzyme tablets & treated milk are also available

Malabsorption Syndromes

Fat Malabsorption – caused by disorders of the stomach, intestine, pancreas & liver

1. Steatorrhea (fatty, loose, foamy, foul smelling stools) with subsequent loss of energy, essential fatty acids, and fat-soluble vitamins
2. Limit fat intake to 35-40 gms/day
3. Supplementation with fat-soluble vitamins (water-miscible forms available)
4. Enzyme replacement to aid digestion & absorption

Malabsorption Syndromes

Pancreatitis – inflammation of the pancreas, resulting in impaired digestion/absorption

1. Symptoms include severe abdominal pain, and nausea & vomiting
2. Initially, N.P.O. (nothing by mouth) to rest the pancreas using I.V. fluids to maintain fluid & electrolyte balance
3. Avoiding alcohol is imperative as diet progresses
4. Chronic pancreatitis may lead maldigestion of fats, chronic abdominal pain, weight loss & diabetes

Malabsorption Syndromes

Cystic Fibrosis – hereditary disease characterized by thick mucus affecting many body organs, including lungs & pancreas, and abnormally high electrolyte concentration in sweat

1. Energy & nutrient needs 120-150% of normal
2. Fat needed to meet high energy needs so enzyme replacements used to control steatorrhea
3. Liberal use of fluids & salt

Malabsorption Syndromes

Celiac Disease (Gluten-sensitive enteropathy) – sensitivity to gliadin, part of the protein gluten, found in wheat, rye, barley & oats

1. Symptoms include weight loss, diarrhea, fatigue, anemia (iron, folate, Vit. B12), generalized malabsorption, bone disease
2. Avoiding foods containing gluten requires reading labels!