

BI 121 Lecture 6 **Nutrition Lab 3 today! More fun about me...**

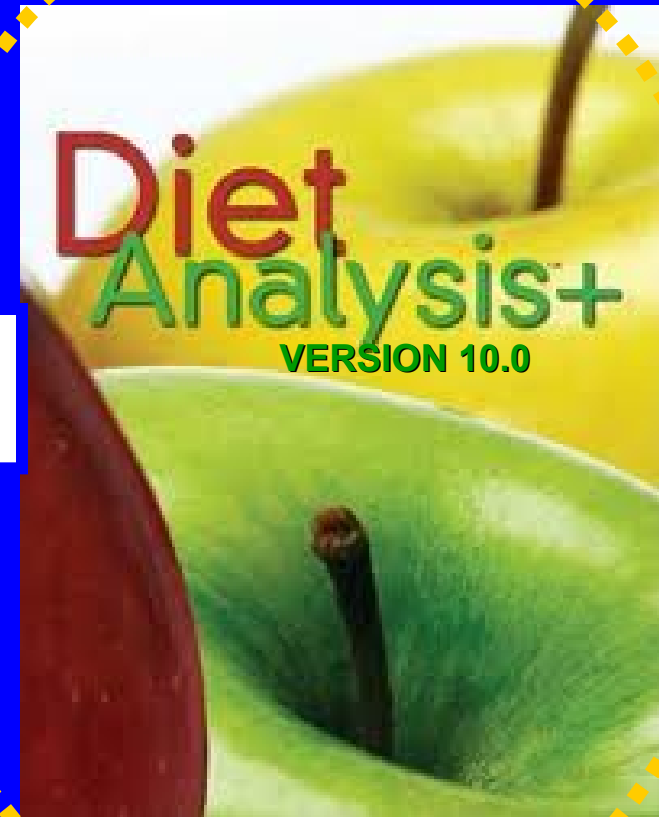


- I. Announcements** Nutrition Lab Today! *Got Data?* Q? If you want notebook to study for Exam I on Oct 28th, turn in prior lecture next Tuesday, Oct 21st. Sample Exam Q.
- II. Nutrition Connections**Sizer & Whitney (S&W) Sci Lib + DC
 - A. Diet or exercise? Diet composition & endurance? Fasting? Zuti & Golding 1976; Sacks **AHA NPAM Council** 2009; AMDR? Adjusted Macronutrient Distribution Range!
 - B. *Beware of Nutrition Quackery* S. Kleiner & Monaco 1990!
- III. Gastrointestinal Physiology** DC Module 3 pp 17-23, LS ch 15+
 - A. Steps of digestion, hydrolysis central theme LS pp 437- 9
 - B. What's missing? LS fig 15-1 p 438
 - C. GI = Donut? GI secretions: What? Where? Why? LS p 438
 - D. How is the gut controlled?
 - E. Organ-by-organ review A&P LS tab 15-1 pp 440-1 +...
 - F. Zymogen? = Inactive precursor LS fig 15-9 p 452...
 - G. Accessory organs? Pancreas, Liver, Recycling! pp 457-63
 - H. Small intestine? Ulcers? LS fig 15-20,15-22 pp 467-8
<http://www.cdc.gov/ulcer> *Beyond the Basics* LS p 456
 - I. Large intestine? LS fig 15-24 pp 472-4

Lab 3: Nutritional Analyses via 2 Programs



+



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

In Lab Today!

Sample Exam I 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.

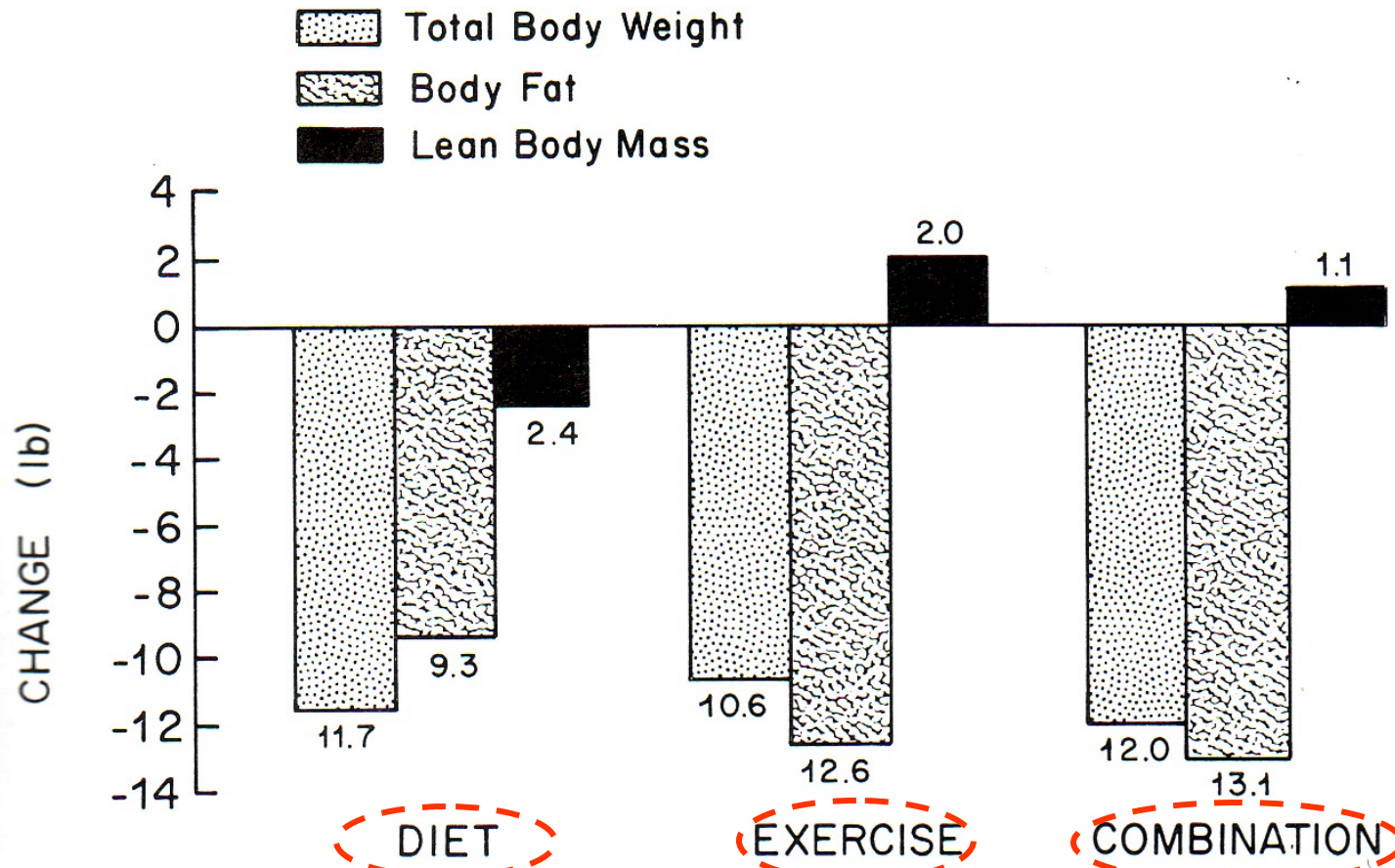


Figure 4-9. Changes in body weight, body fat, and lean body weight for diet, exercise, and combination groups. (From Zuti W. B., and Golding, L. A.: Comparing diet and exercise as weight reduction tools. *Phys. Sportsmed.* 4:49-53, 1976.)

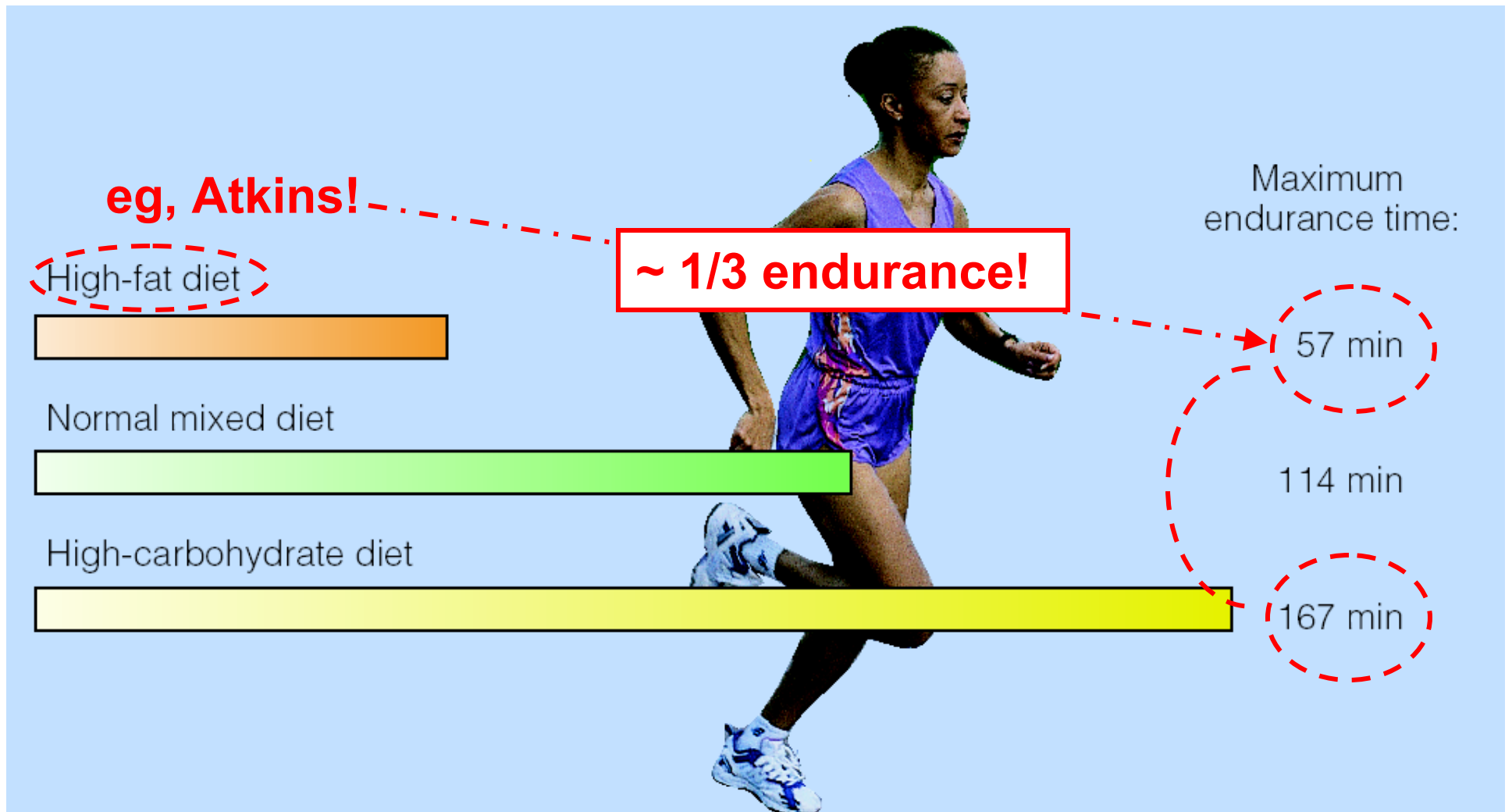
NB: Each group 500 kcal deficit/day, 16 weeks



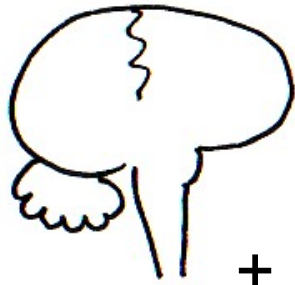
Exercise is better than dieting in lowering body fat & preserving muscles!



Dietary Composition & Physical Endurance

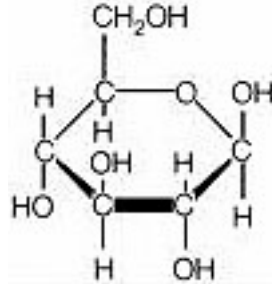


② cns



+

glucose



rbc



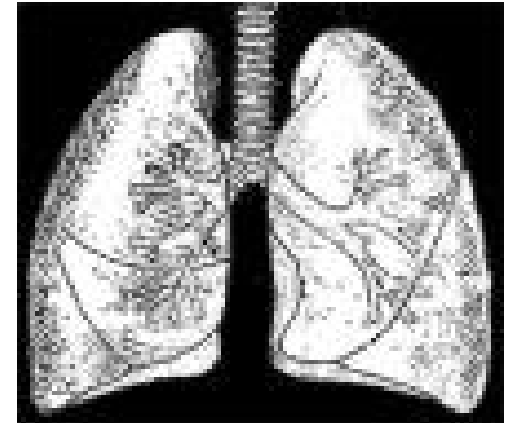
Negative Effects of Low Carbohydrate

①



- ① ↑ fatigue/exhaustion central & peripheral!
- ② ↓ glucose – brain+spinal cord, rbc's thrive upon.
- ③ ↓ variety which reduces intake of phytochemicals, vitamins, minerals & fiber.
- ④ ↑ risk of respiratory infections.

④



+ gall stones,
↓ thermoregulation...

We're better at storing fat vs carbohydrate!

Dietary Fat



3 % Kcal

Body Fat



23 % Kcal

**Dietary
Carbohydrate**



To Help Lower Body Wt & %Fat
EXERCISE!! +*Minimize* These!!



FAT 9 Kcal/g

ETOH 7 Kcal/g

CARB 4 Kcal/g

PRO 4 Kcal/g

**NB: *Minimize* not *Eliminate!*
 Moderation not *Abstinence!!***

***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

>3/4 {
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 are lots of problems!



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

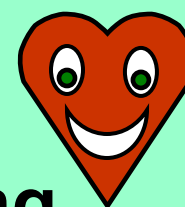
Frank M. Sacks, MD

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.

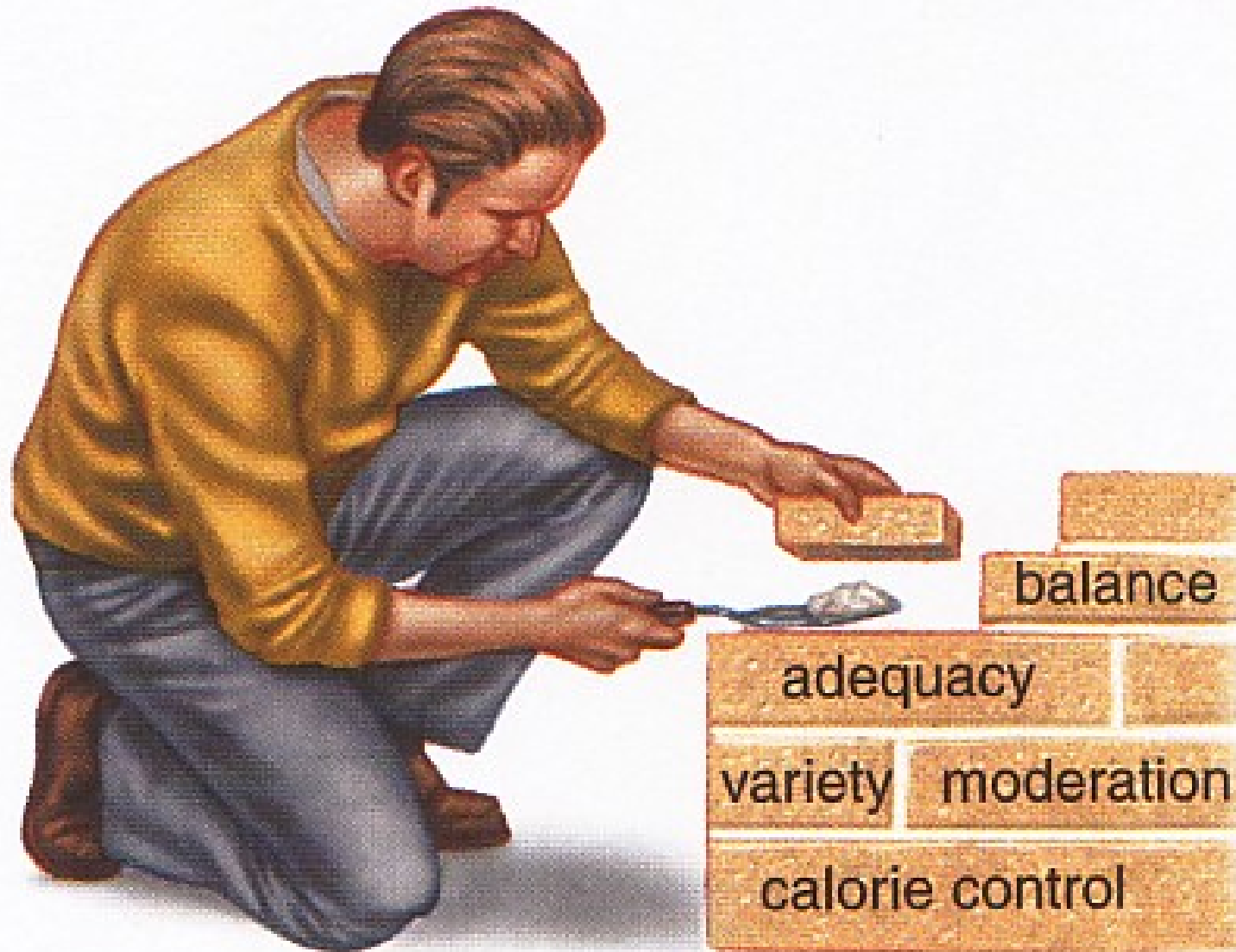
***US Dietary Recommended Intakes (DRI)
Committee Acceptable Macronutrient
Distribution Ranges (AMDR)!***

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

Emphasize ABCs + Variety & Moderation!



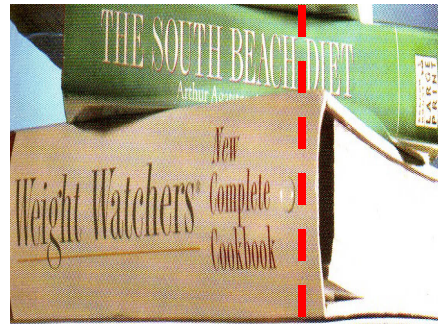
*All of these factors help to build
a nutritious diet.*



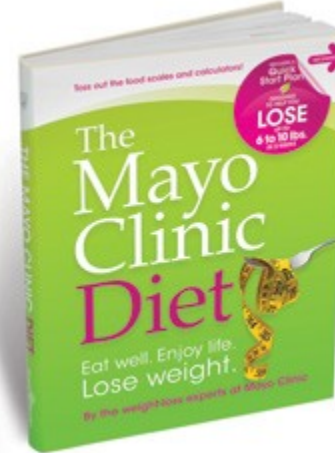
Kleiner's & Monaco's Top 10 Hit List for Nutrition Quackery

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**

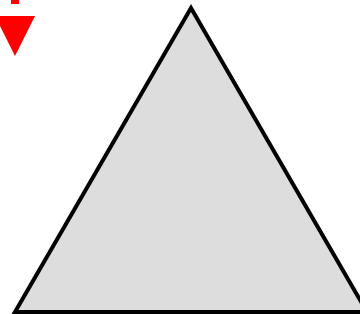


**AHA + DASH +
MAYO CLINIC** 



**LOWER
CARBOHYDRATE**

**ELIMINATE CALORIES
or FOOD GROUPS
ENCOURAGE FASTING**



**LOWER
FAT**



**ADEQUACY
BALANCE
CONSISTENCY
& MODERATION**

5 times per wk? \equiv 106,600 calories/yr \equiv \pm 30.5 lb fat/yr



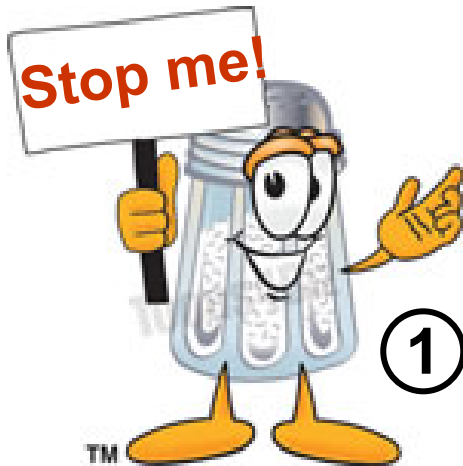
Starbucks
Cinnamon
Dolce Latte,
whipped cream
Venti (20 oz.) | **410 calories**

Jogging | **50 min.**



**Better
choices!**

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.

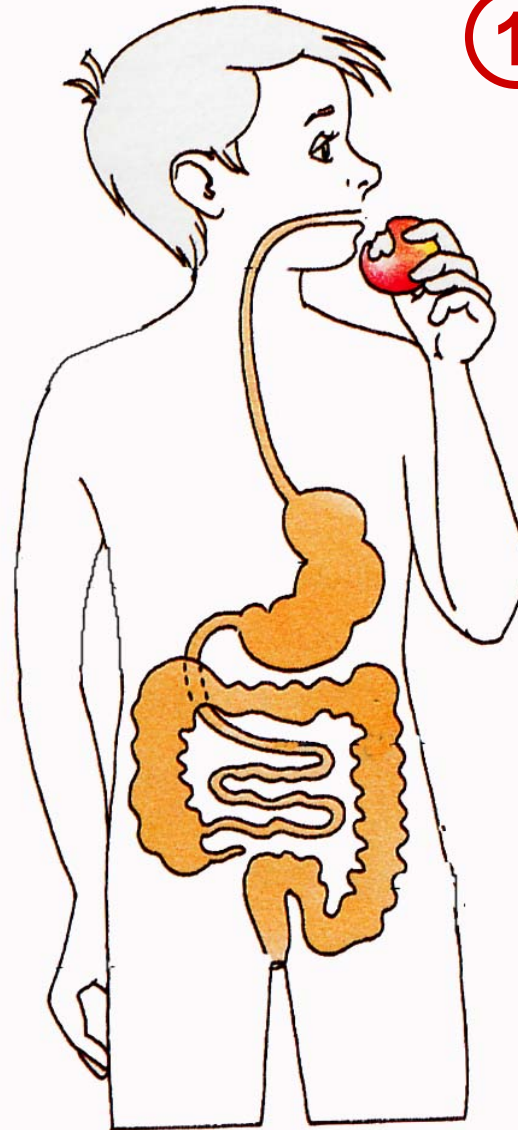
④ GI cancer risk, inflammation?



I'm outta here!!



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.

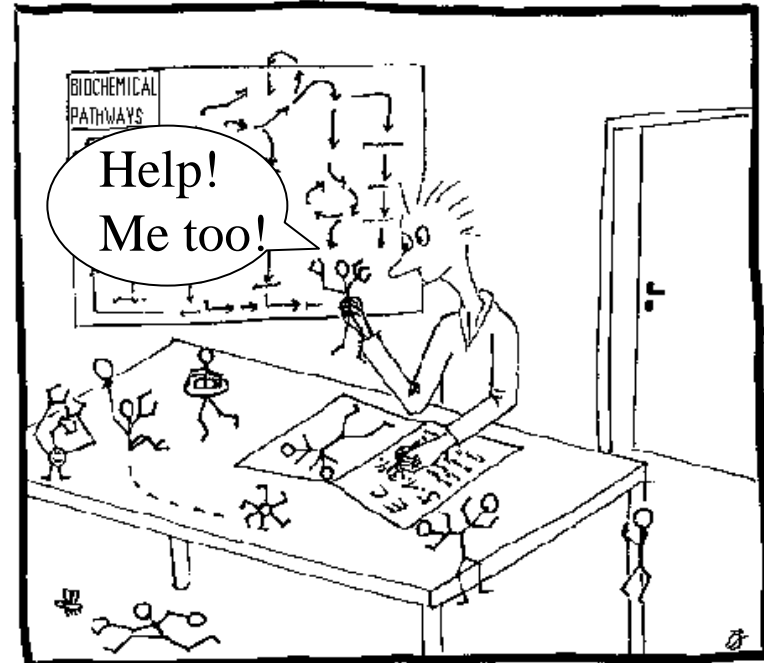
Hydrolysis of Energy Nutrients

Hi gang!!
You need me
for digestion!!



+

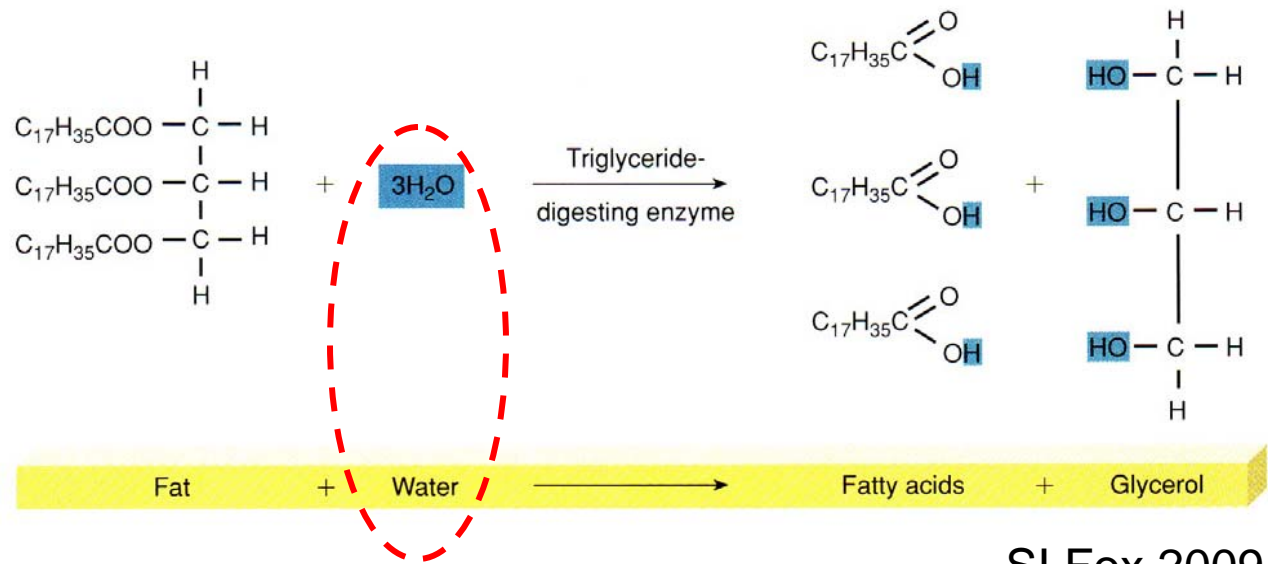
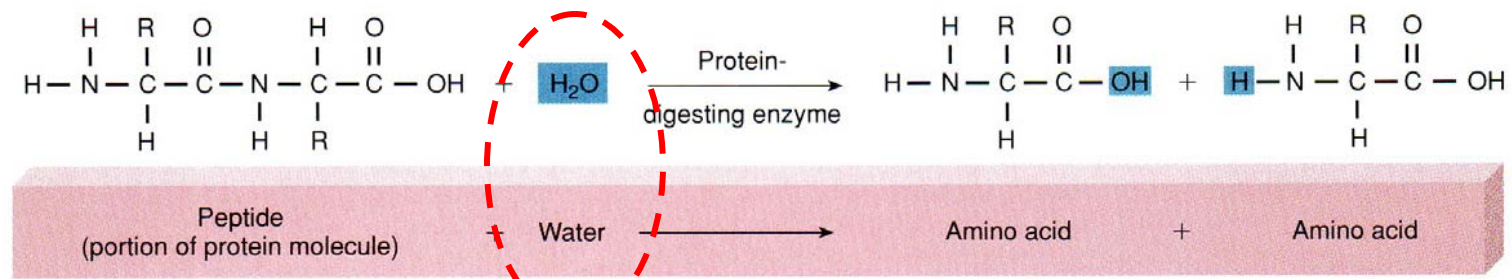
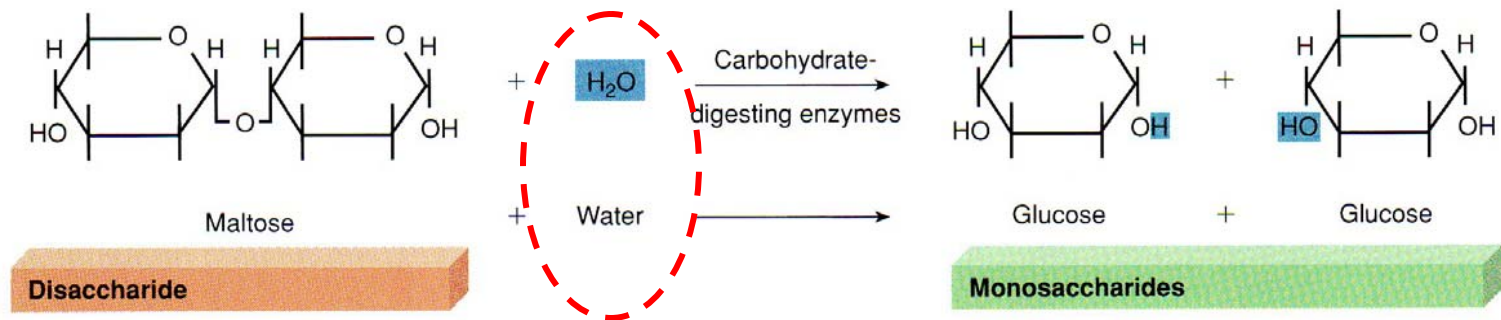
The ENZYME data bank



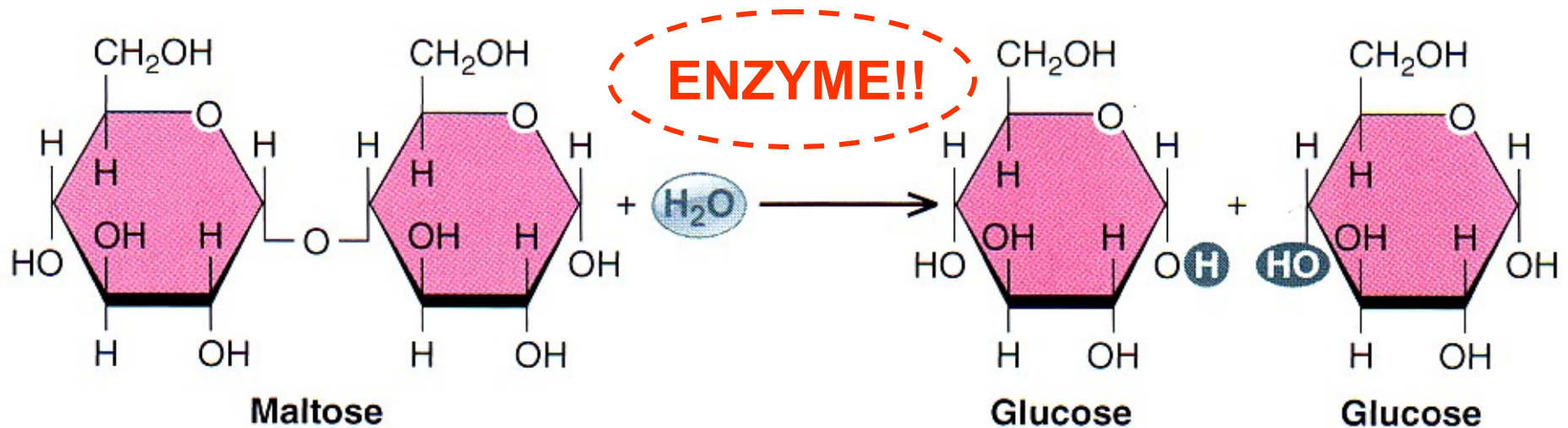
H₂O

+

Enzyme



What's missing?

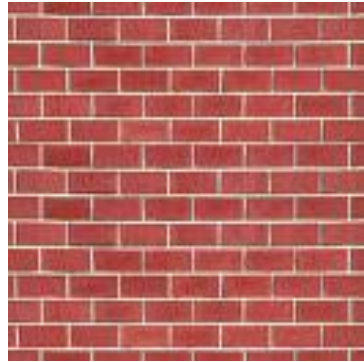


● **FIGURE 15-1 An example of hydrolysis.** In this example, the disaccharide maltose (the intermediate breakdown product of polysaccharides) is broken down into two glucose molecules by the addition of H₂O at the bond site.

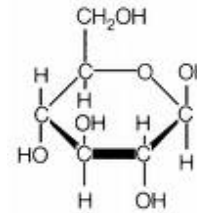
Polymer to Monomer (Many to One)



...Central-linking theme!!

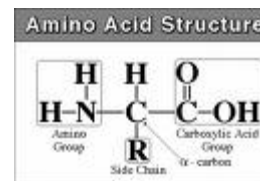


Carbohydrate

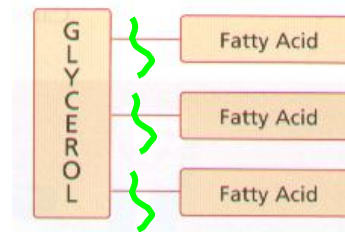


Glucose

Protein
+
Fat

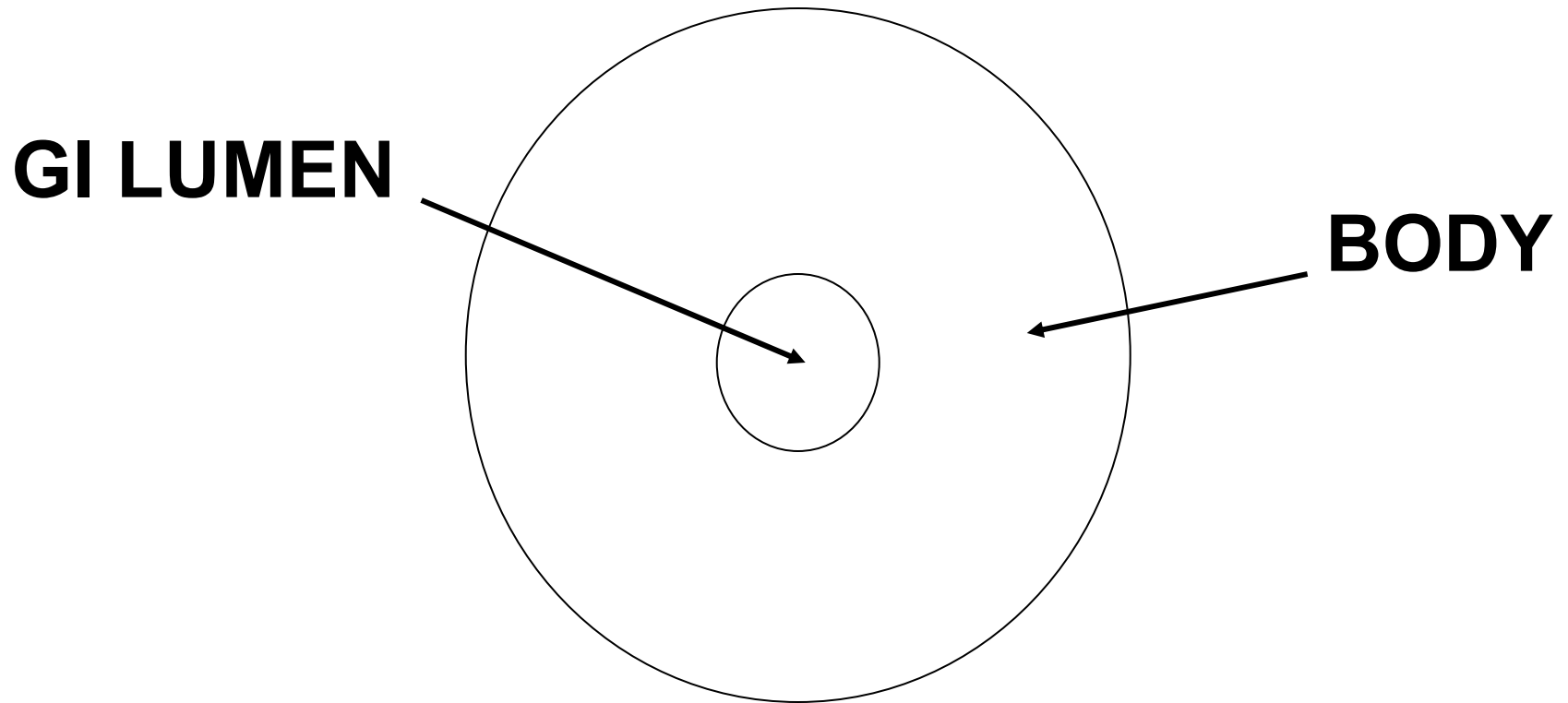


Amino Acids



Fatty Acids
+
Glycerol

GI-DONUT ANALOGY

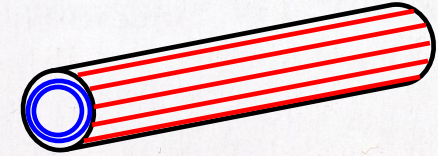


Common Control Mechanisms

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

LS 2012 fig 15-2 p 442

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

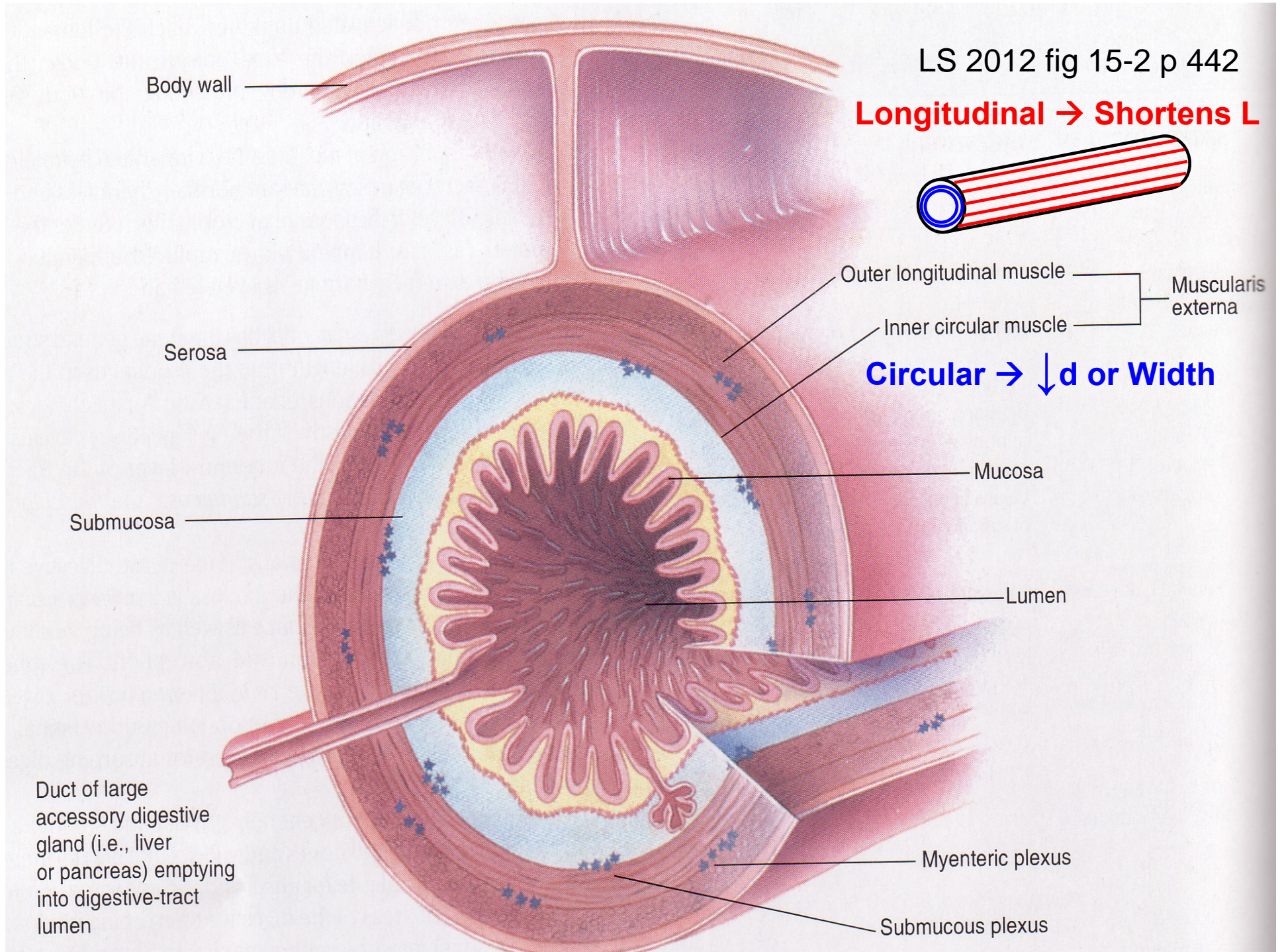
Muscularis externa

Mucosa

Lumen

Myenteric plexus

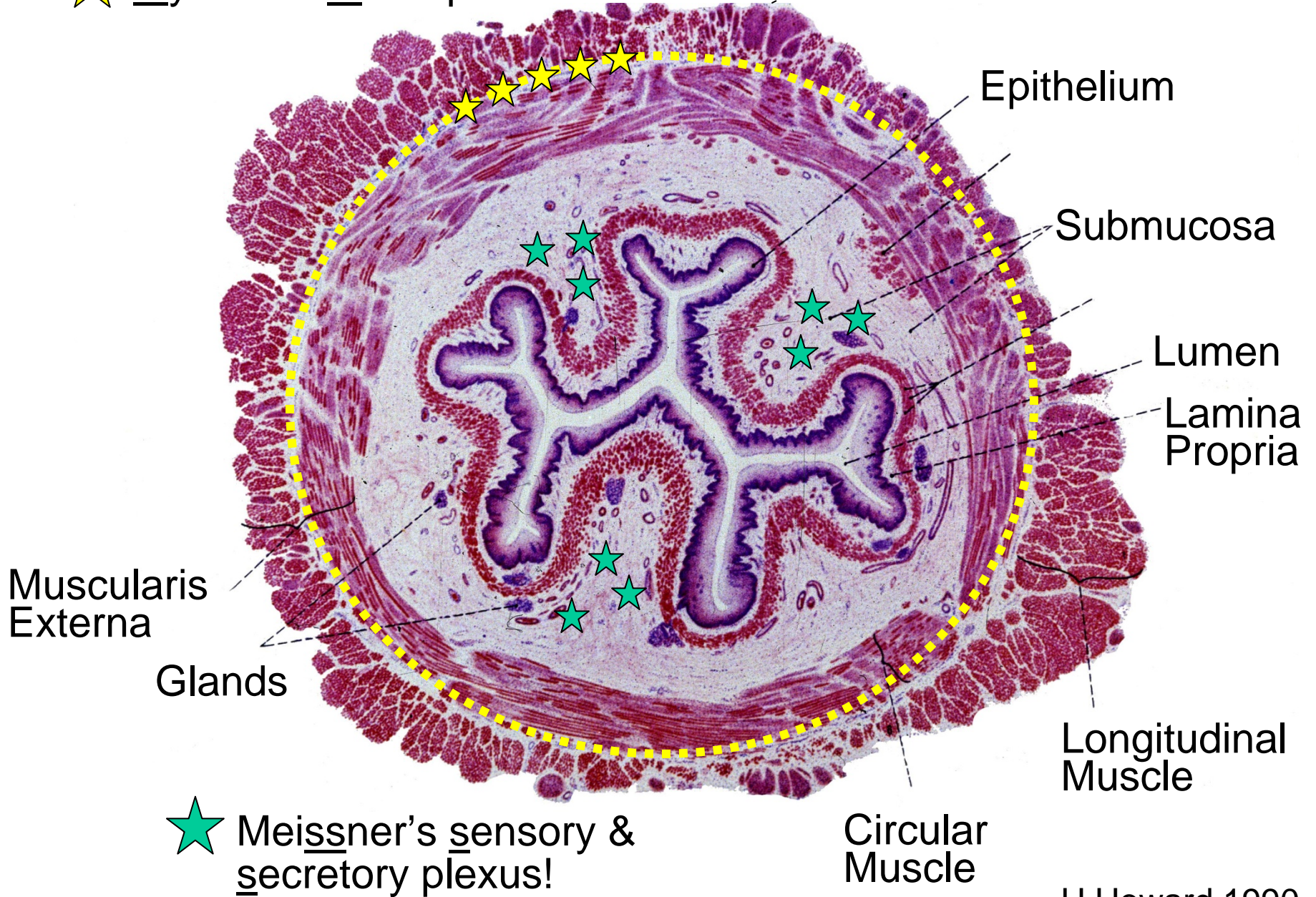
Submucous plexus



★ Myenteric motor plexus!

Serosa

cf: G&H fig 62-2



Epithelium

Submucosa

Lumen

Lamina Propria

Muscularis Externa

Glands

Longitudinal Muscle

★ Meissner's sensery & secretory plexus!

Circular Muscle

H Howard 1990

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

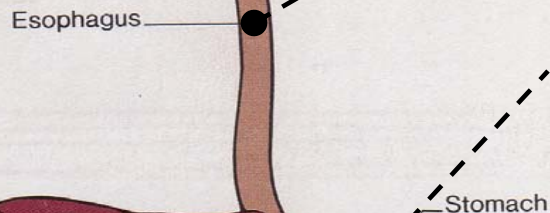
1. Mouth

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



2. Esophagus

Rapid transit
peristalsis
secretion mucus

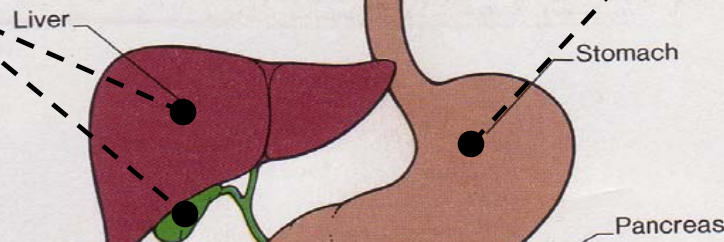


3. Stomach

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

4. Liver-Gall Bladder

Emulsification =
detergent action of bile
+ secretion

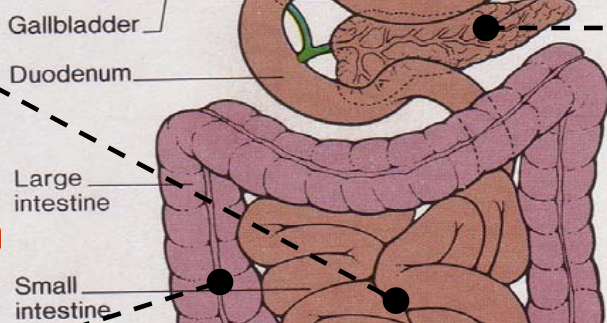


5. Pancreas

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

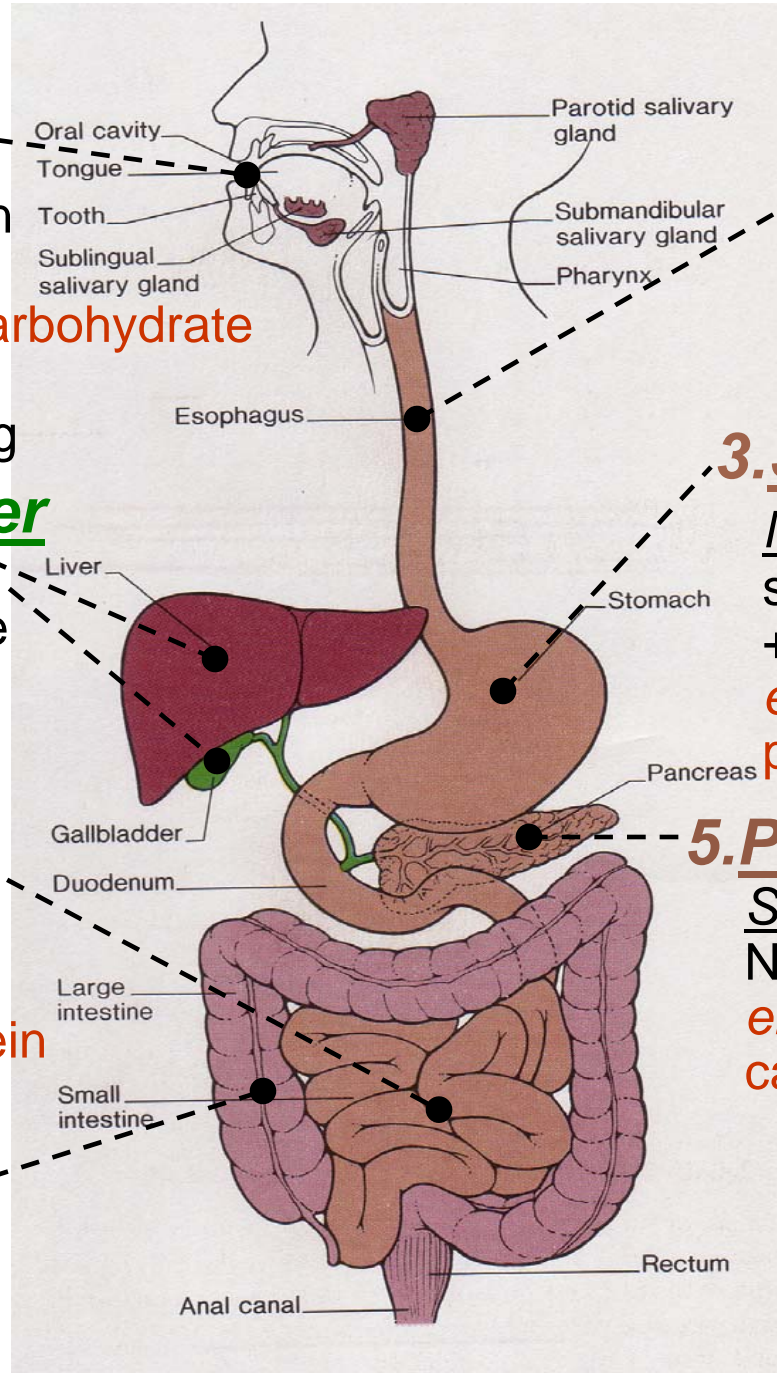
6. Small Intestine

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

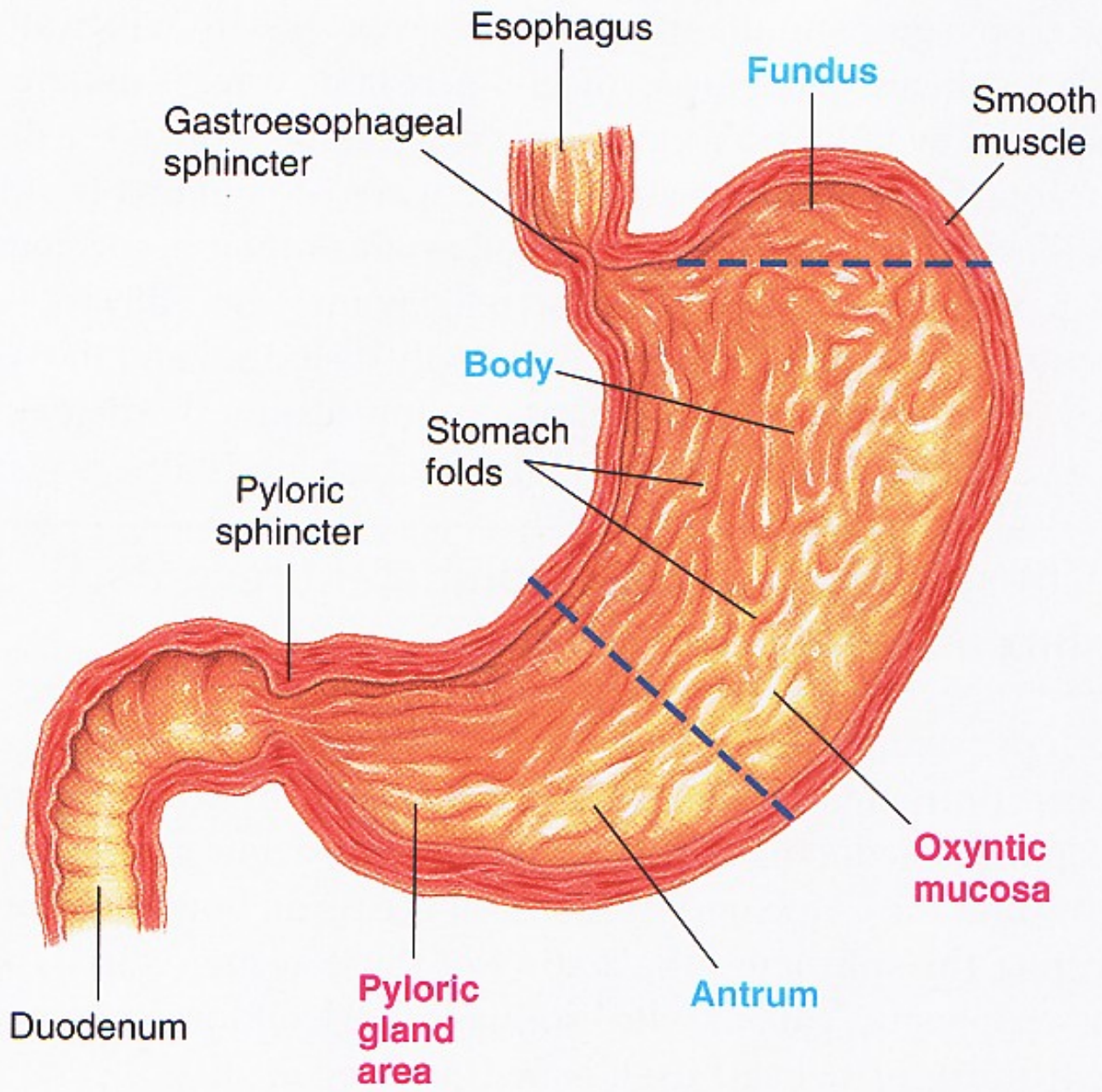


7. Large Intestine

Dehydration
secretion + absorption
storage + peristalsis

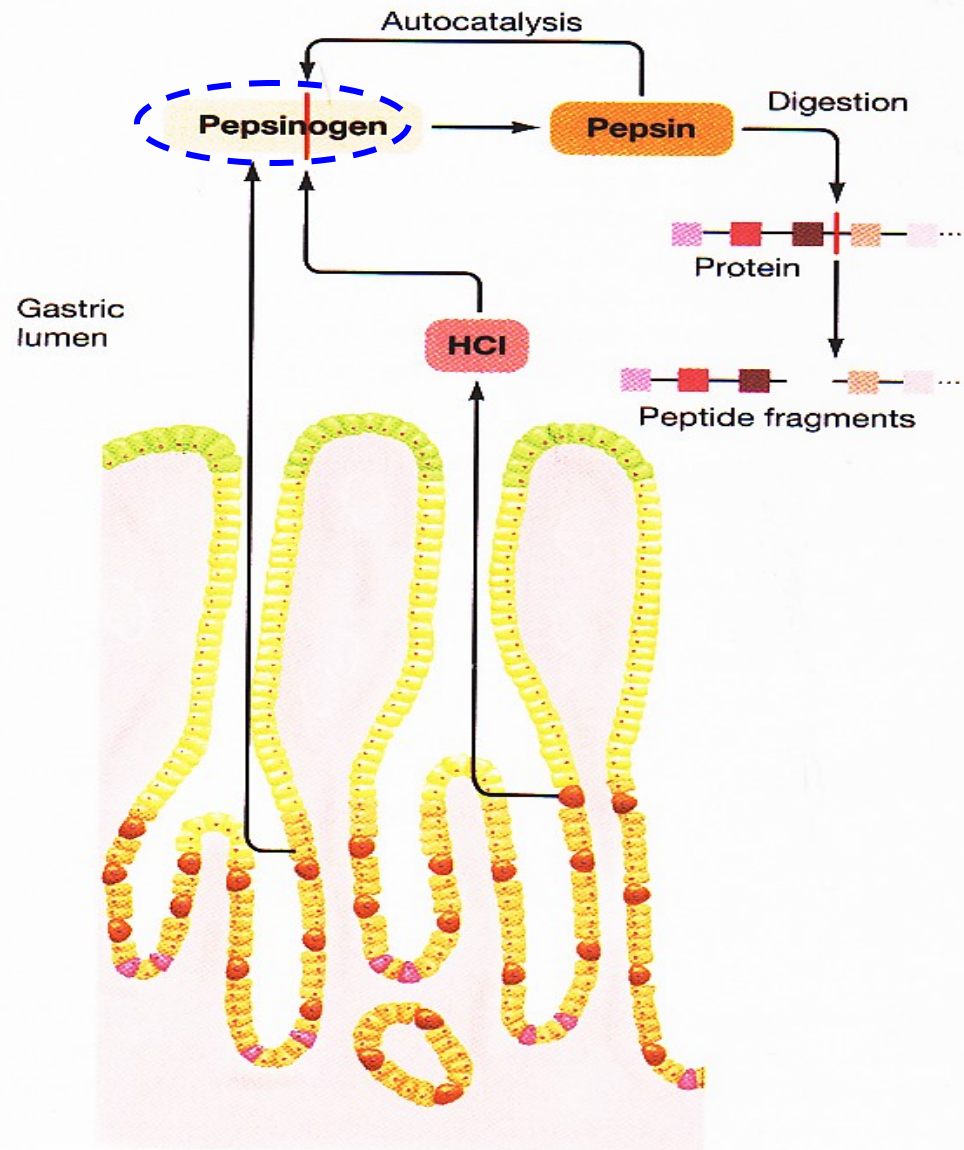


Where does
enzymatic
digestion of
protein
begin?



● FIGURE 15-7

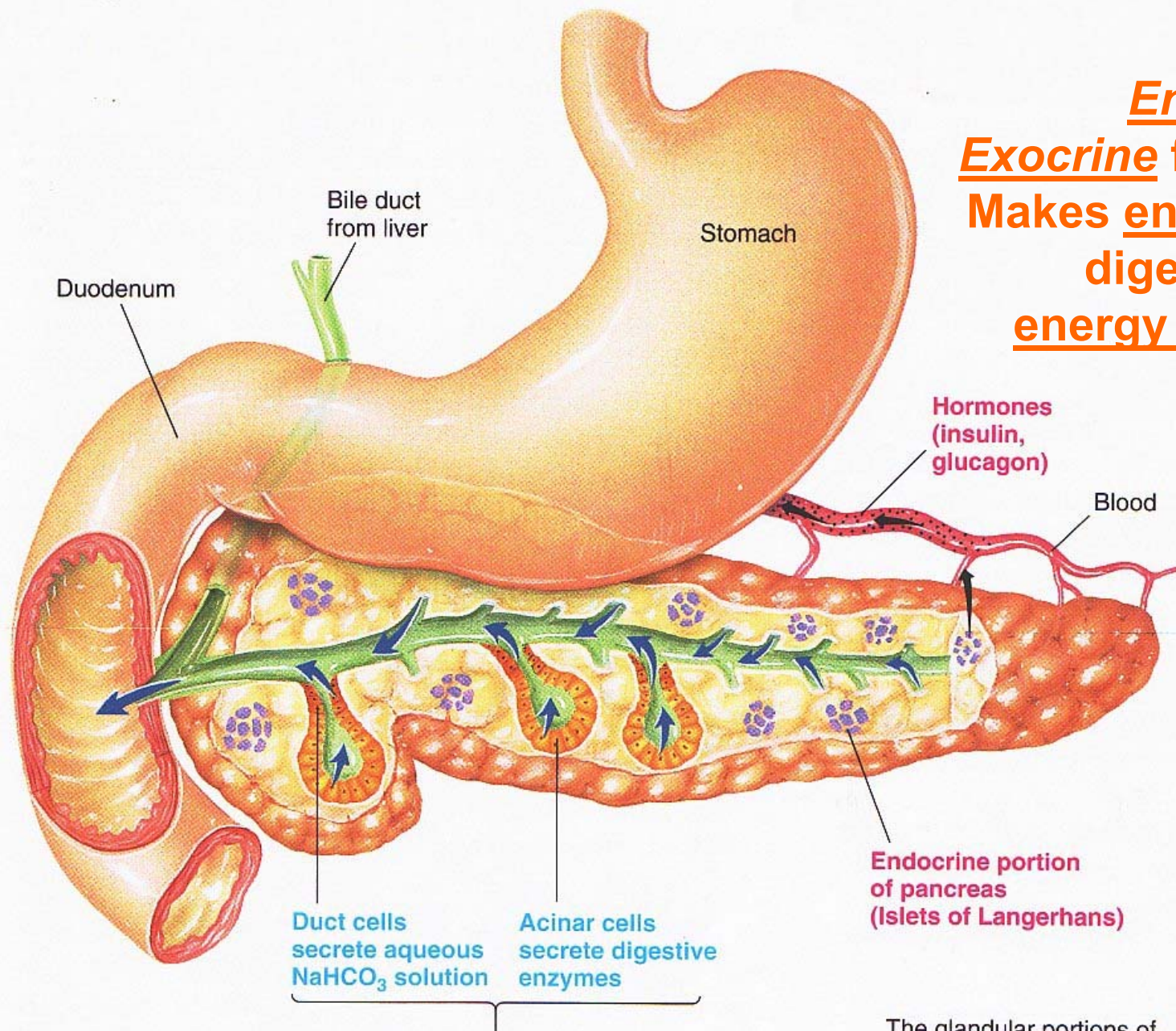
**Zymogen =
an inactive
precursor**



■ ■ ■ = 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!**



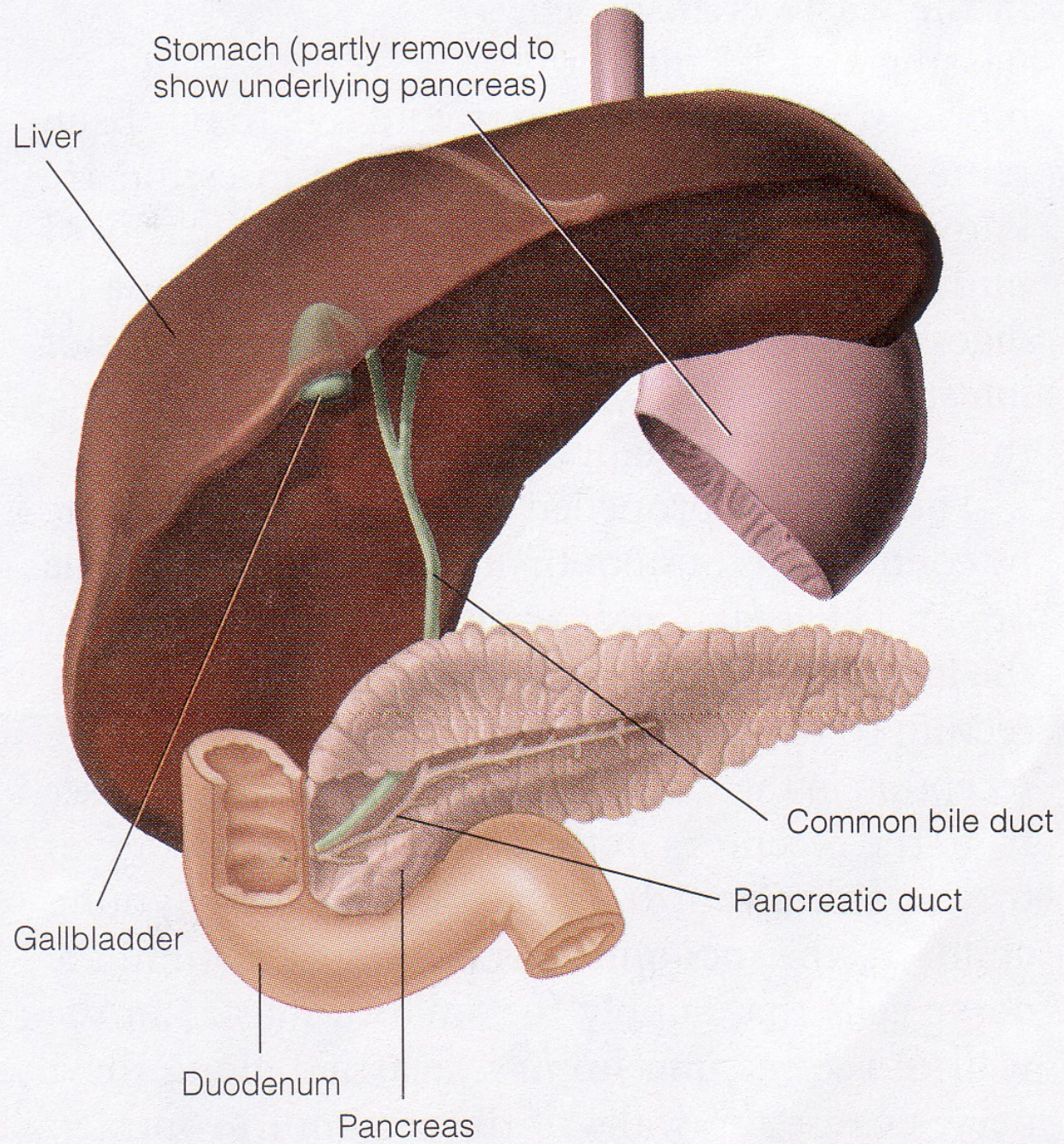
Endocrine portion of pancreas (Islets of Langerhans)

Duct cells secrete aqueous NaHCO_3 solution
Acinar cells secrete digestive enzymes

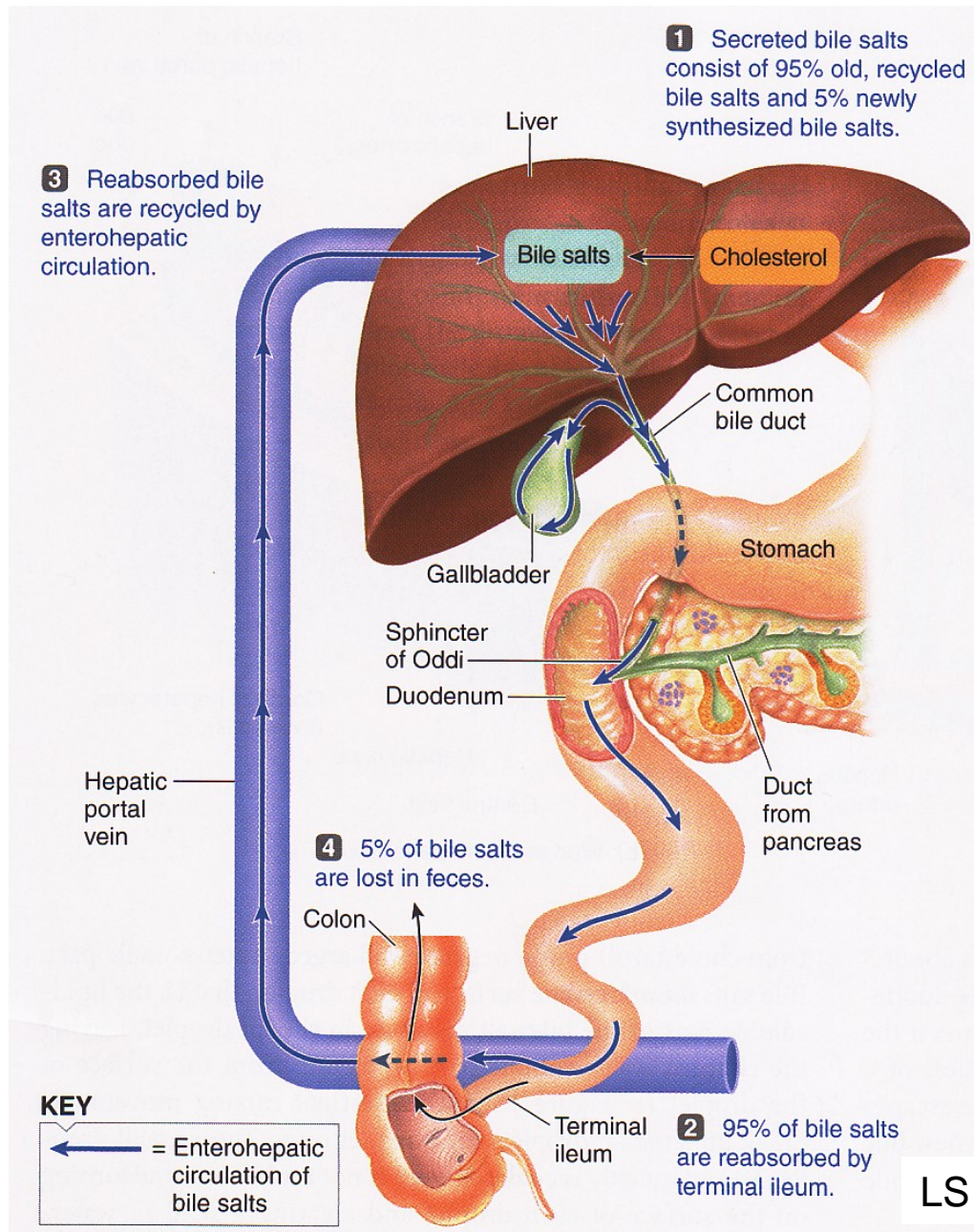
Exocrine portion of pancreas (Acinar and duct cells)

The glandular portions of the pancreas are grossly exaggerated.

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

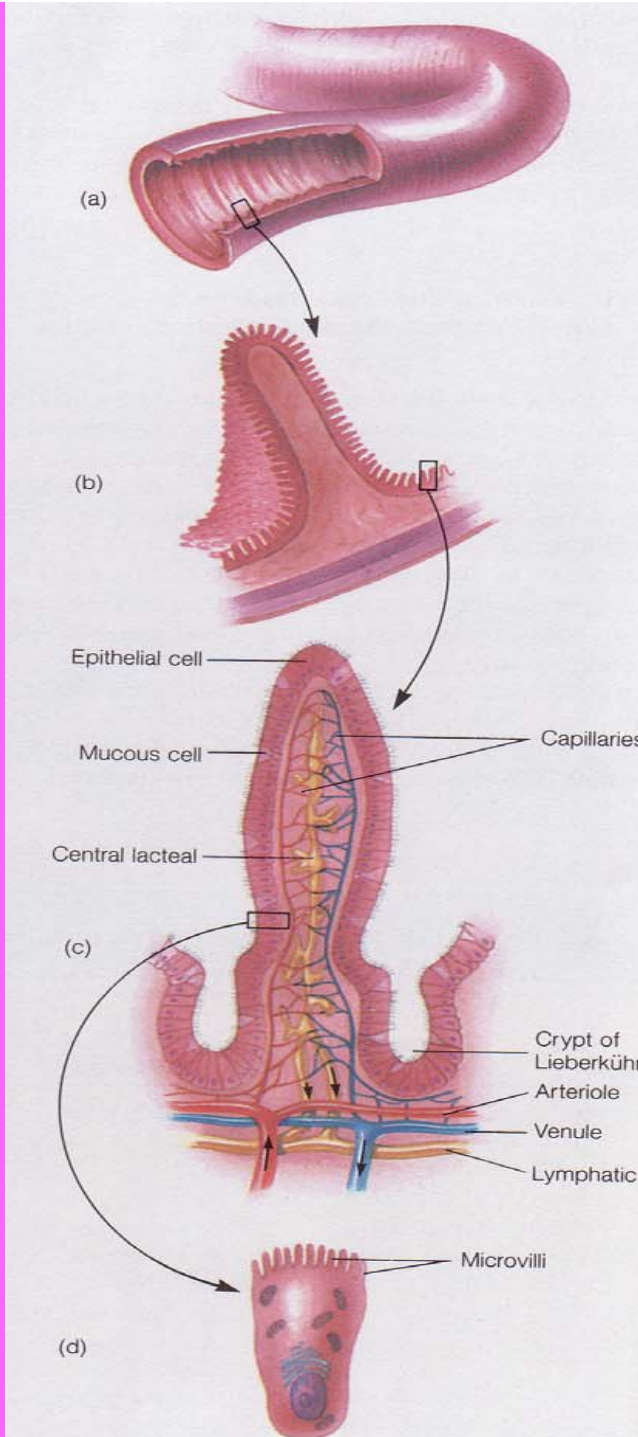


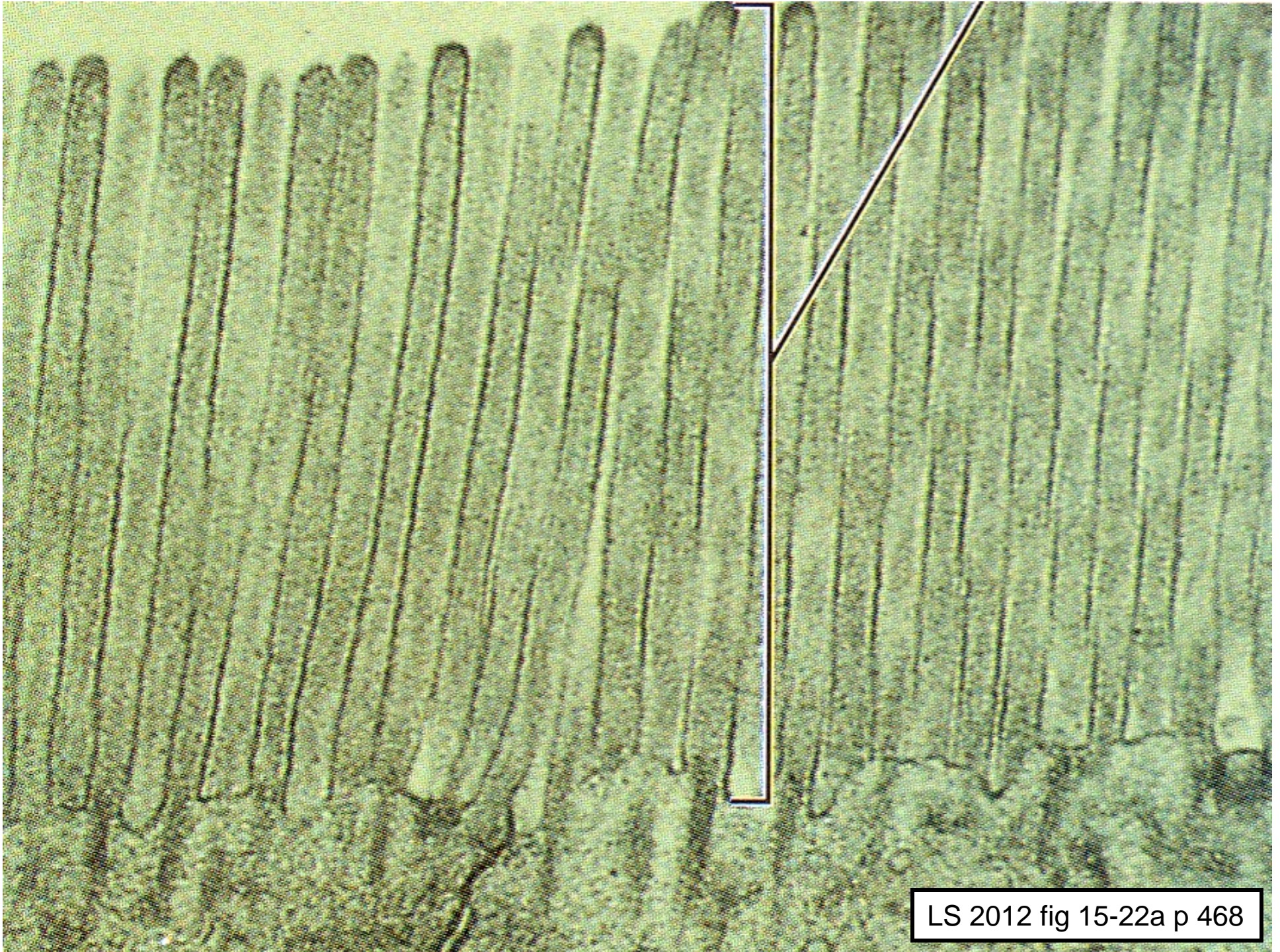
Liver: Amazing Recycling of Bile Salts!



What is the major
function of the
small intestine?

Absorption!!

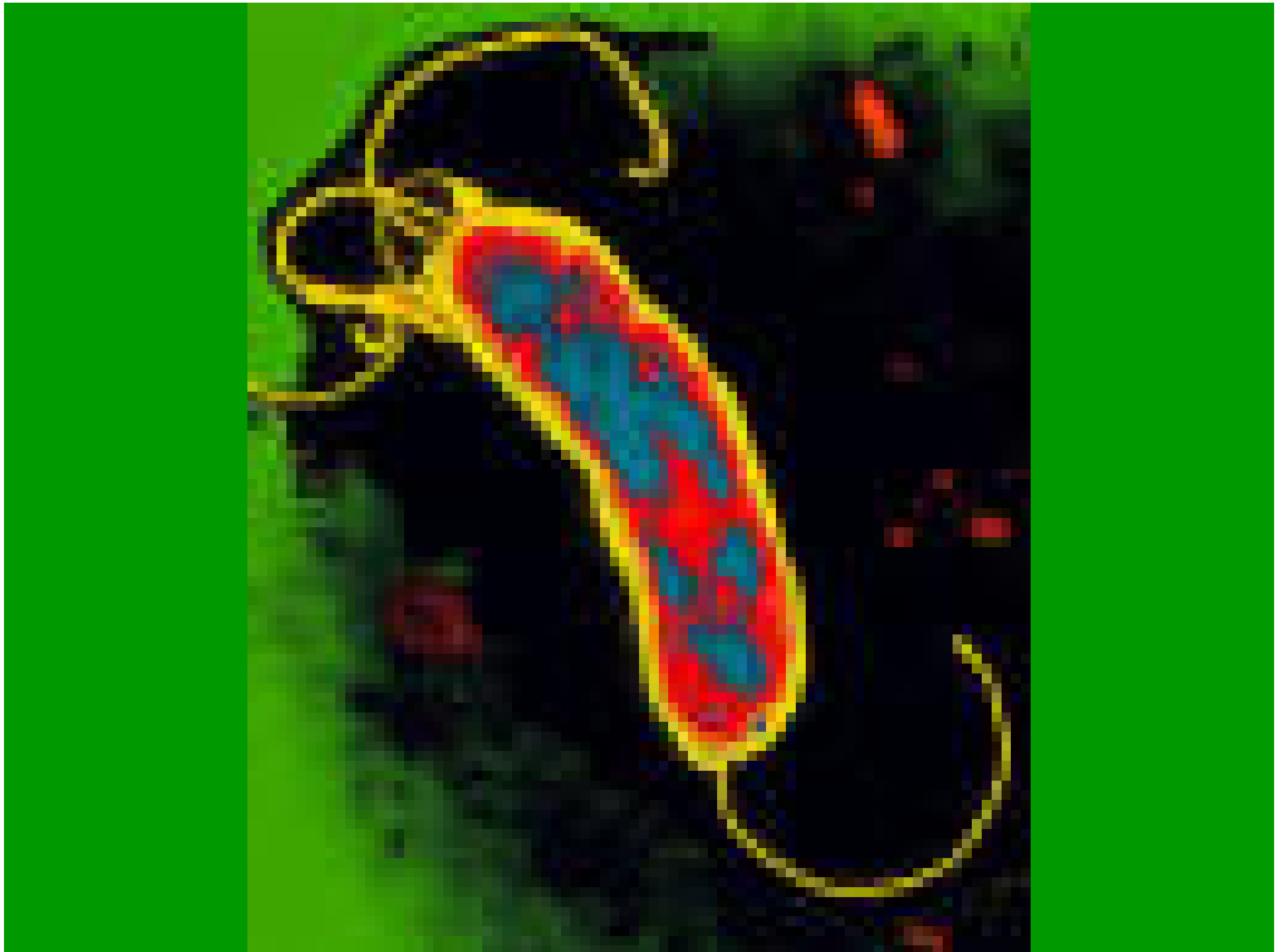




LS 2012 fig 15-22a p 468



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



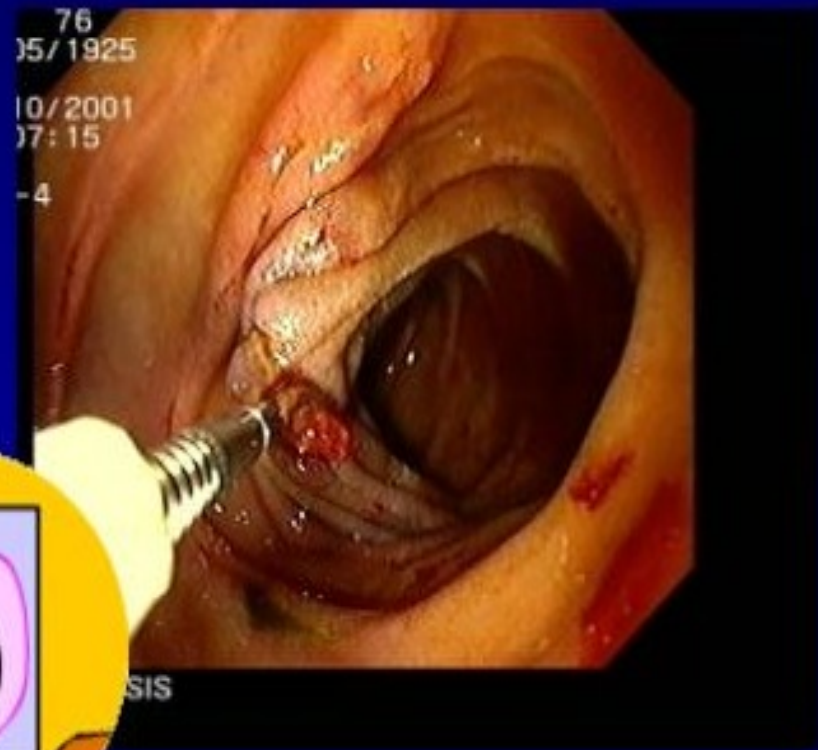
Ulcer Facts

- 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.

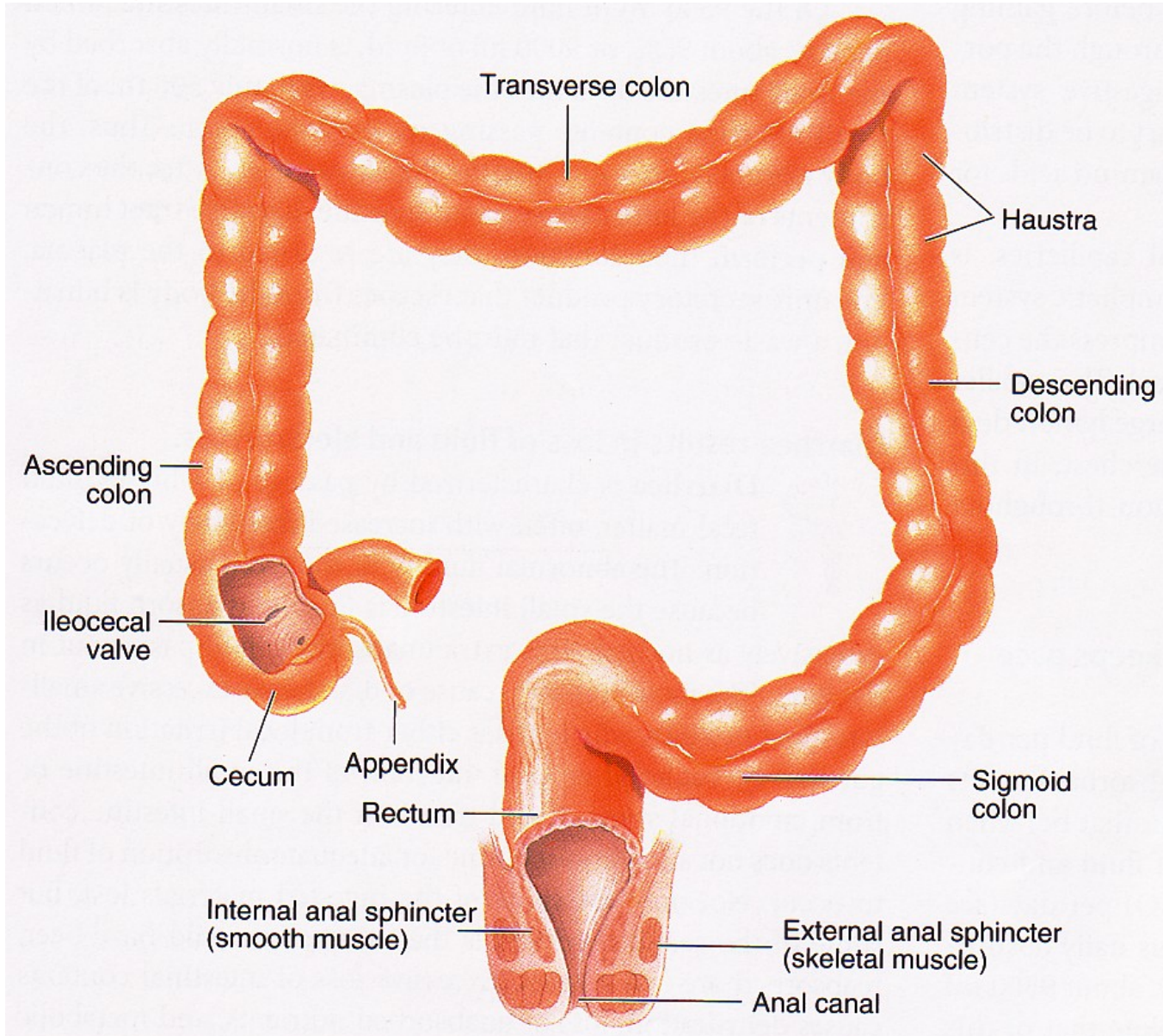
In the second photograph, a disposable metal clip is applied to the ulcer. The patient remained well and left hospital three days later.



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

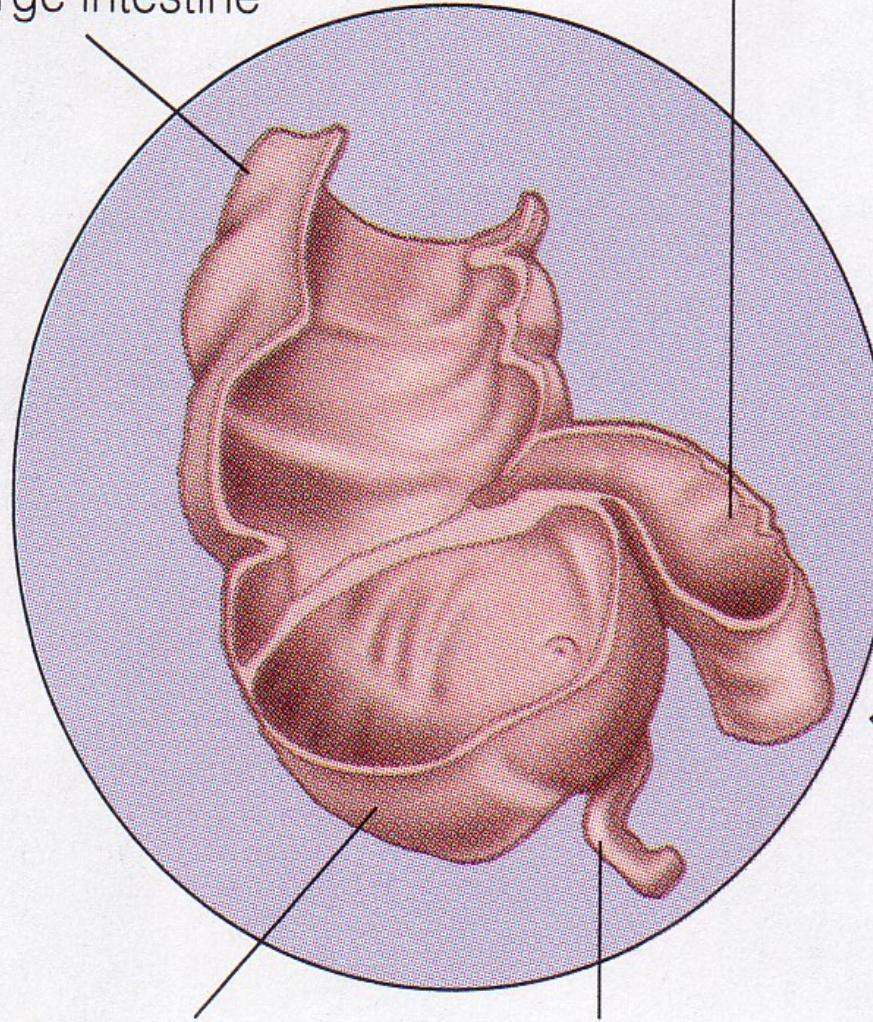
| Nutrients | Enzymes for Digesting the Nutrients | Source of Enzymes | Site of Action of Enzymes | Action of Enzymes | Absorbable Units of the Nutrients |
|----------------------|---------------------------------------------|----------------------------------|------------------------------------|-------------------------------------------------------------|-------------------------------------|
| 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