

Yes, more fun!...



BI 121 Lecture 5

I. Announcements Lab 3 tomorrow Nutritional Analyses.

Thanks for recording dietary data on LM p 3-7 & exploring <https://www.supertracker.usda.gov/>. Sample MT Questions.

II. Nutritional Physiology in the News

UCB Wellness Letter, June 2011, Salt–beyond hypertension

III. Nutrition Primer (continued) DC Module 2, S&W +...

A. Fasting? Dr. Sacks **AHA NPAM Council** 2009; AMDR?

B. *Beware of Nutrition Quackery* S. Kleiner & Monaco 1990

IV. Digestion LS 2012 ch 15, pp 437-9, DC Module 3 pp 17-23

A. Steps of digestion Dr. Evonuk + LS pp 437- 9; DC p 23

B. Hydrolysis: the central linking theme! LS p 438, Fox 2009

C. What's missing? LS fig 15-1 p 438

D. GI-Donut analogy? Dr. Lorraine Brilla WWU

E. Gut secretions: What? Where? Why? LS p 438, 440-1

F. Organ-by-organ review LS tab 15-1 pp 440-1 + DC fig 3-1

G. Histology & control of the gut LS fig 15-2, 15-3 p 442-3

H. Stomach protein digestion + zymogens? LS fig 15-7, 15-9

I. Pancreas & liver accessory organs; Recycling! LS pp 457-63

J. Small intestine? Ulcers? LS fig 15-20,15-22 pp 467- 8

<http://www.cdc.gov/ulcer> LS Beyond the Basics p 456

Sample Midterm Questions

Sample 1. What is *human physiology*? (+2) How does it differ from *human anatomy*? (+2)

Sample 2. Give 2 *examples* of when *positive feedback* may occur normally in the human body. (+4)

Sample 3. *Cells* are progressively organized into

- organs, systems, tissues, then the whole body
- tissues, organs, systems, then the whole body
- systems, tissues, organs, then the whole body
- None of the above are correct.

Does exercise help
prevent cancer? p. 6



WellnessLetter.com

\$5.00 • Volume 27 • Issue 9 • June 2011

University of California, Berkeley

WellnessLetter®

News and expert advice from the School of Public Health

WellnessFacts

■ **Since the early 1970s American men have increased their daily calorie intake by an average of 179 calories, and women by 199 calories**—with nearly all of those added calories coming from carbohydrates, according to a recent study in the *American Journal of Clinical Nutrition*. The proportion of daily calories supplied by carbohydrates increased by an average of 10 percent. We're eating about the same amount of fat (by weight and calories) as earlier, but it accounts for a smaller proportion of our daily calories simply because we're consuming more calories overall. During this time, the obesity rate more than doubled.

■ **People with high HDL ("good") cholesterol are more likely to live to age 85 and are less likely to develop colon cancer,**

The cold war isn't over

Zinc may help prevent colds after all, though not all forms may work

A cure for the common cold has been the holy grail for medical researchers, drug companies, and marketers of dietary supplements. So far nothing has stood up to scientific scrutiny, though you wouldn't know it if you read the claims often made for most over-the-counter cold medicines and countless supplements. Besides vitamin C and echinacea (neither found to be of value), the most widely promoted supplement for colds has been zinc in various forms. Enthusiasm for zinc has seesawed over the years as positive and negative studies have alternated in the news.

It's not certain how zinc may help. Lab tests have found that zinc in the mouth and throat can deactivate cold viruses, block them from adhering to the nasal membranes, and/or stop them from replicating. The mineral may also have some anti-inflammatory and antioxidant effects.

But hardly a eureka moment

The Cochrane review left many infectious disease experts still unconvinced, however, largely because the studies varied so much. Even the Cochrane authors concluded that, due to these inconsistencies,

Salt—beyond hypertension

More reasons to shake the habit

If your blood pressure is fine, is there still reason to be concerned about salt? Most people, after all, are not even “salt-sensitive”—that is, salt has little or no effect on their blood pressure. The short answer is yes.

In population studies, diets high in sodium (a component of salt) have been linked to an increased risk of hypertension—and hypertension, of course, can lead to heart attacks and strokes. But some research suggests that a high sodium intake may increase the risk of cardiovascular problems independent of its effect on blood pressure. Too much sodium can make blood vessels less flexible, which may cause or worsen atherosclerosis (hardening of the arteries).

ance in the body may also be involved in bone health. A high sodium intake increases excretion of calcium in the urine, which causes calcium to be leached from bone, contributing to bone loss and increased risk of fractures over time. Studies have shown that reducing salt has a positive effect on calcium balance—and this may help slow age-related bone loss.

■ **For your kidneys.** Salt contributes to hypertension in many people, and hypertension is a major cause of kidney dysfunction and failure. There is evidence from animal and some human studies that salt may directly impair kidney function in some people, too. By increasing calcium in the urine, a high sodium intake may also increase the risk of kidney stones.

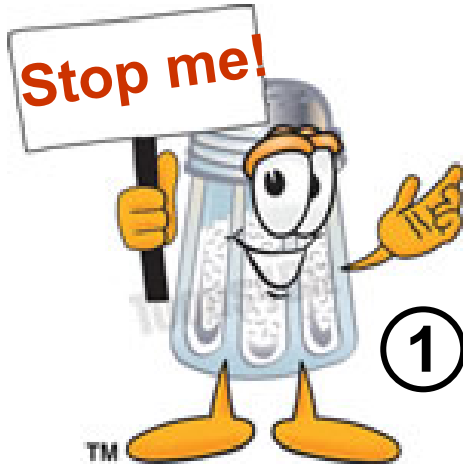
■ **What else?** It’s proposed—but not proven—that a high sodium intake may contribute to inflammation in the body and worsen asthma. It can also damage blood vessels that feed the brain, which can lead to vascular dementia. And there may be an indirect link between sodium and weight gain, since sodium can increase thirst, which often leads to the consumption of high-calorie beverages.

What you gain by cutting back

Sodium is critical for maintaining basic body functions, including the regulation of fluid balance and the transmission of nerve impulses. But most Americans get far more than they need. Cutting back on sodium may reduce your risk of hypertension (and its deadly consequences) and have other potential health benefits as well.

What you also achieve is a better diet—salty foods tend to be high in calo-

More Reasons to Shake the Salt Habit



① ↓ blood vessel vasodilation w/in 30 min by ingesting 1500 mg Na+!

② ↑ Ca²⁺ excretion ↑ bone loss, risk of osteoporosis & fractures.

③ May directly impair kidney function & ↑ risk of kidney stones.

④ GI cancer risk, inflammation?



I'm outta here!!



***I'm not sure I believe you!
Why can't I just starve to
lose weight?***



**TOTAL FAST =
No Energy Nutrients
(No Carbohydrates, Fats
or Proteins)**

ONLY

- 1. Water**
- 2. Vitamins**
- 3. Minerals**

60-day Fast???

Lost 60 lb!! Wow!!

Yet

76.7% {
26 lb Water
20 lb Lean Body Mass
14 lb Fat

Fat < 1/4 total wt loss!

***You can lose weight by
starving – but it's mostly
water & muscle! Also, there
can be complications!***



Potential Complications of Total Fasting

**Nausea, diarrhea, persistent vomiting,
postural hypotension, nutritional
deficiencies, menstrual irregularities,
and...sudden death.**

Positive Aspect??

**General loss of appetite within
first 2 days, maintained
throughout fasting period.**

Council on Nutrition, Physical Activity and Metabolism (NPAM) Spring 2009



Dietary Carbohydrate, Fat and Protein in Weight-Loss Diets: A Report and Insider's Reflections on the Pounds Lost Trial

Frank M. Sacks, MD

Well-controlled studies of energy-reduced diets conducted in controlled environments showed that the macronutrient composition of the diet did not affect weight loss (1). Nonetheless, theories persisted that specific macronutrients would be superior for weight loss. For example, the traditional paradigm for low-fat, high-carbohydrate diets was based on the lower energy density of carbohydrate compared to fat, and the metabolic efficiency of converting dietary fat to body fat (2). Indeed strict vegetarians sustain lower body weight for

years on low-fat diets (3). However, meaningful differences in body weight usually were not achieved in population-based trials of conventional low-fat diets (4). Thus, higher-fat, Mediterranean-style diets were proposed to be better for long-term weight loss because of their variety and satisfaction. Two trials found

that Mediterranean diets were superior to low-fat diets for weight loss (5,6). Others claimed that a radically different approach that used low-carbohydrate, high-fat, and high-protein foods could produce weight loss without attention to reducing intake because of the satiety of protein-rich foods. Low-carbohydrate diets succeeded in the first few months with more rapid weight loss than low-fat diets but by one year, none of the trials found that weight loss on low-carbohydrate

Continued on page 26



Dr. Sacks' Conclusions:

We conclude that healthful diets with varying emphases on carbohydrate, fat & protein levels can all achieve clinically meaningful weight loss & maintenance of weight loss over a 2-yr period. The results give people who need to lose weight the flexibility to choose a diet that they can stick with, as long as it's heart healthy. Such diets can also be tailored for individuals based on their personal & cultural preferences & in this regard may have the best chance for long-term success.

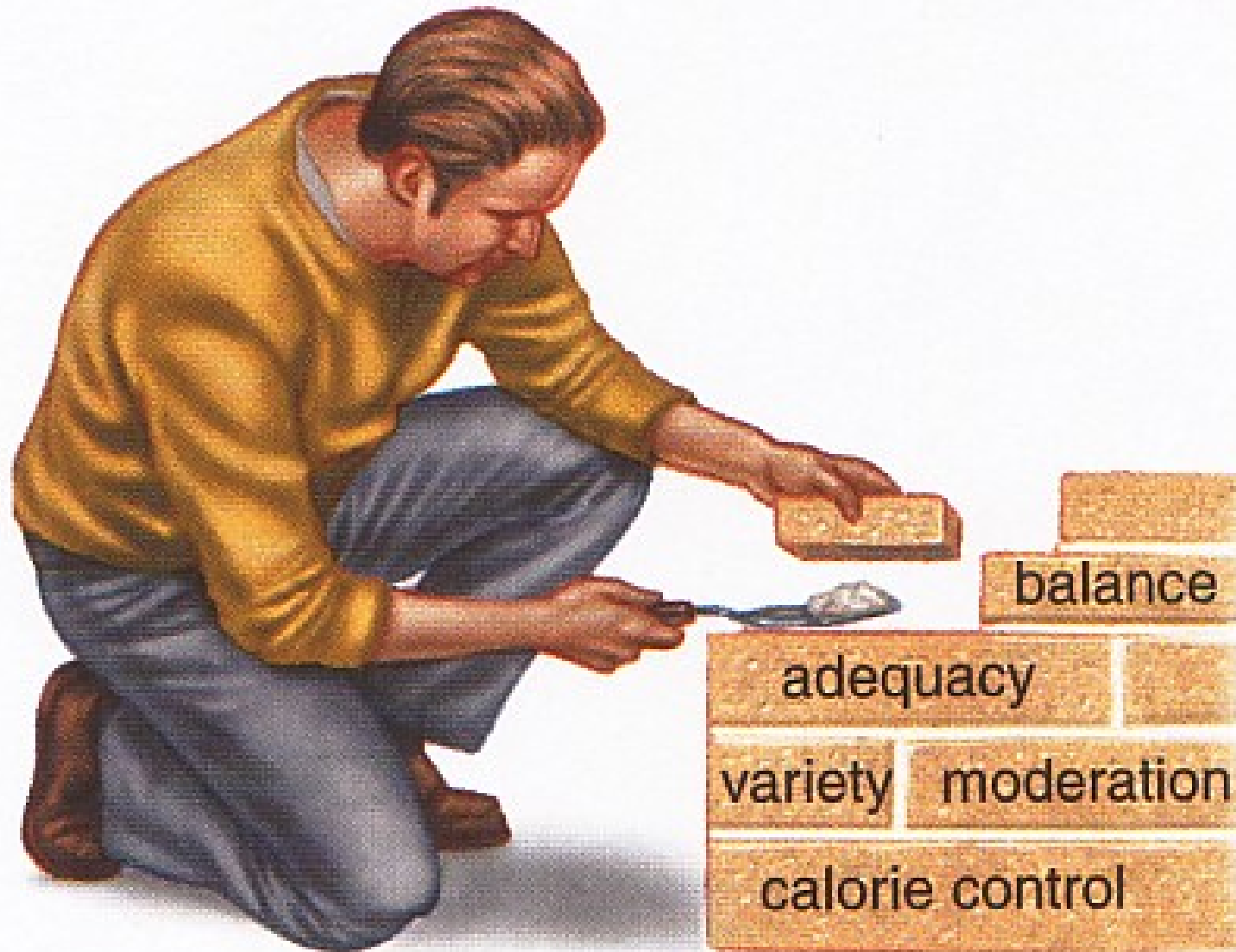
***US Dietary Recommended Intakes (DRI)
Committee Acceptable Macronutrient
Distribution Ranges (AMDR)!***

<u>Energy Nutrient</u>	<u>% Total Calories</u>
Carbohydrate	45-65%
Fat	20-35%
Protein	10-35%

Emphasize ABCs + Variety & Moderation!



*All of these factors help to build
a nutritious diet.*



NUTRITION ACTION

HEALTH LETTER

By Bonnie Liebman

And then there were three. For years, *Dr. Atkins' New Diet Revolution* has dominated best-seller lists. But by last November, Atkins had company. Dr. Phil's *The Ultimate Weight Solution* had cracked the top ten. And *The South Beach Diet* sat comfortably at number one. Where it should be.

South Beach isn't perfect. Its rationale has some flaws. And just because people buy a self-help book, you can't assume that they'll follow its advice (or we'd all be trim, sculpted, happily married, wealthy, and living a purpose-driven life).

But for the first time in a long time, one of the most popular weight-loss books is recommending a healthy diet. Whether it helps those unwanted pounds disappear any better than other diets is another question.

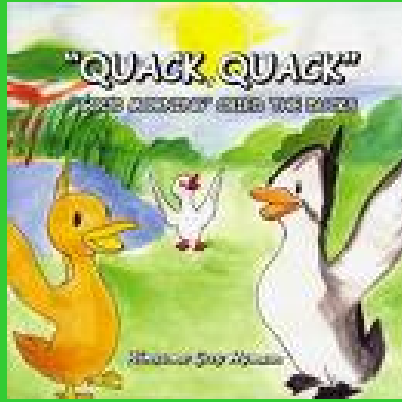
Design: Barbara Quinn. Illustrations: Lori Barr.

THE
Sure-Fire
Lightning-Fast
HUNGER-FREE
EASY-AS-PIE
JUST-4-YOU
Permanent-Weight-Loss
HEALTH-AND-HAPPINESS
DIET

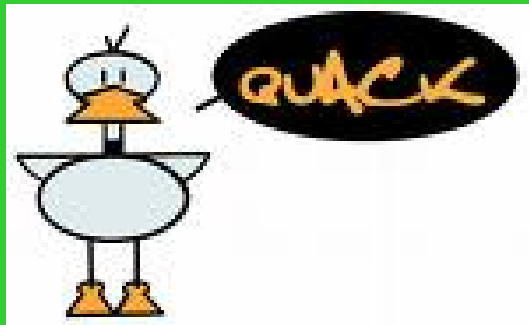


(Continued on page 3)

The Scoop
on Doughnuts
—page 13—



Nutrition Quackery?



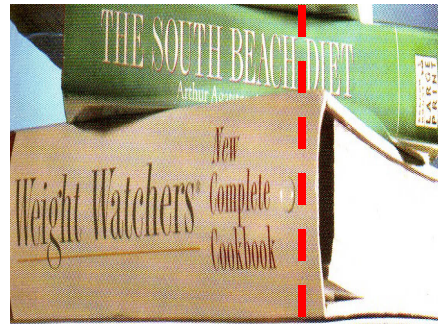
\$\$



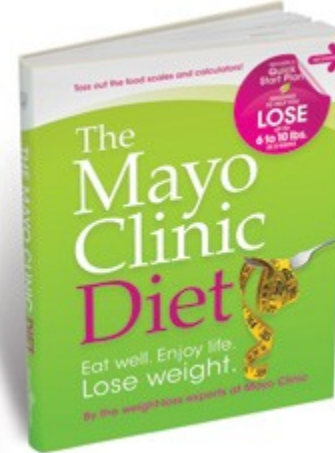
Kleiner's & Monaco's Top 10 Hit List for Nutrition Quackery

1. Treatment based on unproven theory calling for non-toxic, painless therapy.
2. Author's/purveyor's credentials aren't recognized in scientific community.
3. No reports in scientific, peer-reviewed literature but rather mass media used for marketing.
4. Purveyors claim medical establishment is against them & play on public's paranoia about phantom greed of medical establishment.
5. Treatments, potions, drugs manufactured according to secret formula.
6. Excessive claims promising miraculous cures, disease prevention or life extension.
7. Emotional images rather than facts used to support claims.
8. Treatments require special nutritional support including health food products, vitamins and/or minerals.
9. Clients are cautioned about discussing program to avoid negative.
10. Programs based on drugs or treatments not labeled for such use.

**NOT PEER-REVIEWED =
TRADE BOOKS**



**PEER-REVIEWED =
TEXTS →
RESEARCH**

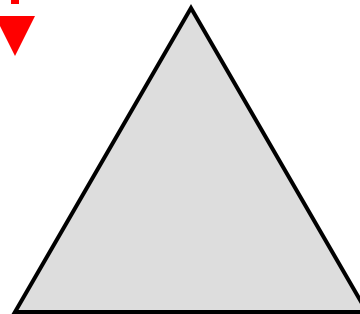


**AHA + DASH +
MAYO CLINIC** 



**LOWER
CARBOHYDRATE**

**ELIMINATE CALORIES
or FOOD GROUPS
ENCOURAGE FASTING**



**LOWER
FAT**

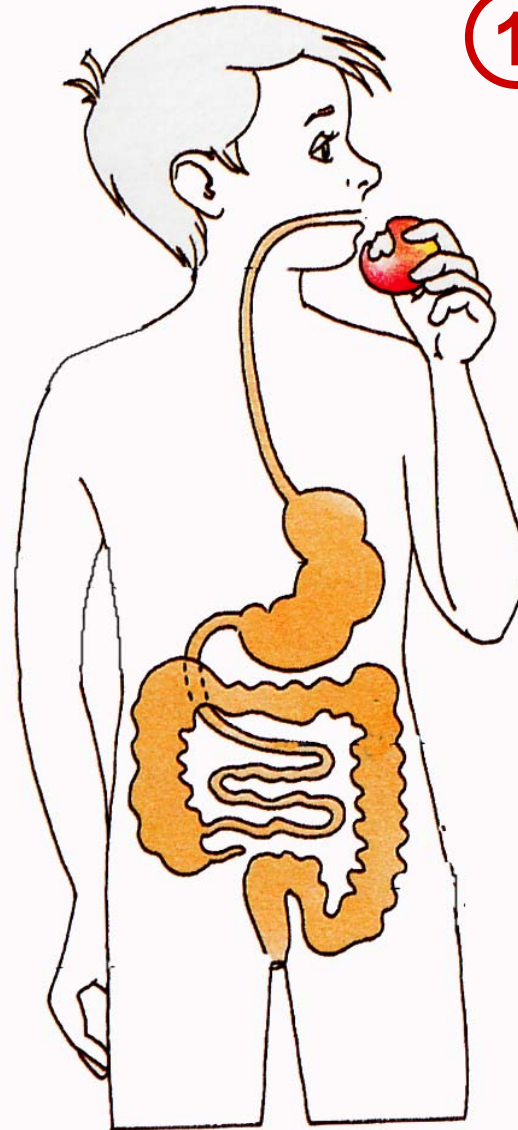


**ADEQUACY
BALANCE
CONSISTENCY
& MODERATION**

Break for discussion/questions!



Digestion Steps



① Ingestion

② Mechanical Digestion

③ Chemical Digestion

④ Peristalsis

⑤ Absorption

⑥ Storage

⑦ Defecation

SOURCE: Dr. Eugene Evonuk, 1989. cf. L Sherwood, 2012 pp 437-8.

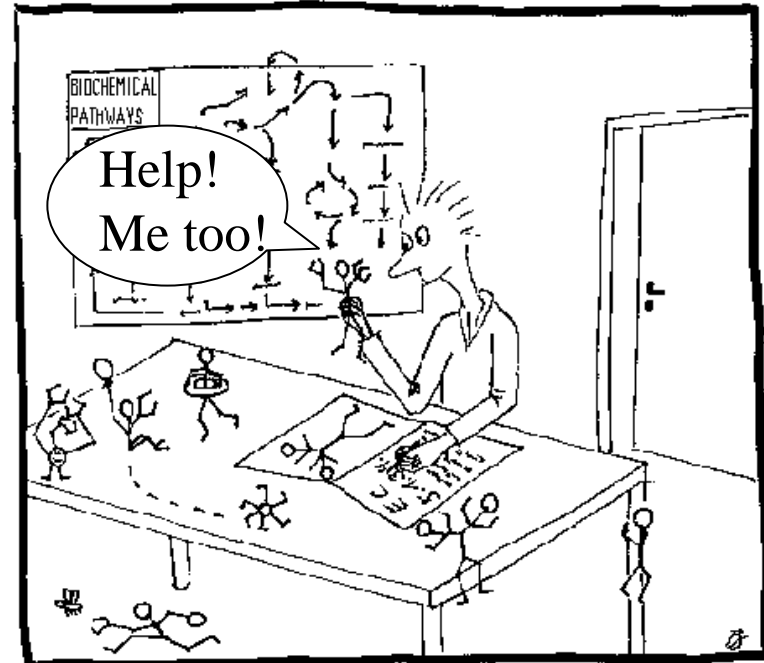
Hydrolysis of Energy Nutrients

Hi gang!!
You need me
for digestion!!



+

The ENZYME data bank

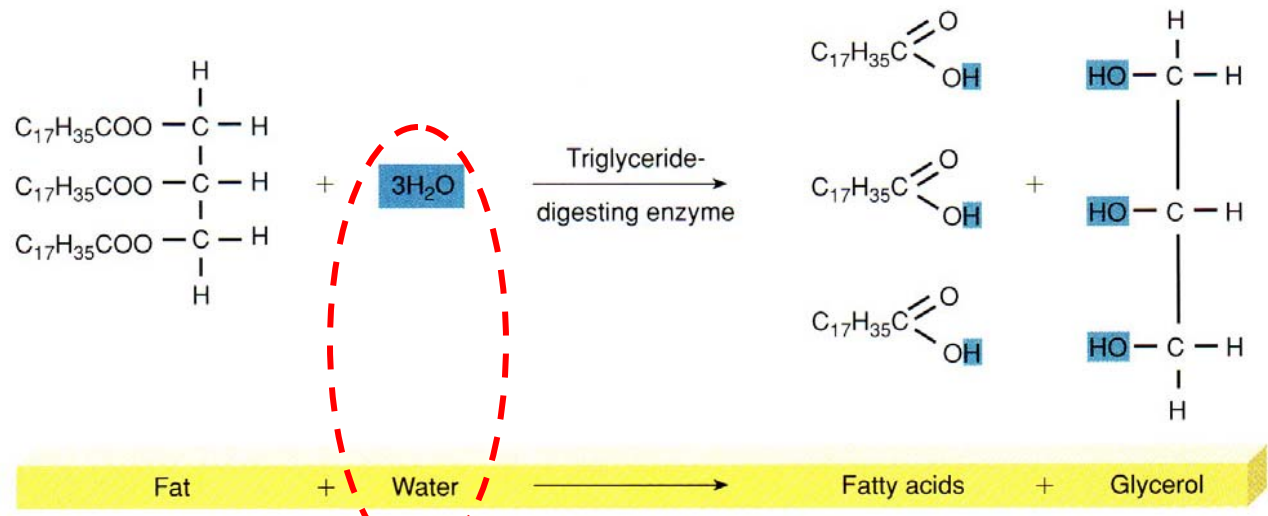
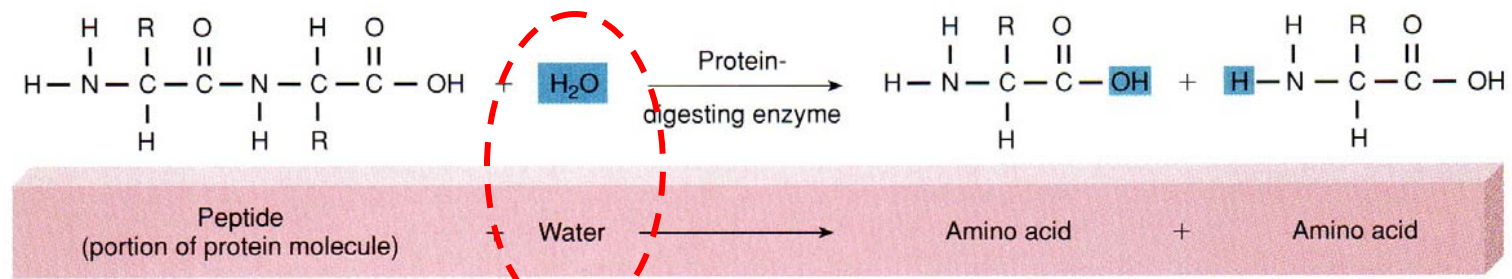
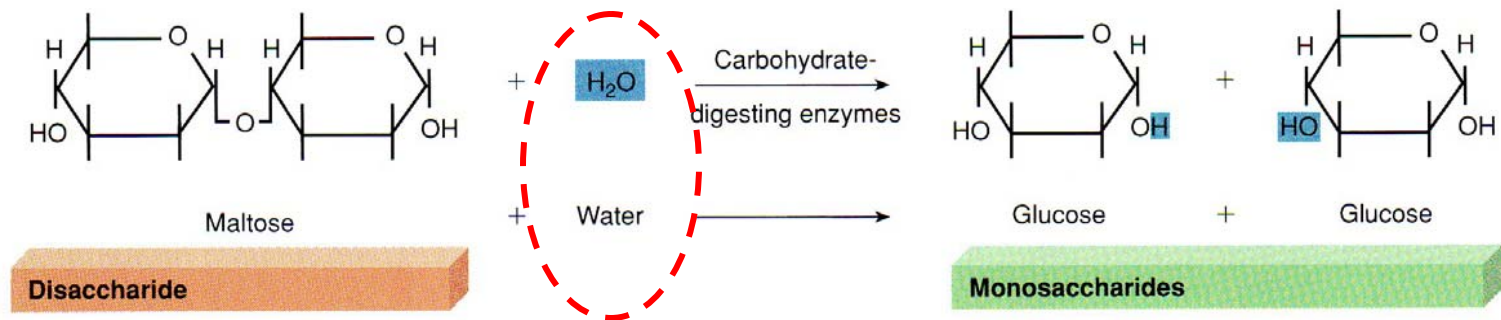


Brigitte Boeckmann / 1995

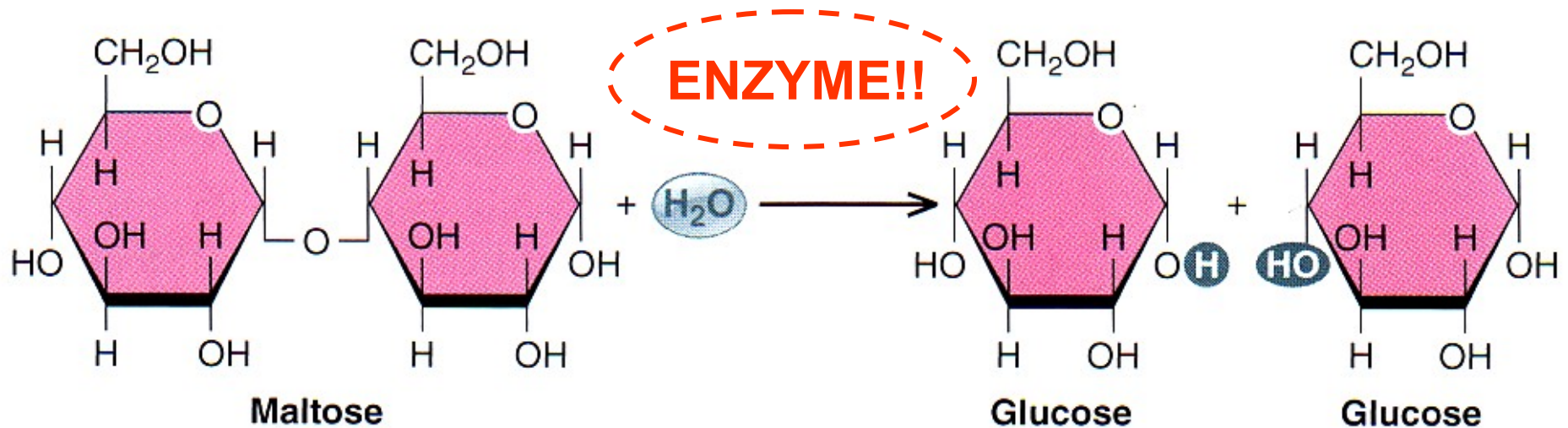
H₂O

+

Enzyme



What's missing?

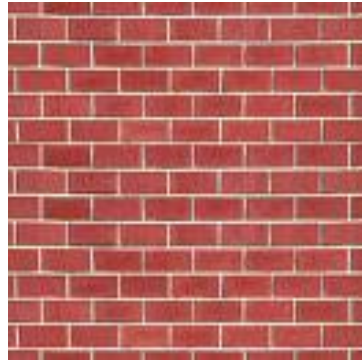


● **FIGURE 15-1 An example of hydrolysis.** In this example, the disaccharide maltose (the intermediate breakdown product of polysaccharides) is broken down into two glucose molecules by the addition of H₂O at the bond site.

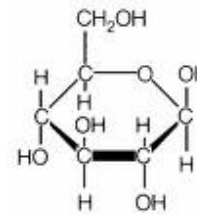
Polymer to Monomer (Many to One)



...Central-linking theme!!

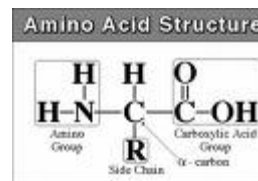


Carbohydrate

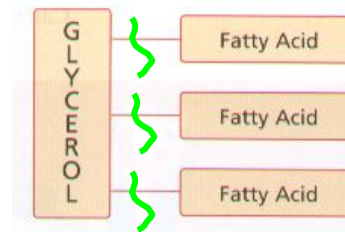


Glucose

Protein
+
Fat

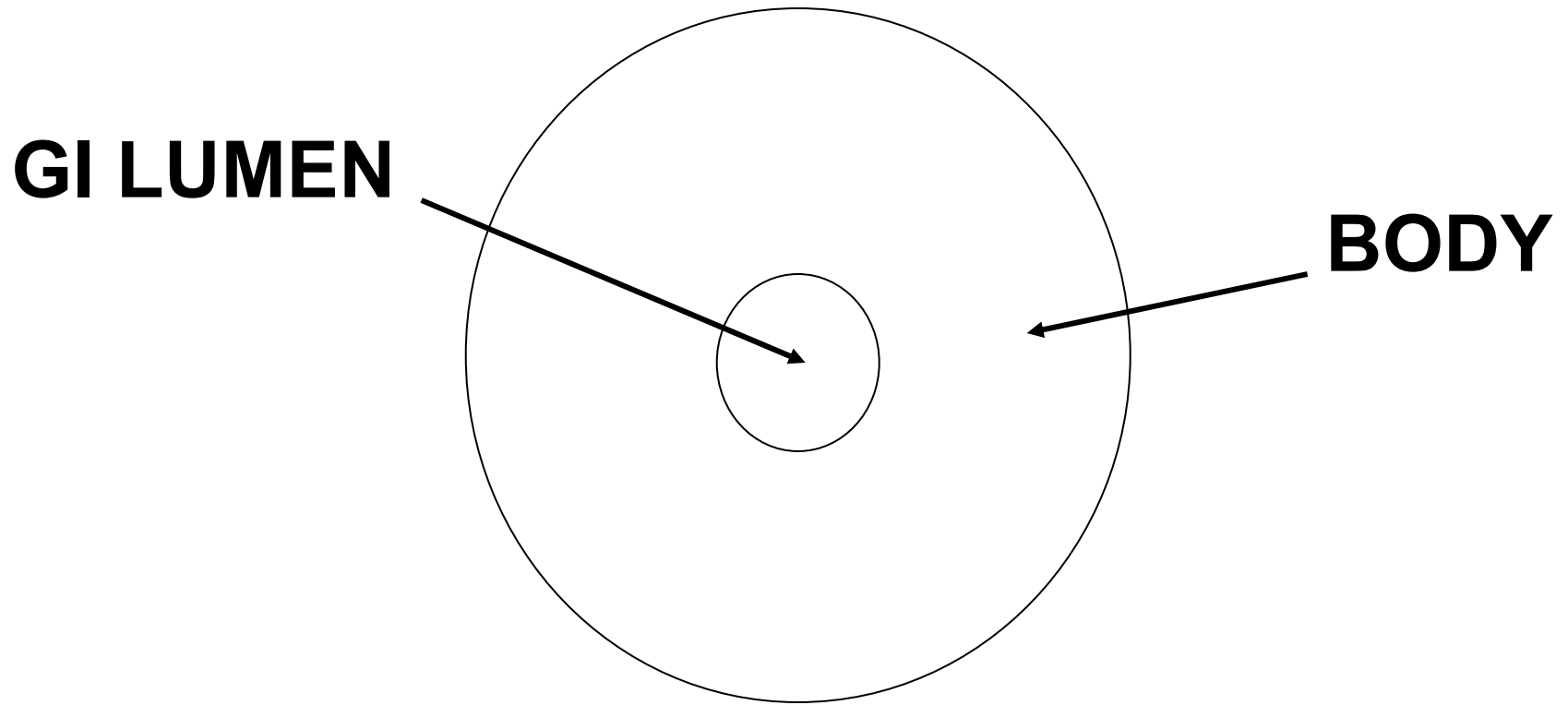


Amino Acids



Fatty Acids
+
Glycerol

GI-DONUT ANALOGY



Gut Secretions

Secretion

Release Site

1. Mucus

into GI Lumen

2. Enzymes

into GI Lumen

3. H₂O, acids, bases+

into GI Lumen

4. Hormones

into Blood

1. Mouth

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

4. Liver-Gall Bladder

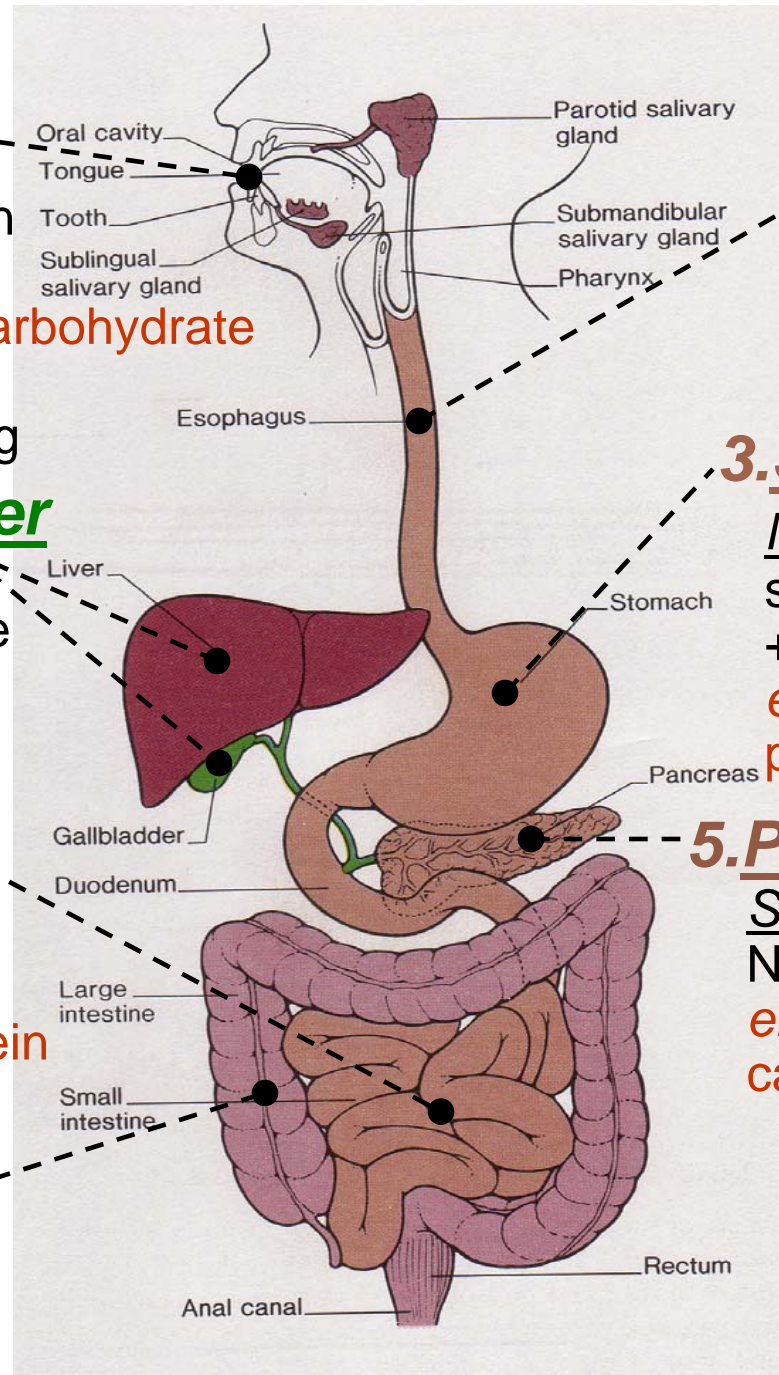
Emulsification =
detergent action of bile
+ secretion

6. Small Intestine

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

7. Large Intestine

Dehydration
secretion + absorption
storage + peristalsis



2. Esophagus

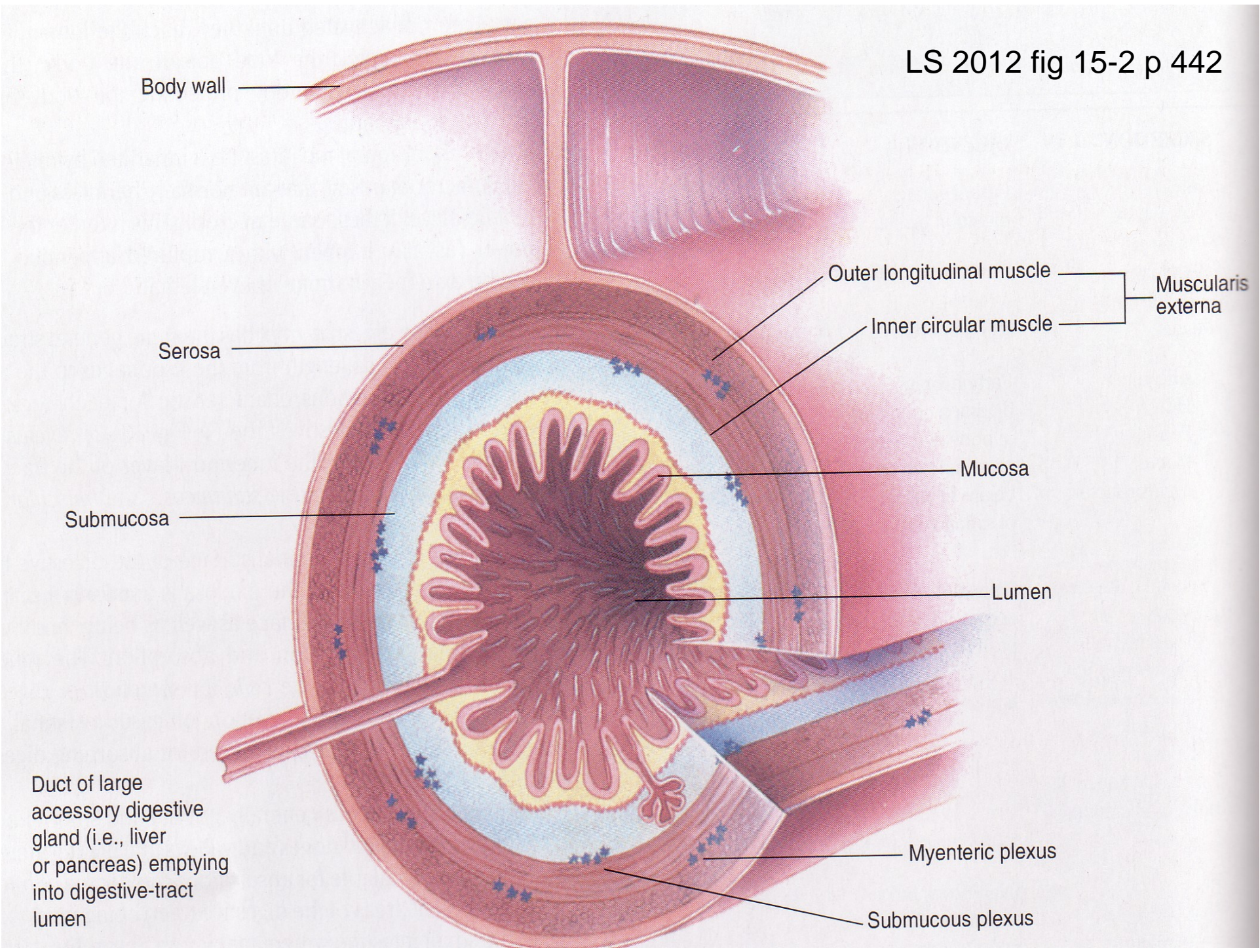
Rapid transit
peristalsis
secretion mucus

3. Stomach

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

5. Pancreas

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



Body wall

Outer longitudinal muscle

Muscularis externa

Inner circular muscle

Serosa

Mucosa

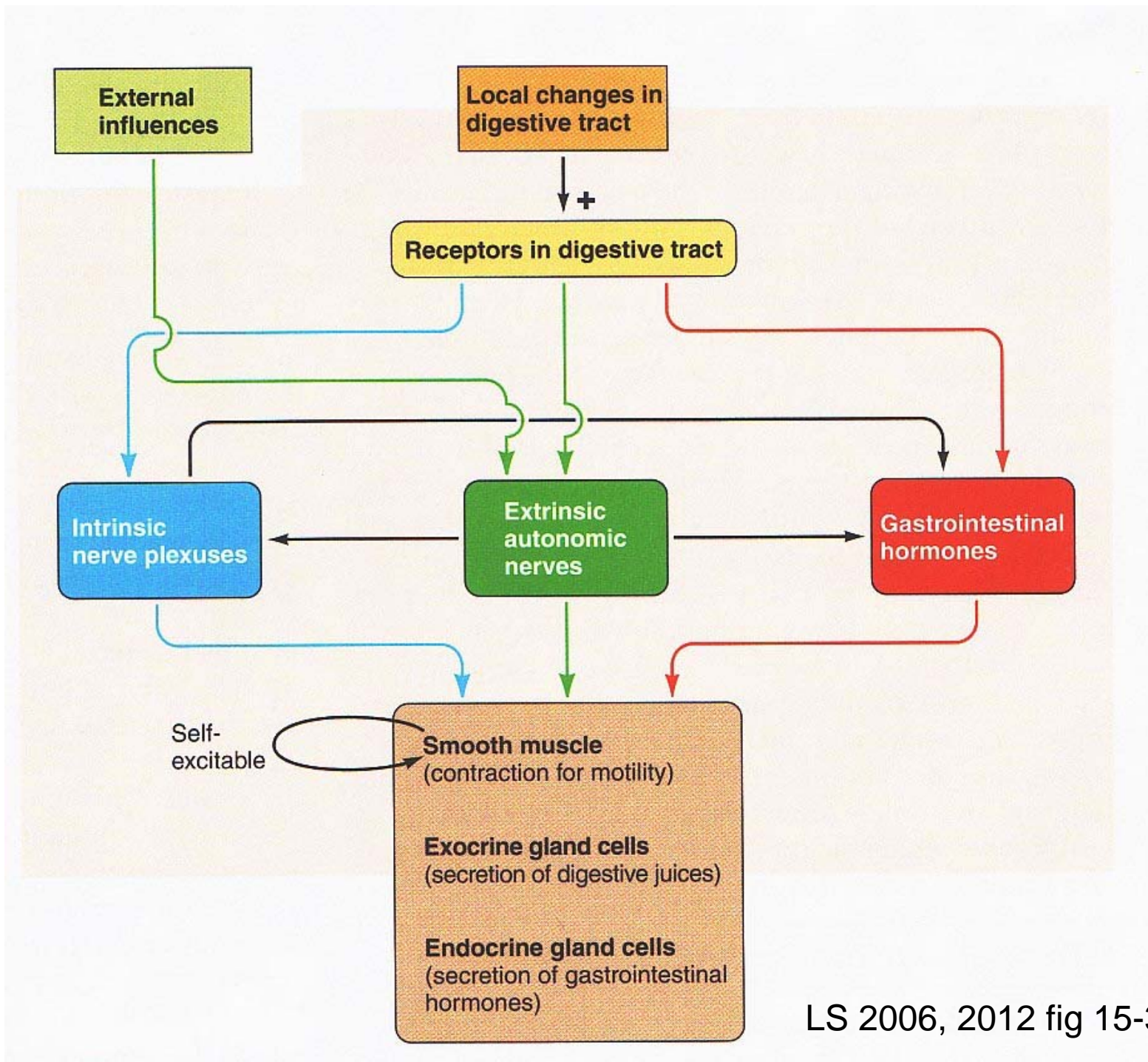
Submucosa

Lumen

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

Myenteric plexus

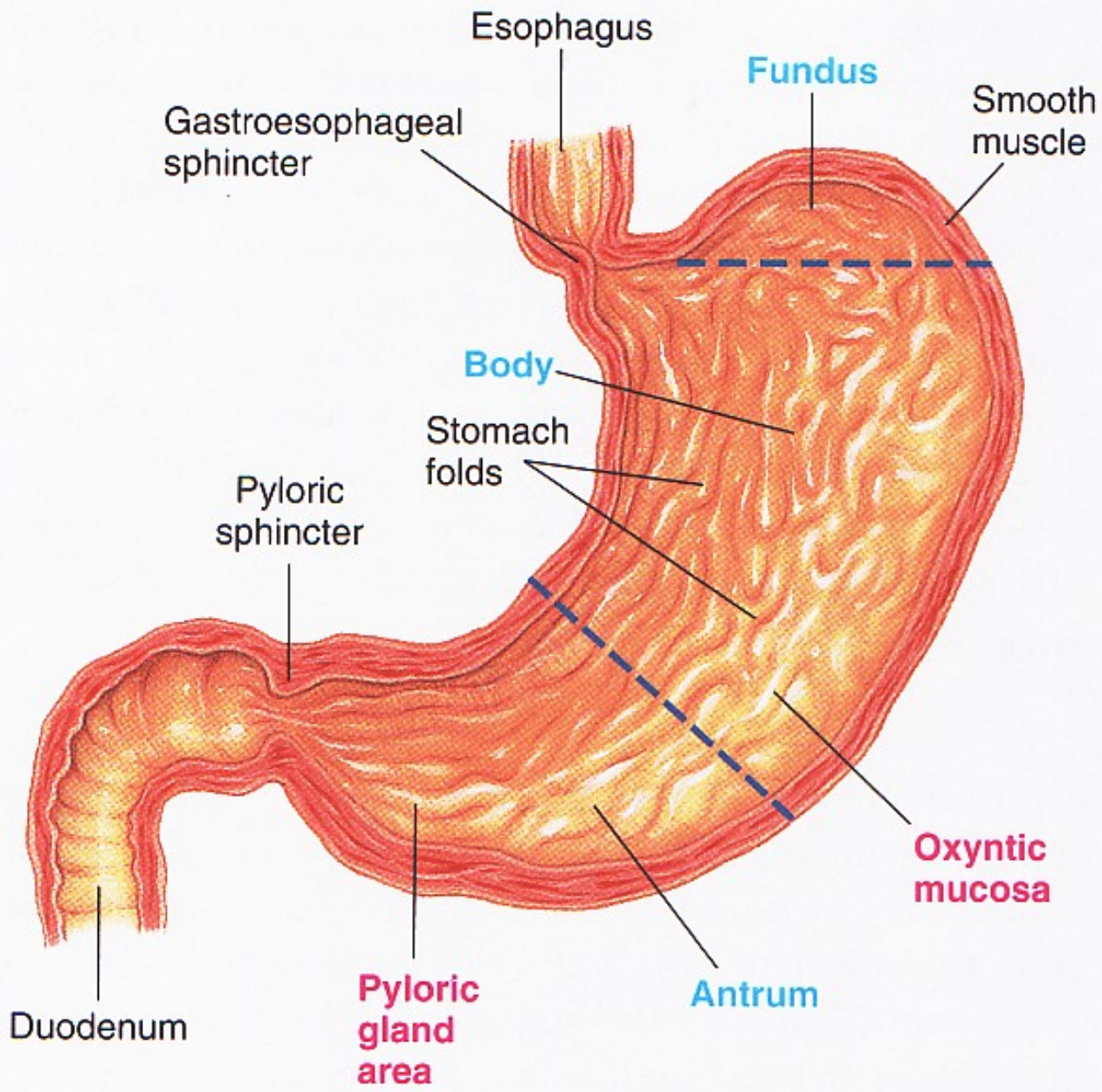
Submucous plexus



Common Control Mechanisms

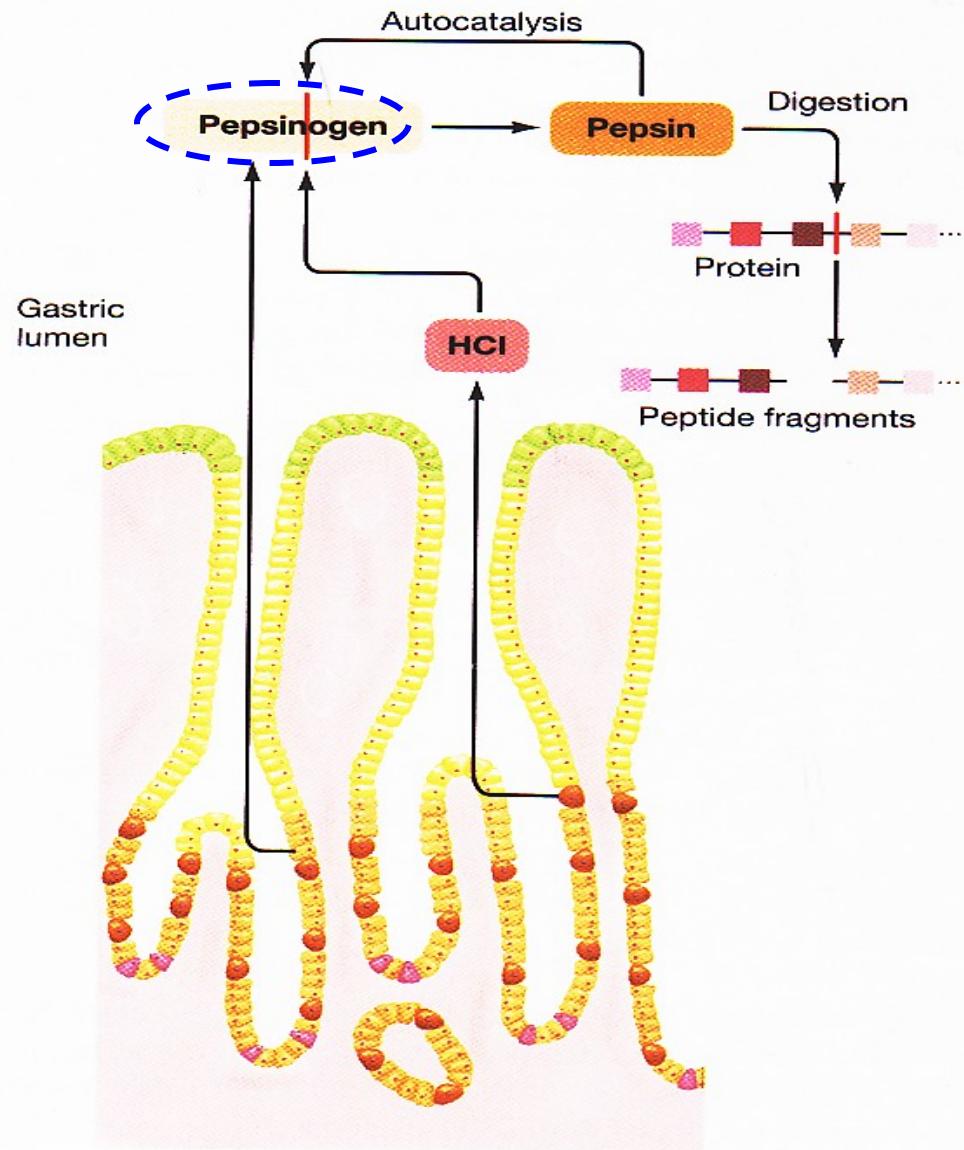
- 1. Local (autoregulation)**
- 2. Nervous (rapidly-acting)**
- 3. Hormonal (slower-acting/
reinforcing)**

**Where does
enzymatic
digestion of
protein
begin?**



● **FIGURE 15-7**

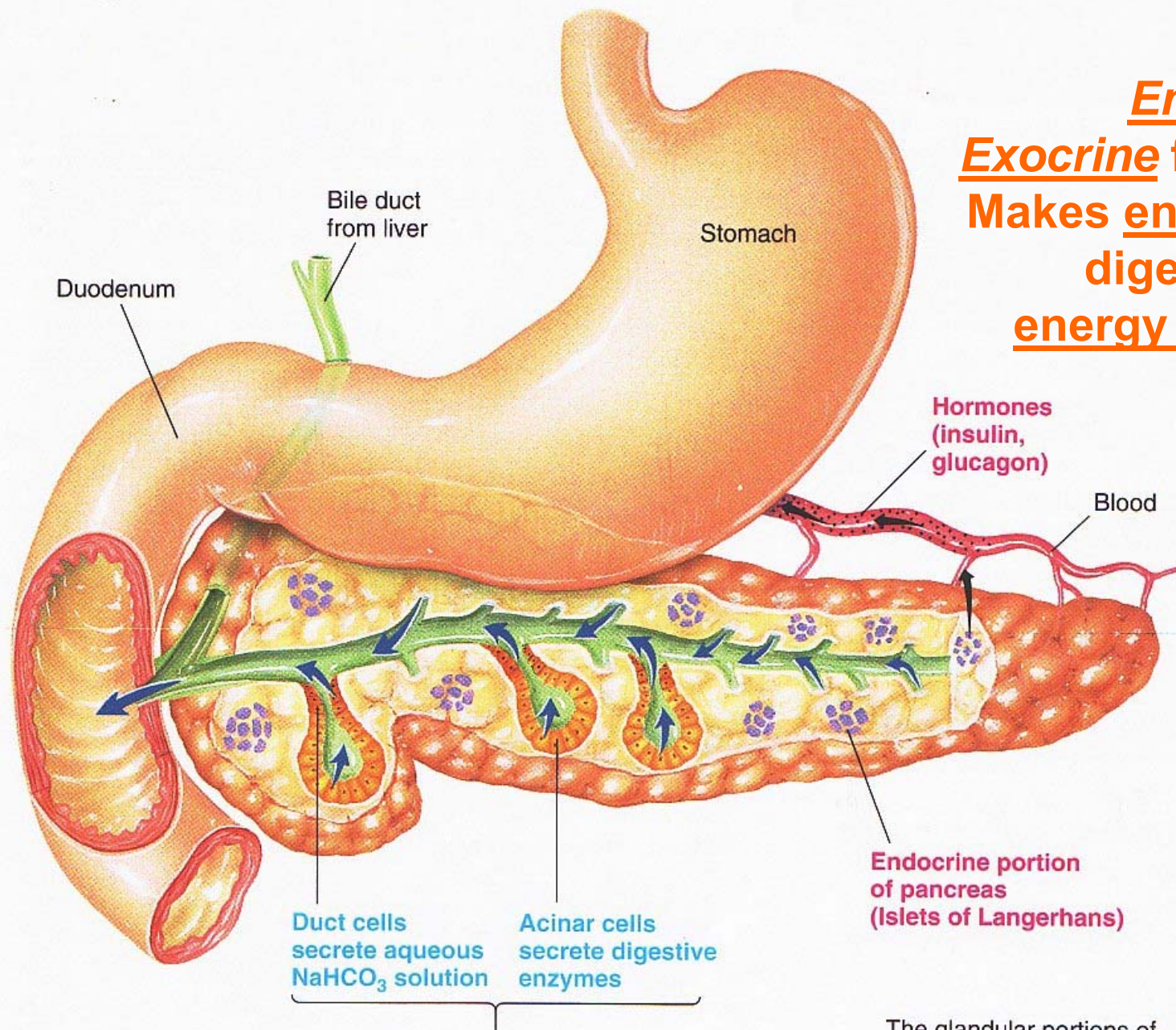
*Zymogen =
an inactive
precursor*



■ ■ ■ = Various amino acids
| = Enzymatic splitting of a chemical bond

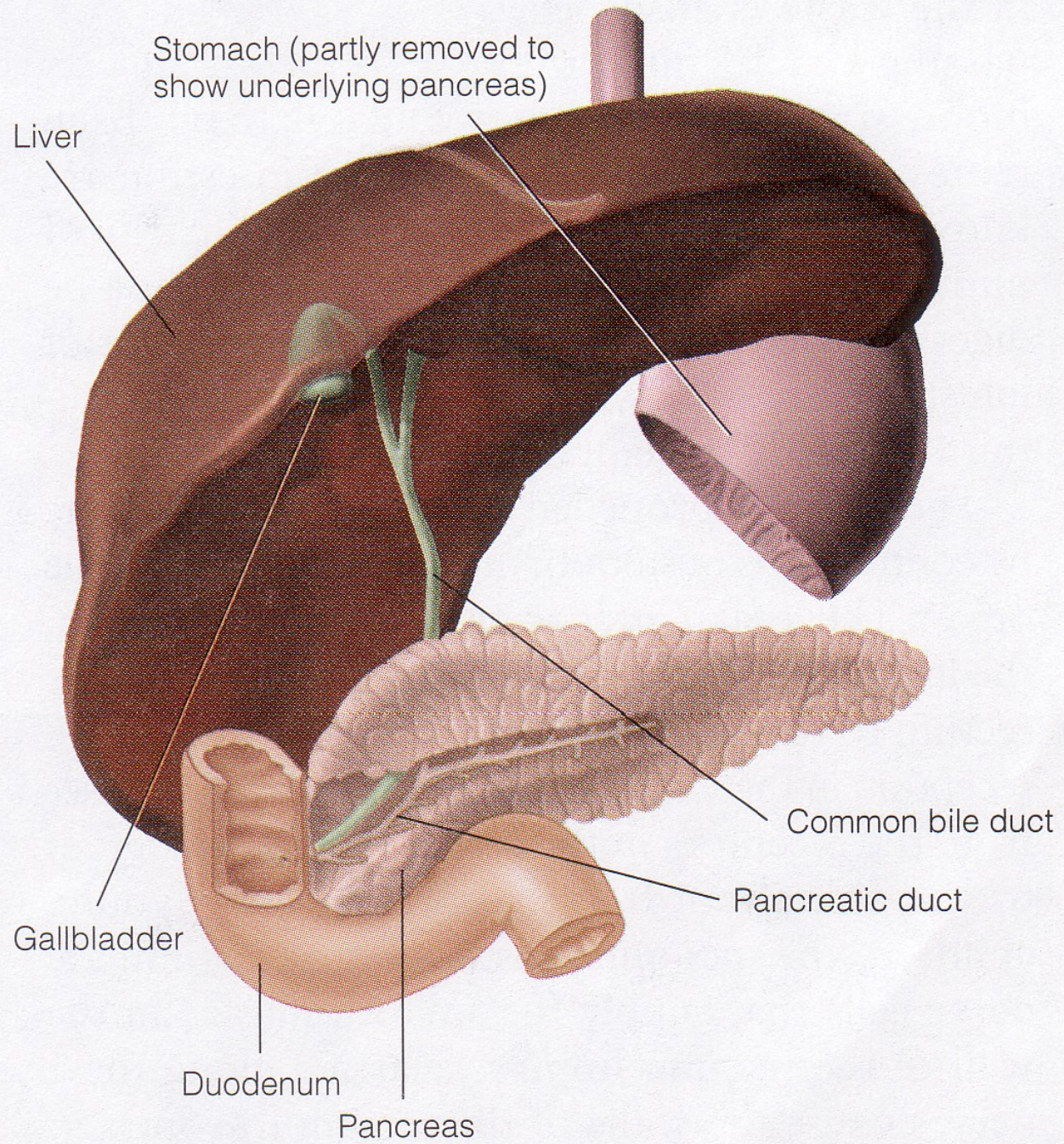
**Why is the
pancreas so
unique?**

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

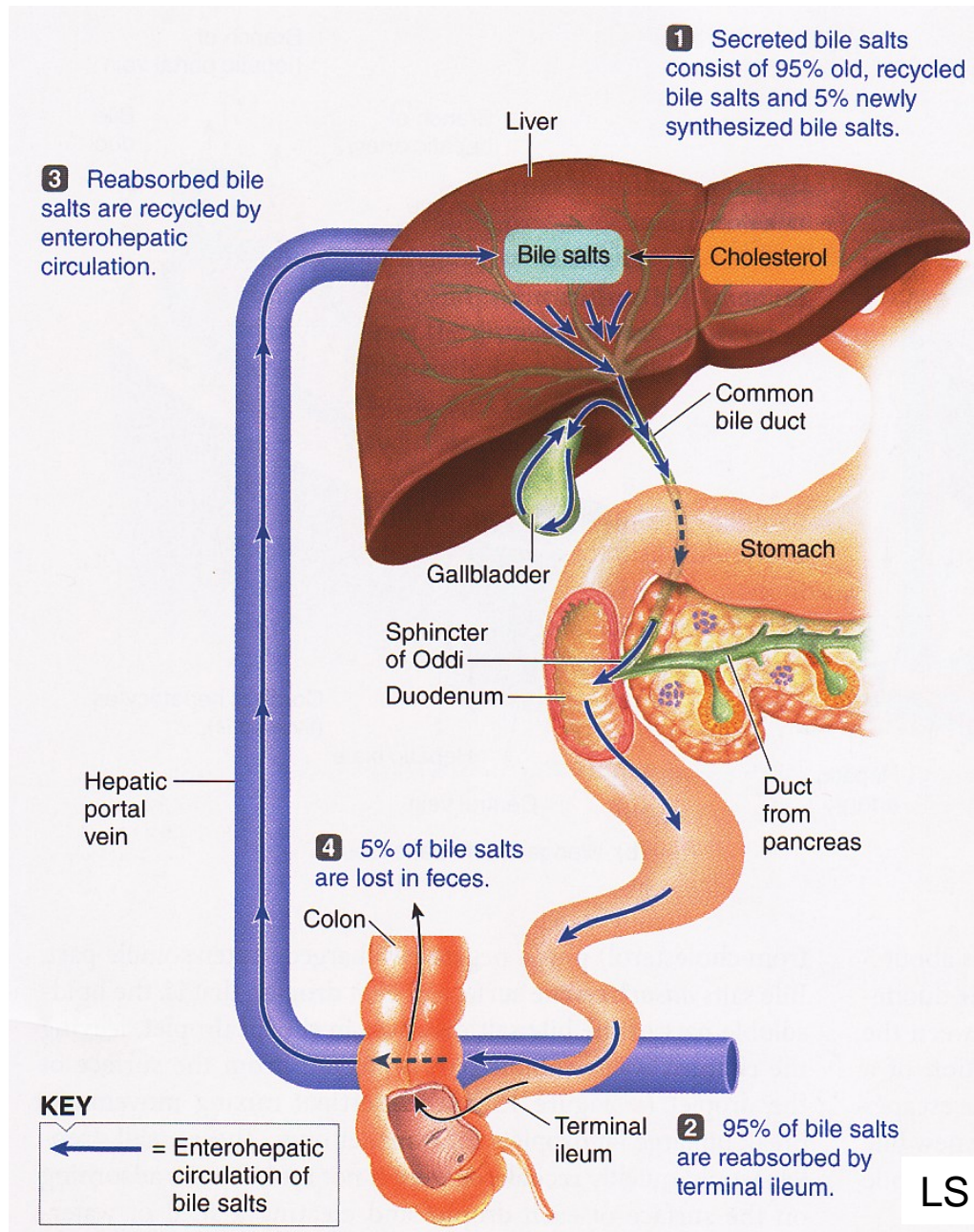


LS 2012 fig 15-11 p 457 Exocrine portion of pancreas (Acinar and duct cells)

The glandular portions of the pancreas are grossly exaggerated.

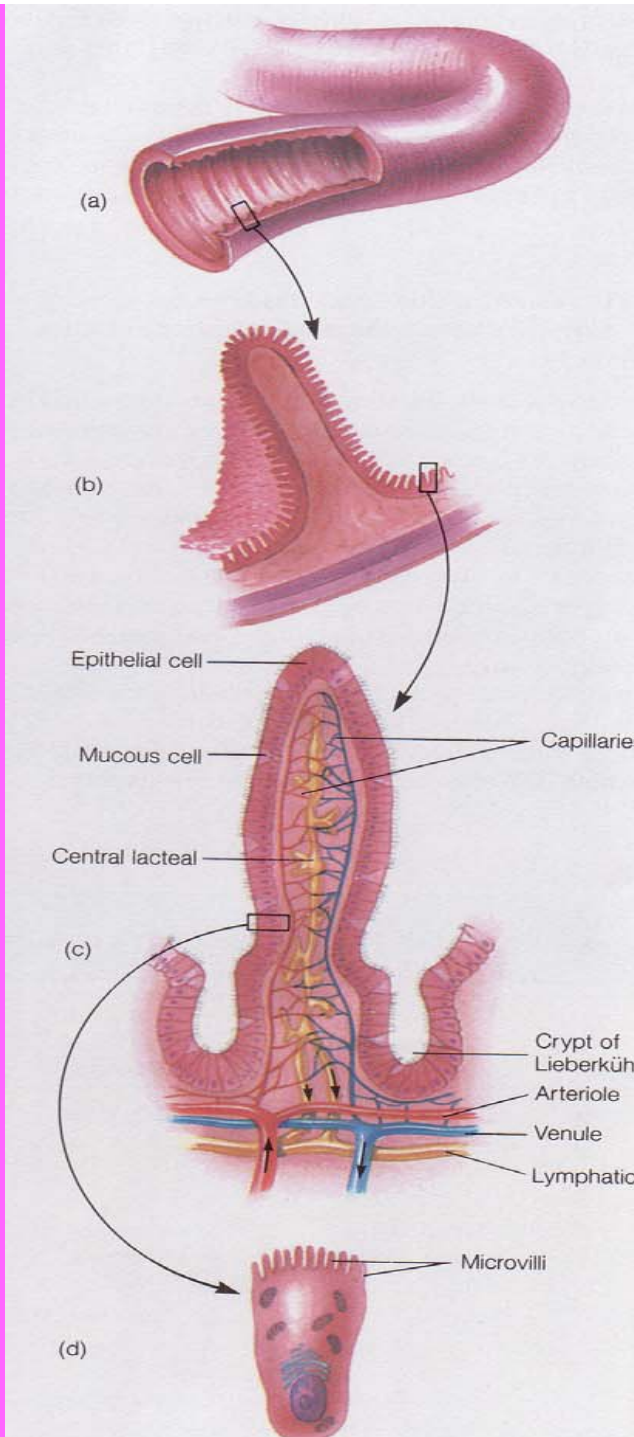


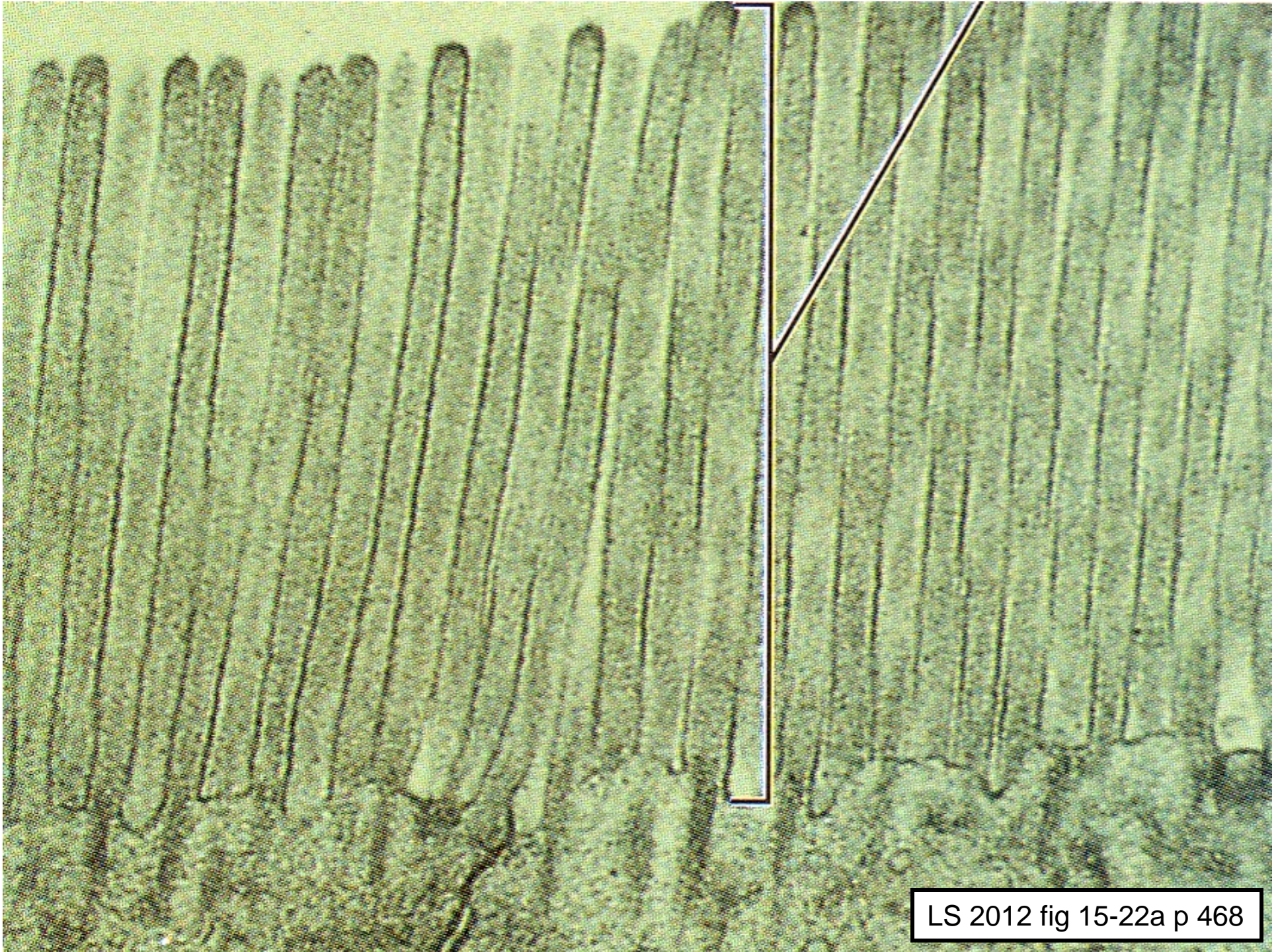
Liver: Amazing Recycling of Bile Salts!



What is the major
function of the
small intestine?

Absorption!!

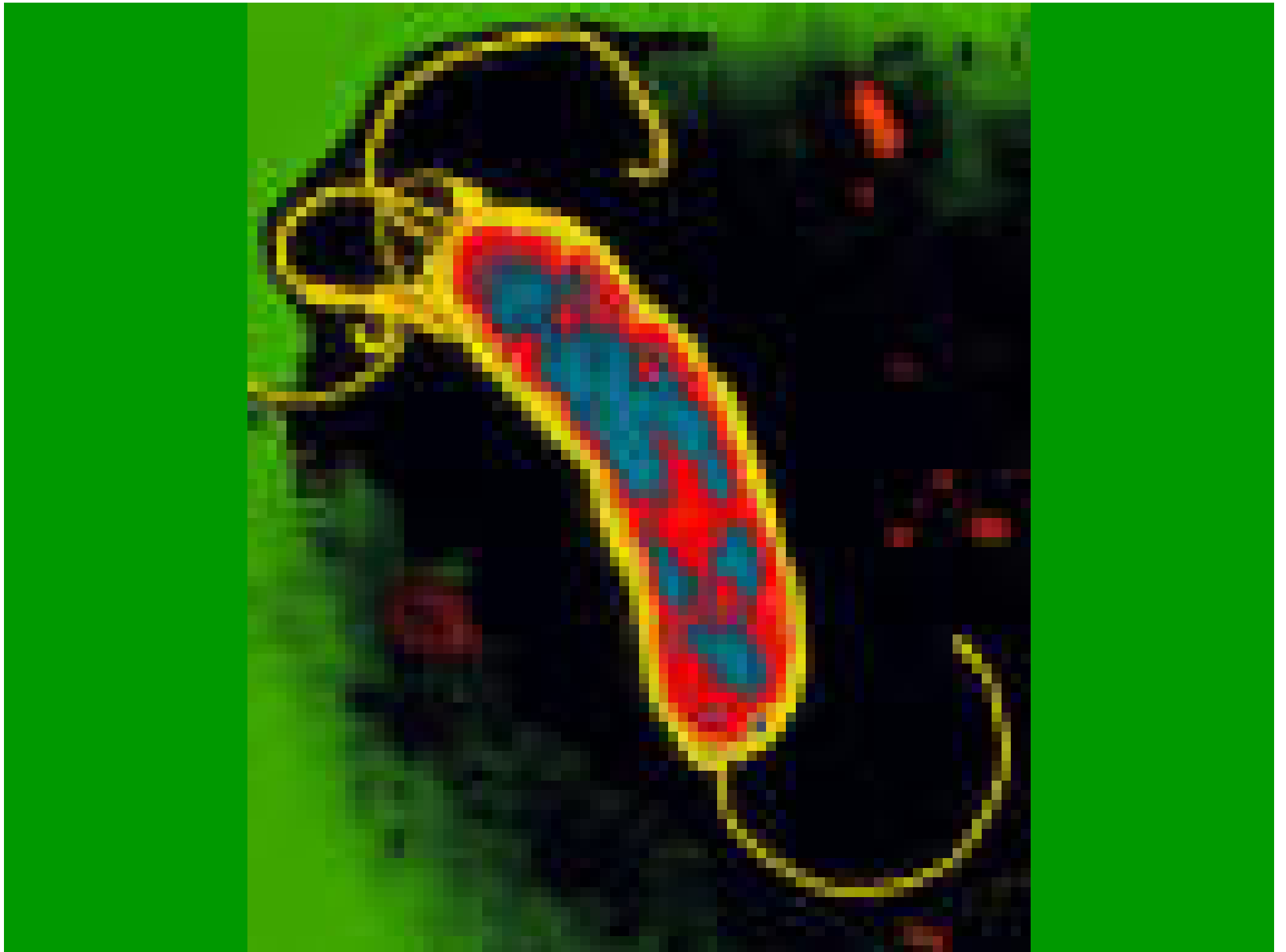




LS 2012 fig 15-22a p 468



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



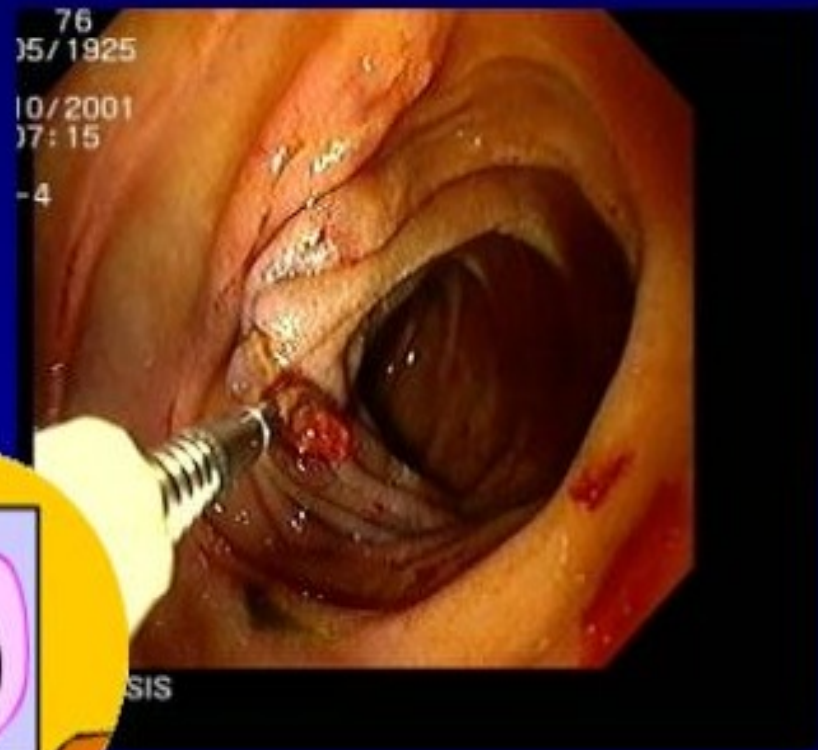
Ulcer Facts

- 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.

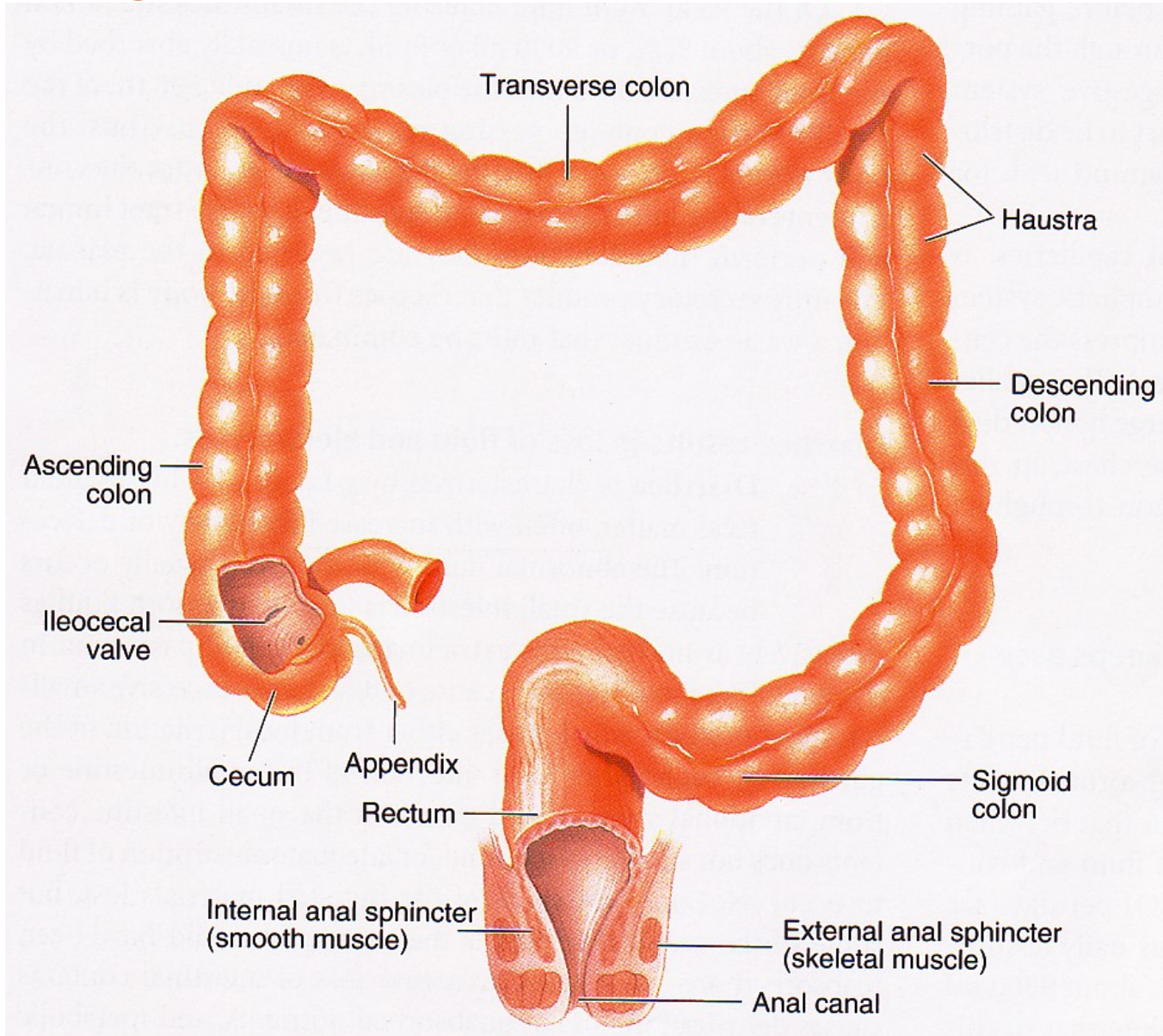
In the second photograph, a disposable metal clip is applied to the ulcer. The patient remained well and left hospital three days later.



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

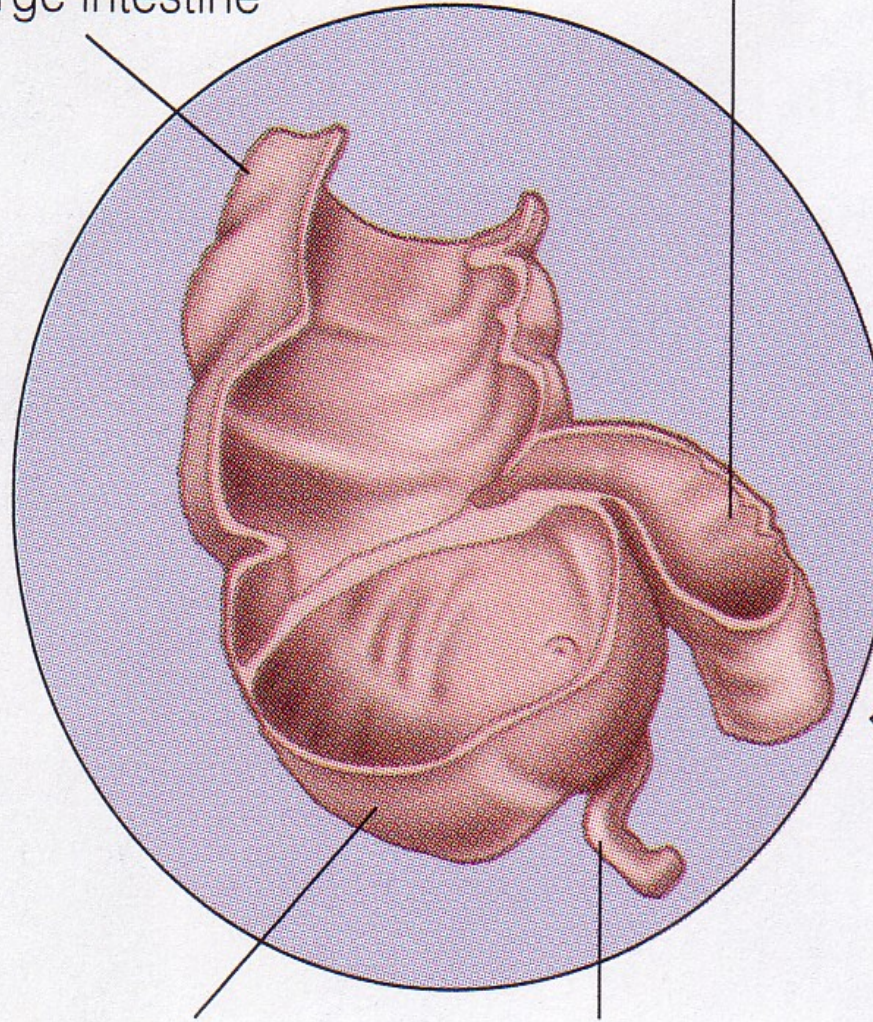
Nutrients	Enzymes for Digesting the Nutrients	Source of Enzymes	Site of Action of Enzymes	Action of Enzymes	Absorbable Units of the Nutrients
Carbohydrates	Amylase	Salivary glands	Mouth and (mostly) body of stomach	Hydrolyzes polysaccharides to disaccharides (maltose)	
		Exocrine pancreas	Small-intestine 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

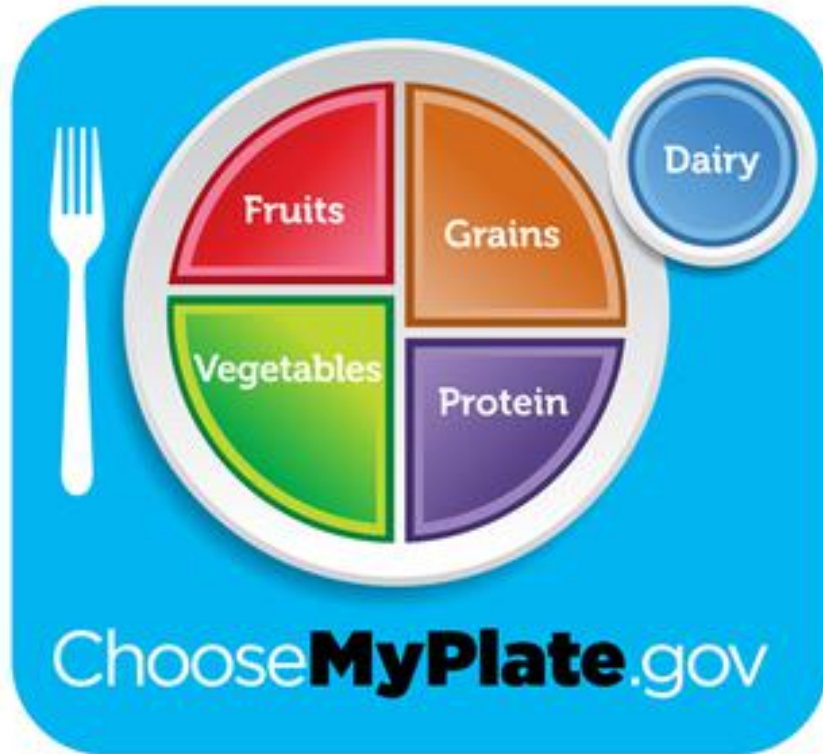
Ileum
of small
intestine



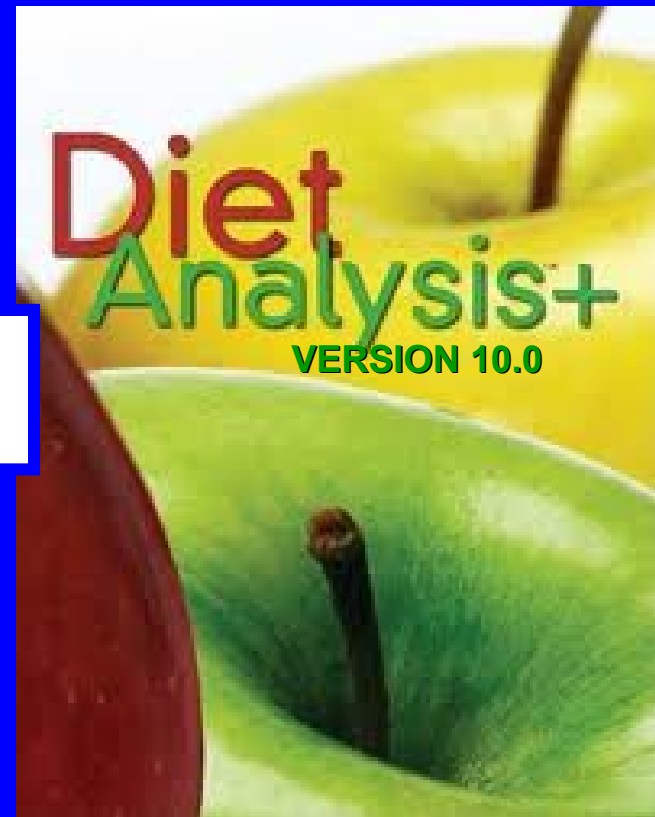
Cecum

Appendix

Lab 3: Nutritional Analyses via 2 Programs



+



<https://www.supertracker.usda.gov/>