



BI 121 Lecture 6

I. Announcements **Got Data?** Crucial for today's lab! Q?

If you want notebook to study for Exam I on Oct 27th, turn in prior lecture next Tuesday, Oct 20st. Sample Exam Q.

II. Nutritional Physiology in the News Shake the salt habit! Gain weight by drinking your calories? Coconuts are on a roll? *UCB Identifying Nutrition Quackery*, Kleiner & Monaco

III. Nutrition Connections DC Mod 2,Sizer & Whitney (S&W) Sci Lib

- A. Diet & endurance? What's the best path to losing weight?
- B. Low-carbohydrate dieting? What about fasting?
- C. Balanced approach, Dr. Sacks **AHA NPAM Council**

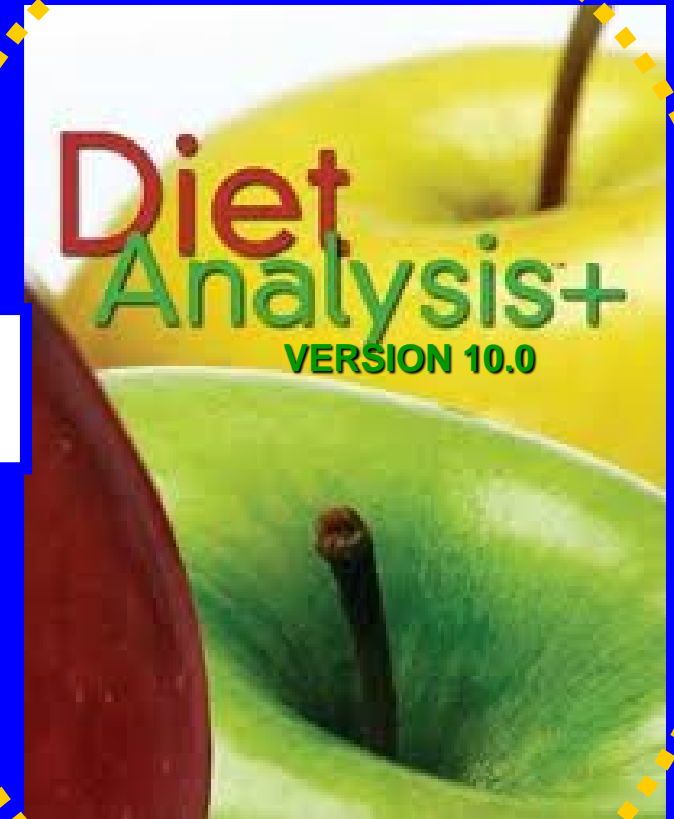
IV. Gastrointestinal Physiology DC Module 3 pp 17-23, LS ch 15+

- A. GI = Donut? GI secretions: What? Where? Why? LS p 438
- B. How is the gut controlled?
- C. Organ-by-organ review A&P LS tab 15-1 pp 440-1 +...
- D. Zymogen? = Inactive precursor LS fig 15-9 p 452...
- E. Accessory organs? Pancreas, Liver, Recycling! 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. 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

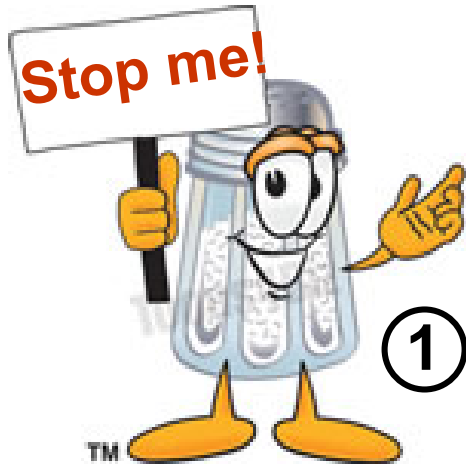
Sample 1. What is *human physiology*? (+2) How does it differ from *human anatomy*? (+2)

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.

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!!



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!**



The Amazing BENEFITS Coconut^{of} Oil

Nutritional Content in Coconut Oil:

Anti
oxidants

MCT
Medium-Chain
Triglycerides

Lauric
Acid

Caprylic
Acid

Capric
Acid

The Health & Healing Benefits of Coconut Oil:

Skin Care

The **MCT** in Coconut oil act as a natural skin conditioner. Deeply penetrating & moisturizing, they protect against environmental & free radical damage. It also helps with anti-aging, eczema & even provides some sun protection.

Hair Care

Coconut oil is one of the best ways to provide nutrients to your hair. The fatty acids condition deeply from the insides of the strands out. Providing protein, eliminating dandruff & aiding in re-growth. Many people use it as a conditioner!

Stress Relief

Coconut oil is very soothing. The natural aroma of coconut is also very soothing. You can apply the oil to your head & gently massage to help remove mental fatigue.

Weight Loss

The Fatty Acids in coconut oil destroy candida, (yeast overgrowth) which triggers weight gain, carbohydrate cravings & fatigue. They're easily digested & converted into energy, which helps to speed up metabolism & help burn stored fat.

Immunity

The unique saturated fats of coconut oil contain antibacterial, antiviral, anti-fungal, and anti-parasitic properties that help strengthen the immune system. Consuming coconut oil regularly will reduce incidences of sickness.

Infections

Lauric Acid (found only in breast milk & coconut oil) is converted into monolaurin in the body. This may destroy bacterial & viral infections like measles, influenza, hepatitis C & even HIV. Monolaurin may also eliminate Athlete's foot.

Digestion

MCT molecules in coconut oil are small so they are easily digested with less strain on the pancreas & digestive system. People suffering from diabetes, obesity, gallbladder disease, or Crohn's disease may benefit greatly from coconut oil.

Diabetes

Coconut oil may improve insulin sensitivity & glucose tolerance over time. It helps regulate blood sugar levels & protects against insulin resistance. It can even help prevent Type II Diabetes.

Heart Health

The fat in coconut oil does **not** have a negative effect on cholesterol. In fact, it helps improve your cholesterol profile. It helps prevent heart attack & stroke and may even cure heart disease.

TIP: Buy Organic, Unrefined, Cold-Pressed, Extra-Virgin Coconut Oil!

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.

Many claims with little scientific, peer-reviewed, research support

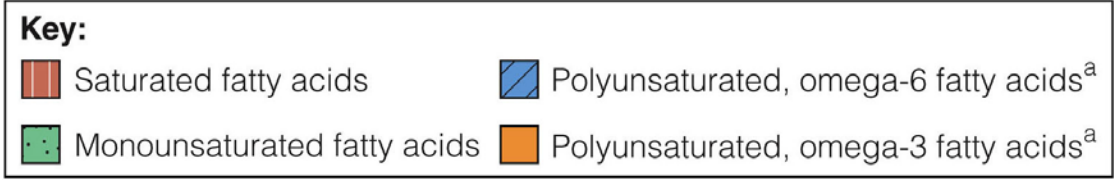


<http://www.doctoroz.com/videos/surprising-health-benefits-coconut-oil>

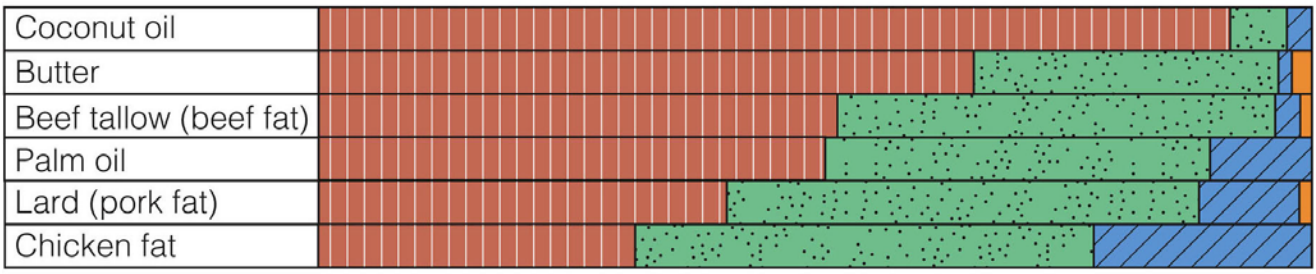
Coconut Oil Health Benefits

- 
- A list of health benefits for coconut oil, presented in two columns. The text is overlaid on a background image of a coconut and green palm fronds. The coconut is cracked open, showing the white flesh and the brown husk. The text is in a dark blue, sans-serif font.
- Improves or Reverses Alzheimer's Disease
 - Improves Type 2 AND Type 1 Diabetes
 - Improves or Heals Many Skin Diseases
 - Fungal Infections
 - Acne
 - Eczema
 - Keratitis Polaris
 - Psoriasis
 - Rosacea
 - Provides Peak Performance Energy
 - Drug-free Energy
 - Longer Endurance
 - Kills Candida Fungus
 - Helps with Hypothyroidism
 - Increases Metabolism
 - Raises Body Temperature
 - Conditions and Strengthens Hair
 - Penetrates Roots
 - Kills Lice
 - Improves Dandruff
 - Kills many Bacteria AND Viruses
 - Promotes Weight Loss
 - Preserves Muscle Mass
 - Promotes Ketosis

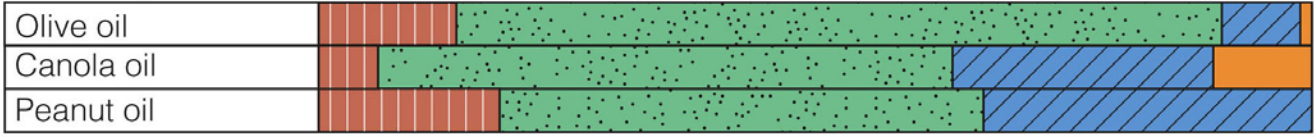
Find all the research at: CoconutOil.com



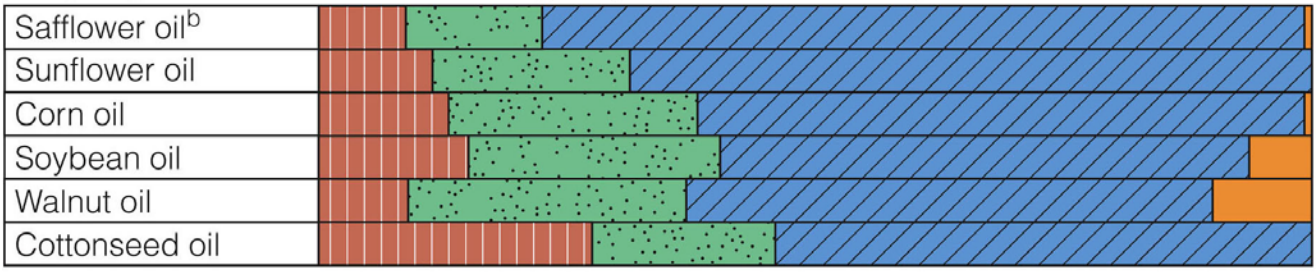
Animal fats and the tropical oils of coconut and palm contain mostly saturated fatty acids.



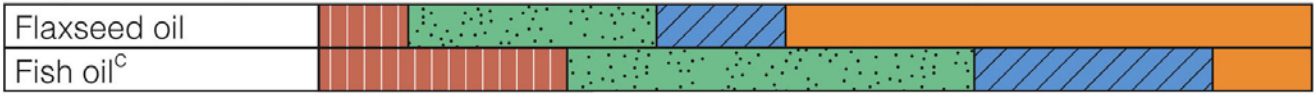
Some vegetable oils, such as olive and canola, are rich in monounsaturated fatty acids.



Many vegetable oils are rich in omega-6 polyunsaturated fatty acids.^a



Only a few oils provide significant omega-3 polyunsaturated fatty acids.^a



^aThese families of polyunsaturated fatty acids are explained in a later section.

^bSalad or cooking type over 70% linoleic acid.

^cFish oil average values derived from USDA data for salmon, sardine, and herring oils.

Coconut Oil Nutritional Wonder?

Claims?

<http://coconutoil.com/about-us/>

Review articles:calves, hamsters, mice...rare humans

<http://www.ncbi.nlm.nih.gov/pubmed/?term=coconut+oil+health+benefits>

The bottom line?

<http://www.cspinet.org/nah/articles/coconut-oil.html>

http://www.health.harvard.edu/newsletters/Harvard_Health_Letter/2011/May/coconut-oil

<http://health.clevelandclinic.org/2012/05/heart-healthy-cooking-oils-101/>

http://en.wikipedia.org/wiki/Smoke_point



Coconuts are on a roll?



1. **Blood Cholesterol & ❤️ Health?** Lauric acid, 1^o saturated fat may ↑ HDL good > LDL bad cholesterol, but depends on fat replaced. Neutral effect? Still don't really know!
2. **Weight Loss?** Medium chain fatty acids metabolized uniquely. Few human studies on body weight have had inconsistent results. Like all edible oils, high in kcal (120/Tbsp) so counterproductive.

UCB Wellness Letter Nov 2014 p 1 & 5

<http://www.berkeleywellness.com/healthy-eating/diet-weight-loss/food/nutrition/article/coconut-oil-all-its-cracked-be>

Dietary Composition & Physical Endurance

eg, Atkins!

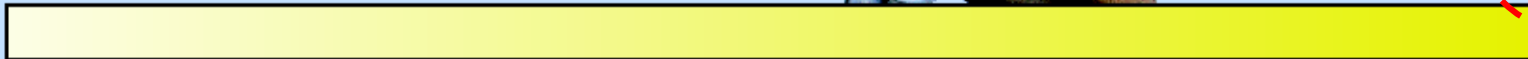
High-fat diet



Normal mixed diet



High-carbohydrate diet



~ 1/3 endurance!

Maximum endurance time:

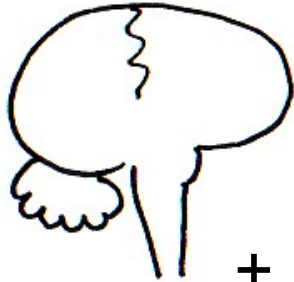
57 min

114 min

167 min

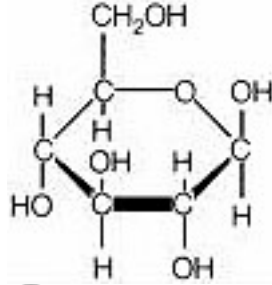


2



+

glucose



rbcs



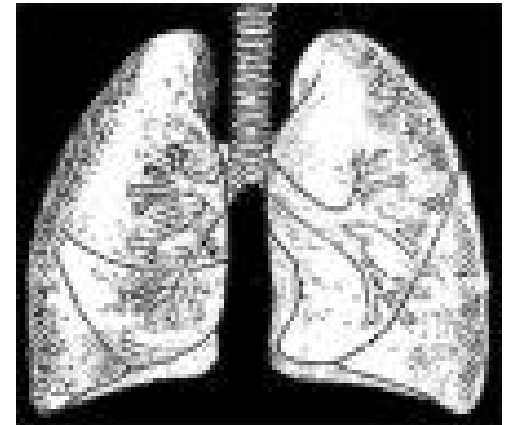
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Negative Effects of Low Carbohydrate

4



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



+ 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

26 lb Water

20 lb Lean Body Mass

14 lb Fat

Fat < $\frac{1}{4}$ total wt loss!

> $\frac{3}{4}$

***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

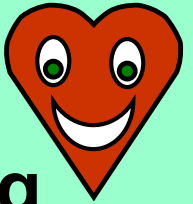
that Mediterranean diets were superior to low-fat diets for weight loss (5,6). Others claimed that a radically different approach that used low-carbohydrate, high-fat, and high-protein foods could produce weight loss without attention to reducing intake because of the satiety of protein-rich foods. Low-carbohydrate 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



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

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.

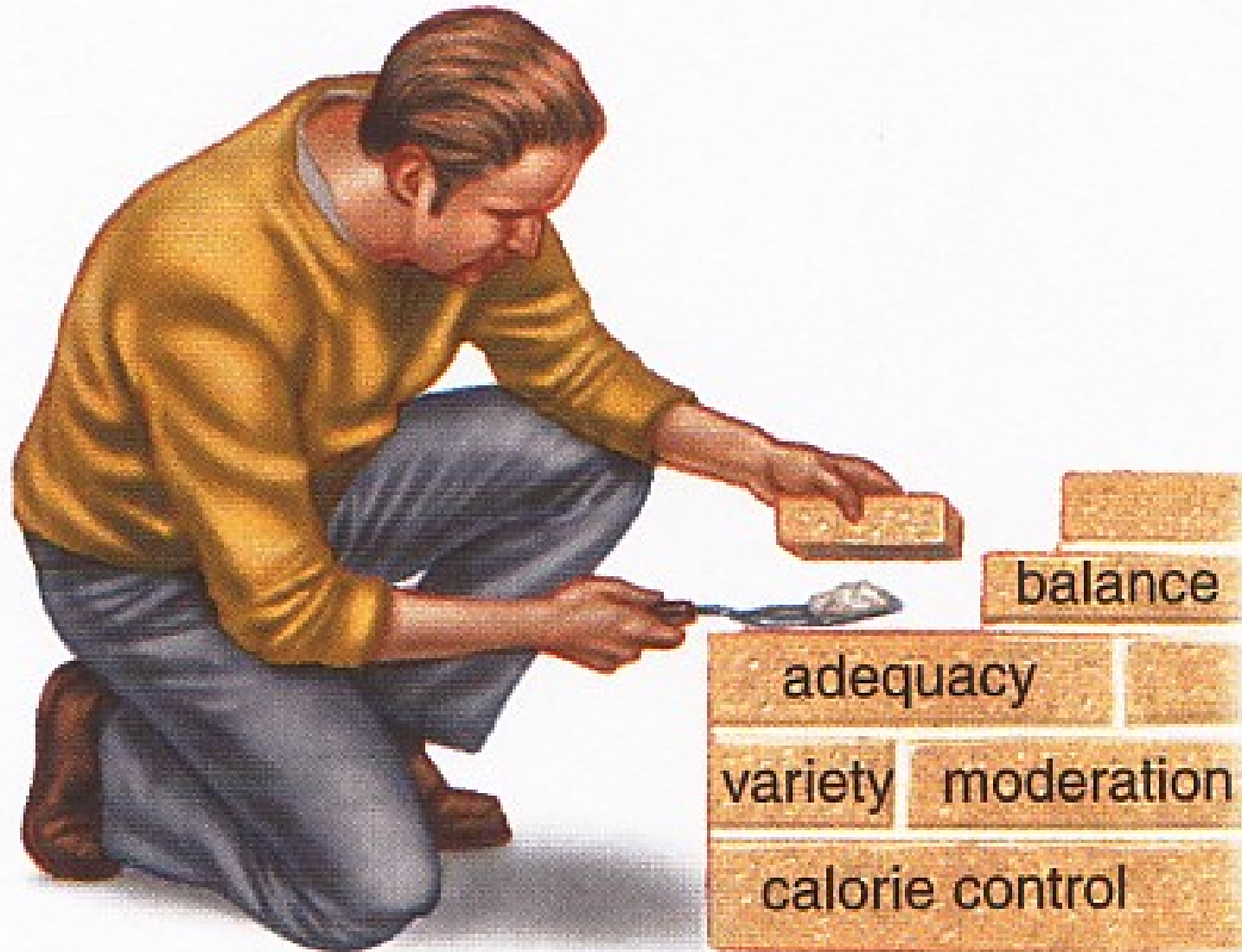
***US Dietary Recommended Intakes (DRI)
Committee Acceptable Macronutrient
Distribution Ranges (AMDR)!***

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

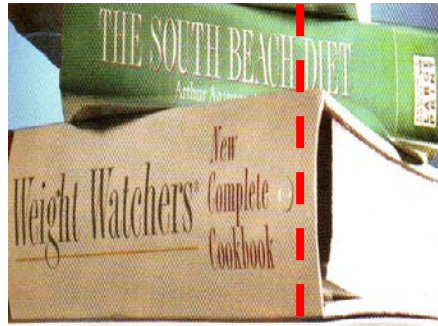
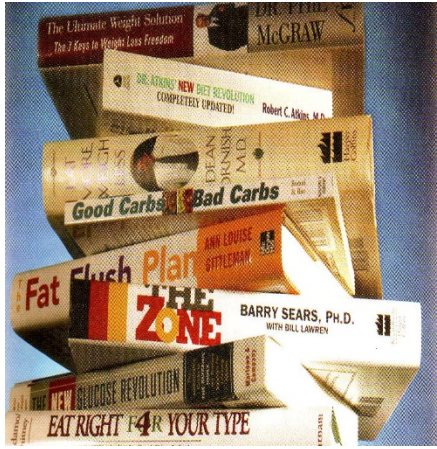
Emphasize ABCs + Variety & Moderation!



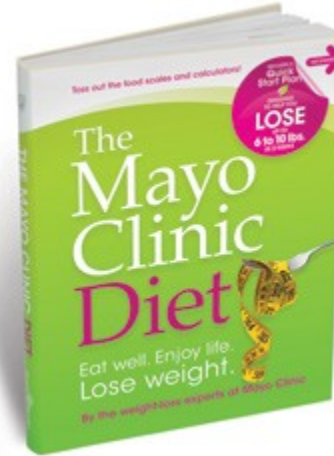
*All of these factors help to build
a nutritious diet.*



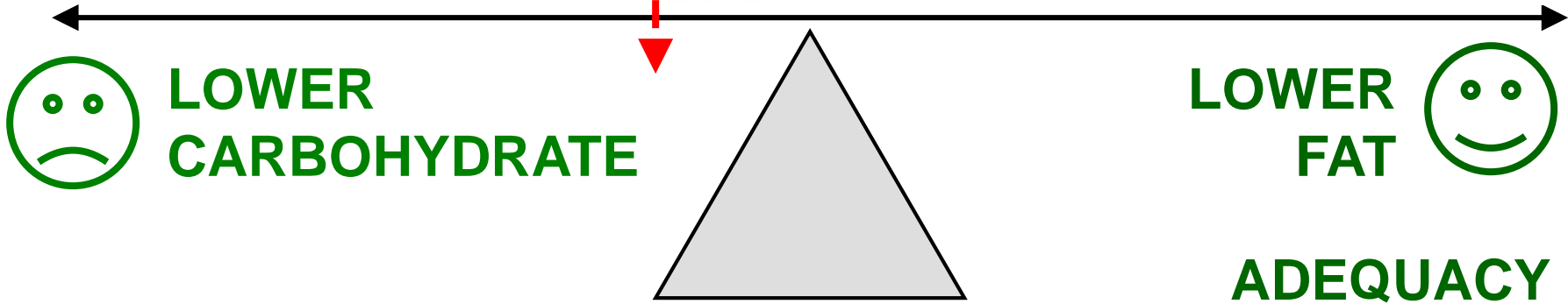
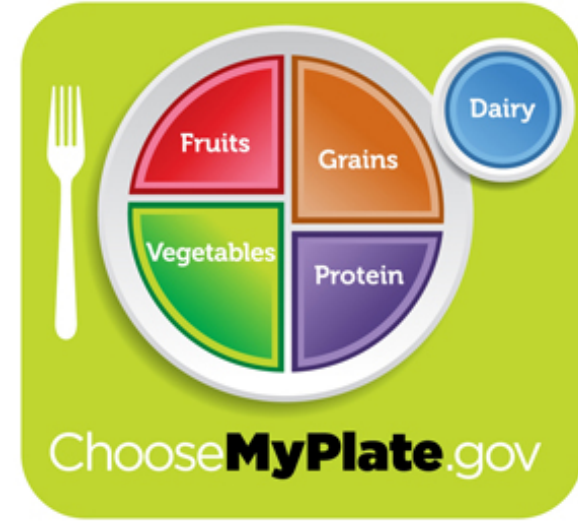
**NOT PEER-REVIEWED =
TRADE BOOKS**



**PEER-REVIEWED =
TEXTS →
RESEARCH**



**AHA + DASH +
MAYO CLINIC** 



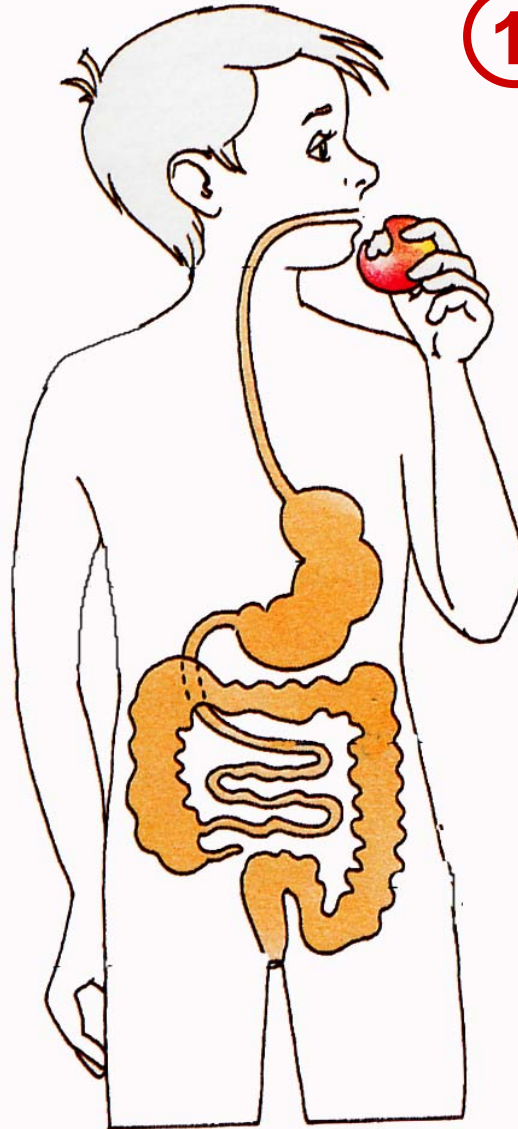
 **LOWER CARBOHYDRATE**

LOWER FAT 

**ELIMINATE CALORIES
or FOOD GROUPS
ENCOURAGE FASTING**

**ADEQUACY
BALANCE
CONSISTENCY
& MODERATION**

Digestion Steps



① Ingestion

② Mechanical Digestion

③ Chemical Digestion

④ Peristalsis

⑤ Absorption

⑥ Storage

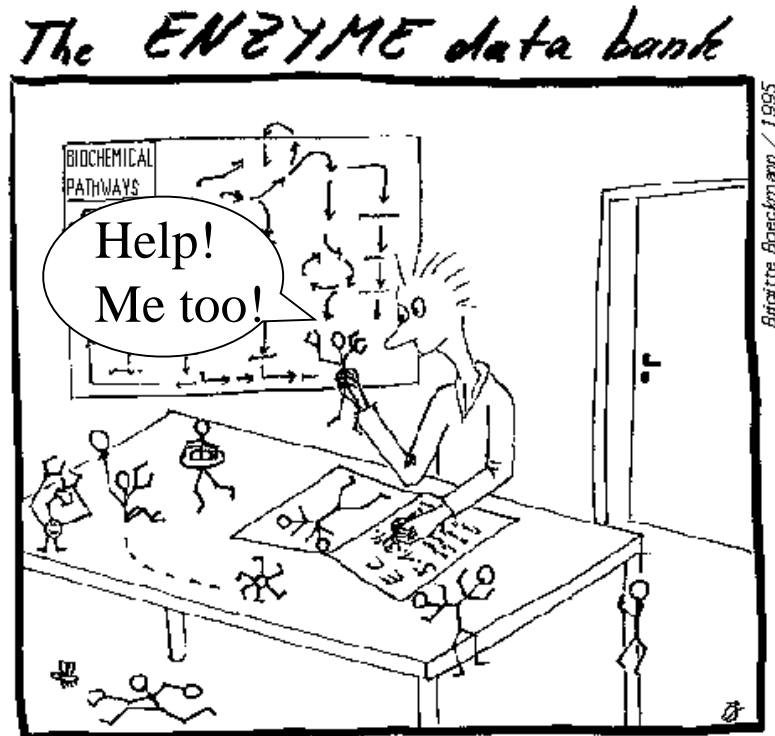
⑦ Defecation

Hydrolysis of Energy Nutrients

Hi gang!!
You need me
for digestion!!



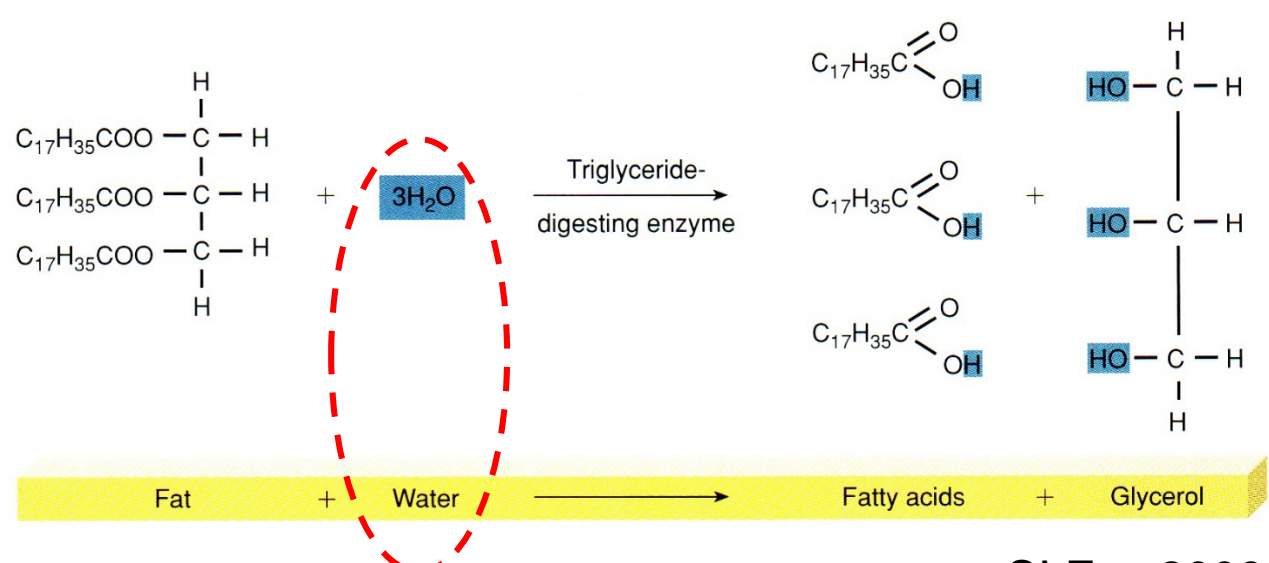
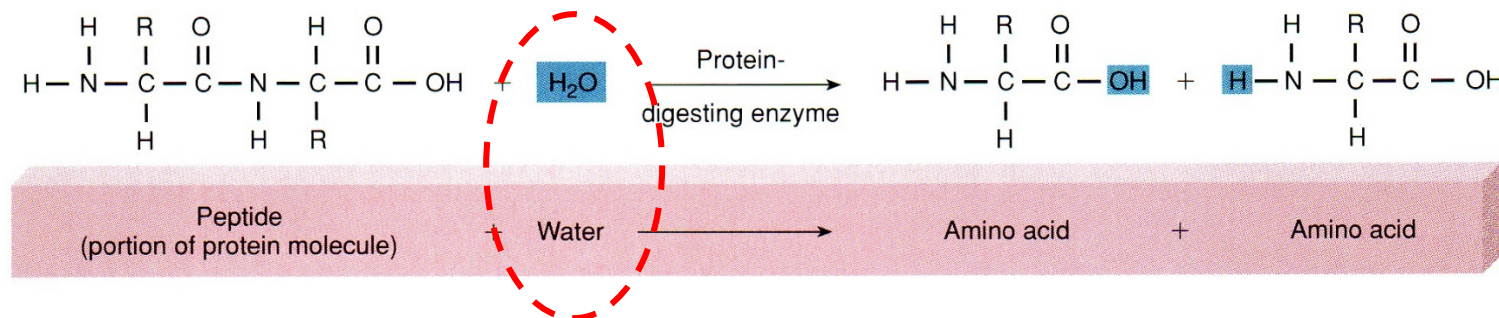
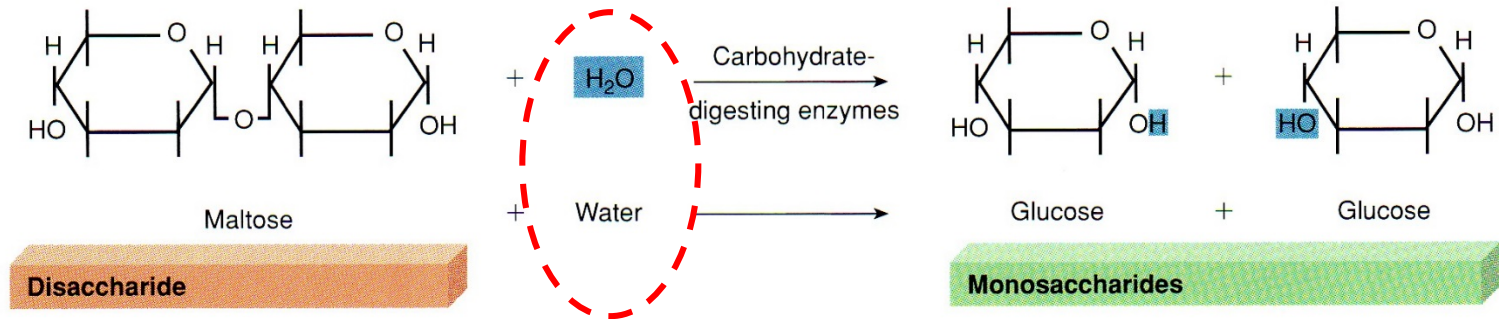
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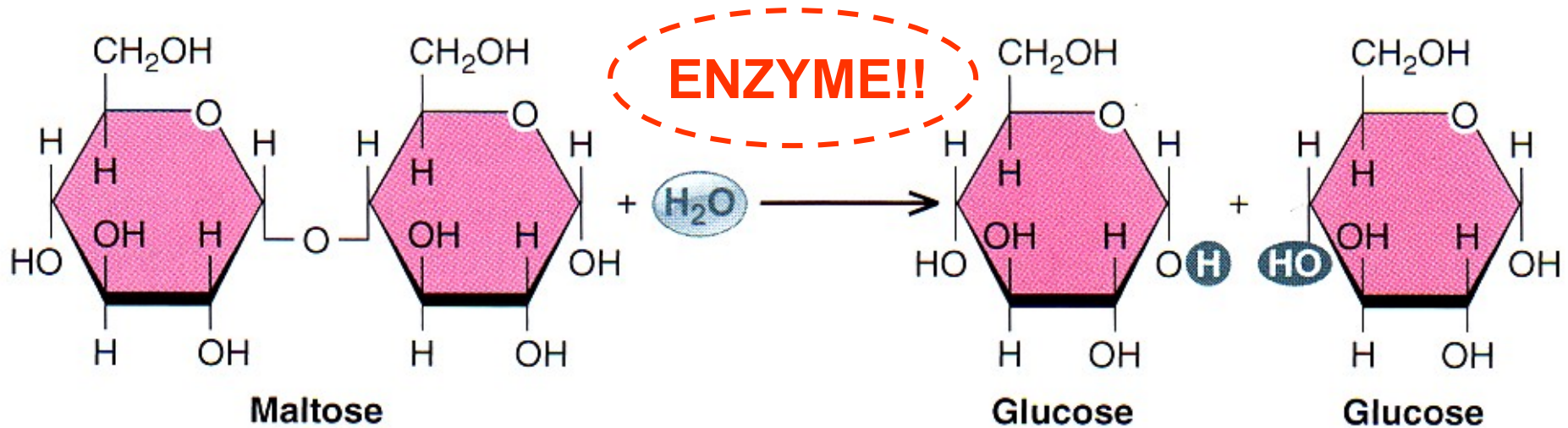
H₂O

+

Enzyme



What's missing?

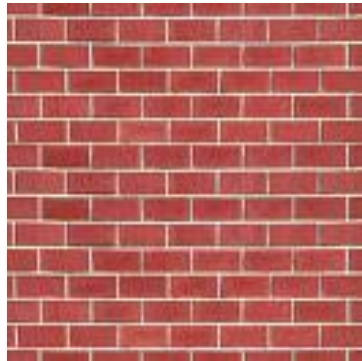


● **FIGURE 15-1** An example of hydrolysis. In this example, the disaccharide maltose (the intermediate breakdown product of polysaccharides) is broken down into two glucose molecules by the addition of H₂O at the bond site.

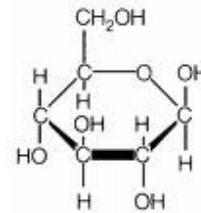
Polymer to Monomer (Many to One)



...Central-linking theme!!

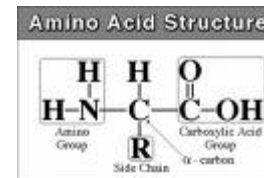


Carbohydrate

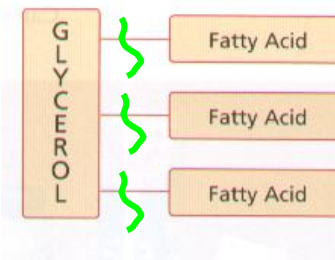
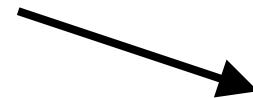


Glucose

Protein
+
Fat

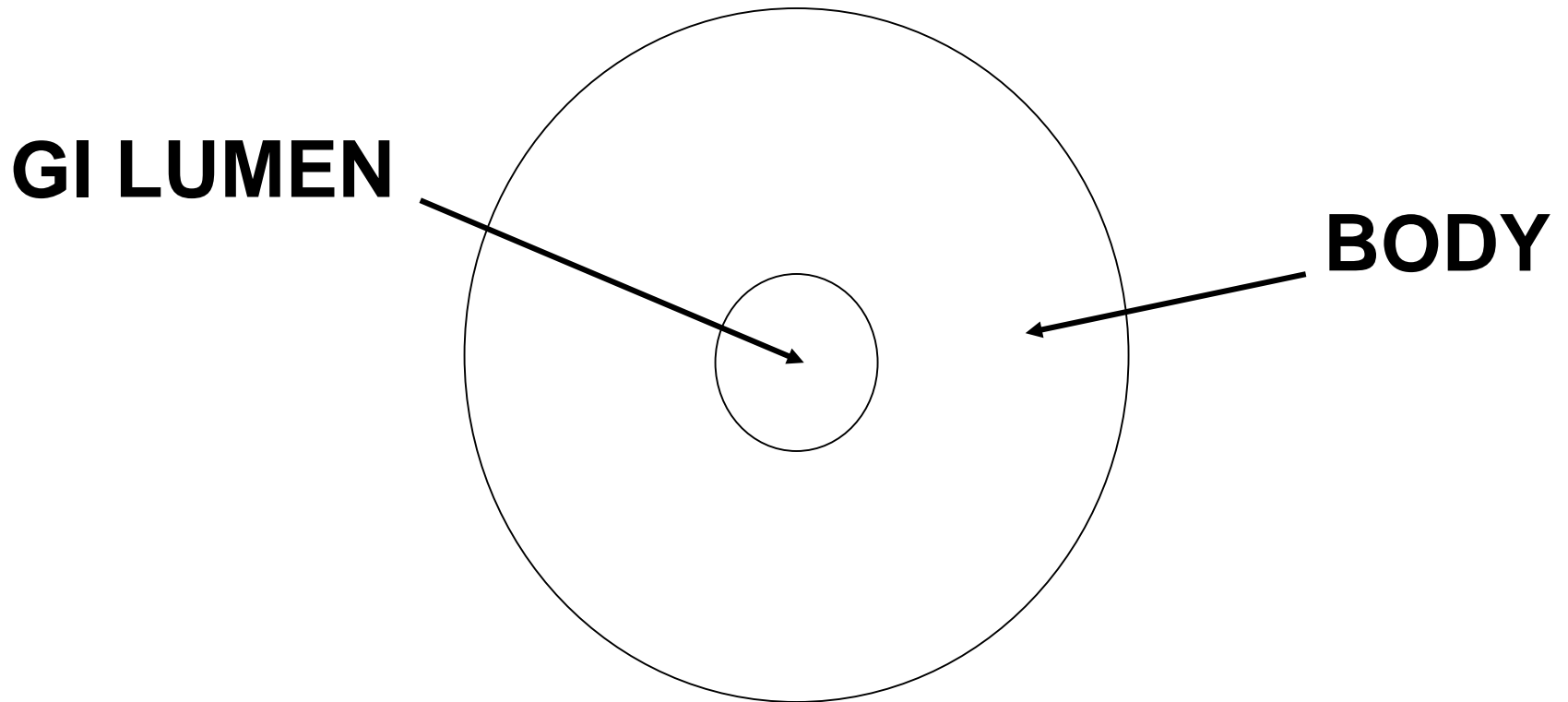


Amino Acids



Fatty Acids
+
Glycerol

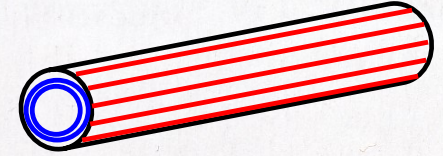
GI-DONUT ANALOGY



Common Control Mechanisms

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

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

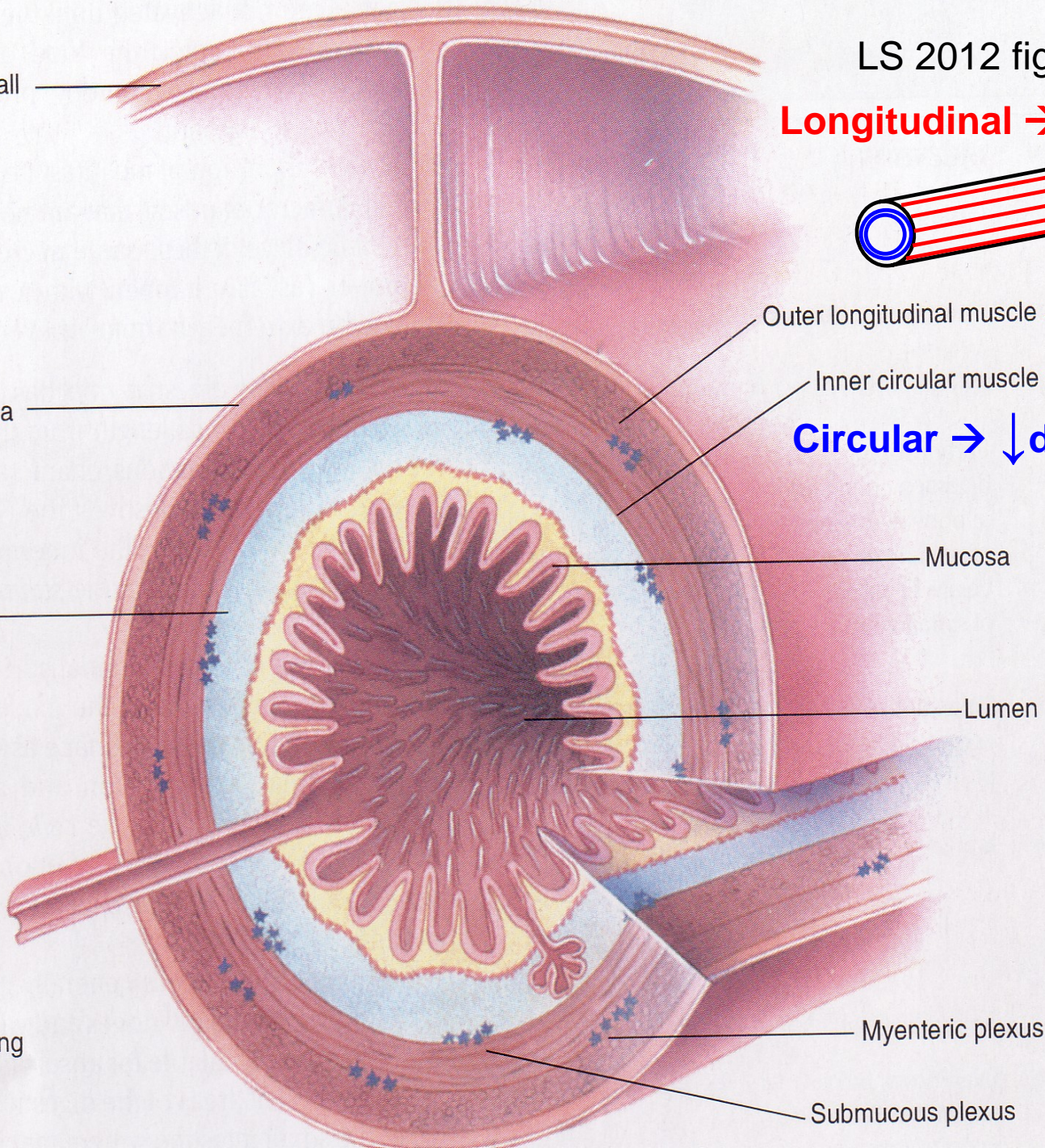
Muscularis externa

Mucosa

Lumen

Myenteric plexus

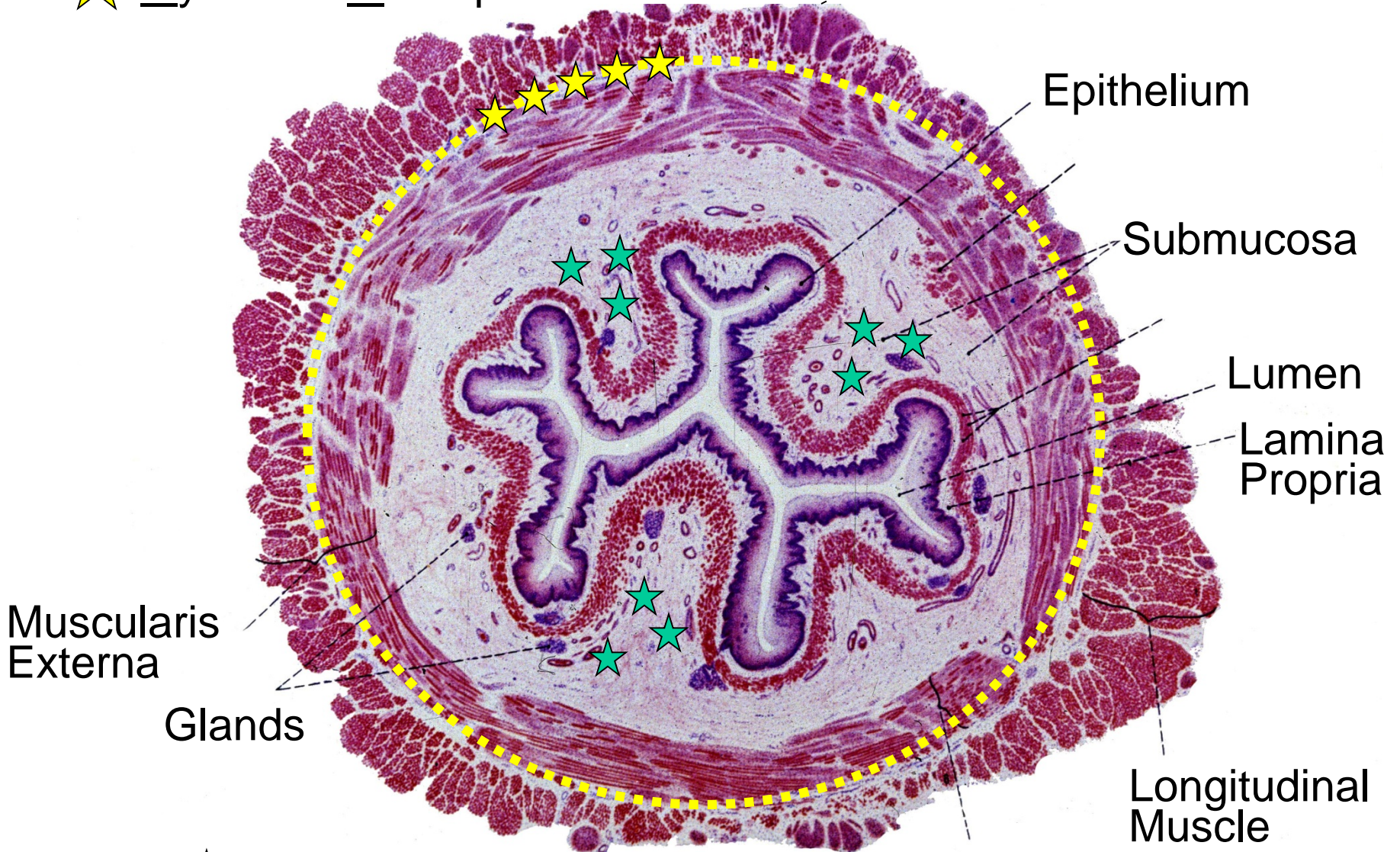
Submucous plexus



★ Myenteric motor plexus!

Serosa

cf: G&H fig 62-2



Epithelium

Submucosa

Lumen

Lamina Propria

Muscularis Externa

Glands

Longitudinal Muscle

★ Meissner's sensory & 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+

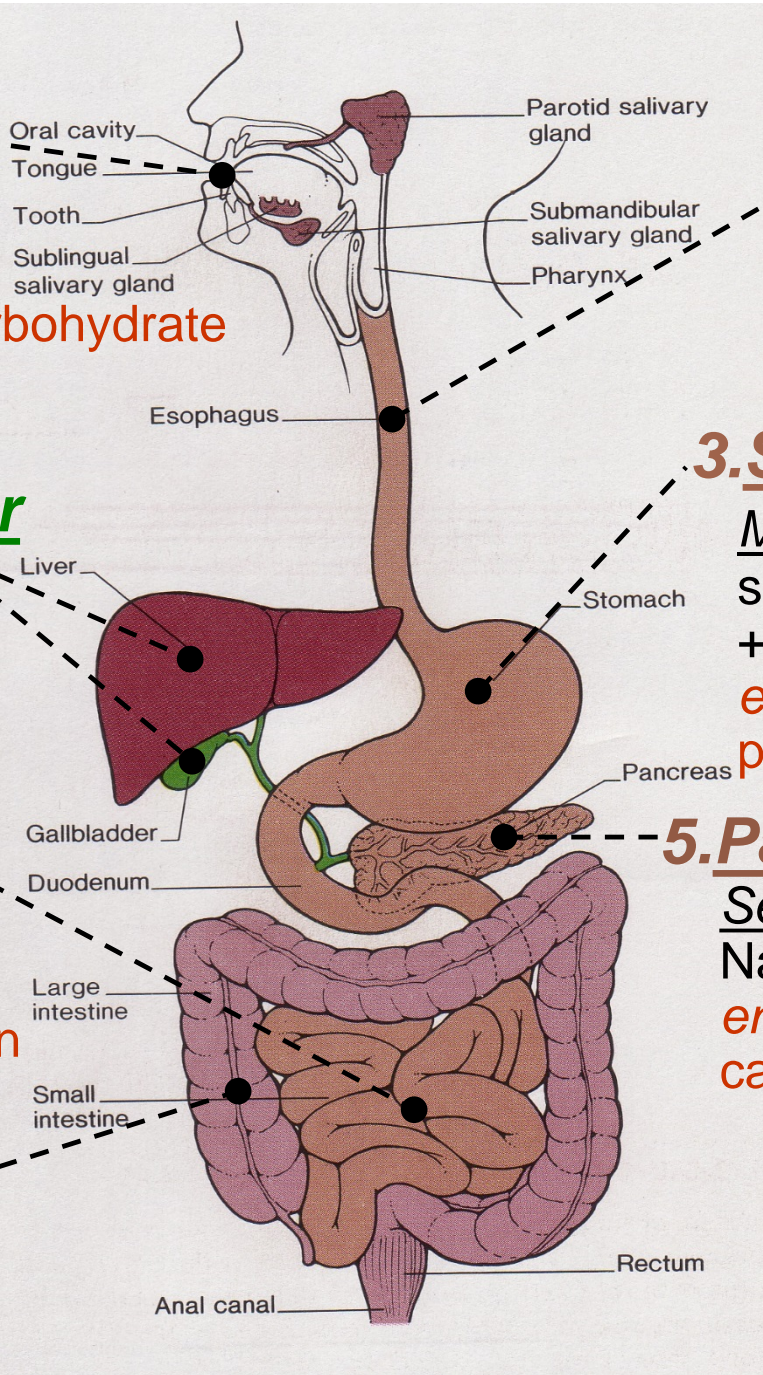
into GI Lumen

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!

5. Pancreas

Secretion mucus +
 NaHCO_3 + enzymes
enzymatic digestion:
carbohydrate, fat, protein

4. Liver-Gall Bladder

Emulsification =
detergent action of bile
+ secretion

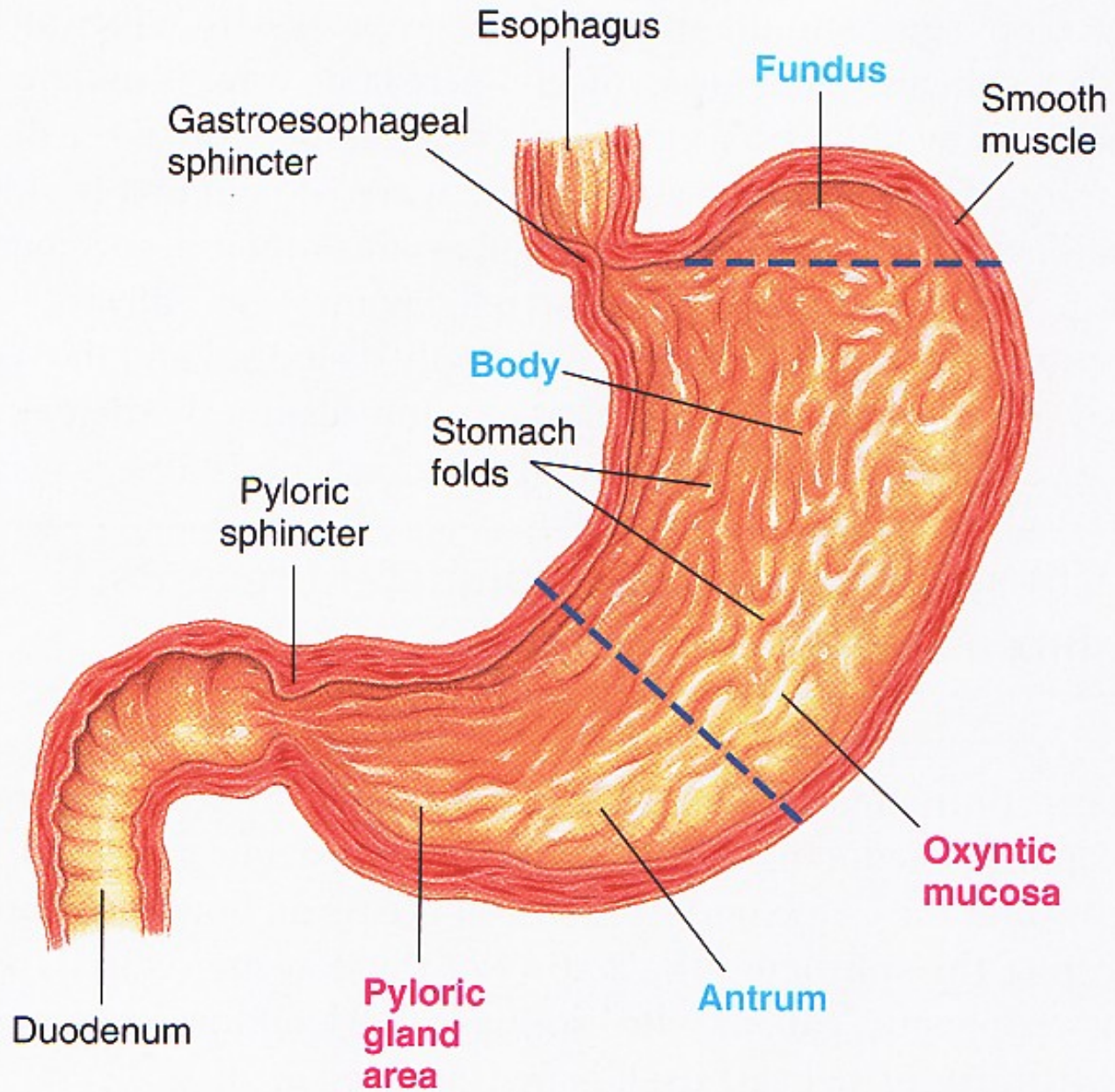
6. Small Intestine

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

7. Large Intestine

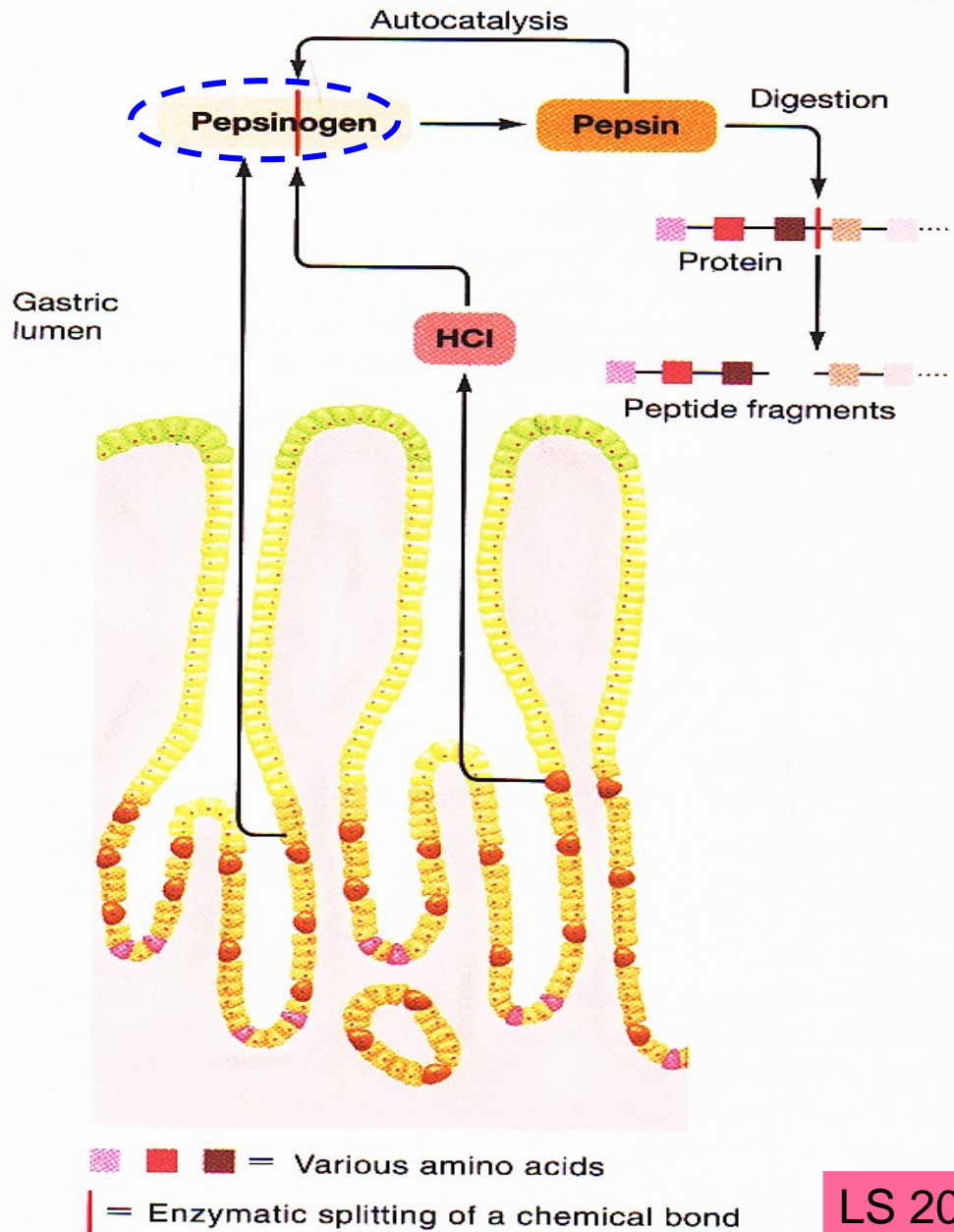
Dehydration
secretion + absorption
storage + peristalsis

Where does
enzymatic
digestion of
protein
begin?



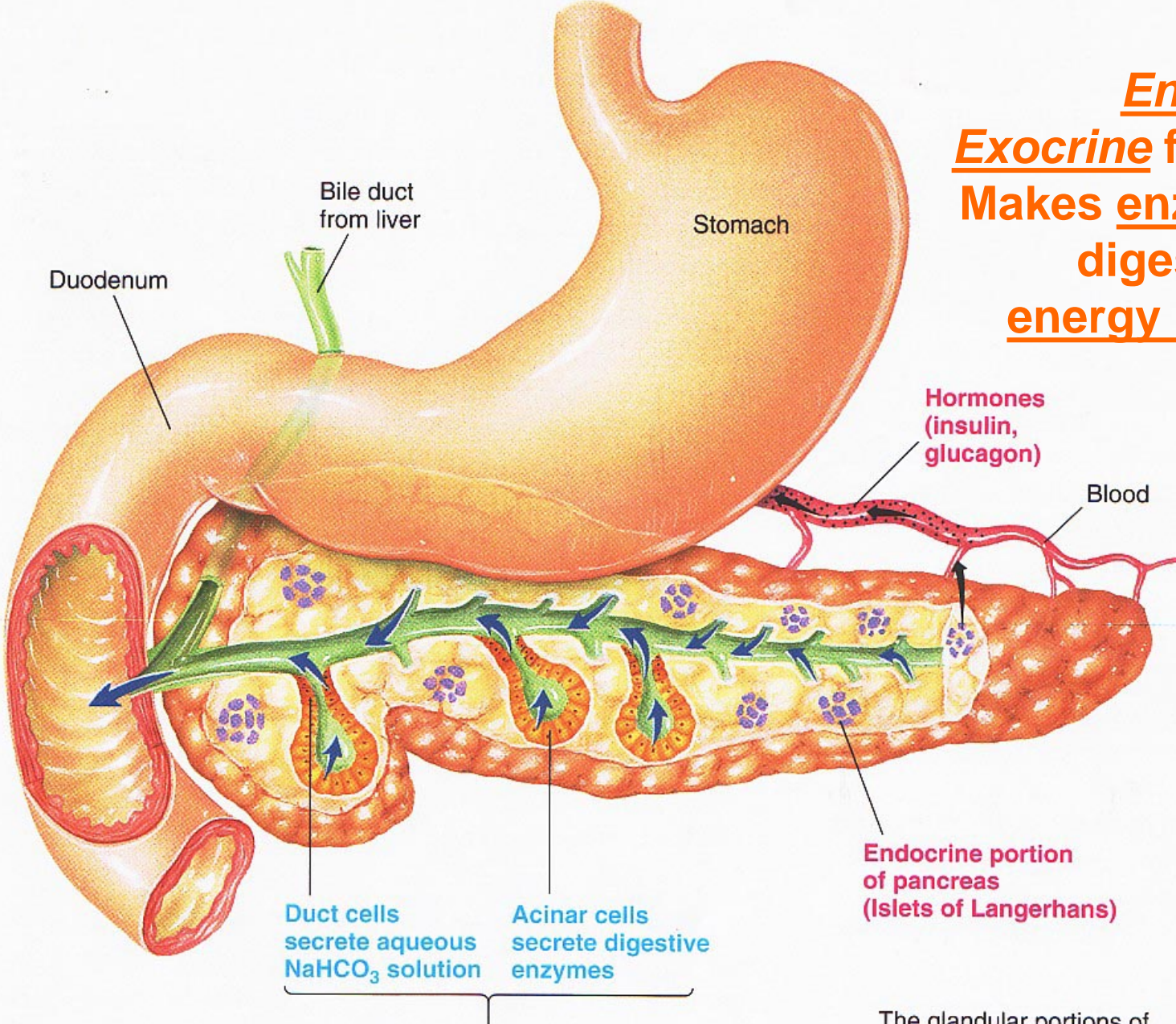
● **FIGURE 15-7**

Zymogen=
an inactive
precursor



Why is the
pancreas so
unique?

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

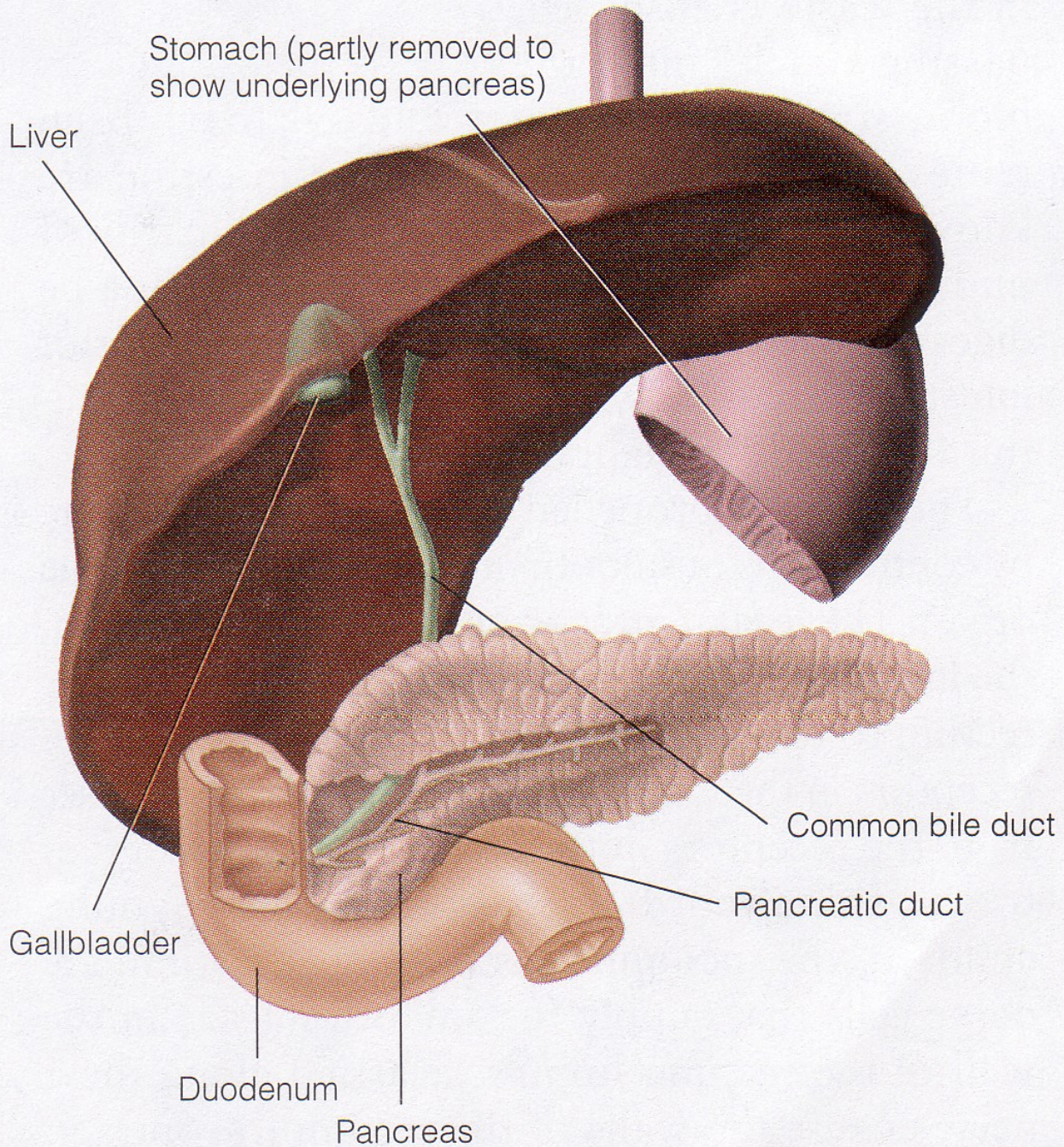


LS 2012 fig 15-11 p 457

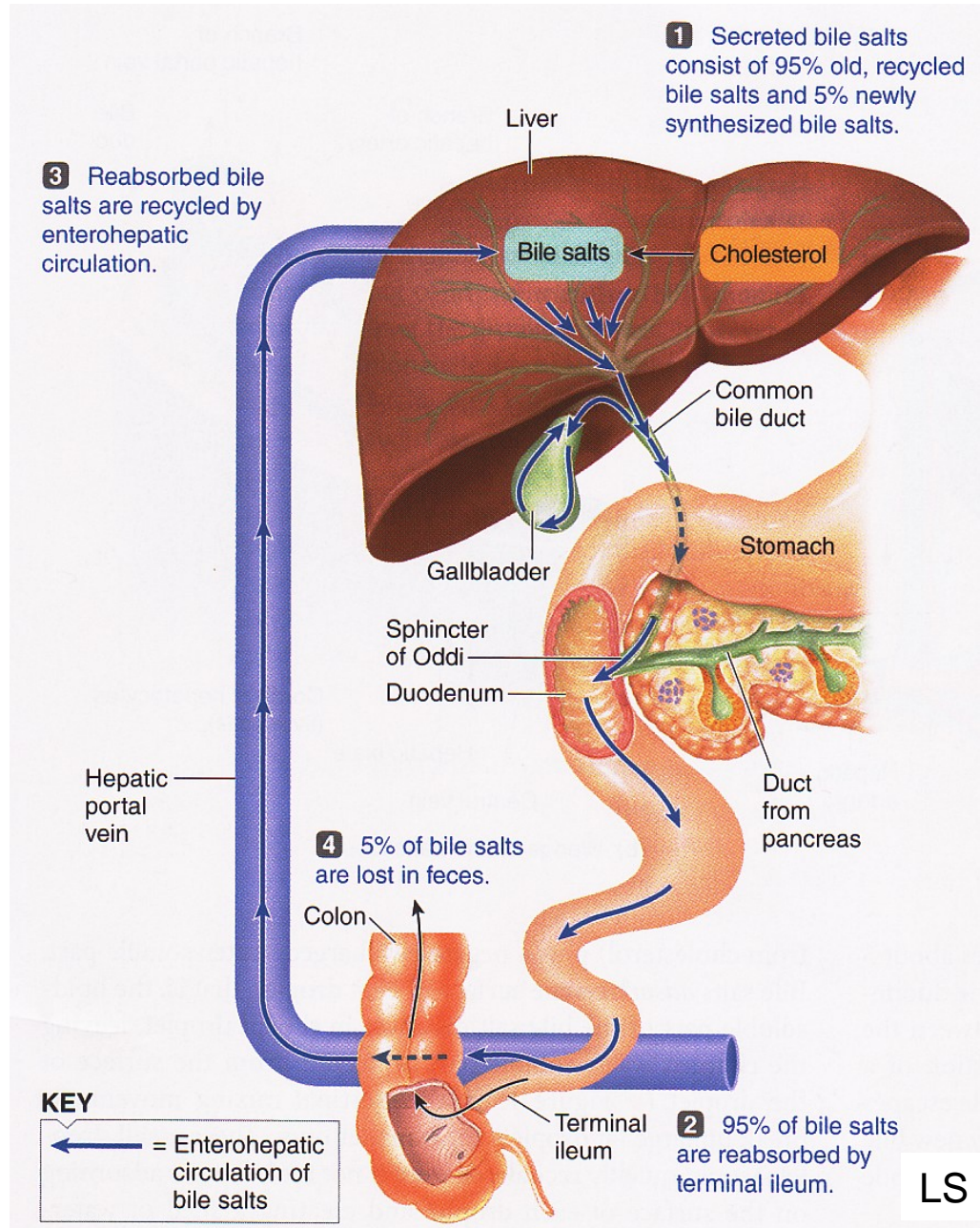
**Exocrine portion of pancreas
(Acinar and duct cells)**

The glandular portions of the pancreas are grossly exaggerated.

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

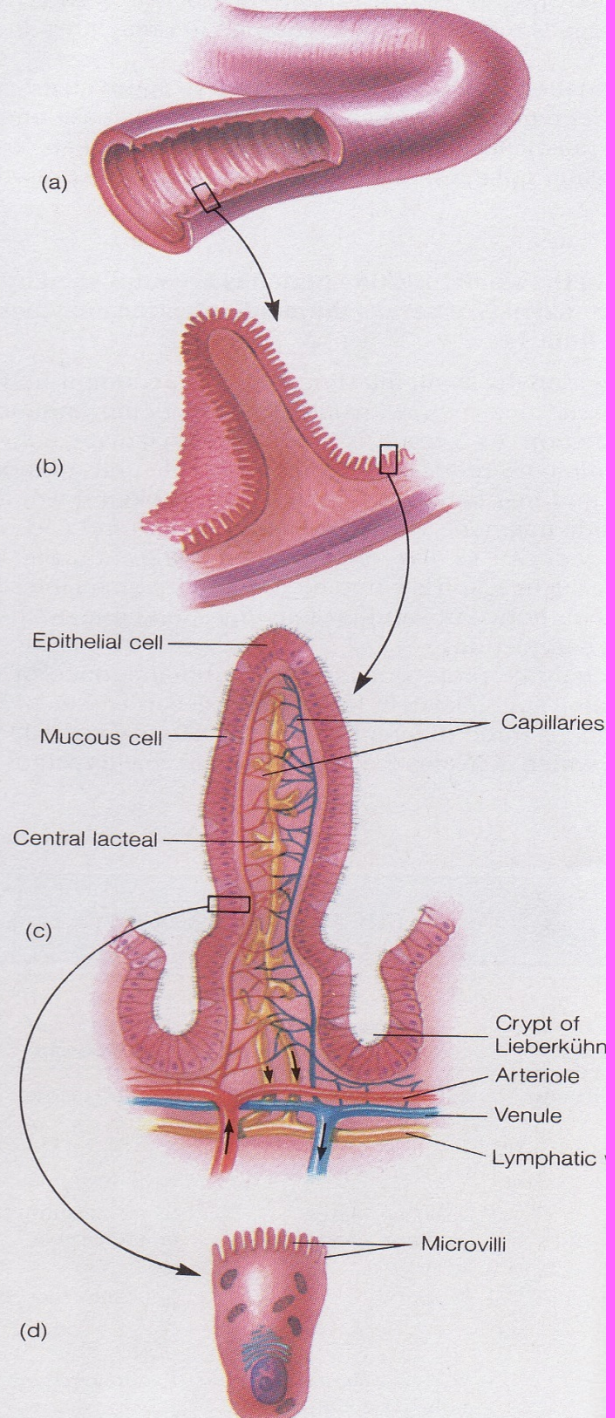


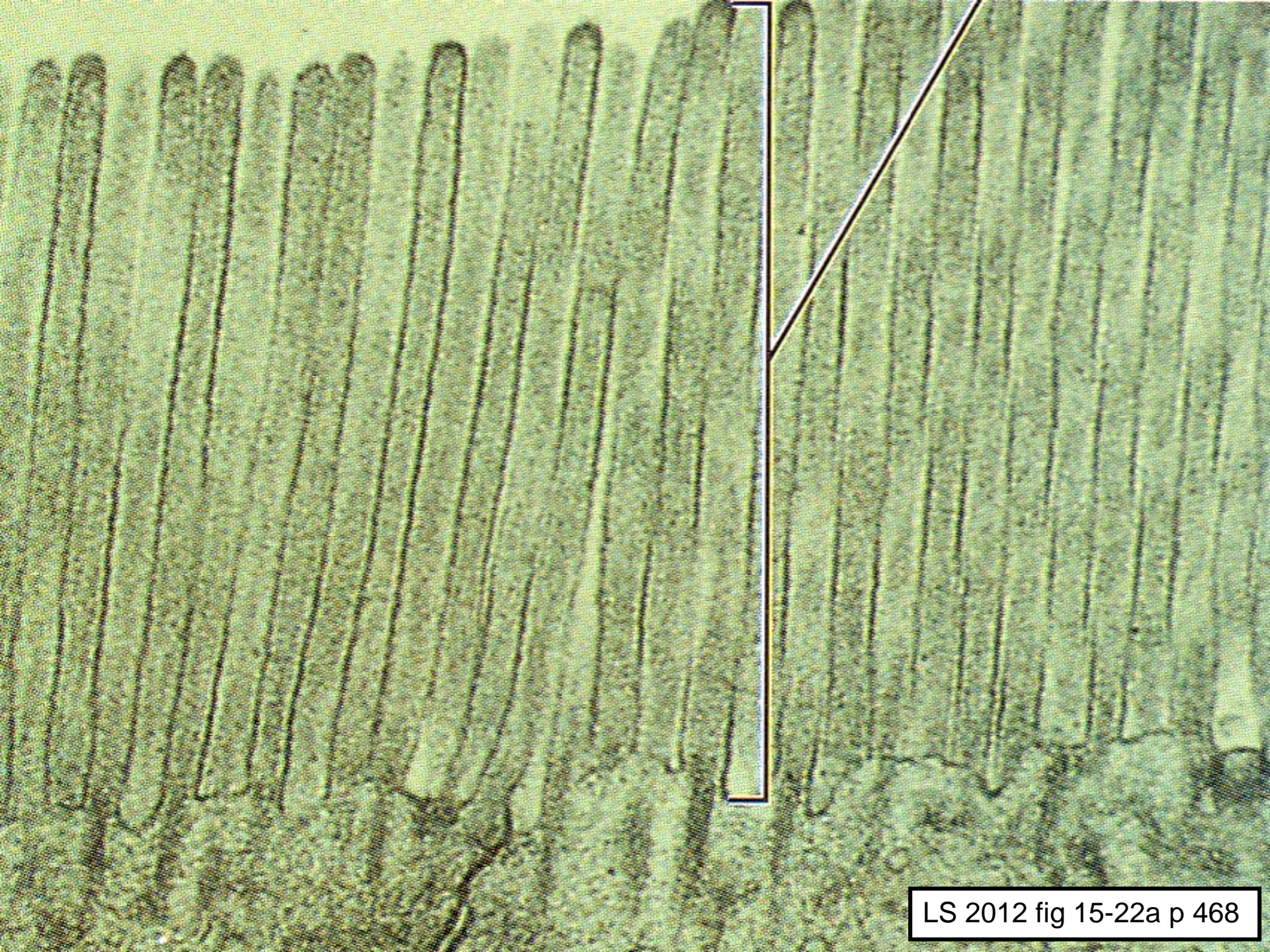
Liver: Amazing Recycling of Bile Salts!



What is the major
function of the
small intestine?

Absorption!!







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



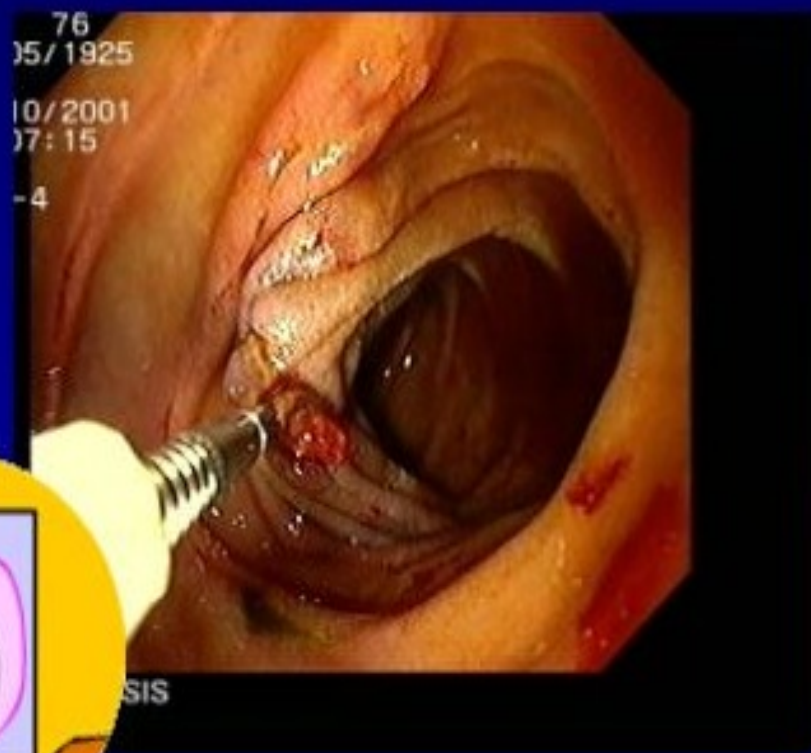
Ulcer Facts

- 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.

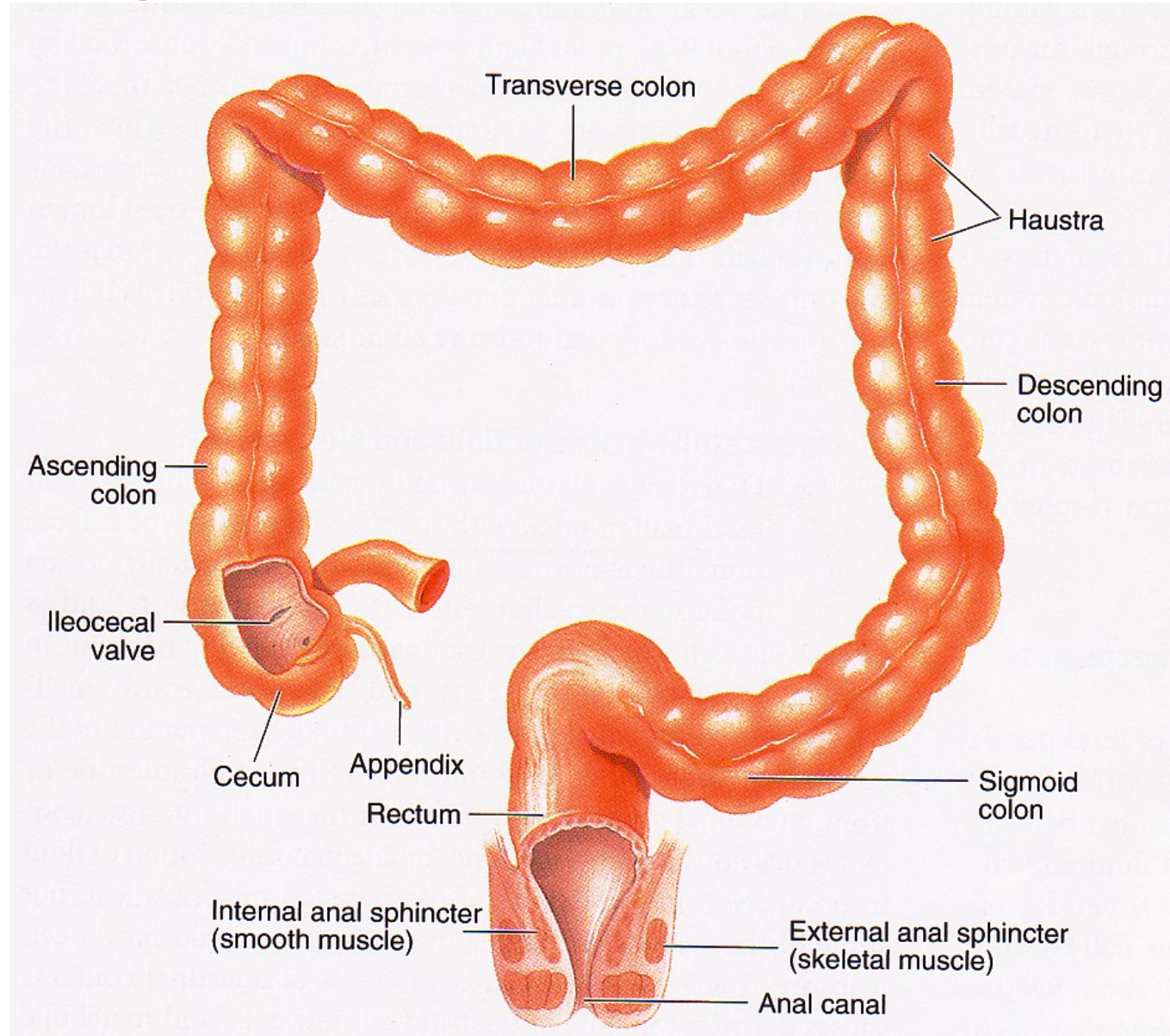
In the second photograph, a disposable metal clip is applied to the ulcer. The patient remained well and left hospital three days later.



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

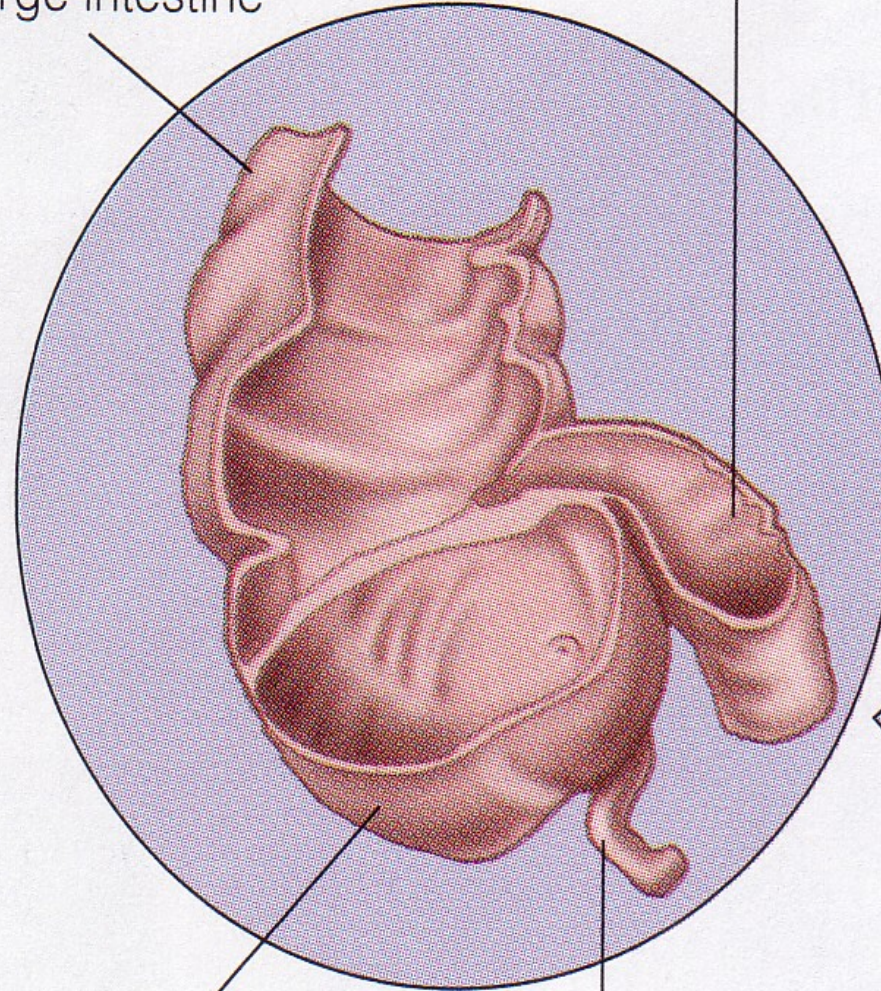
Nutrients	Enzymes for Digesting the Nutrients	Source of Enzymes	Site of Action of Enzymes	Action of Enzymes	Absorbable Units of the Nutrients
Carbohydrates	Amylase	Salivary glands	Mouth and (mostly) body of stomach	Hydrolyzes polysaccharides to disaccharides (maltose)	
		Exocrine pancreas	Small-intestine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