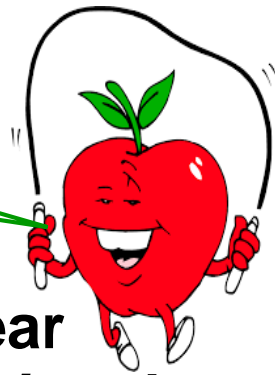


BI 358 Lecture 4

Heck yeah! Nutrition Lab next Tuesday!
Move more, eat smart, weigh less!



- I. Announcements** Dr. Bovee feedback due < 5 pm today. Outline + Quiz 1 update? Quiz Key posted near lab. **NB:** Group member feedback. Next T Lab ***Nutritional Analyses***. Record diet ≥ 2 d to analyze w/***DietController!***
- II. Addiction Medicine Follow-up** Opioid overdose + Narcan story/ies! Vaping linked to host of new health risks.
- III. Nutritional Physiology** Zuti & Golding, Diet vs. Exercise historical research! Estimating food & liquid quantities.
- IV. Gastrointestinal Physiology** G&H ch 63, 64, 65, 66 + LS2
 - A. Digestion overview + alimentary tract fig 63-1
 - B. Gut cross section, histology + plexi fig 63-2
 - C. Secretions + phases tab 65-1, fig 65-7
 - D. **Hydrolysis:** Central theme of digestion ch 66 p 833-42
 1. **Carbohydrate** fig 66-1
 2. **Fat** fig 66-3, fig 66-4
 3. **Protein** fig 66-2

WOW!



SUPER



~ TOP 5-10!

EXCELLENT!!



~ TOP 15!

GREAT EFFORT



~ TOP 20-25!

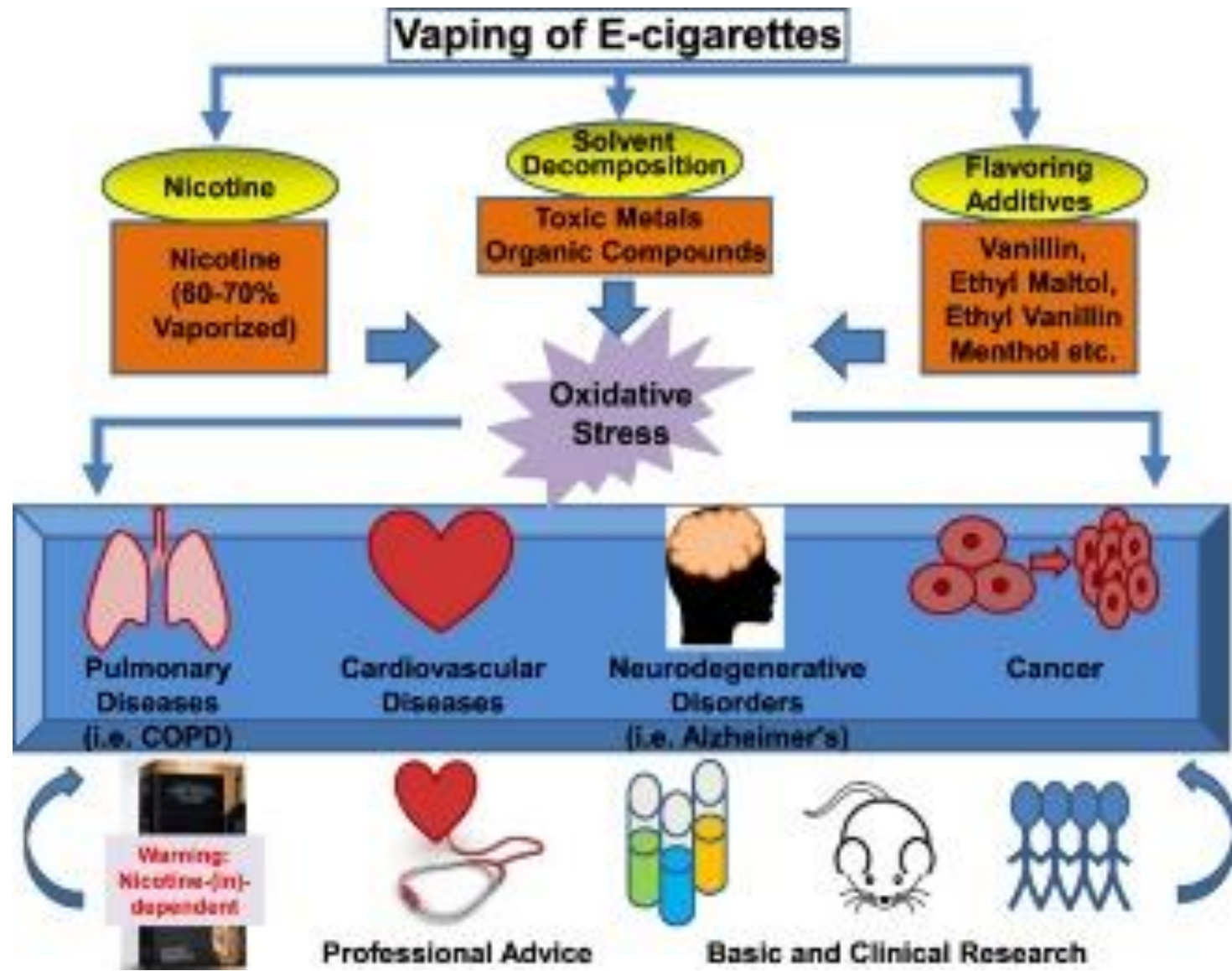
Vaping Linked to Host of New Health Risks



<https://www.sciencenews.org/article/hospitalizations-highlight-potential-dangers-e-cigs-teen-lungs>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5493817/>

<https://www.sciencenewsforstudents.org/article/vaping-may-threaten-brain-immunity-and-more>



SOURCE: H Cai & C Wang, *Redox Biol.* 2017 Oct; 13: 402-6.

4 oz → 3 oz



Deck of Cards



or

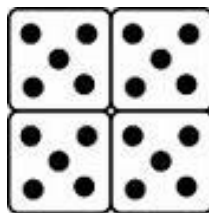


≡ 1 c

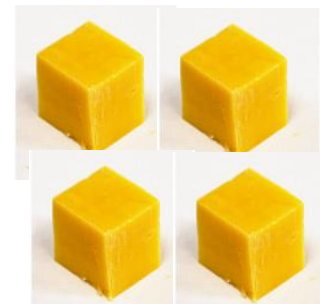
raw → cooked



≡ 1/3 c



≡ 1 oz



≡ 1/4 c



≡ 1.5 oz



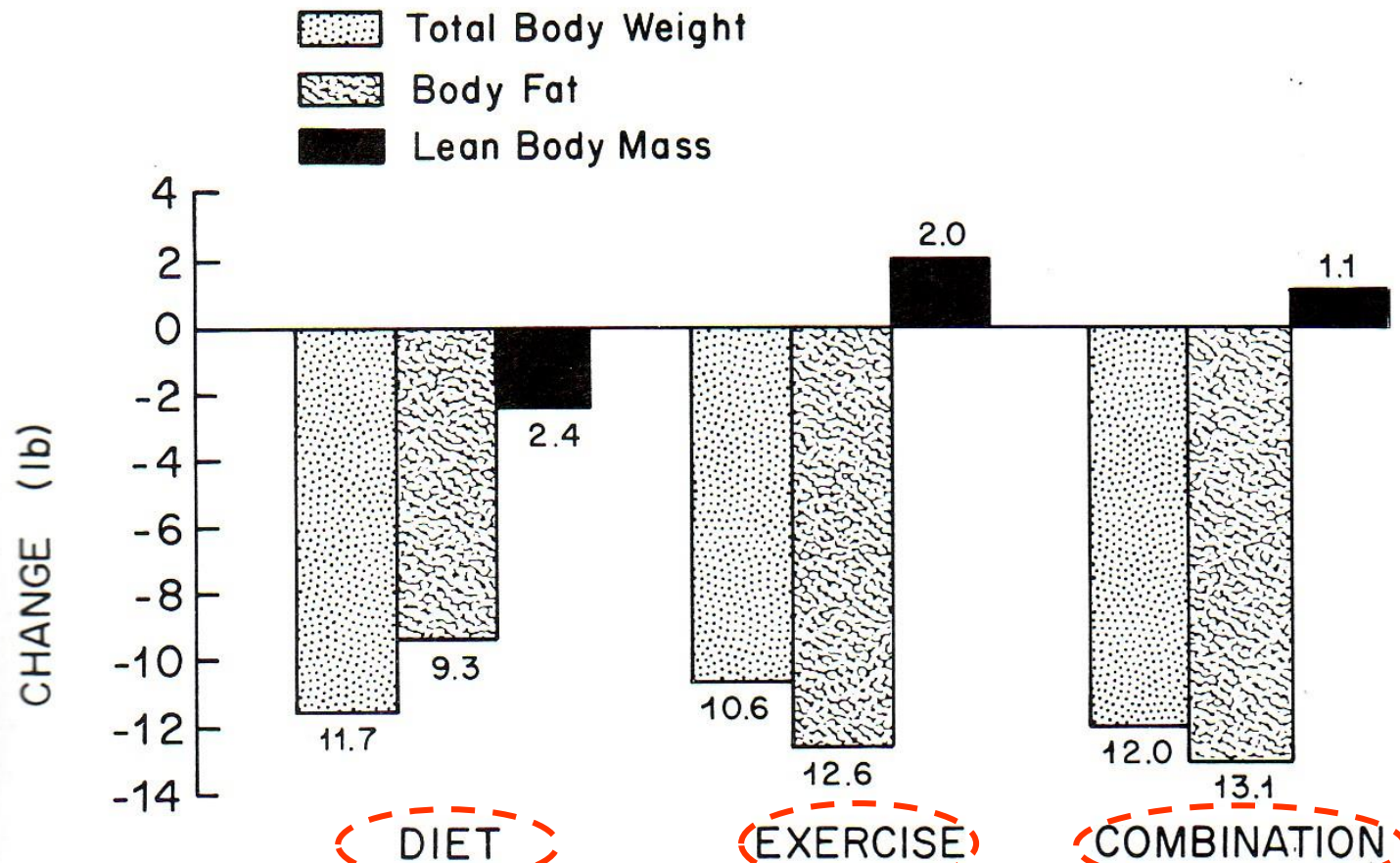


Figure 4-9. Changes in body weight, body fat, and lean body weight for diet, exercise, and combination groups. (From Zuti W. B., and Golding, L. A.: Comparing diet and exercise as weight reduction tools. *Phys. Sportsmed.* 4:49-53, 1976.)

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



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



Dietary Composition & Physical Endurance

eg, Atkins!

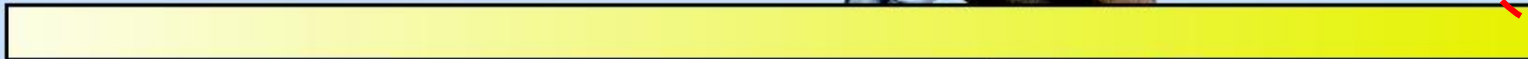
High-fat diet



Normal mixed diet



High-carbohydrate diet



~ 1/3 endurance!

Maximum endurance time:

57 min

114 min

167 min



Tedium of Metabolic Lab & Dietary Research



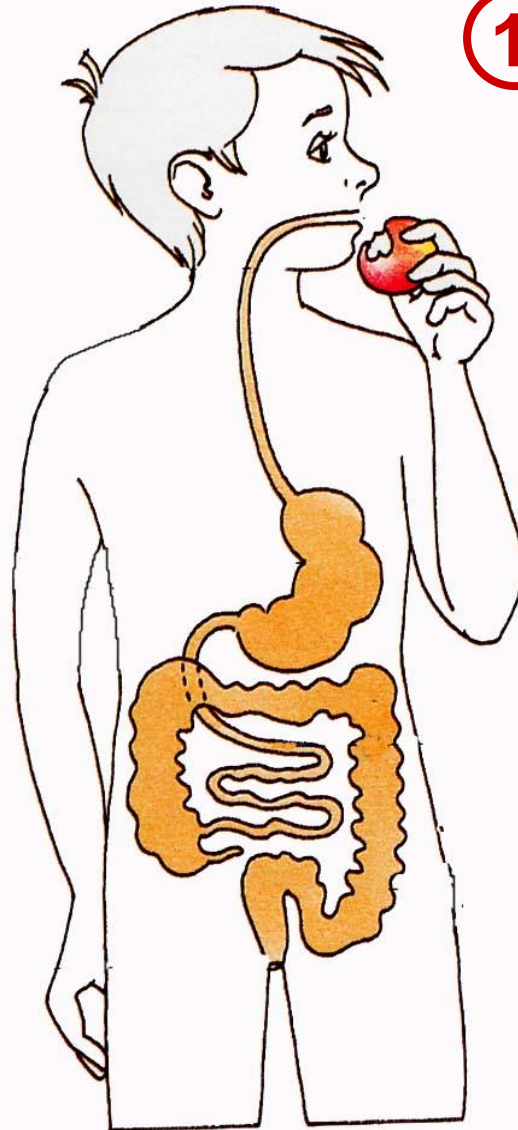
Discussion/Lab 4: Nutritional Analyses



Record diet for ≥ 2 d!
**No need to purchase software,
as we have on computers in lab!**
<http://www.dietcontroller.com/>



Digestion Steps



① Ingestion

② Mechanical Digestion

③ Chemical Digestion

④ Peristalsis

⑤ Absorption

⑥ Storage

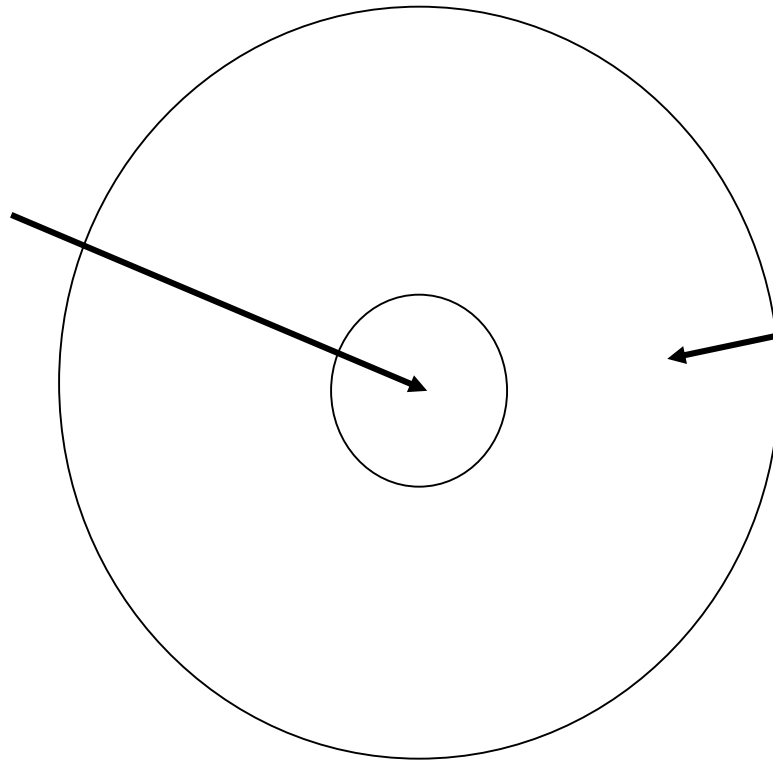
⑦ Defecation



GI-Doughnut Analogy



GI Lumen

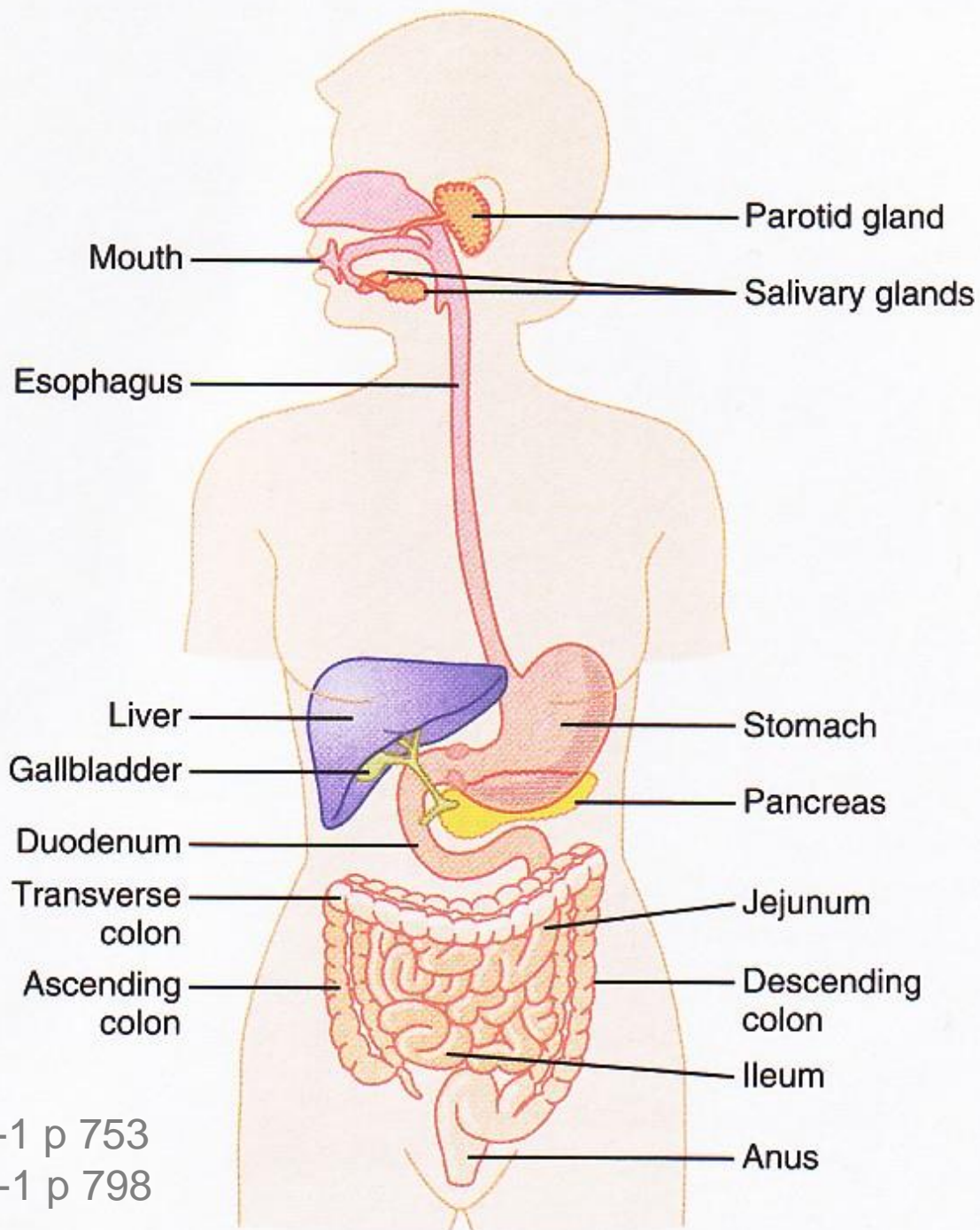


Body



Me
?





G&H 2011 fig 62-1 p 753
G&H 2016 fig 63-1 p 798

GI Regulation

1. Local/Intrinsic → autoregulation

rapid { 2. Nervous

{ 3. Hormonal

→ extrinsic

Slower,
but longer
lasting!

★ Myenteric motor plexus!

Serosa

Epithelium

Submucosa

Lumen

Lamina
Propria

Longitudinal
Muscle

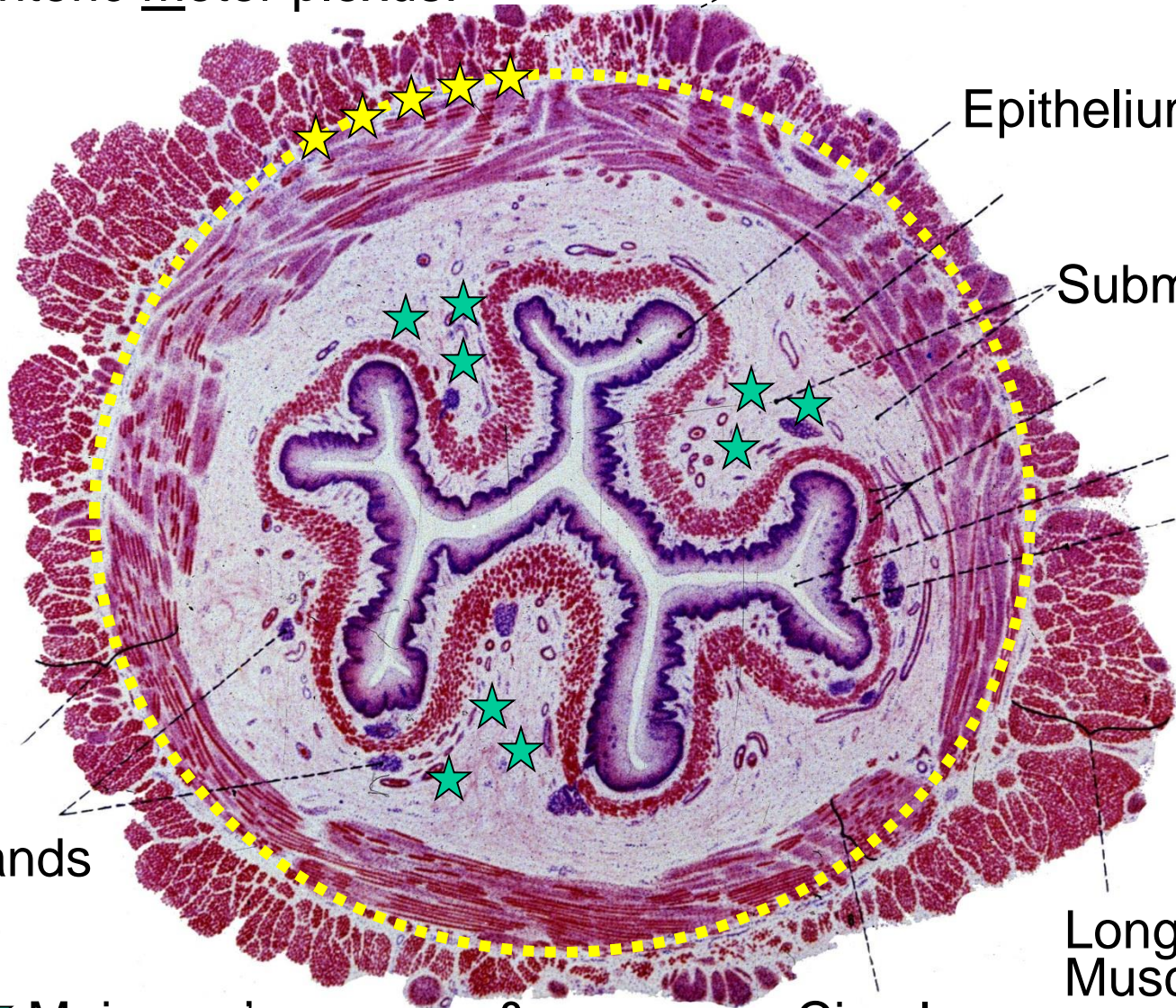
Circular
Muscle

★ Meissner's sensory & secretory plexus!

LOCAL

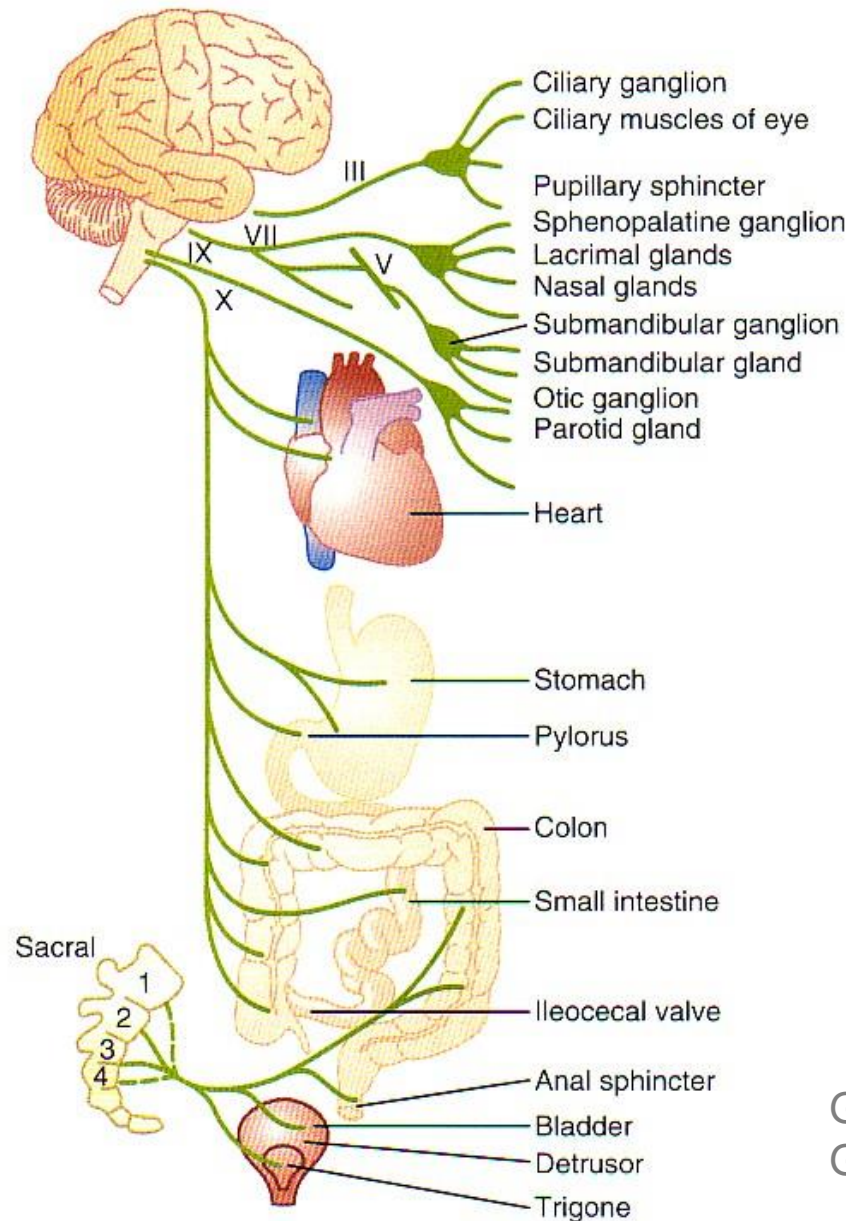
Muscularis
Externa

Glands



Parasympathetic Branch Activates the Gut!

NERVOUS



G&H 2011 fig 60-3 p 731
G&H 2016 fig 61-3 p 775

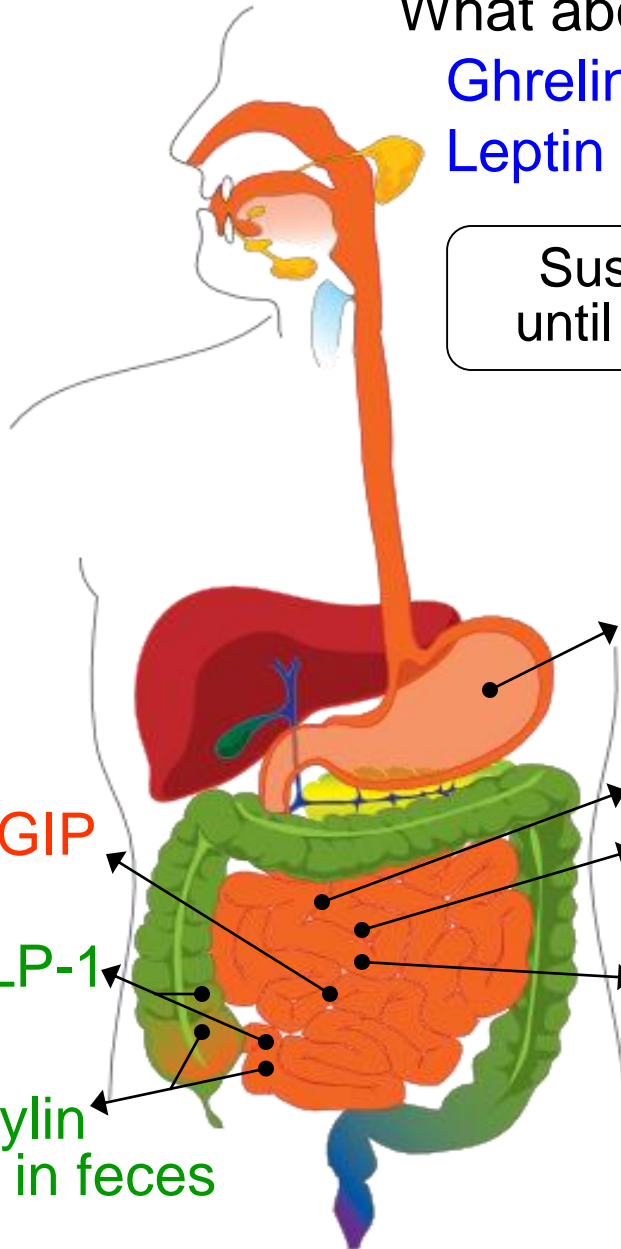
HORMONAL

What about feedback for hunger-satiety?

Ghrelin (stomach fundus, pancreas,...)

Leptin (adipocytes)

Suspense –
until next time!



Gastrin → HCl, Pepsinogen
by stomach

Motilin → ↑ Motility

Secretin → HCO_3^- , H_2O
by pancreas

Cholecystokinin → Gallbladder
contraction +
Pancreatic
enzymes

↓ Motility ← GIP
↑ Insulin

↓ Motility ← GLP-1
↑ Insulin

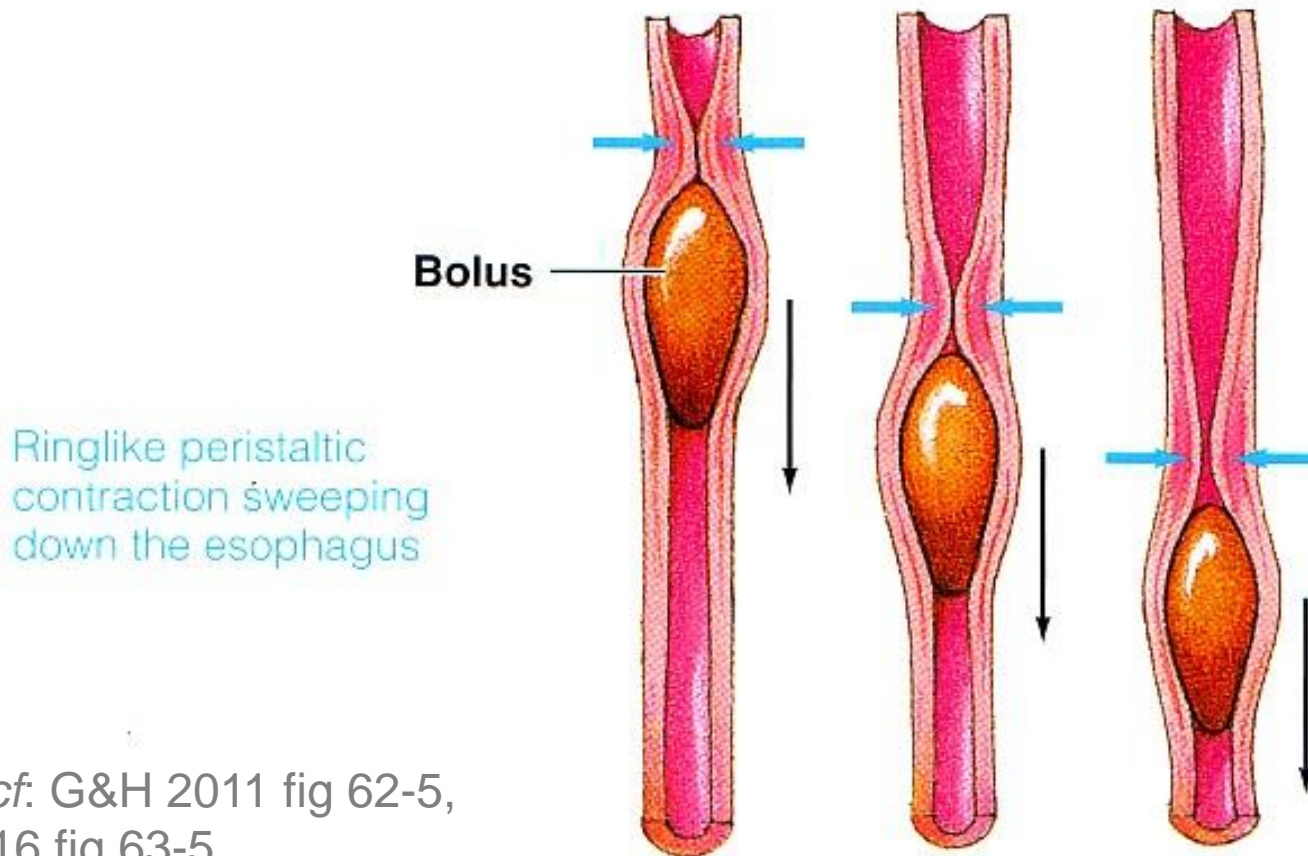
↑ Cl^- ← Guanylin
↑ $\text{NaCl} + \text{H}_2\text{O}$ in feces

● FIGURE 15-6

Peristalsis in the esophagus. As the wave of peristaltic contraction sweeps down the esophagus, it pushes the bolus ahead of it toward the stomach.



For an animation of this figure, click the Gastrointestinal Motility tab in the Gastrointestinal Physiology tutorial on the CD-ROM.



LS2 2006; *cf.* G&H 2011 fig 62-5,
G&H 2016 fig 63-5

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

Table 64-1 Daily Secretion of Intestinal Juices

	Daily Volume (ml)	pH
Saliva	1000	6.0-7.0
Gastric secretion	1500	1.0-3.5
Pancreatic secretion	1000	8.0-8.3
Bile	1000	7.8
Small intestine secretion	1800	7.5-8.0
Brunner's gland secretion	200	8.0-8.9
Large intestinal secretion	200	7.5-8.0
Total	6700	

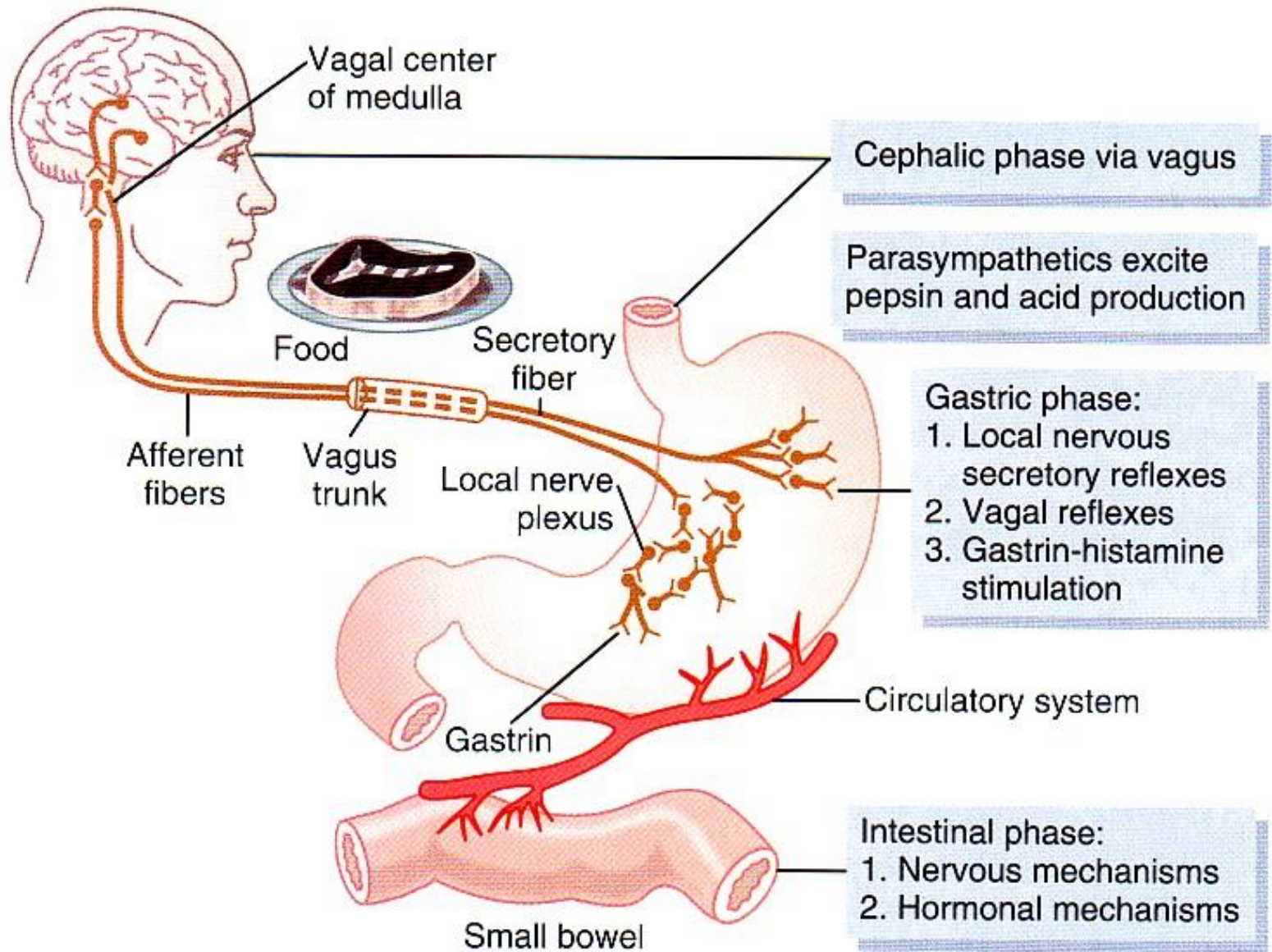


Figure 64-7 Phases of gastric secretion & their regulation. G&H 2011 fig 64-7 p 780, G&H 2016 fig 65-7 p 824.

Hydrolysis of Energy Nutrients

...Central-linking theme!!

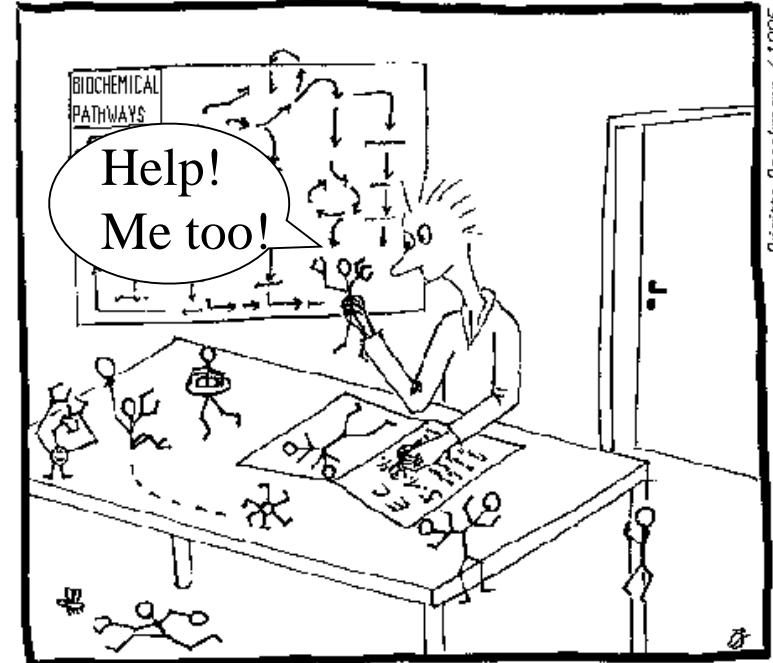


Hi gang!!
You need me
for digestion!!



+

The ENZYME data bank



H₂O

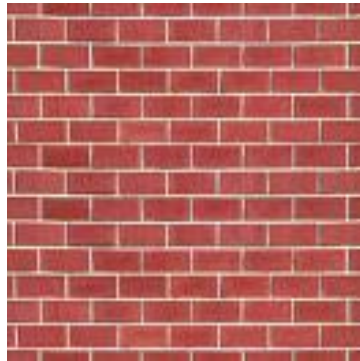
+

Enzyme

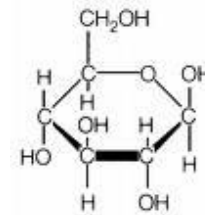
Polymer to Monomer (Many to One)



...Central-linking theme, again!!

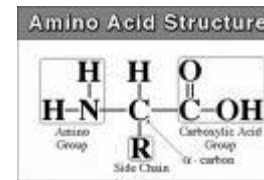


Carbohydrate

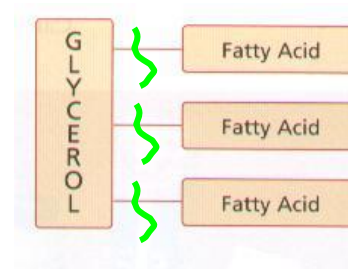
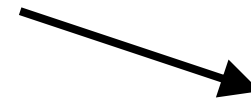


Glucose

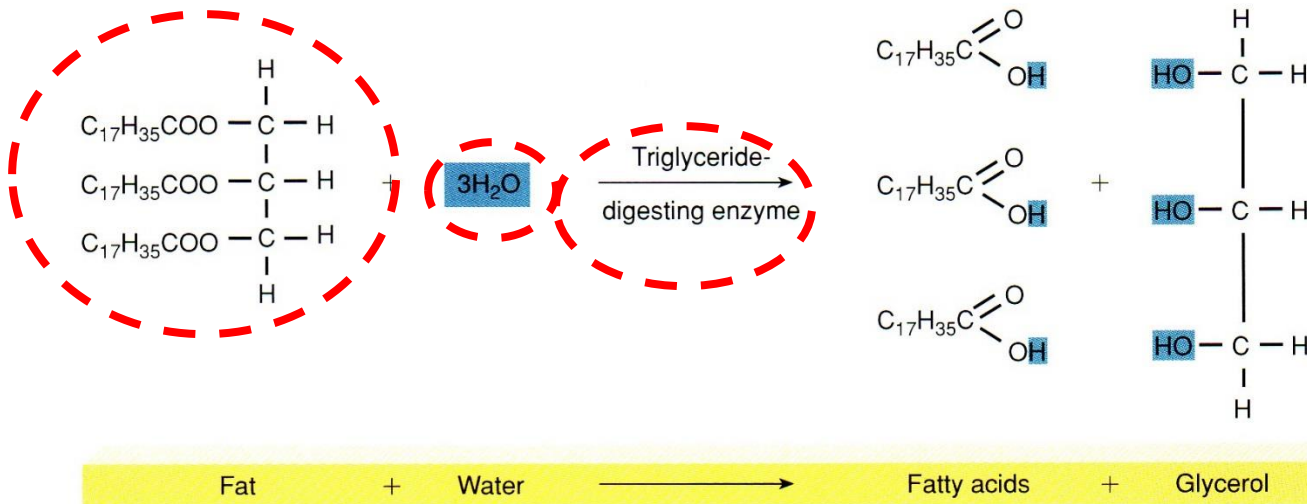
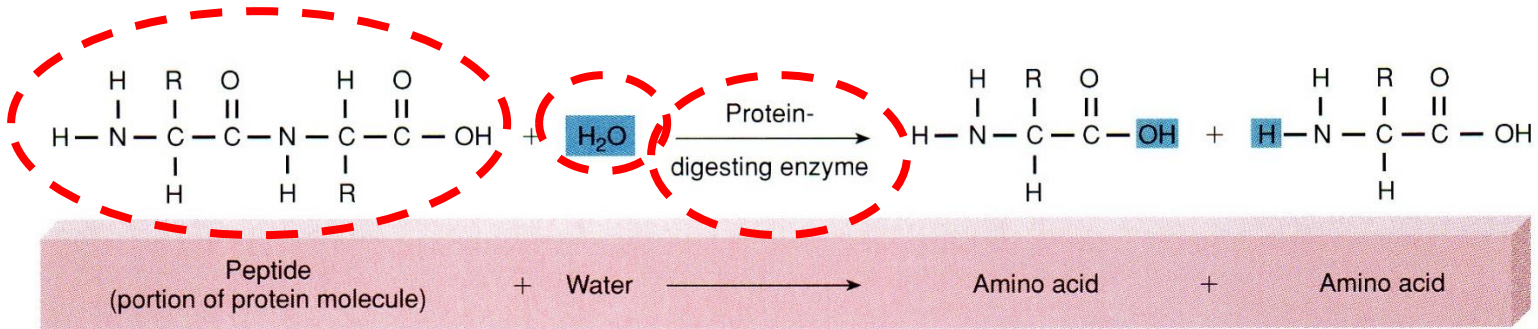
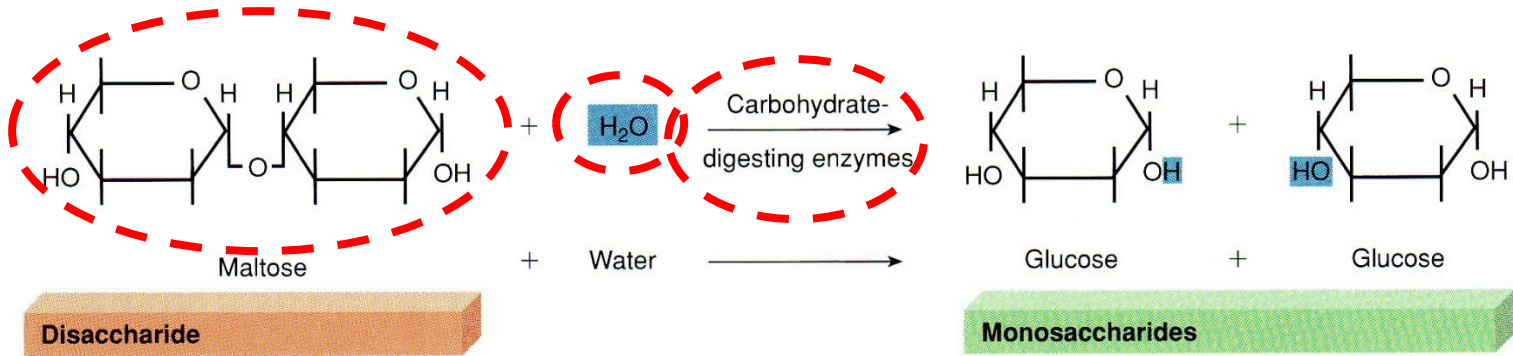
Protein
+
Fat



Amino Acids



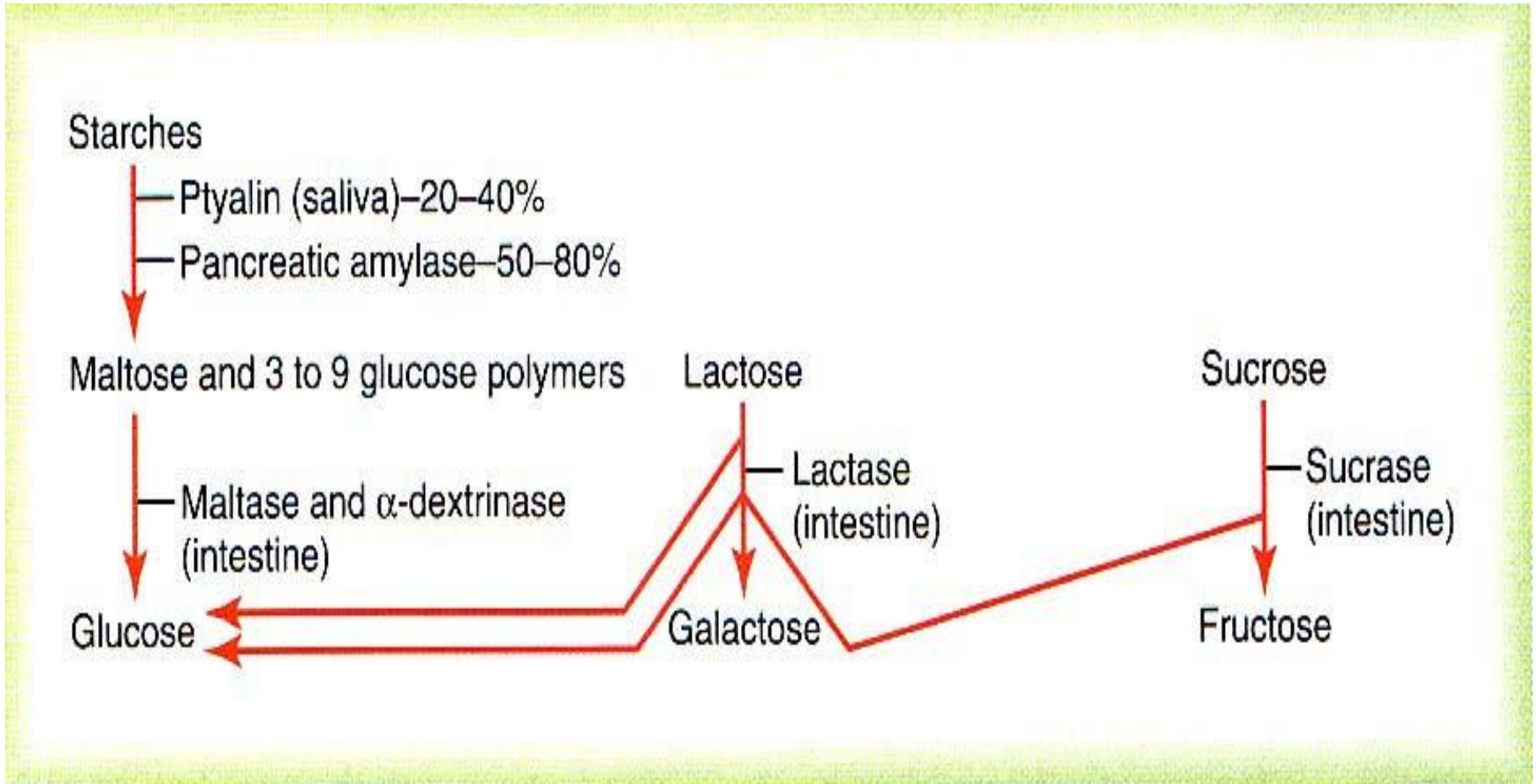
Fatty Acids
+
Glycerol



Carbohydrates in foods



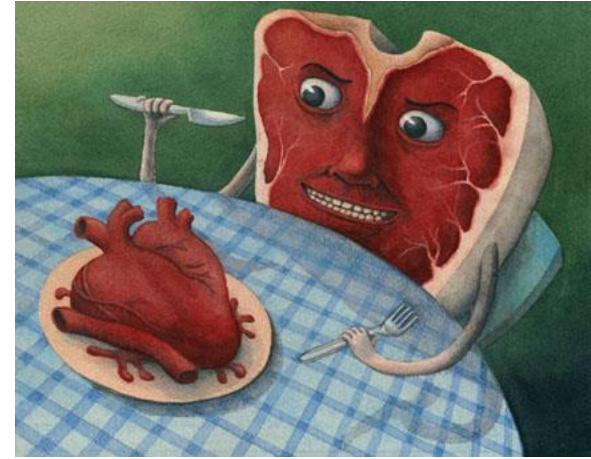
Carbohydrate Digestion = 1^o Energy Nutrient



Why Do Some People Have Trouble Digesting Milk?

- Ability to digest milk carbohydrates varies
 - Lactase
 - Made by small intestine
- Symptoms of intolerance
 - Gas, diarrhea, pain, nausea?
- Milk allergy?
- Nutritional consequences
- Milk tolerance and strategies

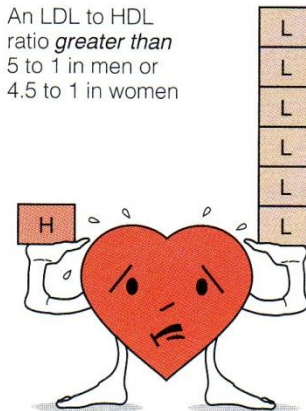




HIGH FAT FOODS



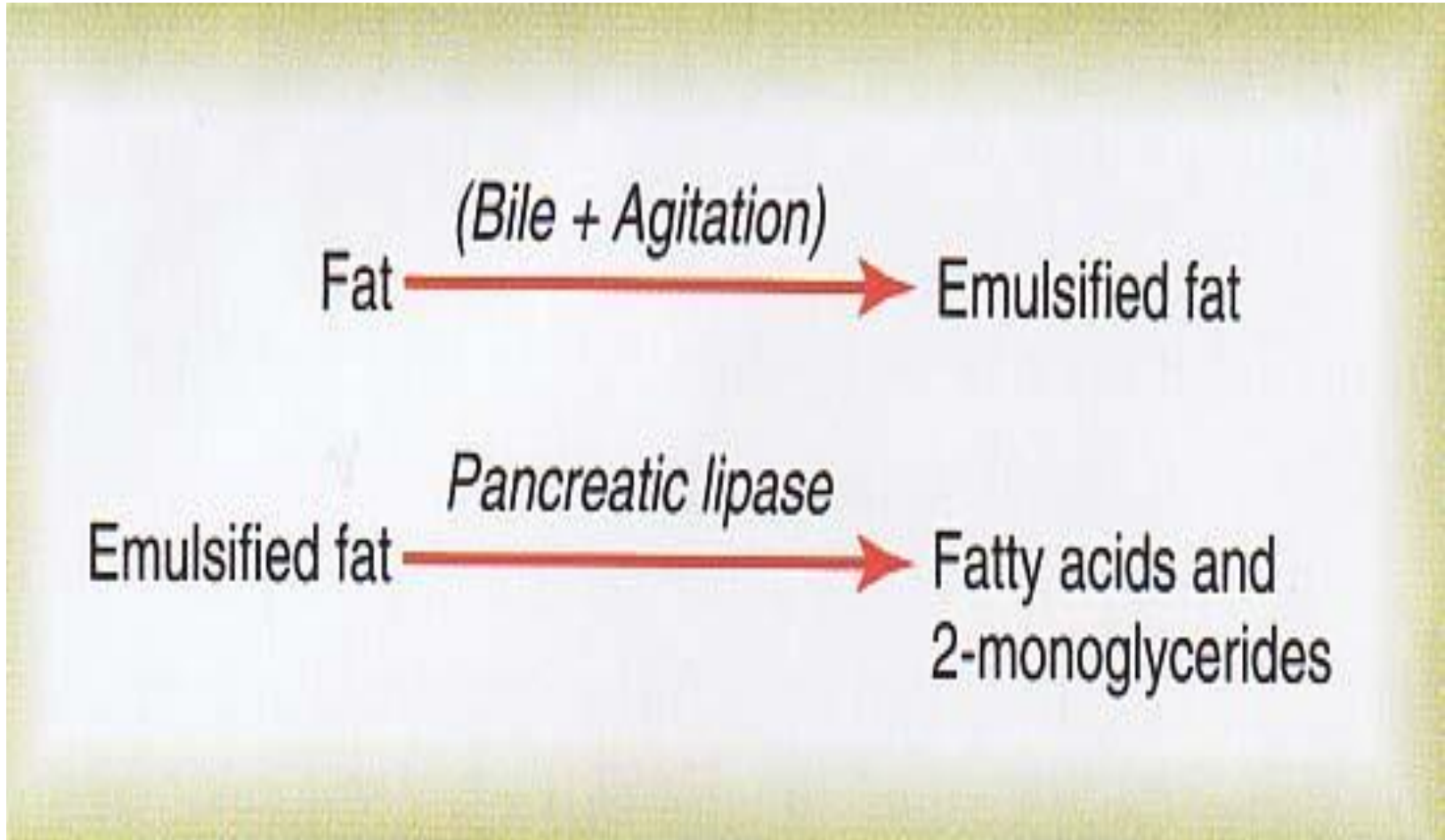
An LDL to HDL ratio *greater than* 5 to 1 in men or 4.5 to 1 in women

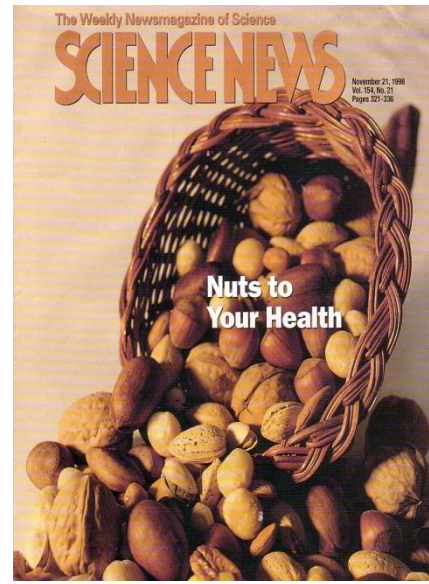


Increased risk of heart disease

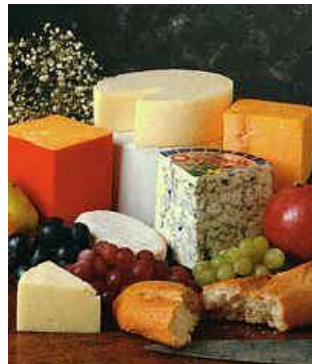


Fat Digestion = 2^o Energy Nutrient



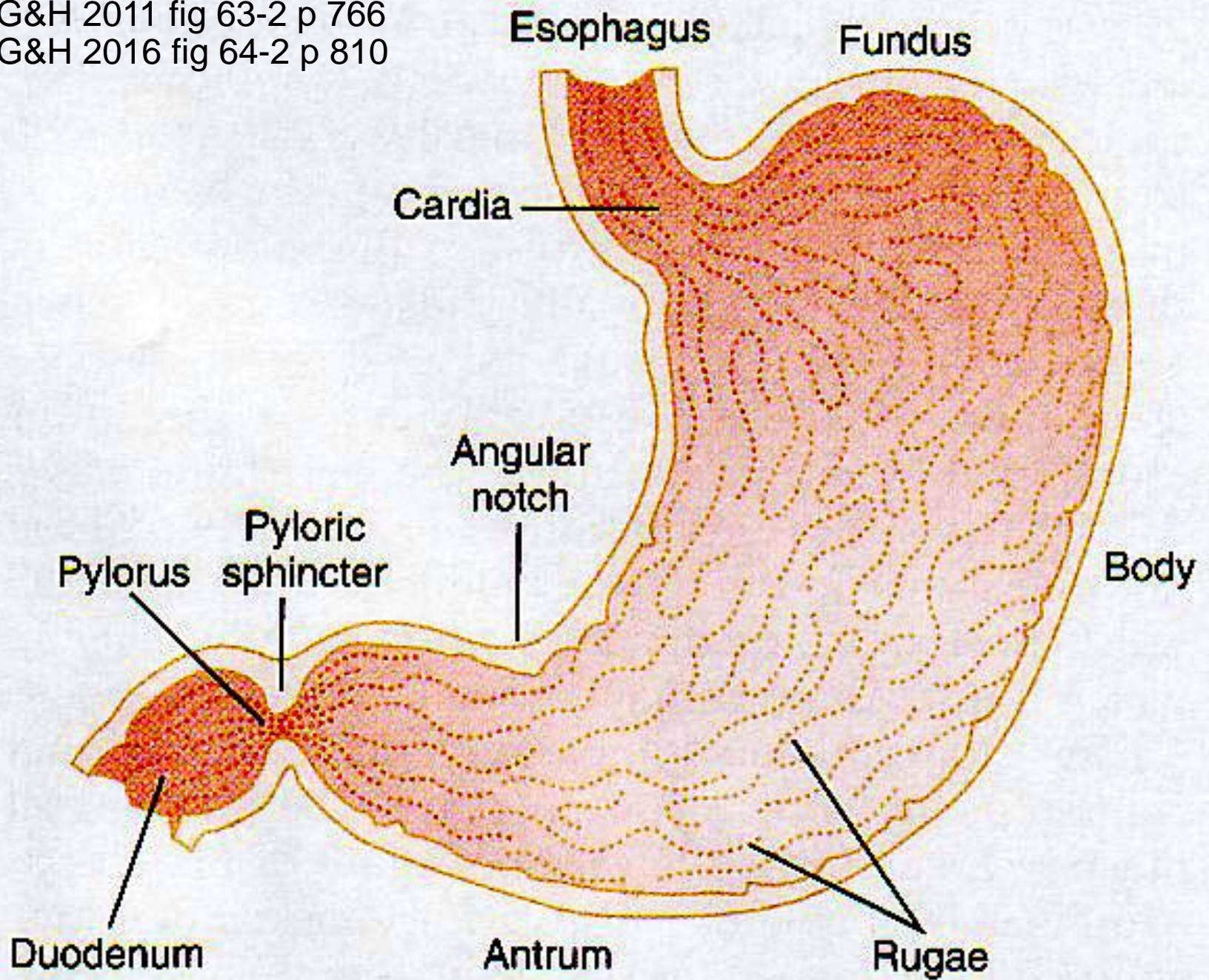


HIGH PROTEIN (FAT?) FOODS?

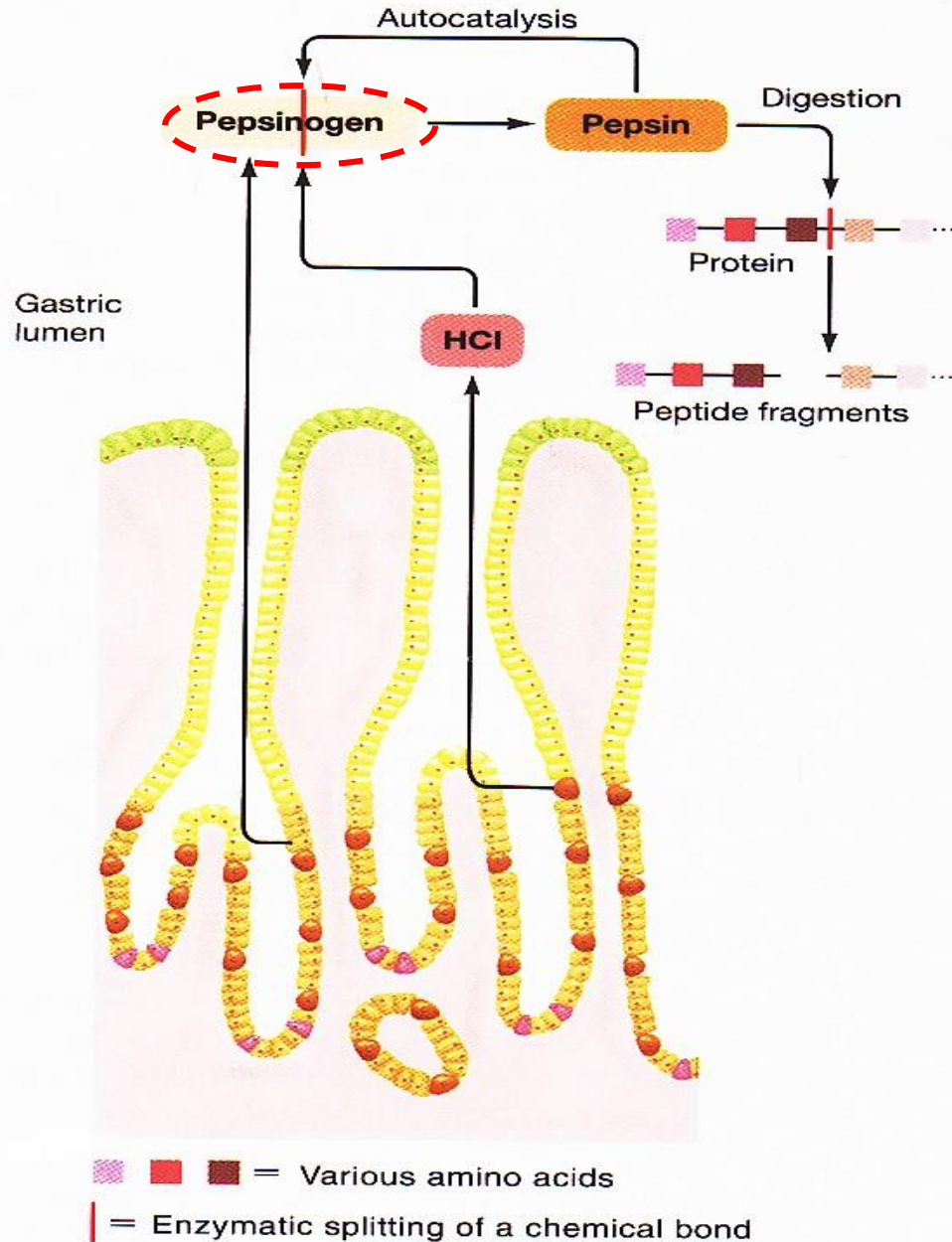


**Where does
enzymatic
digestion of
protein
begin?**

G&H 2011 fig 63-2 p 766
G&H 2016 fig 64-2 p 810

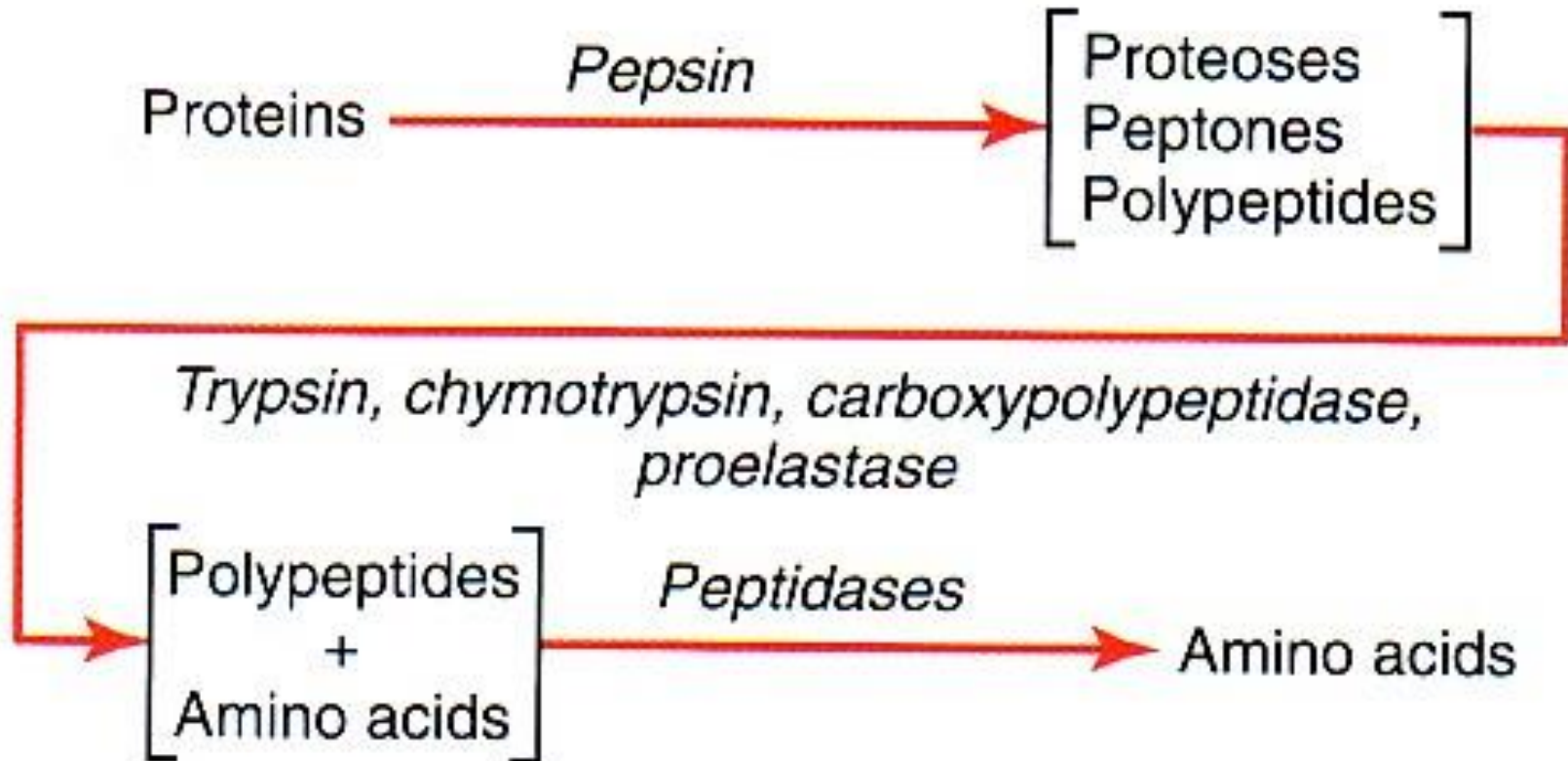


Zymogen
= *inactive precursor*



LS2 2006
G&H 2011
fig 64-4
G&H 2016
fig 65-4

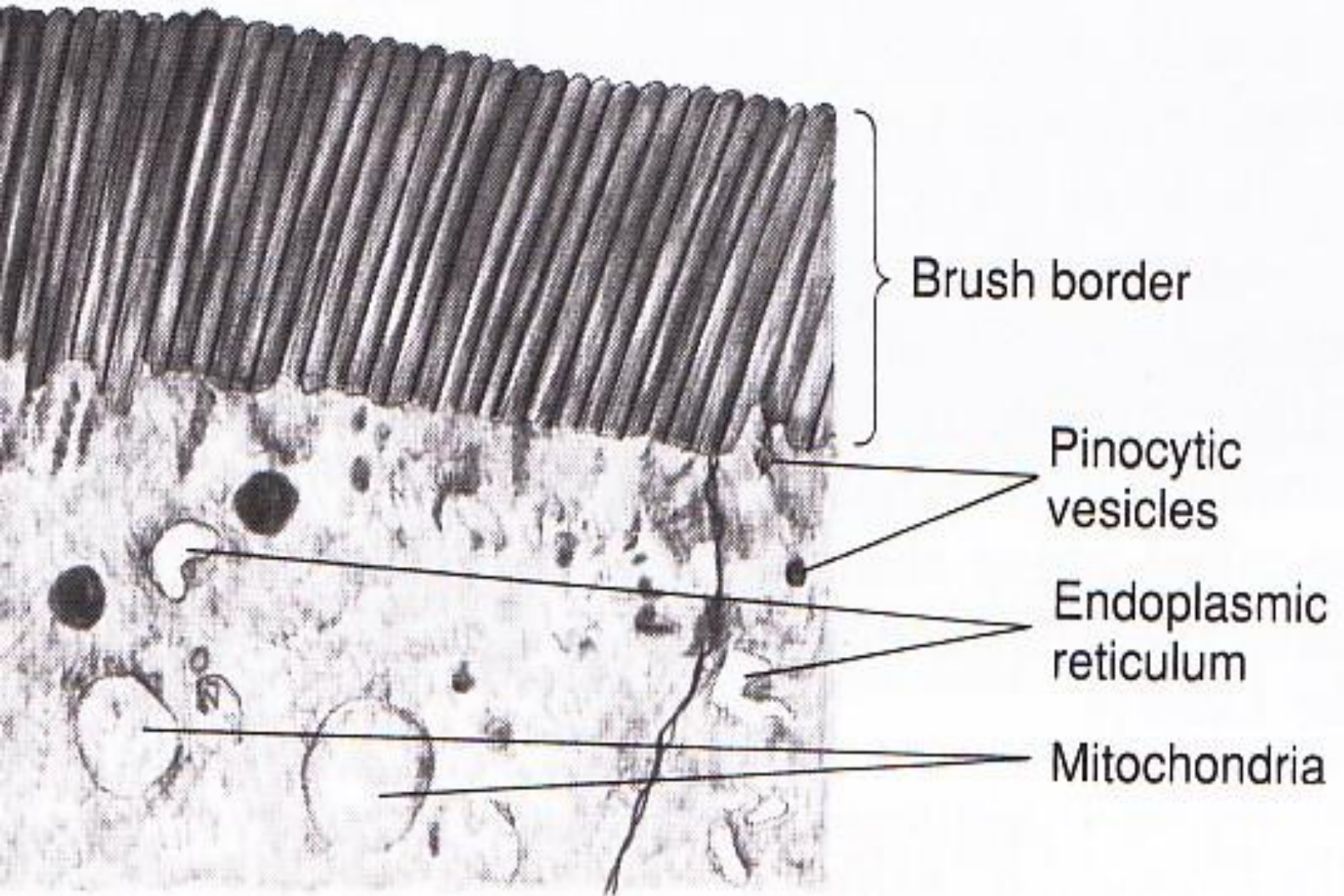
Protein Digestion = 3⁰ Energy Nutrient

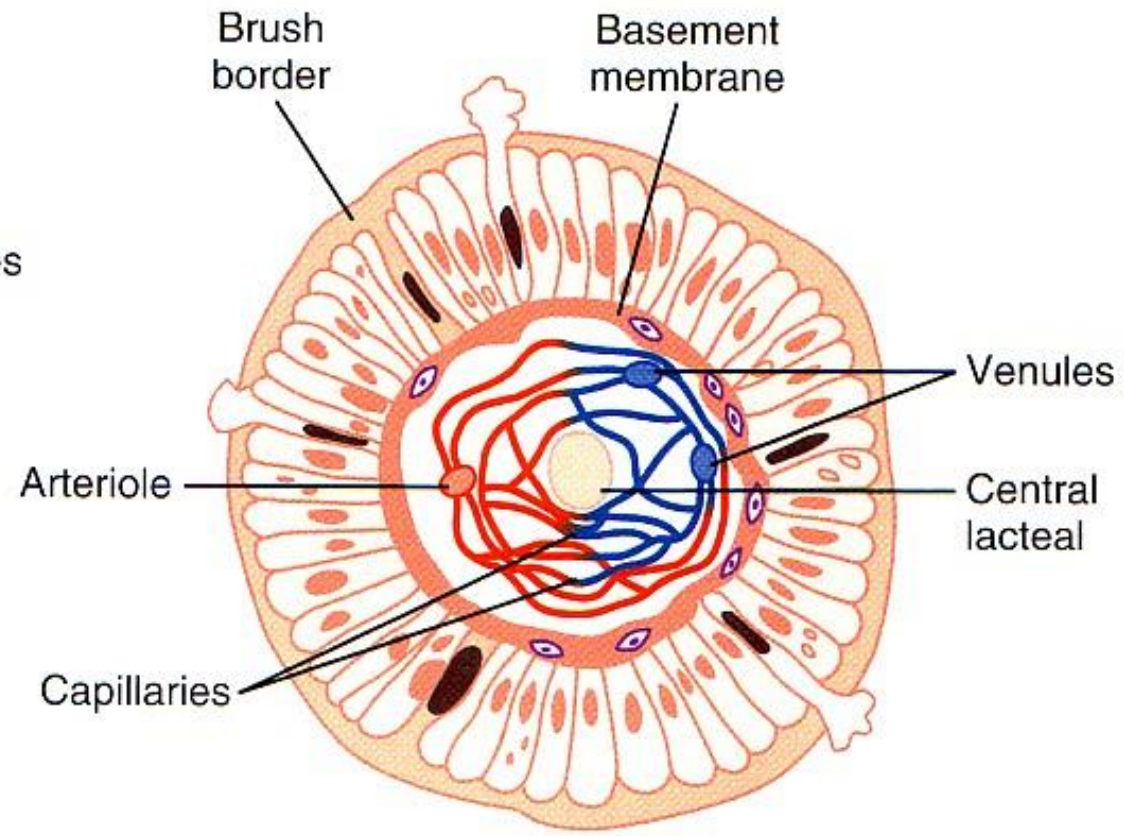
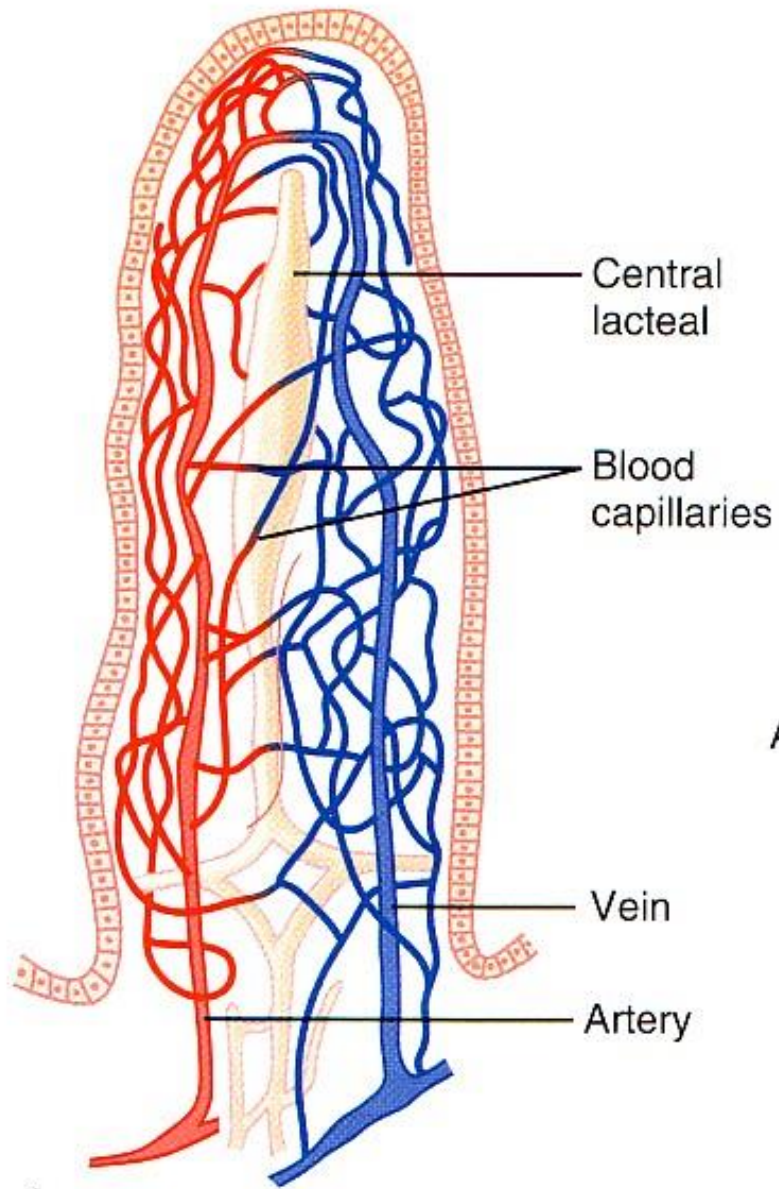


What is the major
function of the
small intestine?

Absorption!!

G&H 2011 fig 65-7
G&H 2016 fig 66-7



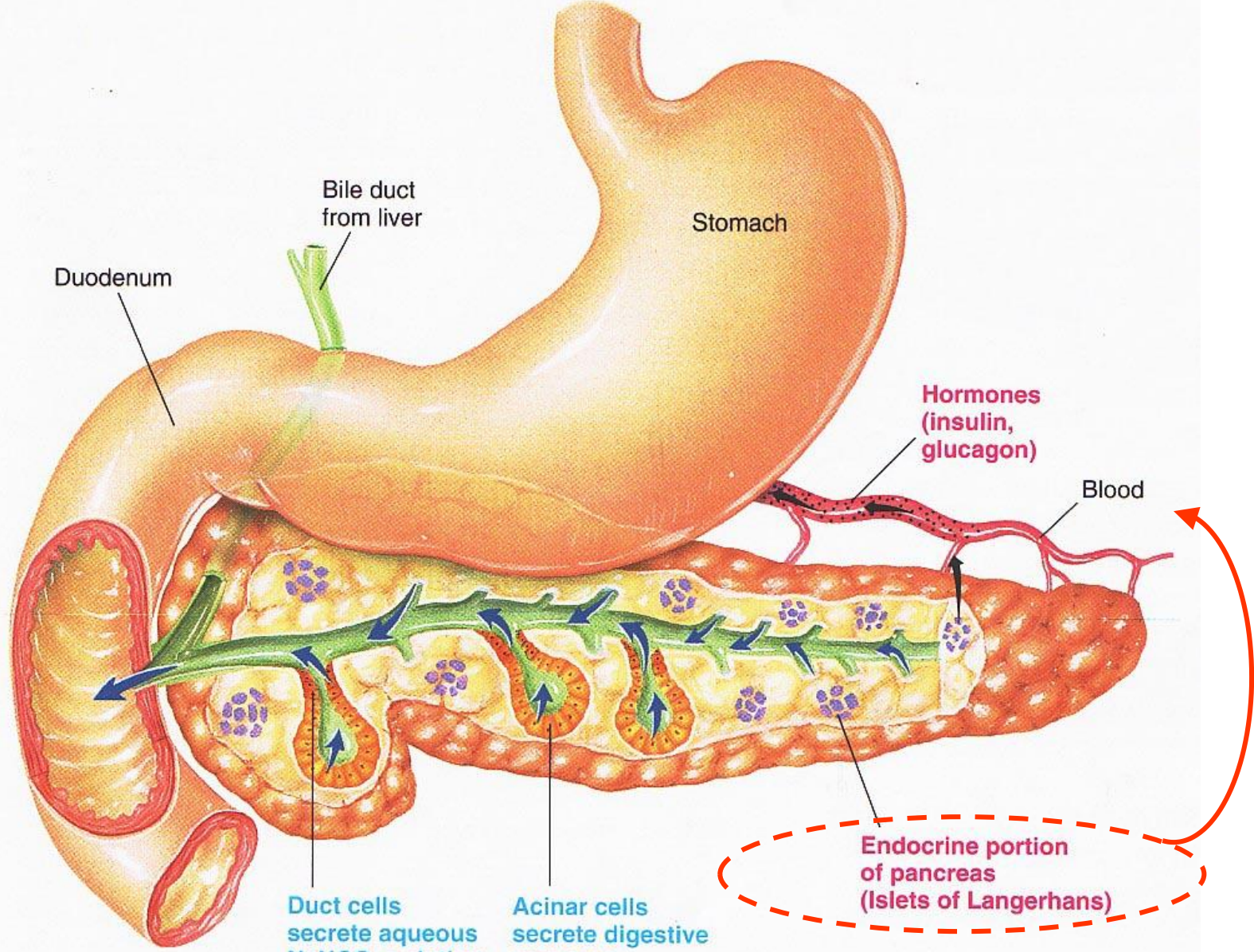


A

B

G&H 2011 fig 65-6, G&H fig 66-6

**Why is the
pancreas so
unique?**

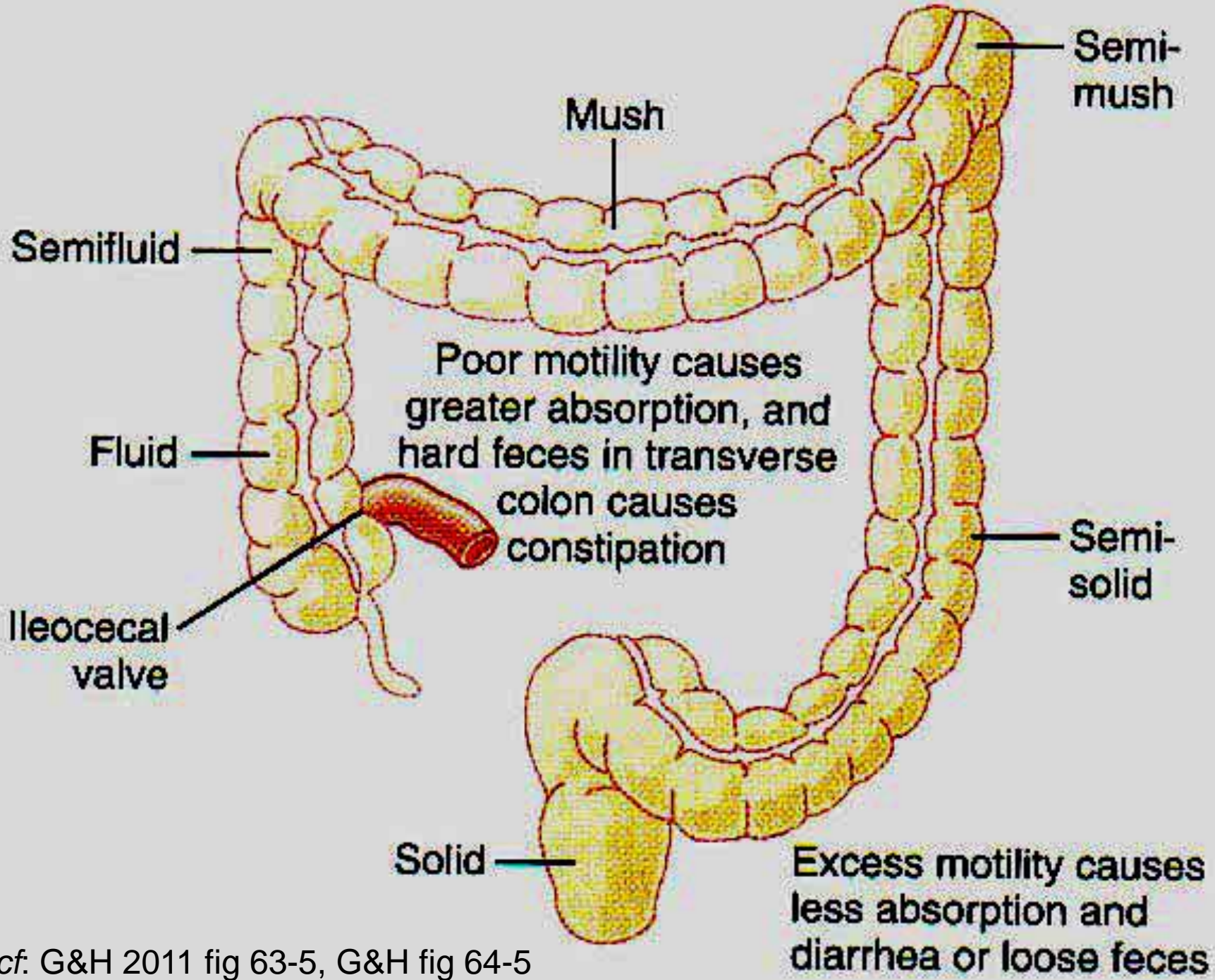


Enzymes specific for all 3 energy nutrients!

Exocrine portion of pancreas (Acinar and duct cells)

Endocrine portion of pancreas (Islets of Langerhans)

The glandular portions of the pancreas are grossly exaggerated.



cf. G&H 2011 fig 63-5, G&H fig 64-5

Questions + Discussion

