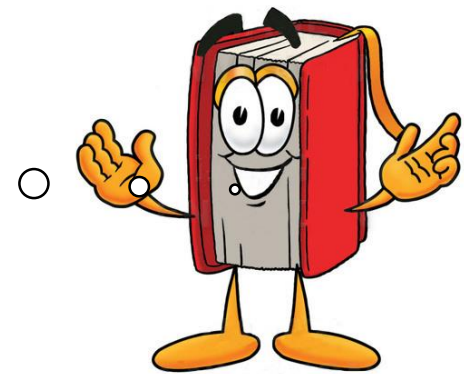


*Hey – I'll be ready
because I book it!!*



BI 121 Lecture 6

- I. Announcements Next session Q? ~1/2 review, then Exam I.**
- II. Nutrition News Be a whiz at healthy grilling! AICR
American Institute for Cancer Research, Grilling Quiz!**
- III. GI Connections LS ch 15, DC Module pp 17-23**
 - A. Gut control mechanisms**
 - B. Histology of the gut LS fig 15-2, 15-3 p 442-3**
 - C. Organ-by-organ review**
 - D. Stomach protein digestion + zymogens? LS fig 15-7, 15-9**
 - E. Accessory organs: Pancreas & Liver + Recycling!
LS pp 457-63**
 - F. Small intestine? Ulcers? LS fig 15-20, 15-22 pp 467-8
<http://www.cdc.gov/ulcer> Beyond the Basics LS p 456**
 - G. Summary of chemical digestion LS tab 15-5 p 466**
 - H. Large intestine? LS fig 15-24 pp 472-4**

Be a Whiz at Healthy Grilling

Summertime is grilling time for Americans. Unless you take some simple precautions, however, grilling food can raise the risk of cancer. Take this multiple-choice quiz to see if you know the dos and don'ts of grilling for great taste and good health. Questions may have more than one correct answer.

1. Grilling can raise cancer risk because:

- A. The grill is usually dirty.
- B. Flies and pollution from the air can land on the food.
- ✓ C. Red meat, poultry or seafood can form carcinogenic compounds called heterocyclic amines (HCAs) when exposed to high heat. HCAs can damage the DNA of our genes, beginning the process of cancer development.
- ✓ D. Fat from red meat, poultry and seafood can drip, creating a cancer-causing substance called polycyclic aromatic hydrocarbons (PAHs). Smoke and flare-ups deposit the PAHs back on the meat.

2. What are the best choices for grilling?

- ✓ A. Vegetables and fruits because they don't form HCAs.
- ✓ B. Vegetables because natural phytochemicals in them stimulate enzymes that can convert HCAs to an inactive form that is easily eliminated from the body.
- ✓ C. Lean meats, like skinless chicken and fish, because they drip less fat.
- ✓ D. Small portions of red meat, like kebabs, because they cook fast.

3. A marinade can decrease carcinogens that form during grilling up to 96 percent because:

- A. It acts as a barrier, keeping flames from directly touching the meat.
- B. Typical marinade ingredients, like vinegar, citrus juices and olive oil, have special protective powers.
- ✓ C. Scientists aren't sure why.

4. If you decide to grill meat, which simple cooking adjustment(s) will reduce the formation of carcinogens?

- ✓ A. Covering the grill with punctured aluminum foil.
- ✓ B. Turning the gas down or waiting for charcoal to become low-burning embers.
- ✓ C. Raising the grilling surface.

- ✓ D. Placing meats to the side of the heat source.

5. Flipping meat every minute can also reduce the formation of carcinogens for the following reason(s):

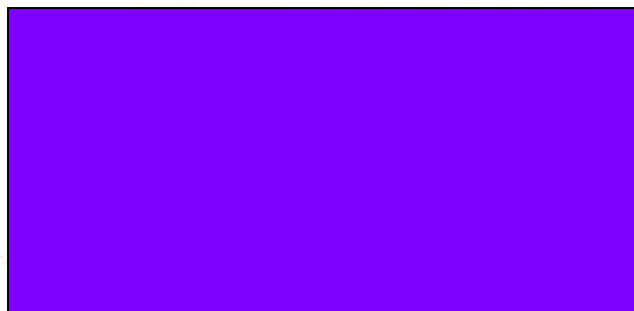
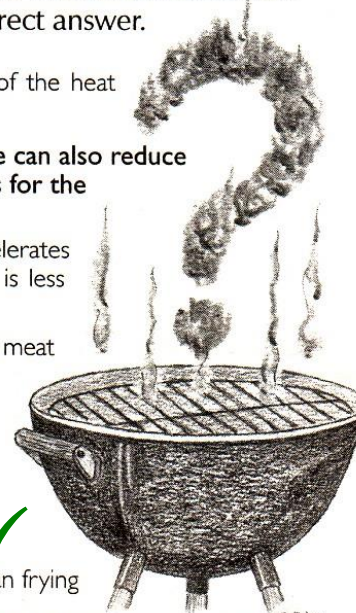
- A. Turning the meat often accelerates the cooking process, so there is less exposure to heat.
- B. Flipping propels HCAs off the meat into the air.
- ✓ C. Charring is less likely.

6. Safer methods of cooking meat than grilling include:

- ✓ A. Microwaving C. Stewing ✓
- ✓ B. Roasting D. High-heat pan frying

7. If you decide to grill red meat, to limit cancer risk you should eat no more in a day than what amount?

- A. 22 ounces C. 10 ounces
- B. 1 pound ✓ D. 3 ounces

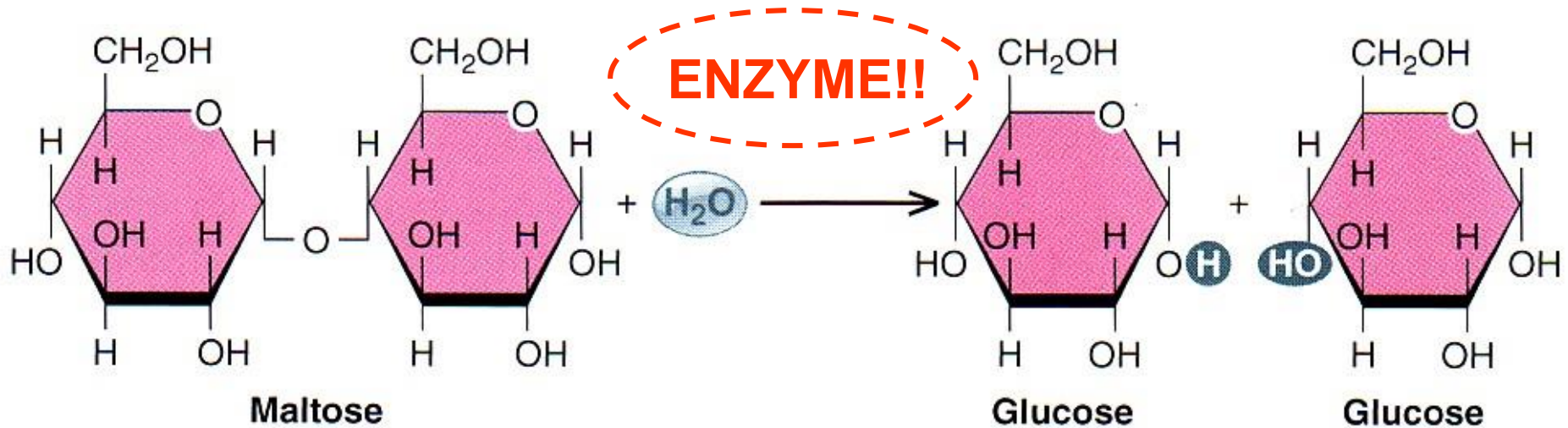


FREEFACTS ▶ For more information about safe grilling, order a free copy of AICR's brochure, "The Facts About Grilling." Check box 4 on the Free Information Request card, or contact AICR national headquarters.

American Institute for Cancer Research (AICR) Healthy Grilling Quiz Summary

1. **Marinade, marinade, marinade!** By doing so, you can decrease carcinogens formed during grilling by $\leq 96\%$!
2. **Cover the grill with aluminum foil,** turn gas down or wait for low-burning embers, cook to the side.
3. **Best choices for grilling include vegetables and fruits** (no HCAs + enzymes to inactivate HCAs!), and lean meats (e.g., fish & skinless chicken ↓ PAHs).
4. **Flip meat every minute** to reduce charring & remove charred portions prior to eating.
5. **To limit cancer risk, eat no more than 3 oz grilled red meat in a day!** Cook small portions/kebabs.

What's missing?

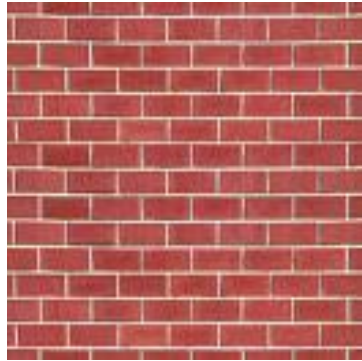


● **FIGURE 15-1** An example of hydrolysis. In this example, the disaccharide maltose (the intermediate breakdown product of polysaccharides) is broken down into two glucose molecules by the addition of H₂O at the bond site.

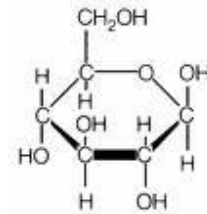
Polymer to Monomer (Many to One)



...Central-linking theme!!

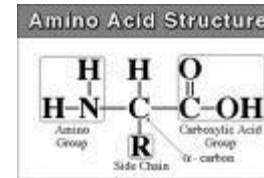


Carbohydrate

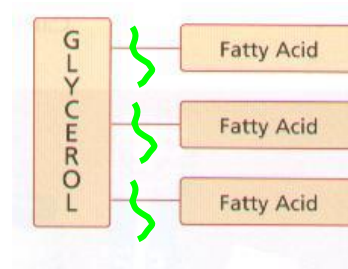
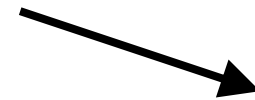


Glucose

Protein
+
Fat



Amino Acids

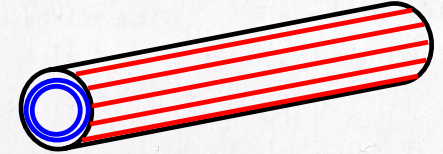


Fatty Acids
+
Glycerol

Common Control Mechanisms

- 1. Local (autoregulation)**
- 2. Nervous (rapidly-acting)**
- 3. Hormonal (slower-acting/
reinforcing)**

Longitudinal → Shortens L



Circular → ↓d or Width

Body wall

Serosa

Submucosa

Duct of large accessory digestive gland (i.e., liver or pancreas) emptying into digestive-tract lumen

Outer longitudinal muscle

Inner circular muscle

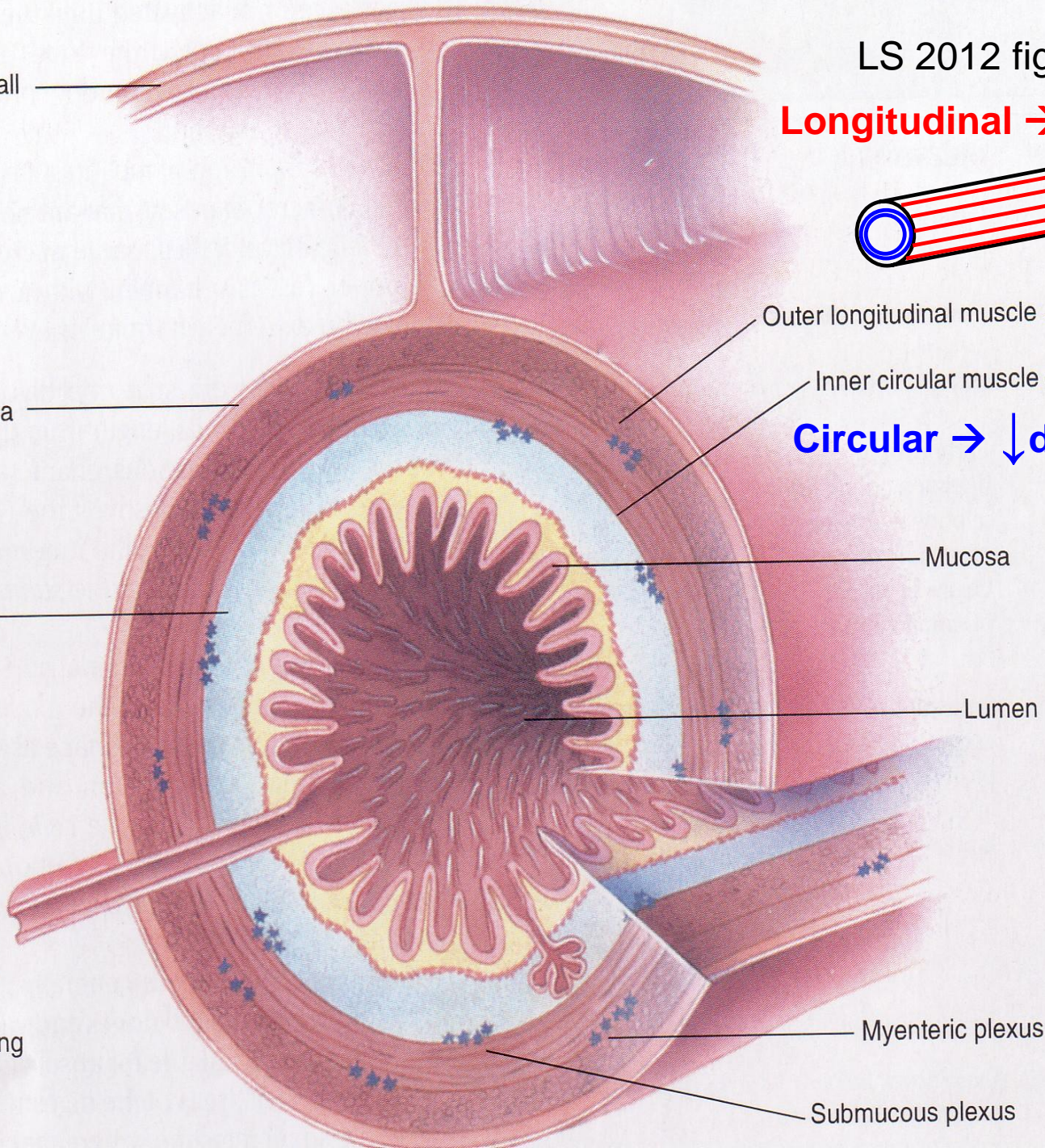
Muscularis externa

Mucosa

Lumen

Myenteric plexus

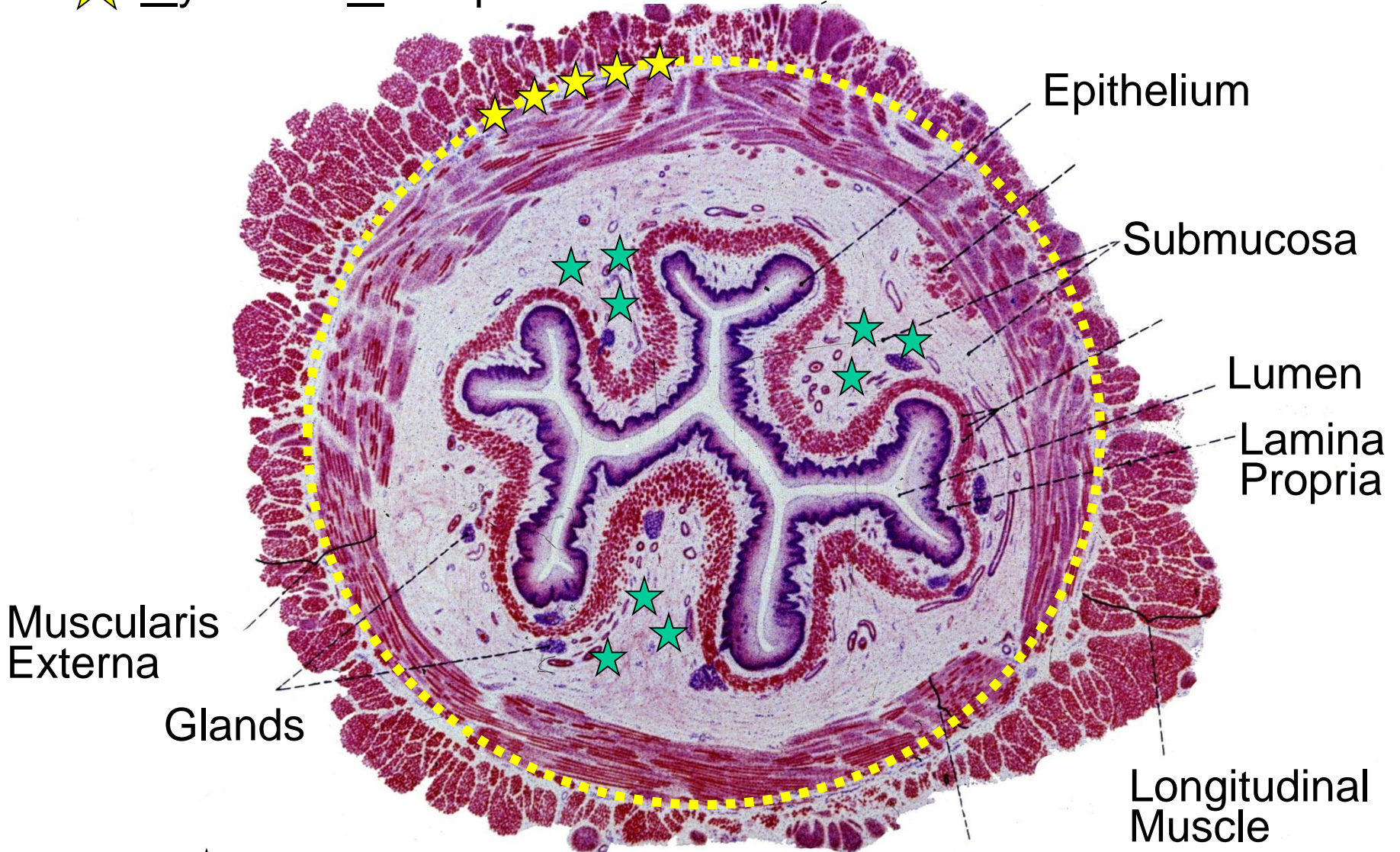
Submucous plexus



★ Myenteric motor plexus!

Serosa

cf: G&H fig 62-2



Epithelium

Submucosa

Lumen

Lamina Propria

Muscularis Externa

Glands

Longitudinal Muscle

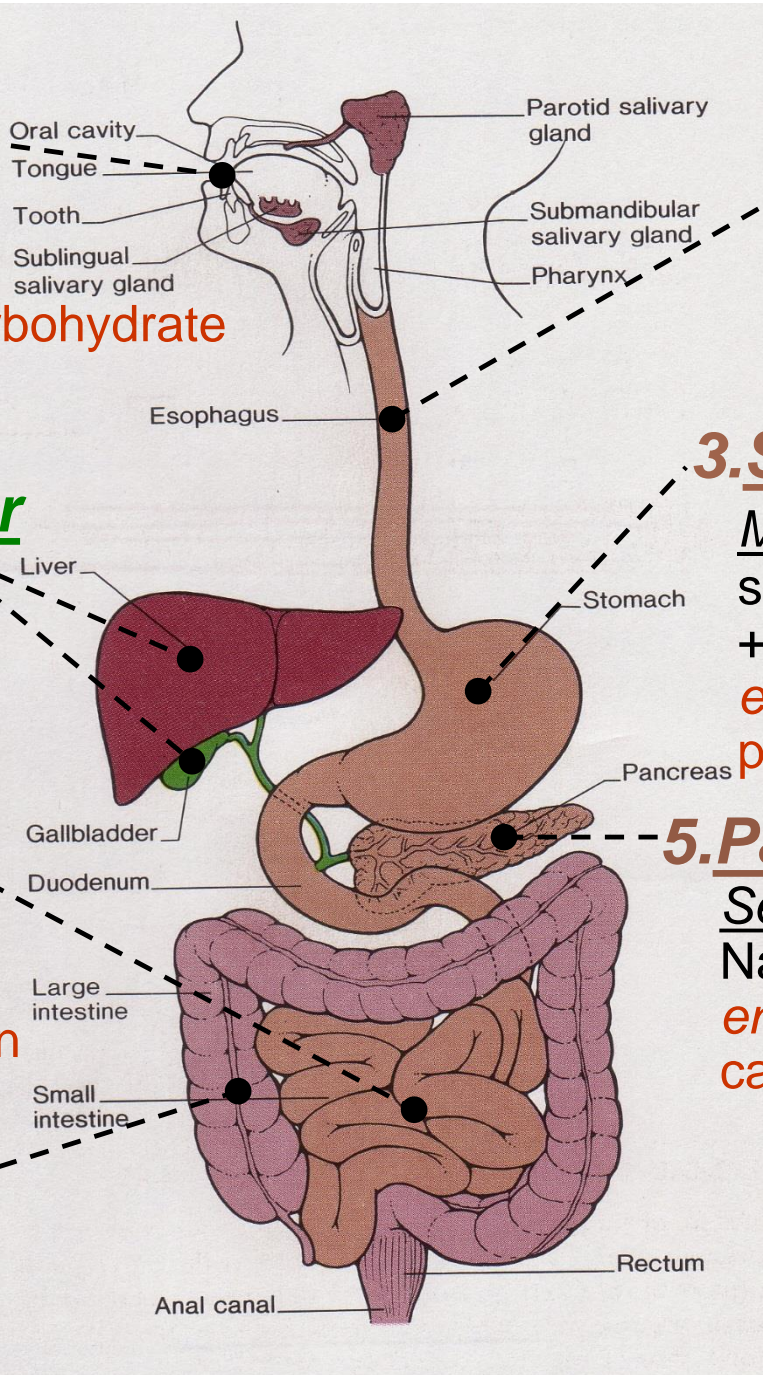
Circular Muscle

★ Meissner's sensery & secretory plexus!

H Howard 1990

1. Mouth

Ingestion entry way
salivary gland secretion
mucus + enzymes
enzymatic digestion: carbohydrate
mastication = chewing
deglutition = swallowing



2. Esophagus

Rapid transit
peristalsis
secretion mucus

3. Stomach

Mixing peristalsis
secretion mucus + HCl
+ enzymes
enzymatic digestion:
protein + butter fat!

5. Pancreas

Secretion mucus +
NaHCO₃ + enzymes
enzymatic digestion:
carbohydrate, fat, protein

4. Liver-Gall Bladder

Emulsification =
detergent action of bile
+ secretion

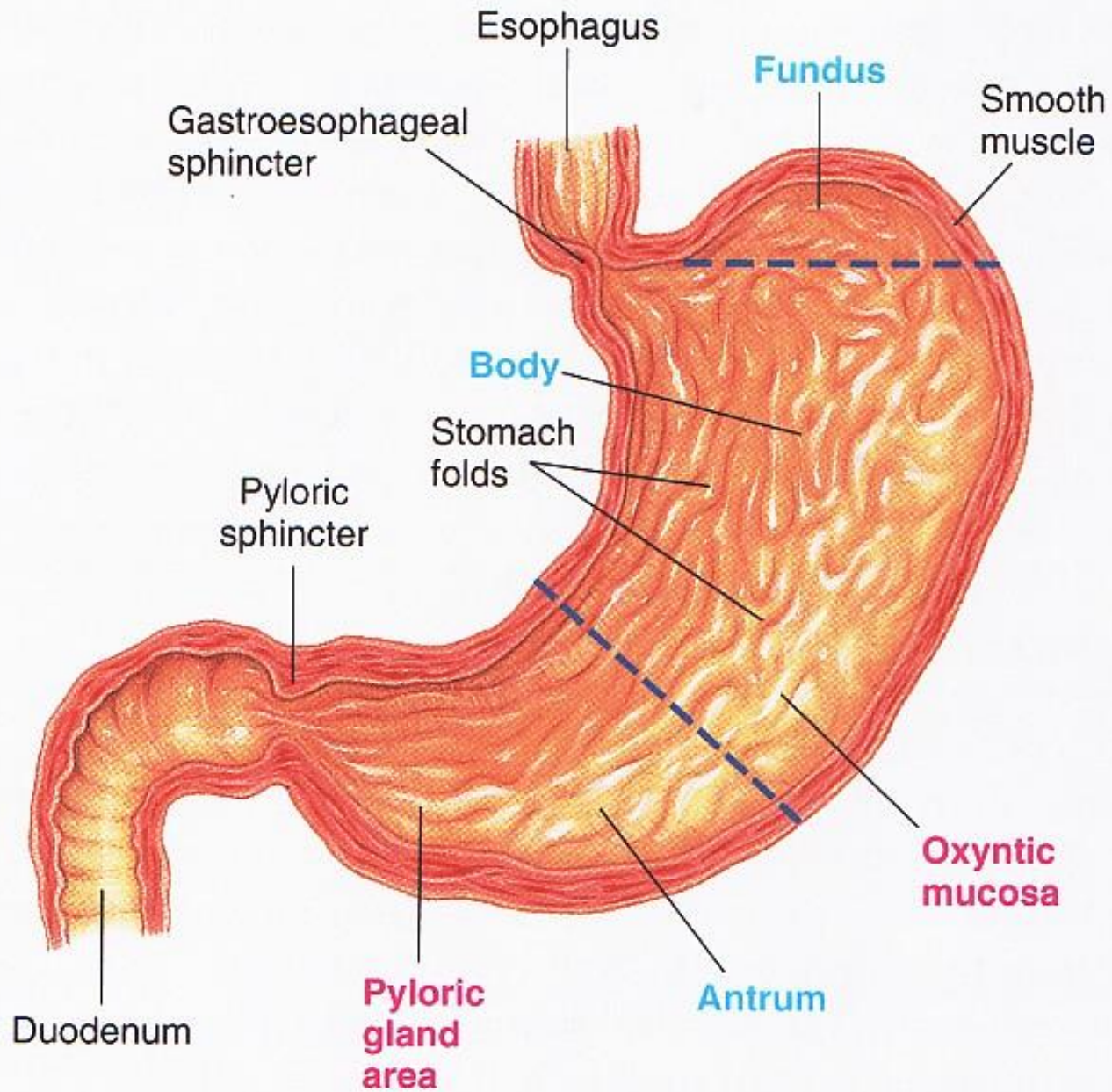
6. Small Intestine

Absorption
Secretion mucus
+ enzymes
enzymatic digestion:
carbohydrate, fat, protein
Peristalsis

7. Large Intestine

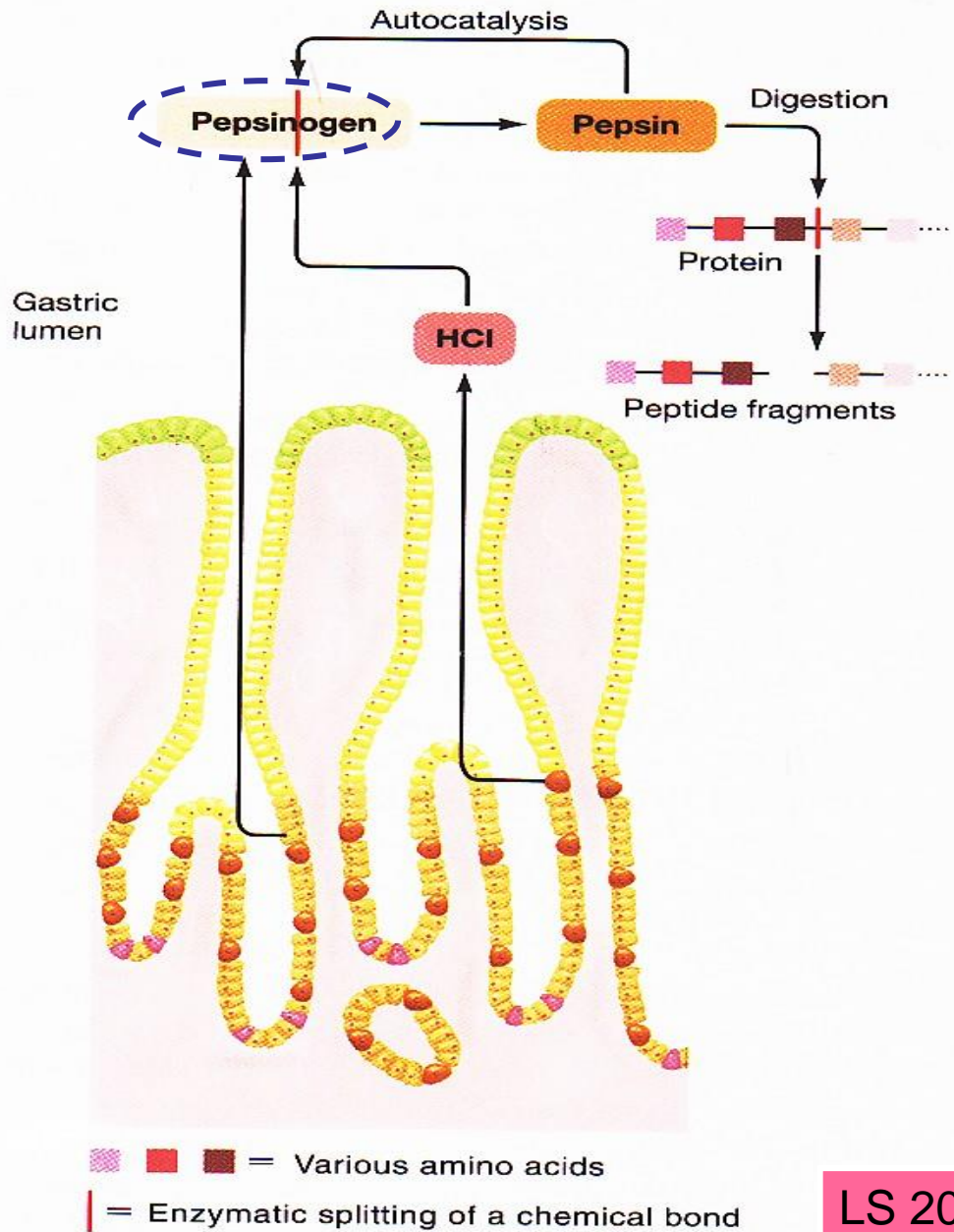
Dehydration
secretion + absorption
storage + peristalsis

Where does
enzymatic
digestion of
protein
begin?

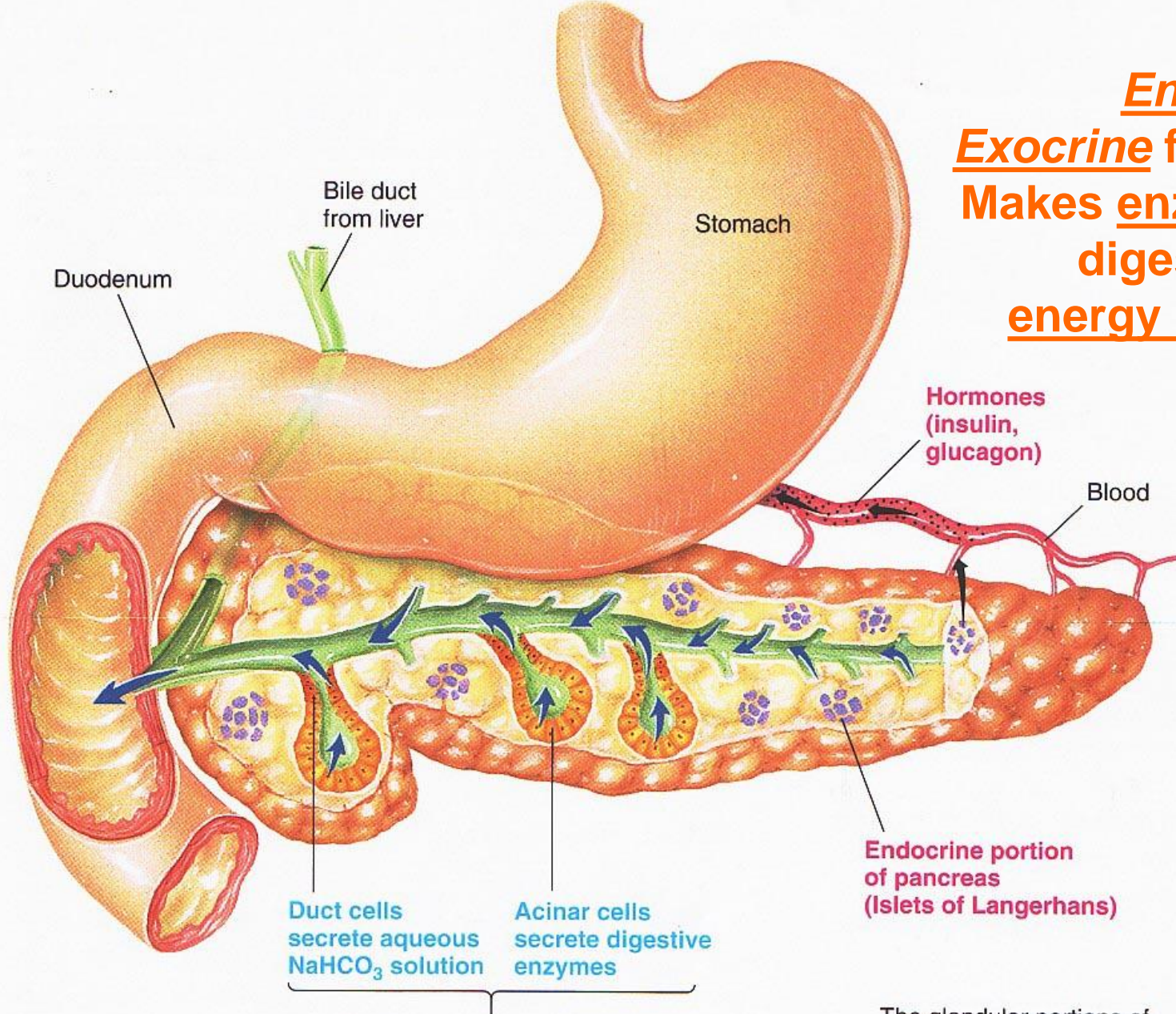


● **FIGURE 15-7**

Zymogen=
an inactive
precursor



Why is the
pancreas so
unique?



Endocrine + Exocrine functions; Makes enzymes for digesting all 3 energy nutrients!

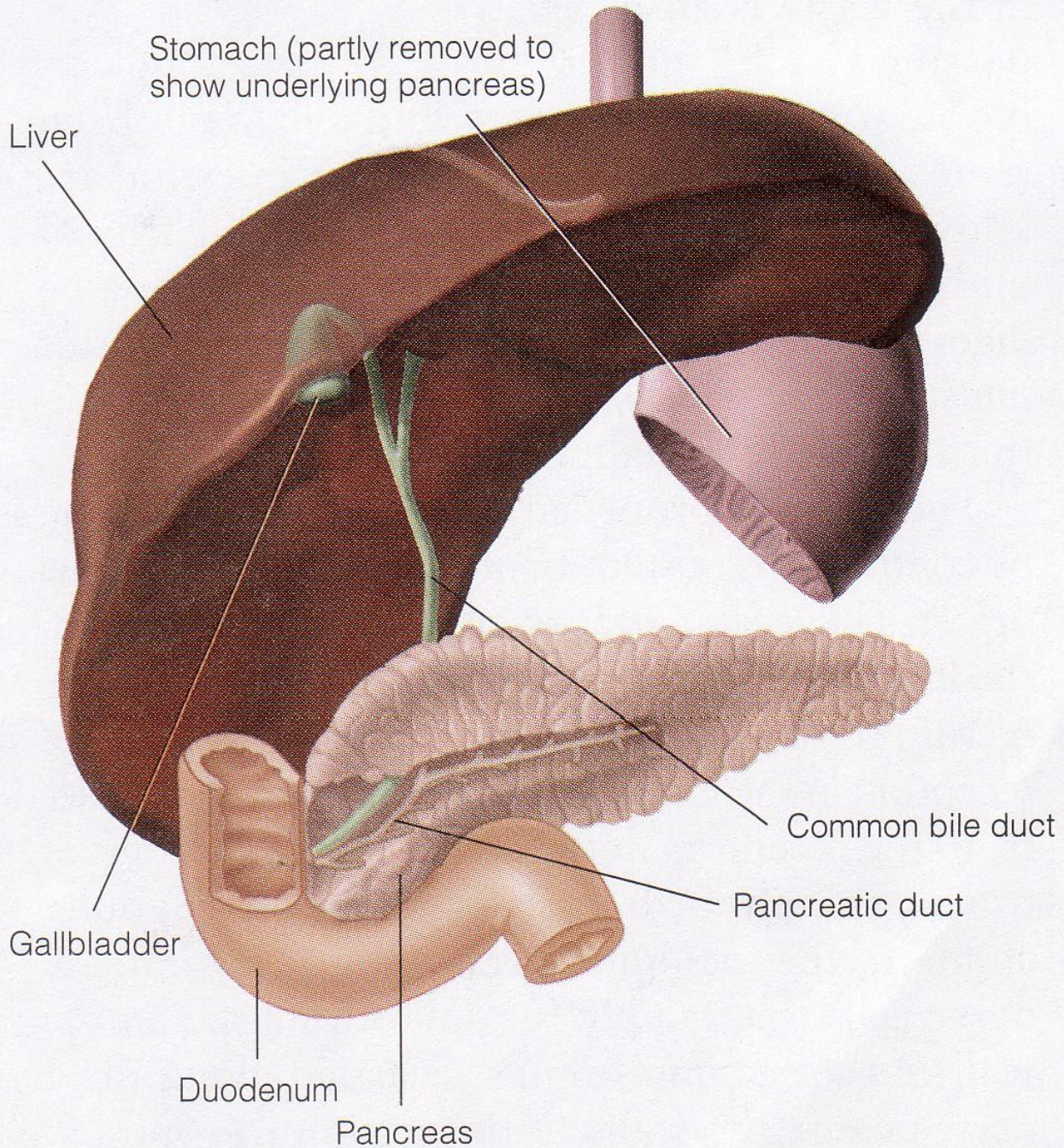
Duct cells secrete aqueous NaHCO_3 solution
 Acinar cells secrete digestive enzymes

Endocrine portion of pancreas (Islets of Langerhans)

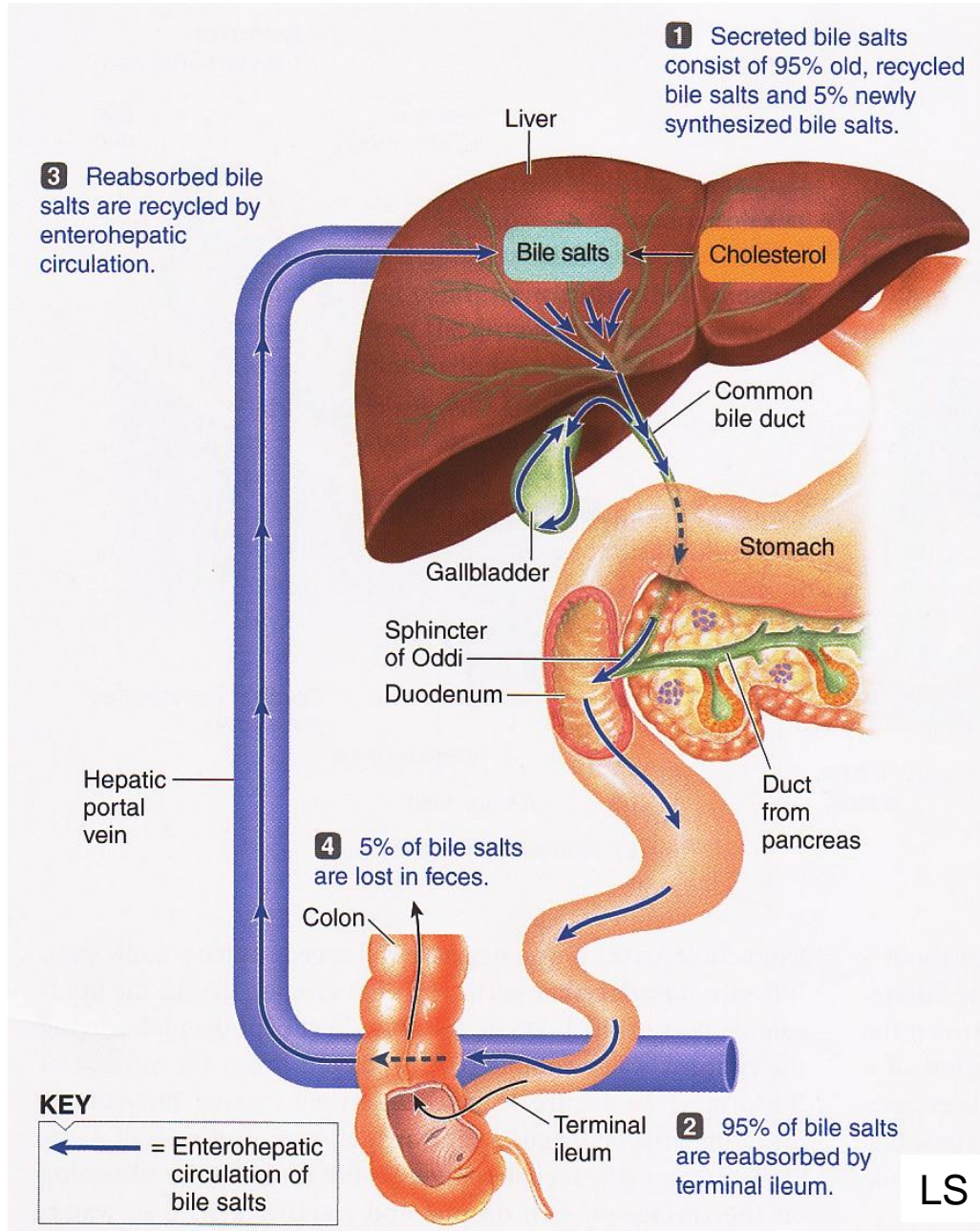
The glandular portions of the pancreas are grossly exaggerated.

LS 2012 fig 15-11 p 457 Exocrine portion of pancreas (Acinar and duct cells)

**What are other
accessory organs
of digestion, that is,
off-shoots of the
primary tube?**

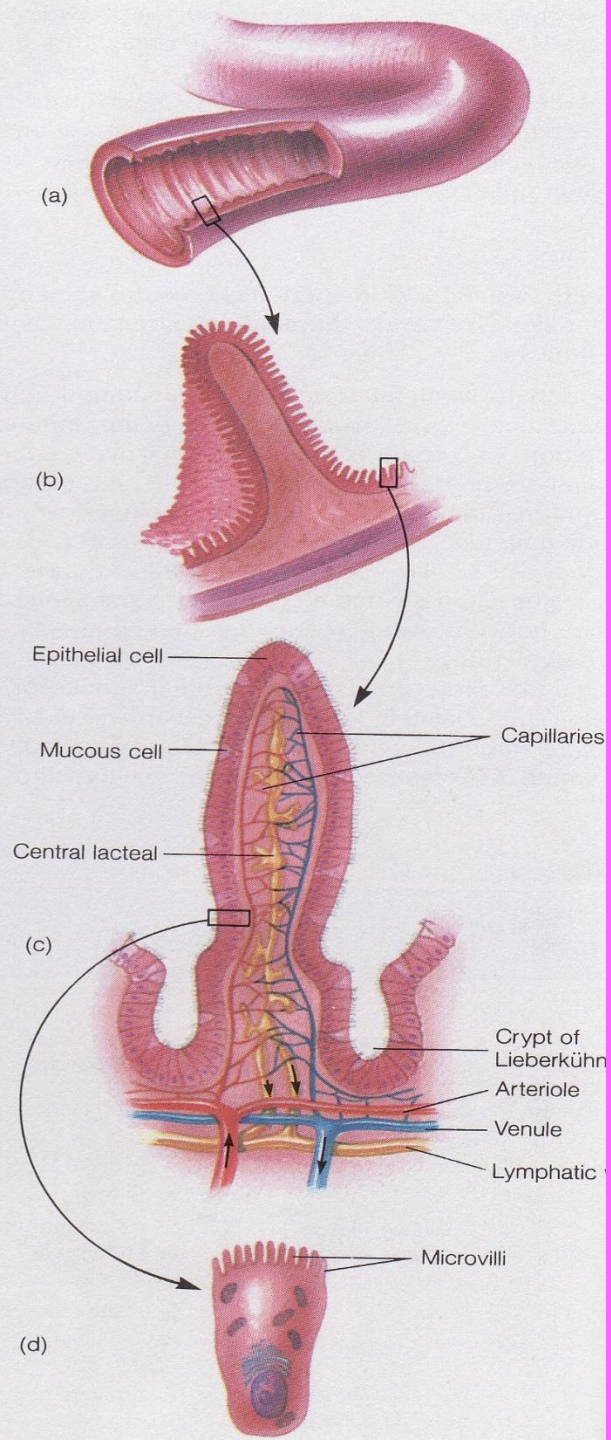


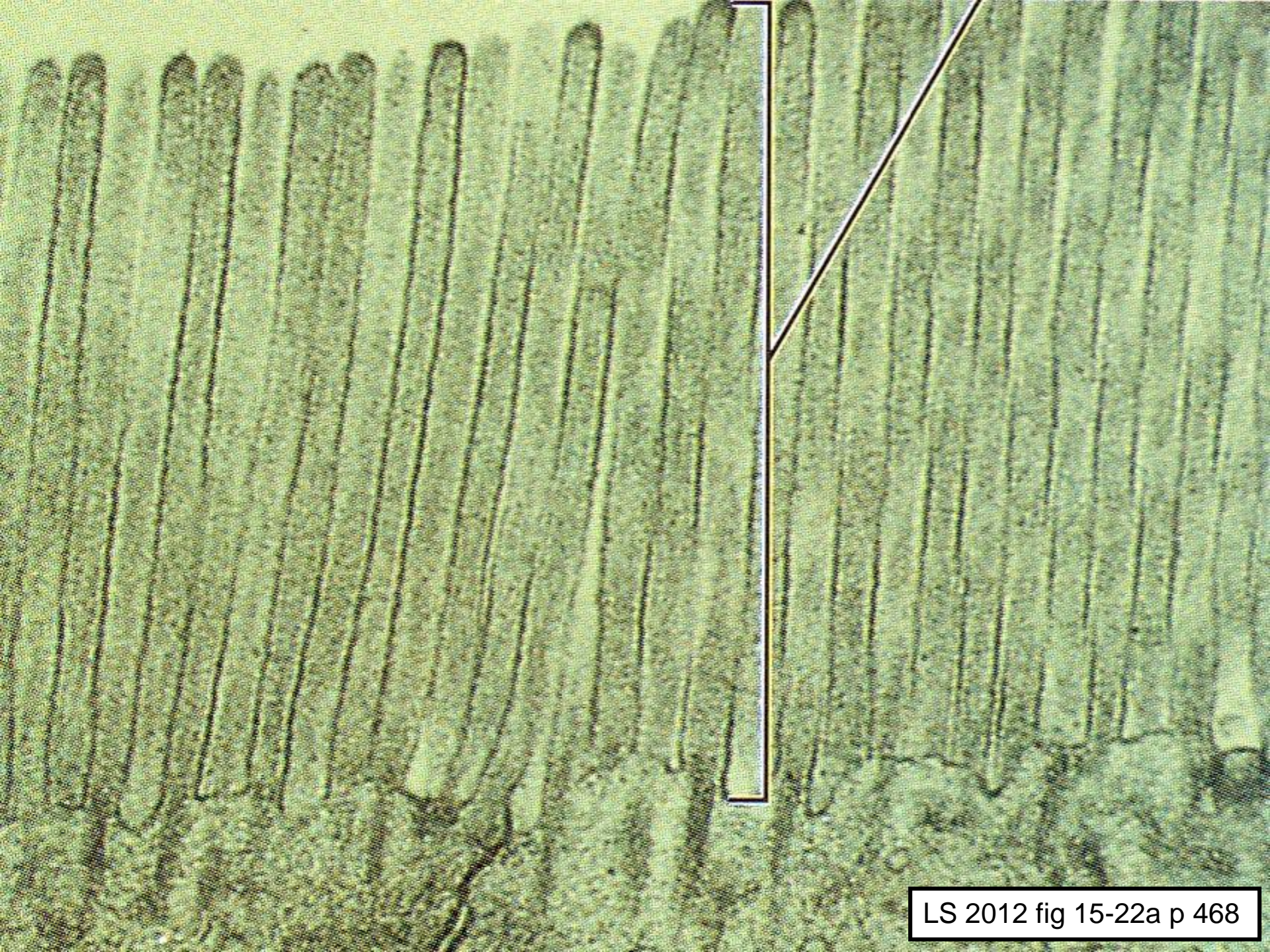
Liver: Amazing Recycling of Bile Salts!



What is the major
function of the
small intestine?

Absorption!!







<http://www.cdc.gov/ulcer/>



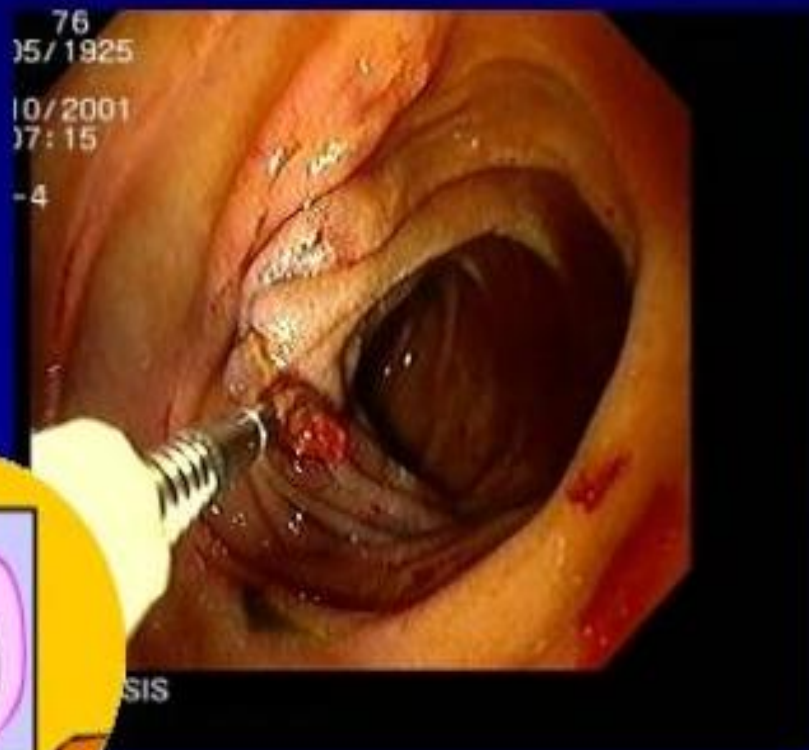
Ulcer Facts

- Most ulcers are caused by an infection, not spicy food, acid or stress.
- The most common ulcer symptom is burning pain in the stomach.
- Your doctor can test you for *H. pylori* infection.
- Antibiotics are the new cure for ulcers.
- Eliminating *H. pylori* infections with antibiotics means that your ulcer can be cured for good.

Clipping a Duodenal Ulcer

Peering through the pylorus into the duodenum, we see some blood and a vessel sticking out of the wall, just at the front edge of a small but deep ulcer.

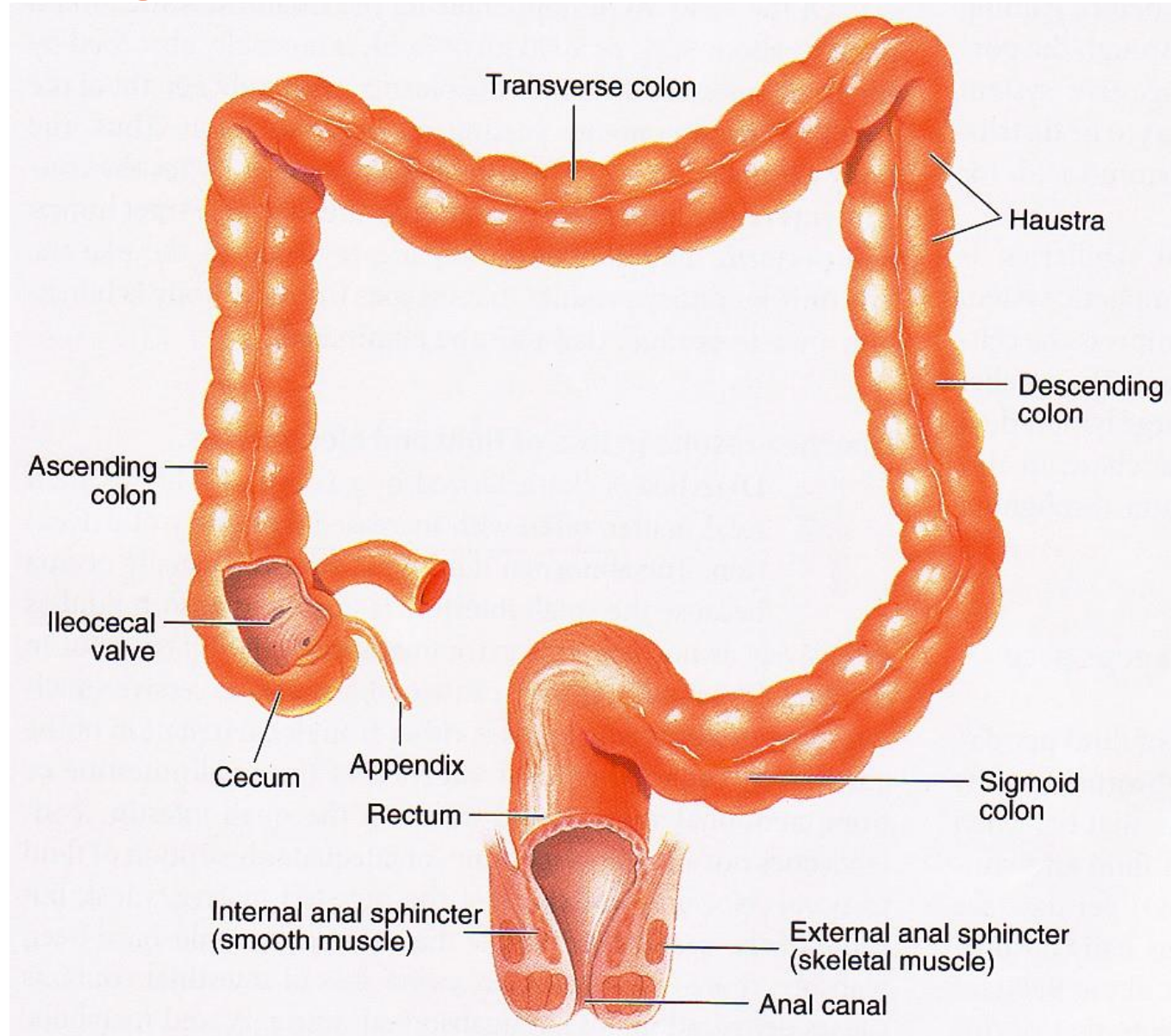
In the second photograph, a disposable metal clip is applied to the ulcer. The patient remained well and left hospital three days later.



▲ **Table 15-5 Digestive Processes for the Three Major Categories of Nutrients**

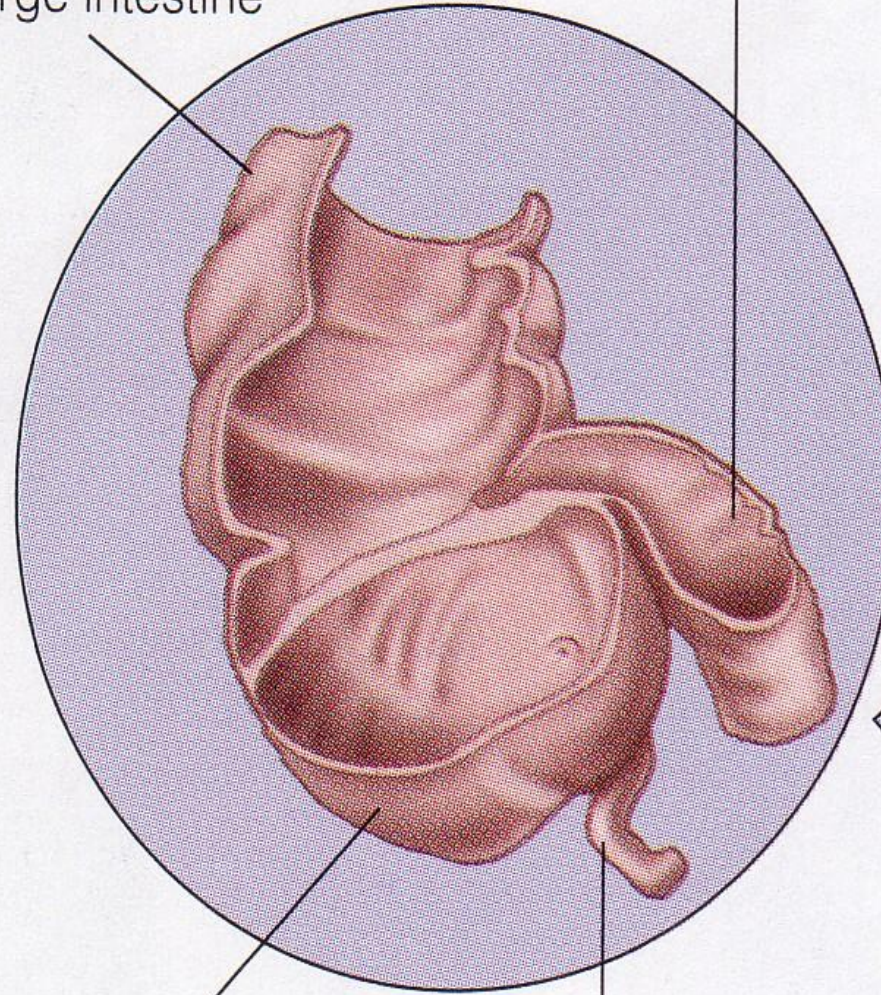
Nutrients	Enzymes for Digesting the Nutrients	Source of Enzymes	Site of Action of Enzymes	Action of Enzymes	Absorbable Units of the Nutrients
Carbohydrates	Amylase	Salivary glands	Mouth and (mostly) body of stomach	Hydrolyzes polysaccharides to disaccharides (maltose)	
		Exocrine pancreas	Small-intestine lumen		
	Disaccharidases (maltase, sucrase, lactase)	Small-intestine epithelial cells	Small-intestine brush border	Hydrolyze disaccharides to monosaccharides	Monosaccharides, especially glucose
Proteins	Pepsin	Stomach chief cells	Stomach antrum	Hydrolyzes protein to peptide fragments	
	Trypsin, chymotrypsin, carboxypeptidase	Exocrine pancreas	Small-intestine lumen	Attack different peptide fragments	
	Aminopeptidases	Small-intestine epithelial cells	Small-intestine brush border	Hydrolyze peptide fragments to amino acids	Amino acids
Fats	Lipase	Exocrine pancreas	Small-intestine lumen	Hydrolyzes triglycerides to fatty acids and monoglycerides	Fatty acids and monoglycerides
	Bile salts (not an enzyme)	Liver	Small-intestine lumen	Emulsify large fat globules for attack by pancreatic lipase	

Large Intestine Structure & Function



Ascending
portion of
large intestine

Ileum
of small
intestine



Cecum

Appendix