

We're almost 1/5 finished! Learn & enjoy every moment!!...



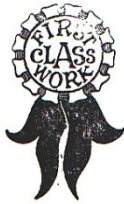
BI 358 Lecture 4

- I. Announcements Outline & Quiz 1 update? Quiz Key will be posted in the glass box near 112 HUE. MU Quiz? Next T *Nutritional Analyses*; Record your diet ≥ 1 d on DLN p 4-8.
- II. Addiction Medicine Follow-up CB1 & CB2 receptors & immunity? ETOH dependence-endocannabinoids? Anxiety?
- III. Nutritional Physiology in the News Eye-Mouth Gap? UCB Wellness 2007 + Zuti & Golding, Diet vs. Exercise 1976!
- IV. Metabolic Lab Research cf: Dietary Intake Estimation
- V. Gastrointestinal Physiology G&H ch 62, 63, 64, 65 + LS2
 - A. Digestion overview + alimentary tract fig 62-1 p 753-4
 - B. Gut cross section, histology + plexi fig 62-2 pp 754-9
 - C. Secretions+phases tab 64-1, fig 64-1,64-2,64-7 pp 775-87
 - D. Hydrolysis: Central theme of digestion ch 65 p 789-93
 1. Carbohydrate fig 65-1 p 790
 2. Fat fig 65-3 p 791, fig 65-4 p 792
 3. Protein fig 65-2 p 791

WOW!



SUPER



~ TOP 5-10!

EXCELLENT!!



~ TOP 15!

GREAT EFFORT



~ TOP 20-25!

Endocannabinoid Receptors

CB-1

Brain Structures

Controlling Energy
Intake

(*e.g.*, Hypothalamic
Hunger-Satiety Center)

Endocannabinoid
hyperactivity →

CB-2

Leukocytes/WBCs

Immune & Inflammatory
Reactions

(*e.g.*, Lymphocytes &
Macrophages)

Metabolic & Eating Disorders

1. Abdominal Obesity
2. Dyslipidemia
3. Hyperglycemia

<http://www.jimmunol.org/content/165/1/373.full?ijkey=YriEsKcvAs2z>

<http://www.ncbi.nlm.nih.gov/pubmed/23824763>

ETOH Dependence + Link to Endocannabinoids?

Suspect Genes?

Dopaminergic Receptor DA D2
ETOH Dehydrogenase
Aldehyde Dehydrogenase
Fatty Acid Amide Hydrolase (FAAH)
G- vs A-allele μ -Opioid Receptor (OPRM 1)
Cation Transport & Synaptic Transmission

*e.g., Delete Gene for FAAH or Block
FAAH Action by URB597*

1. ↑ Preference for ETOH
2. ↑ Sensitivity to ETOH Sedation
3. ↑ Recovery from ETOH Motor Incoordination

Metabolizes Anandamide + Δ 9-THC
Anandamide Deficient → Anxiety

Membrane-bound enzyme



e.g., G- vs A-Allele for OPRM 1

1. ↑ Feelings of Intoxication/Sedation
2. ↑ Happiness/Euphoria
3. Naltrexone more effective in patients with G-allele?

<http://www.ncbi.nlm.nih.gov/pubmed/24325918>

<http://www.ncbi.nlm.nih.gov/pubmed/24268660>

The Eye-Mouth Gap? UC Berkeley Wellness Engagement Calendar, September 2007



Ask people what they ate yesterday or even today, and the odds are that they'll underestimate the amount. This discrepancy is called the *eye-mouth gap*.

One study found that some obese people actually ate twice as much as they reported. Research has shown that perhaps 80% of us – even lean and athletic people – underestimate our food intake.



The Eye-Mouth Gap?

Yikes!



Adults underestimate, on average, their daily intakes by 800 calories.

> 1 ½ lb per wk!!

They overestimate intakes of fruit & dairy products, but underestimate amounts of sweets, refined grains, oils, and other fats they eat.

Misreporting is seldom a deliberate deception – it's likely an unconscious response perhaps to social & family pressure, combined with wishful thinking.

People don't know how much food they put on their plates.

The Eye-Mouth Gap Bottom Line

If you're trying to lose weight or improve your diet, don't trust your eyes.

Weigh or measure the food you eat to get a good sense of how much you're really eating ??



Lombo editorial comments:

- 1. Train yourself to make good guesses/estimates rather than weigh everything.*
- 2. Train yourself...that is...
Exercise! Exercise!! Exercise!!!*

Deck of Cards

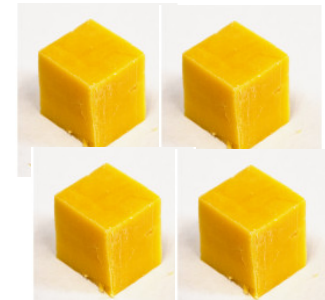


≡

4 oz → 3 oz



raw → cooked



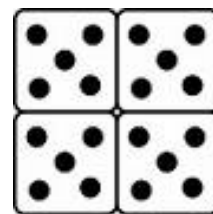
or



≡ 1 c



≡ 1/3 c



≡ 1 oz



≡ 1/4 c



≡ 1.5 oz

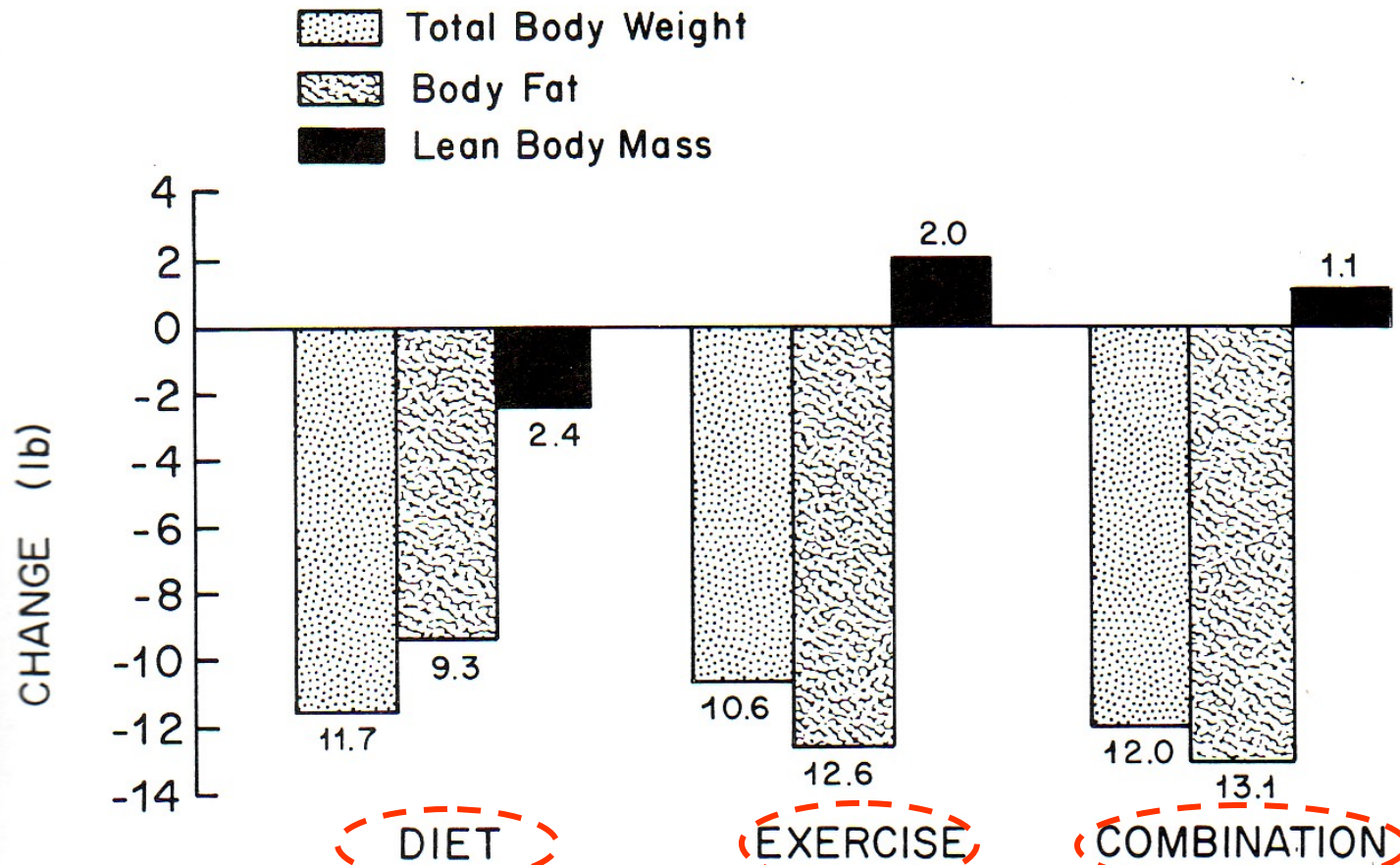


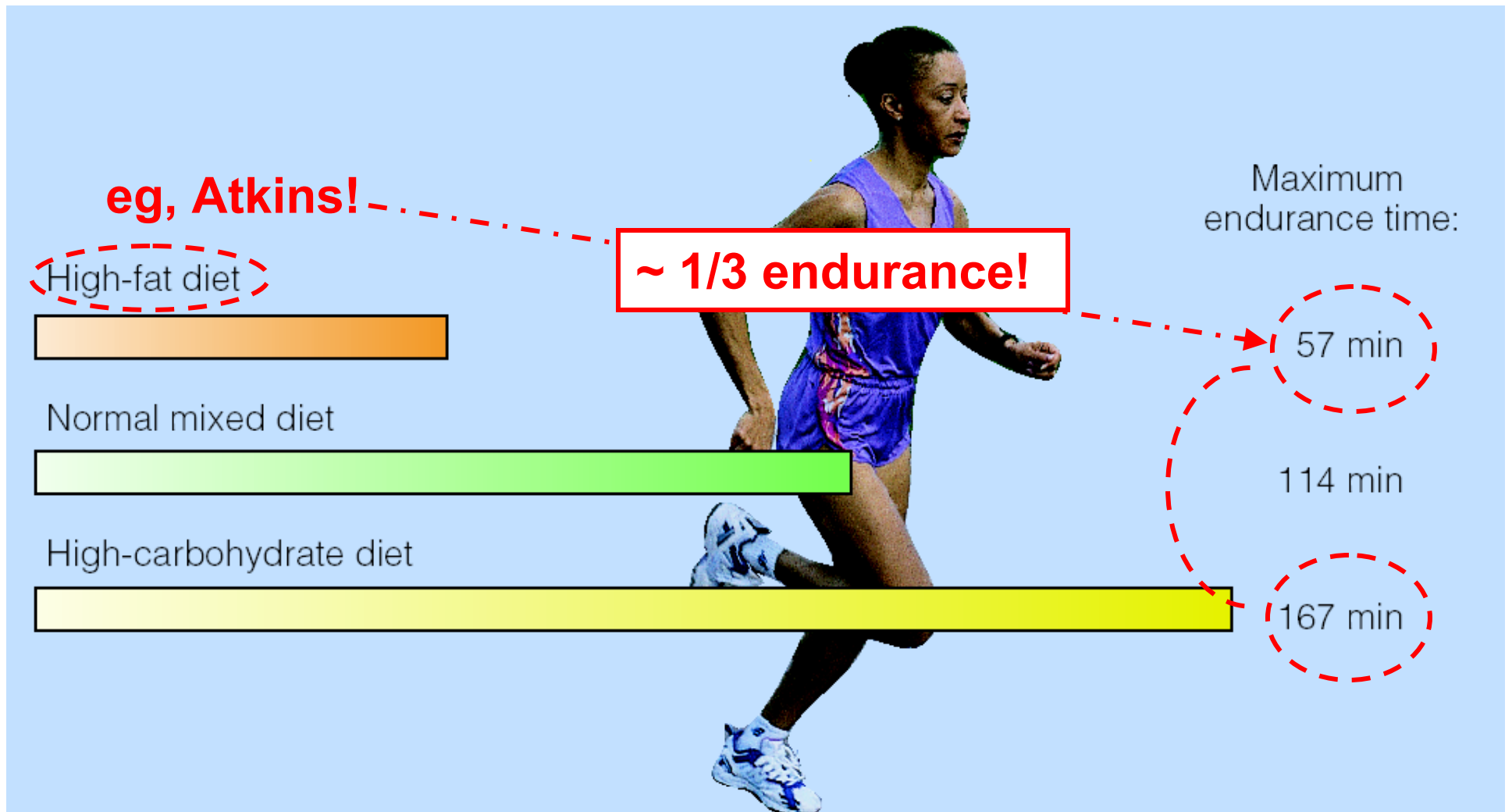
Figure 4-9. Changes in body weight, body fat, and lean body weight for diet, exercise, and combination groups. (From Zuti W. B., and Golding, L. A.: Comparing diet and exercise as weight reduction tools. *Phys. Sportsmed.* 4:49-53, 1976.)

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



**Compared to dieting,
exercise is superior in
inducing % body fat
reduction & preserving
lean body mass!**

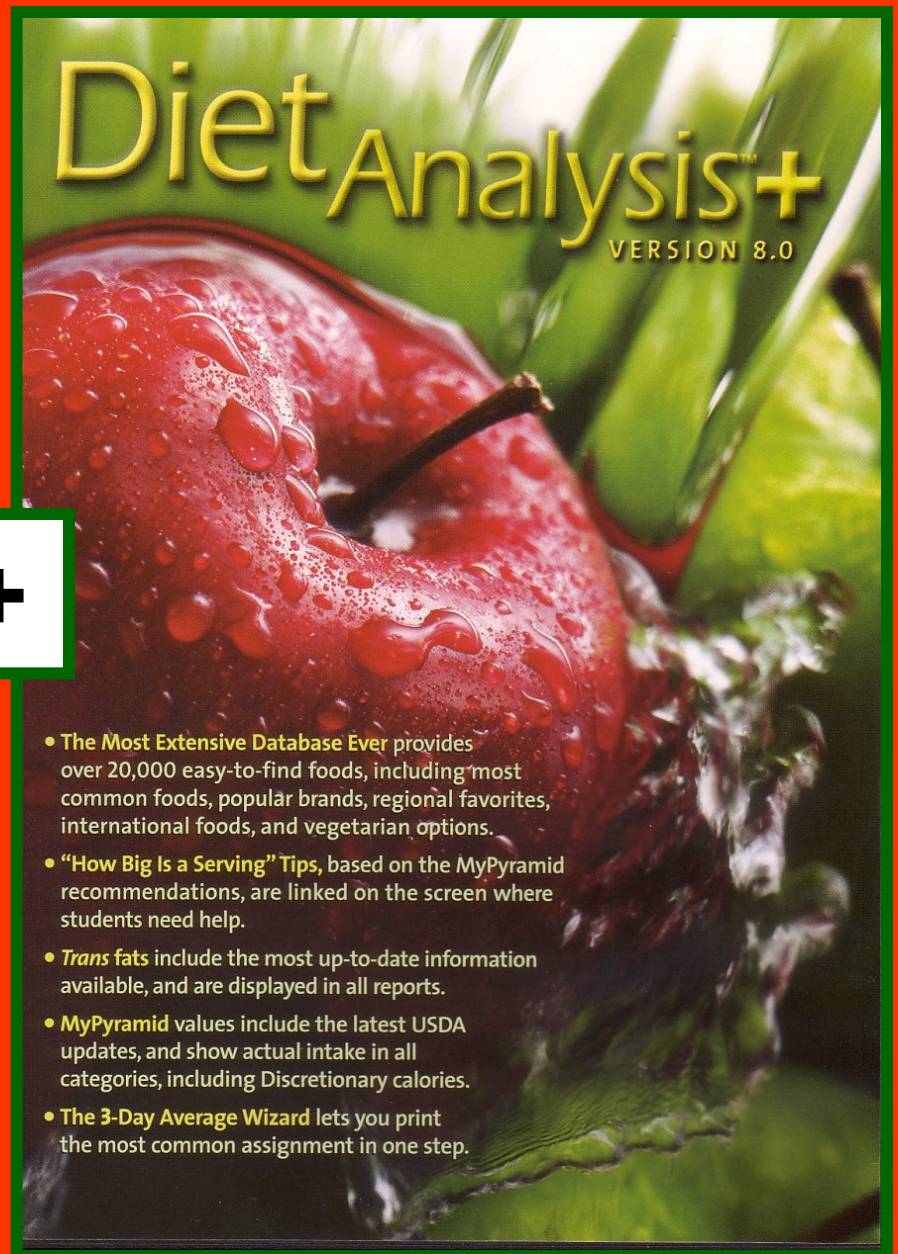
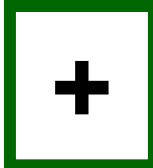
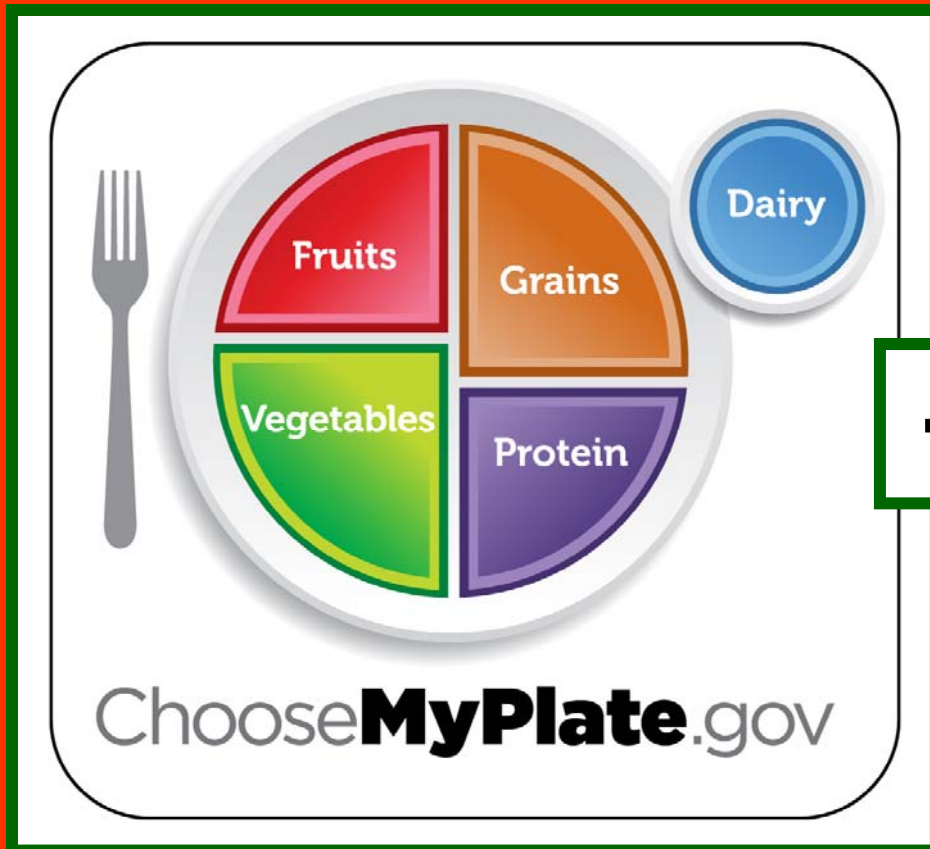
Dietary Composition & Physical Endurance



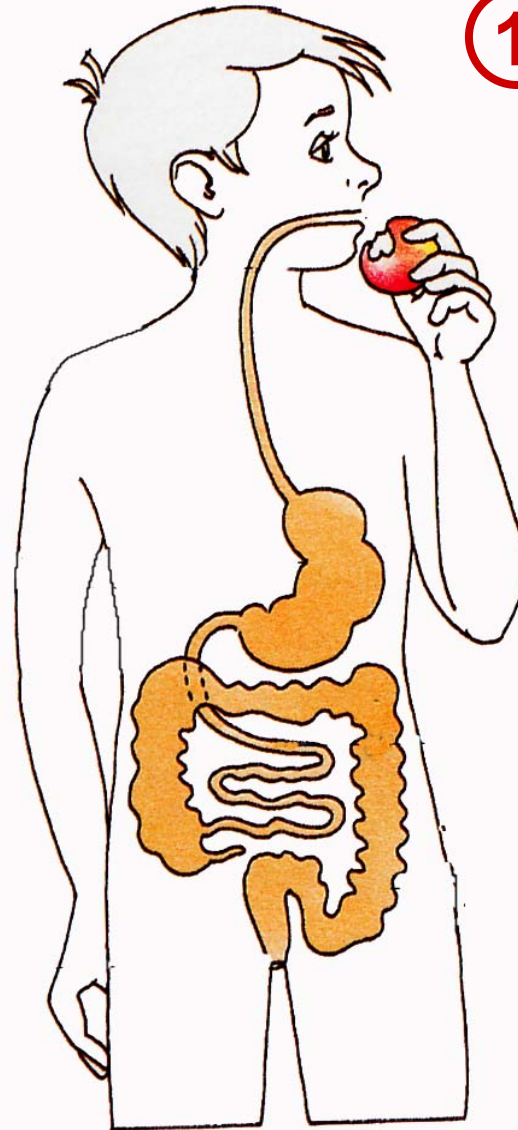
Tedium of Metabolic Lab & Dietary Research



Discussion 4: Nutritional Analyses via 2 Programs



Digestion Steps



① Ingestion

② Mechanical Digestion

③ Chemical Digestion

④ Peristalsis

⑤ Absorption

⑥ Storage

⑦ Defecation

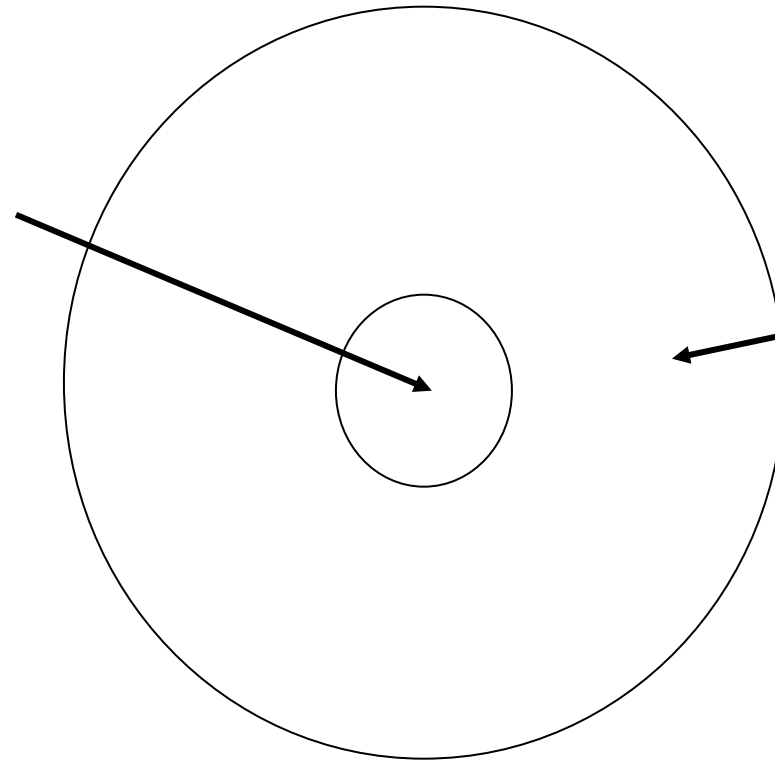
SOURCE: Dr. Eugene Evonuk, 1989. cf. L Sherwood, 2012 pp 437-8.



GI-Doughnut Analogy



GI Lumen

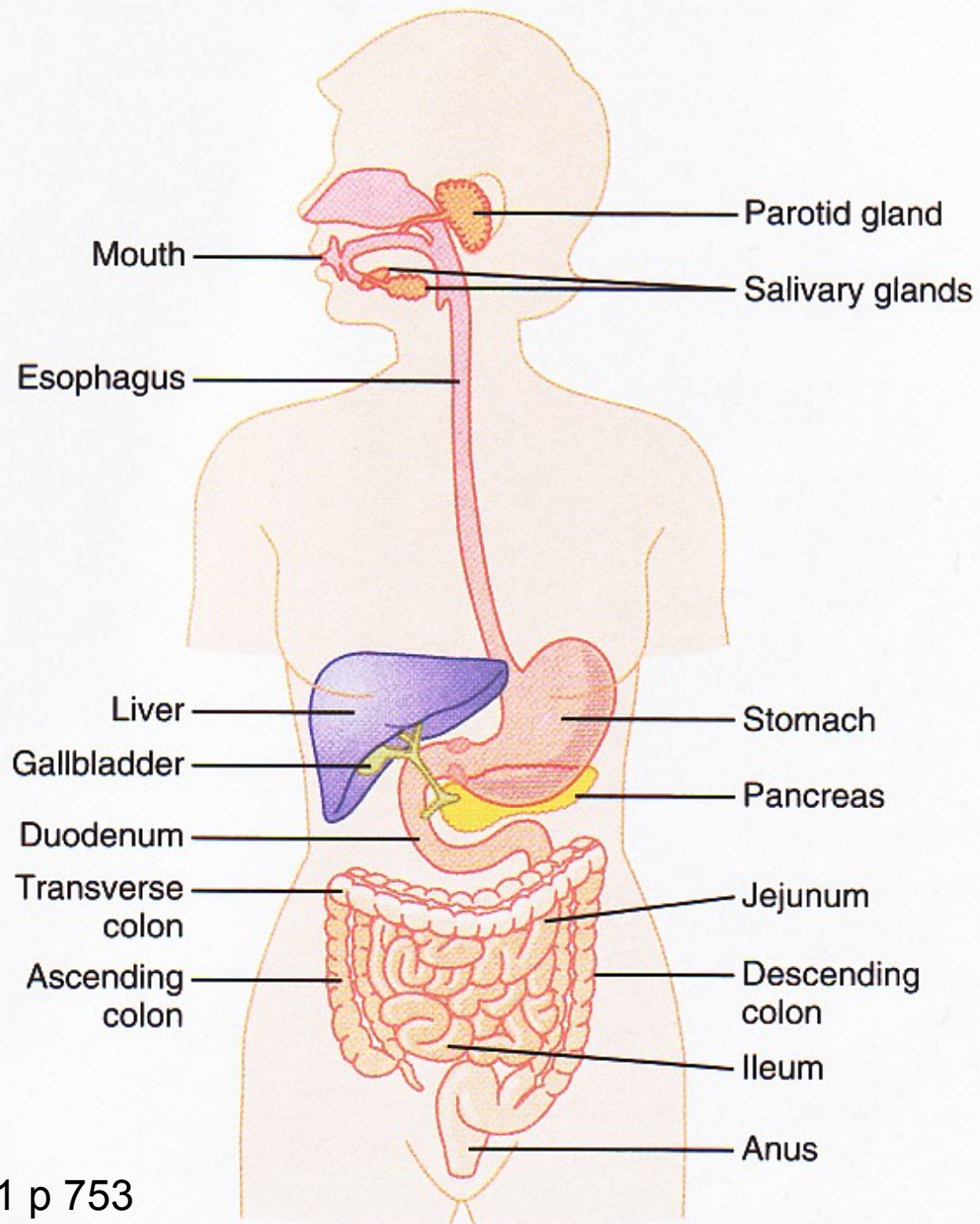


Body



Me?





GI Regulation

1. Local/Intrinsic → autoregulation

rapid

2. Nervous

3. Hormonal

→ extrinsic

Slower,
but longer
lasting!

★ Myenteric motor plexus!

Serosa

cf: G&H fig 62-2

LOCAL

Epithelium

Submucosa

Lumen

Lamina
Propria

Muscularis
Externa

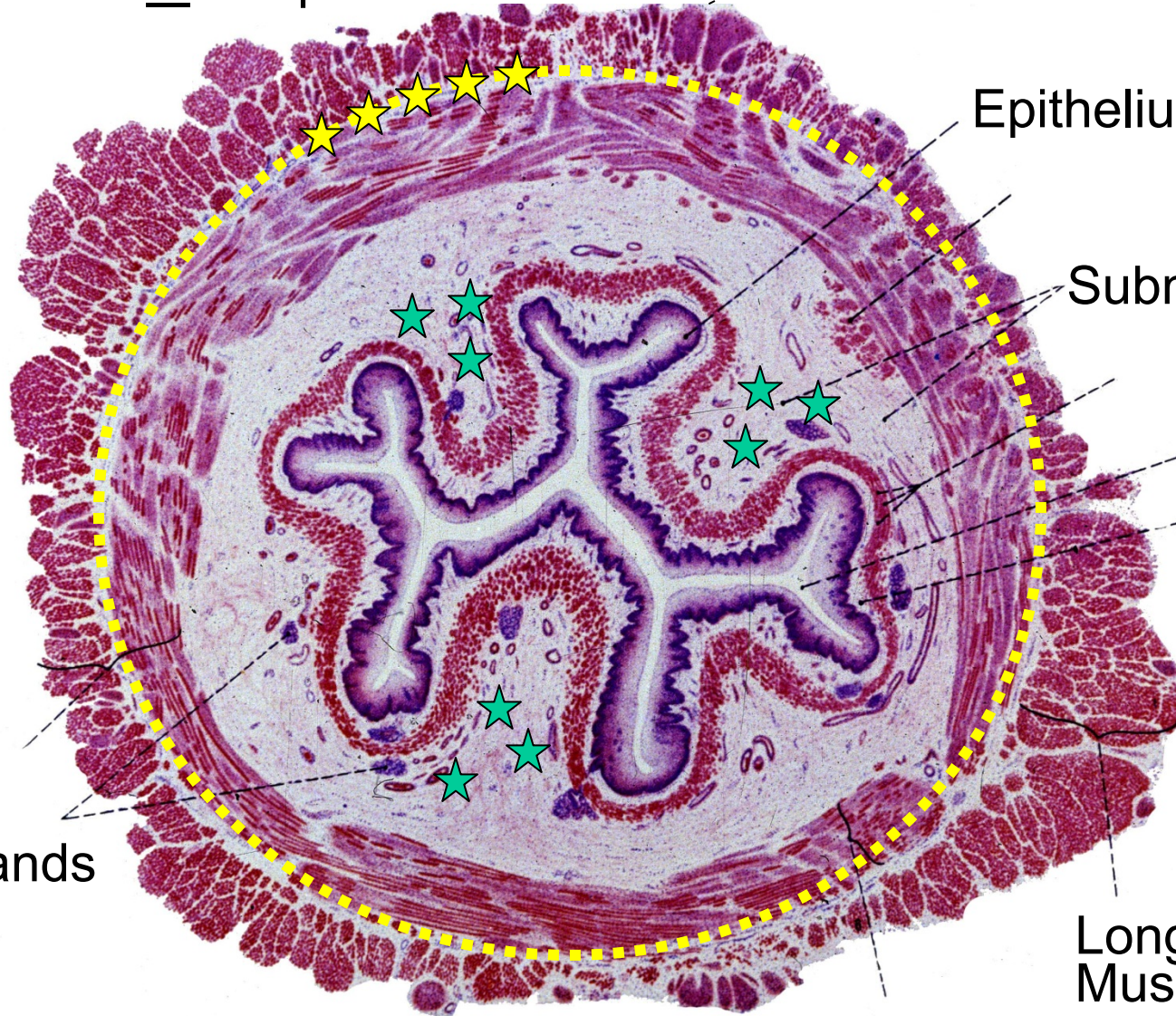
Glands

Longitudinal
Muscle

★ Meissner's sensory & secretory plexus!

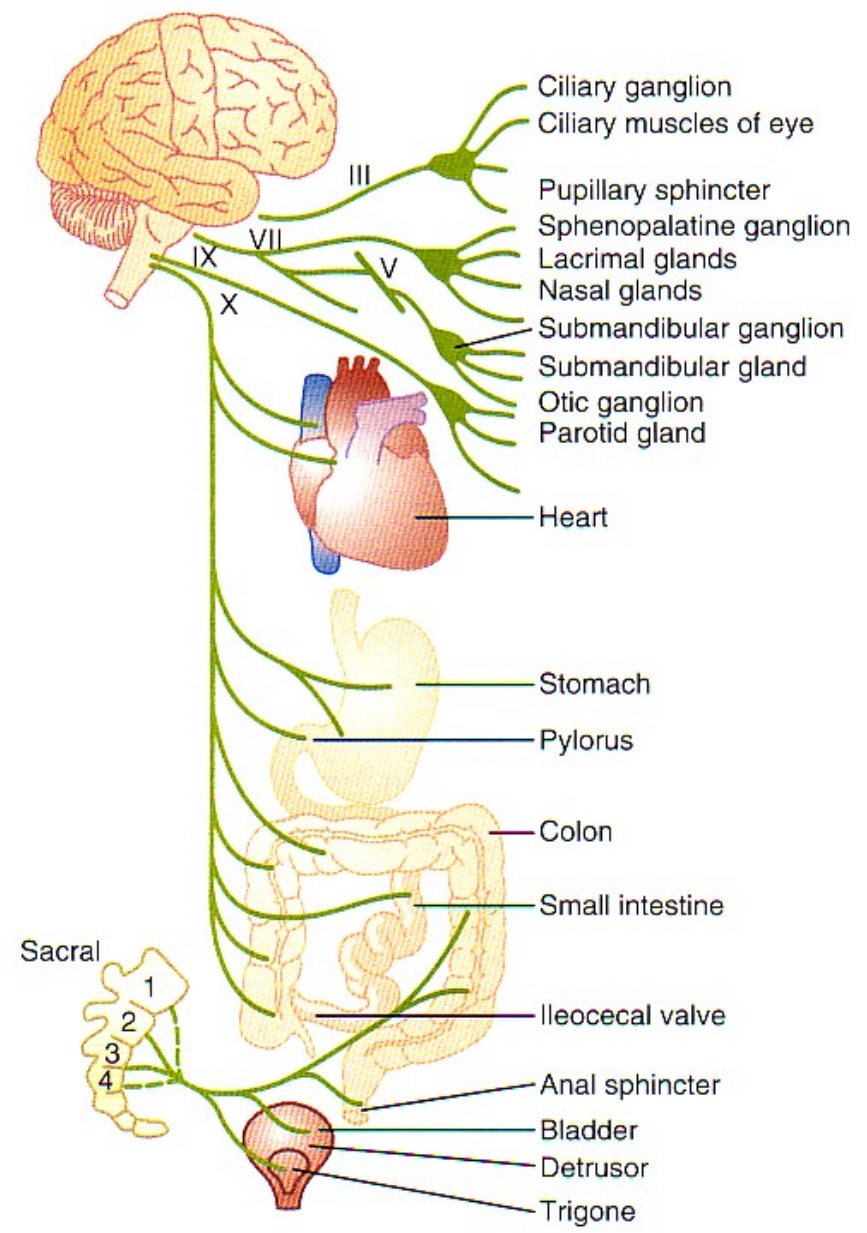
Circular
Muscle

H Howard 1990



Parasympathetic Branch Activates the Gut!

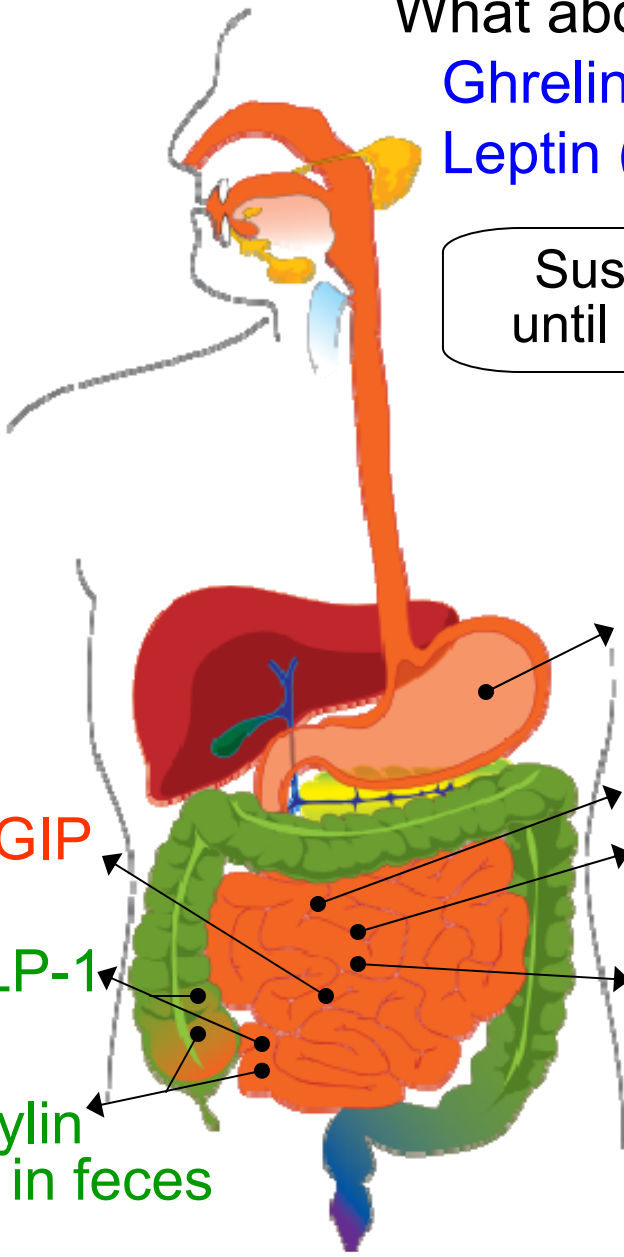
NERVOUS



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 → HCO₃⁻, H₂O by pancreas

Cholecystikinin → Gallbladder contraction + Pancreatic enzymes

↓ Motility ← GIP
↑ Insulin

↓ Motility ← GLP-1
↑ Insulin

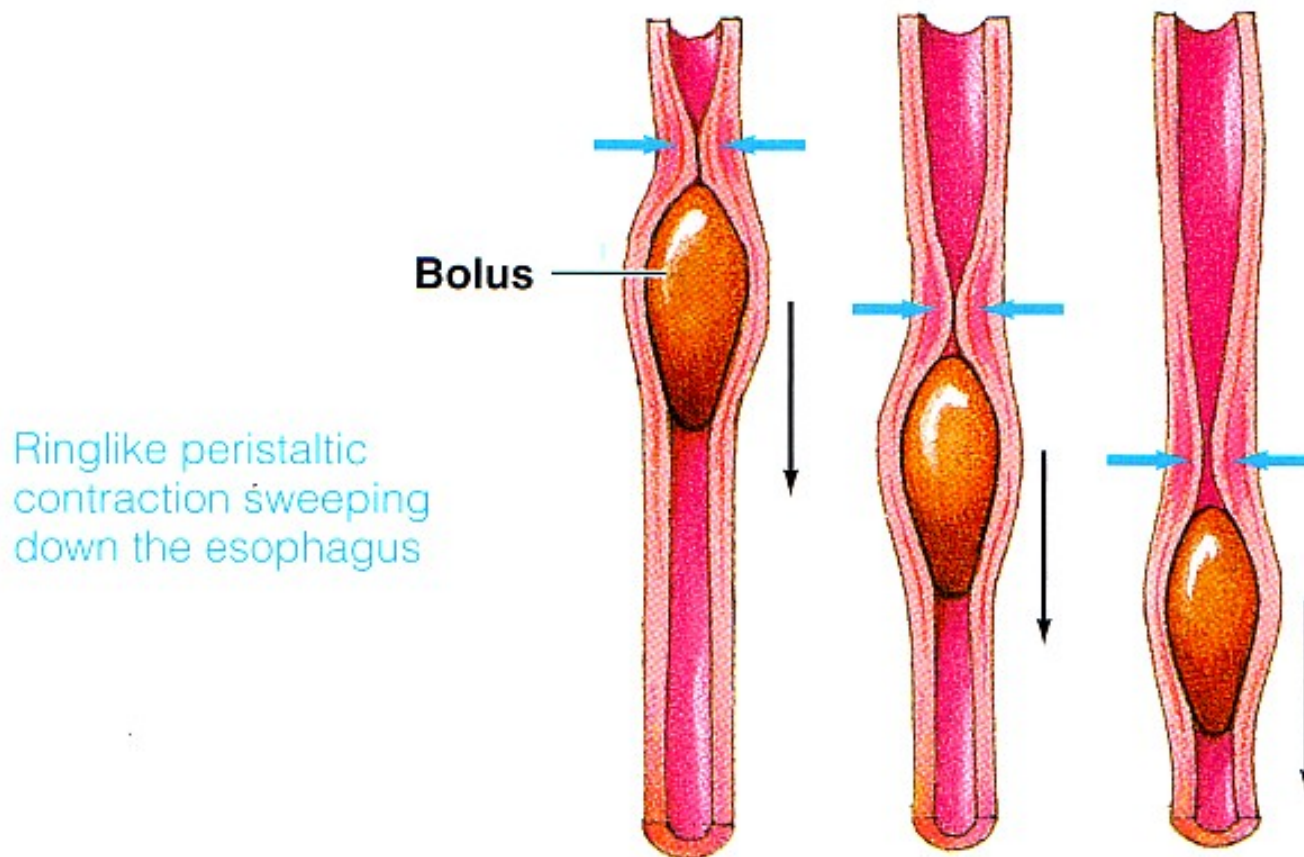
↑ Cl⁻ ← Guanylin
↑ NaCl + H₂O in feces

● **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.



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	

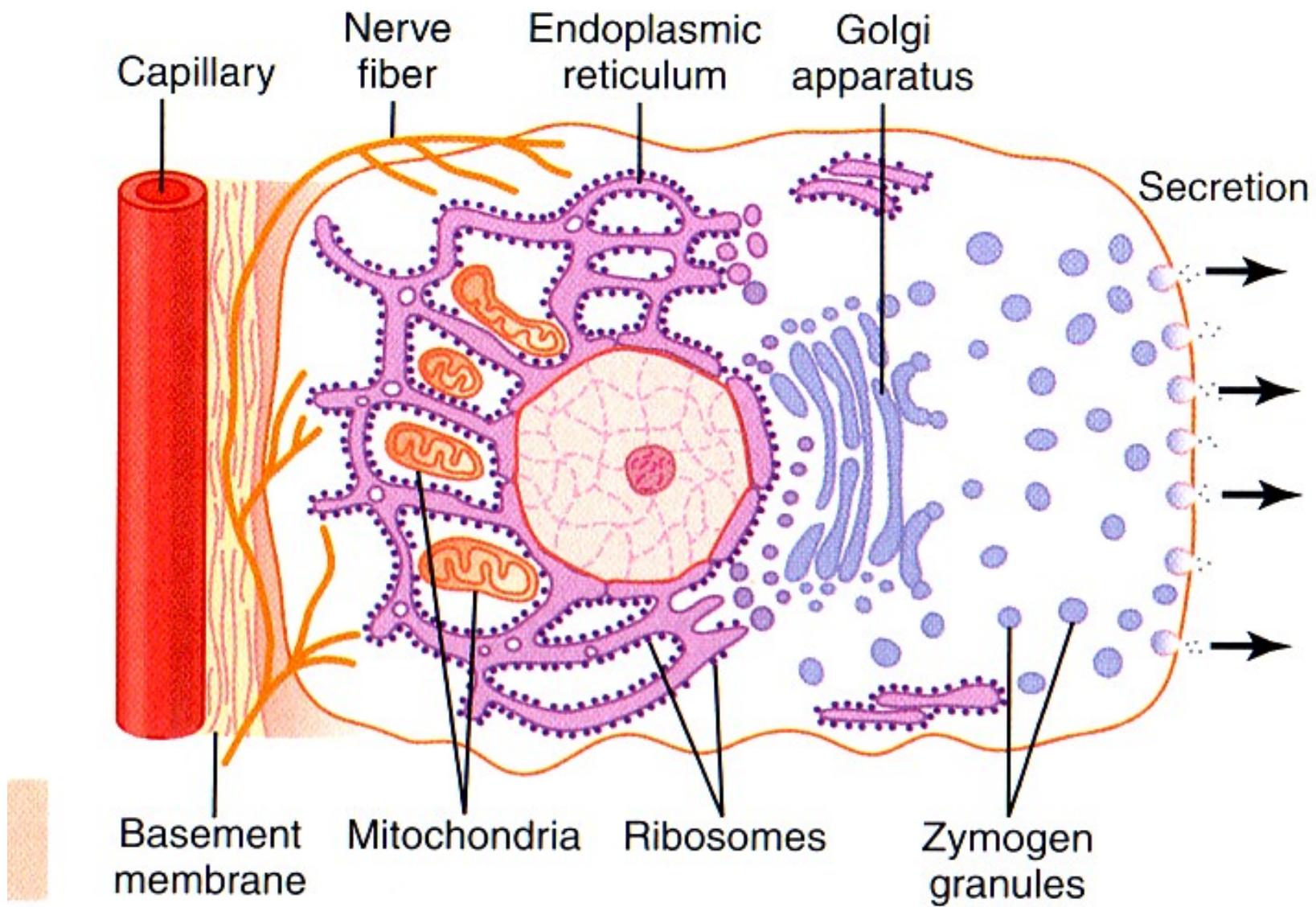


Figure 64-1 Typical function of a glandular cell for formation and secretion of enzymes and other secretory substances.

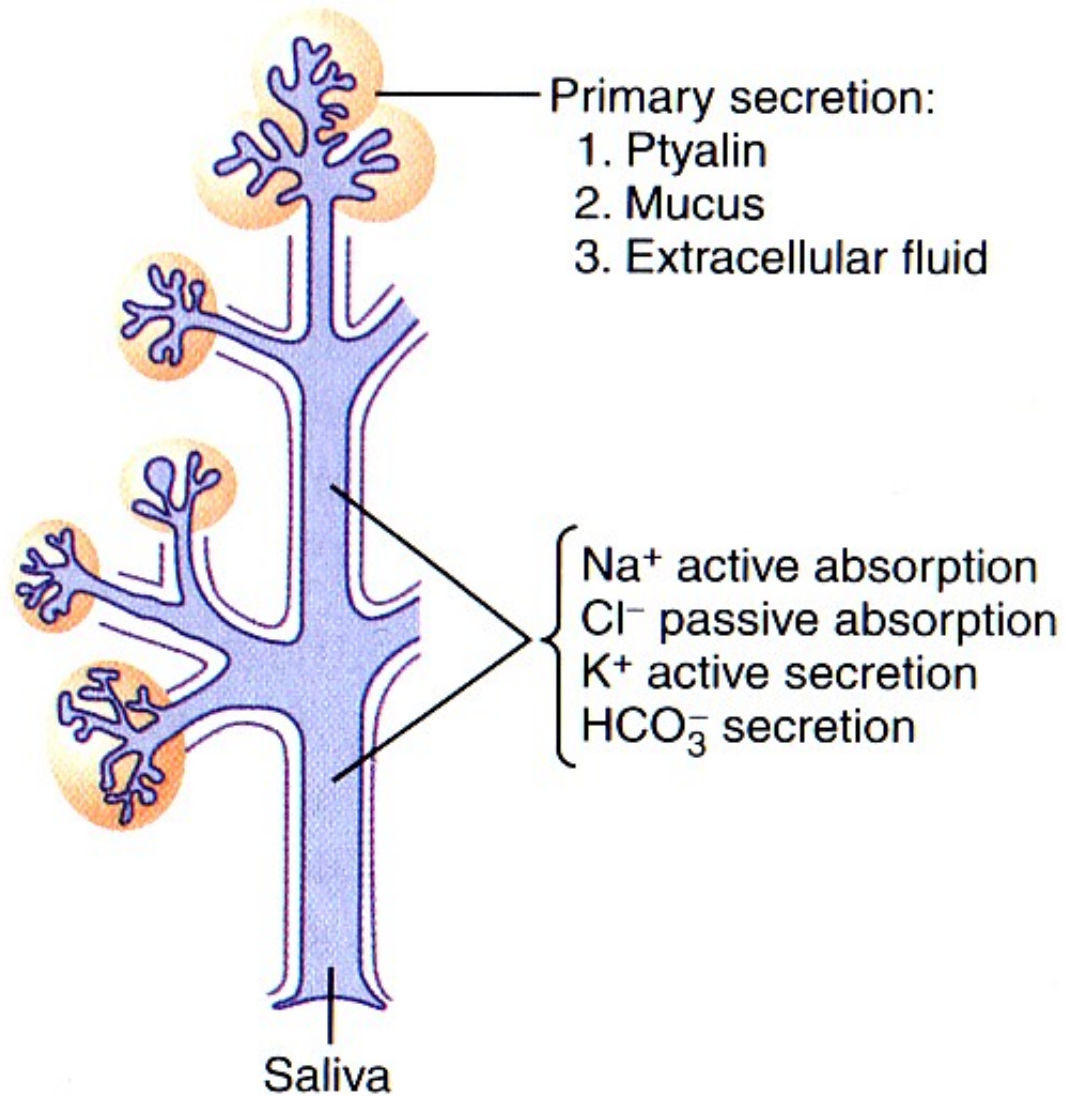


Figure 64-2 Formation and secretion of saliva by a submandibular salivary gland.

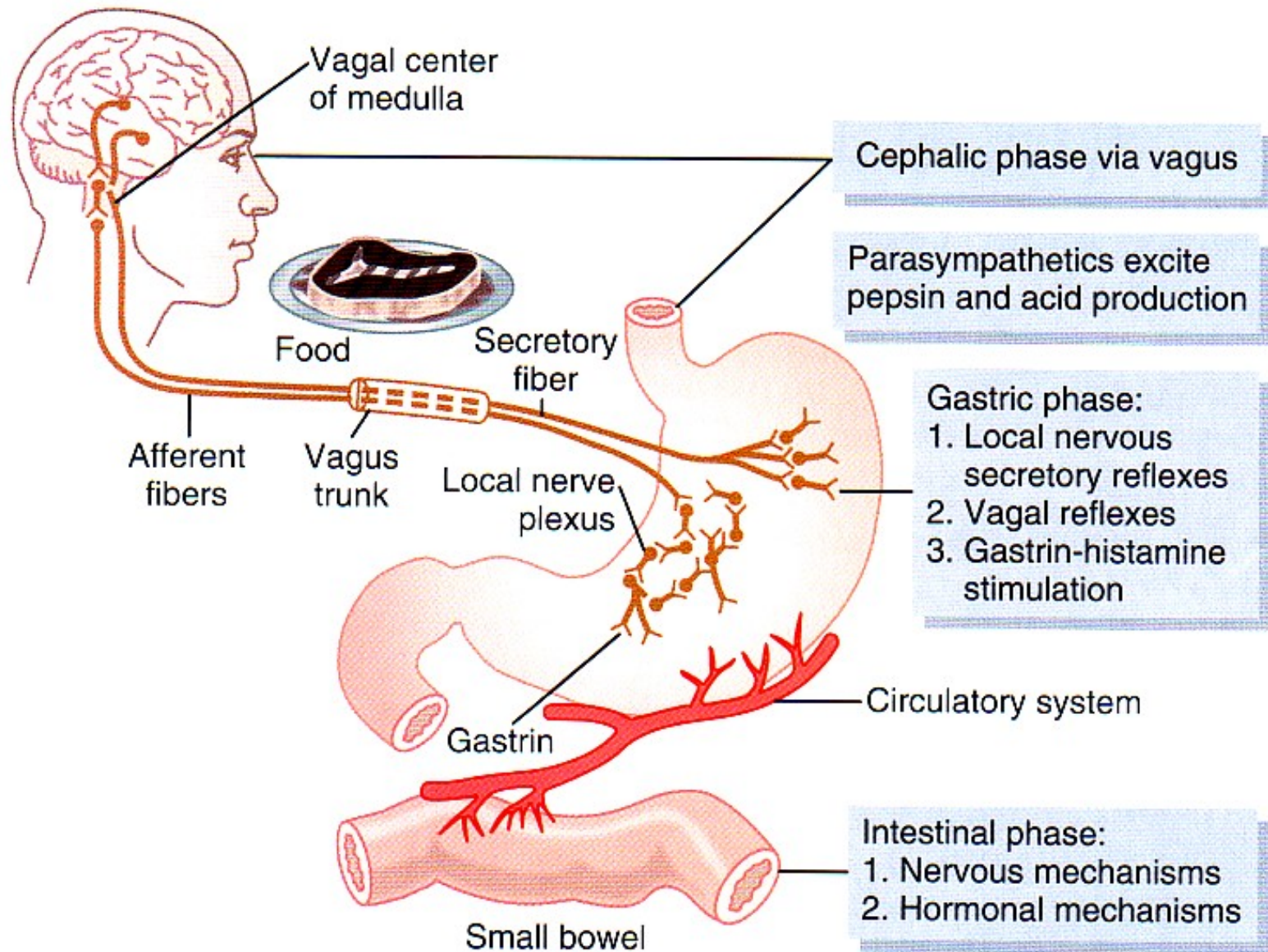


Figure 64-7 Phases of gastric secretion & their regulation. G&H 2011 p 780.

Hydrolysis of Energy Nutrients

...Central-linking theme!!

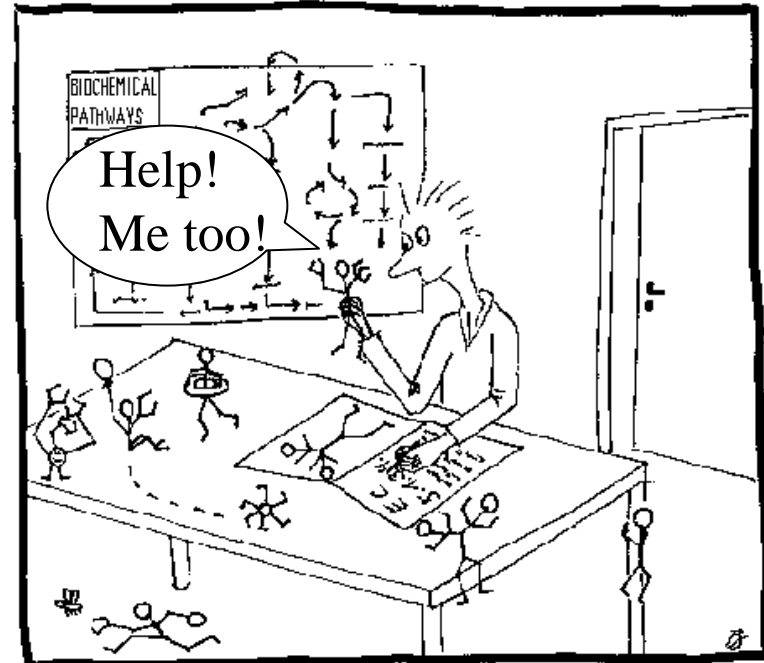


Hi gang!!
You need me
for digestion!!



+

The ENZYME data bank



H₂O

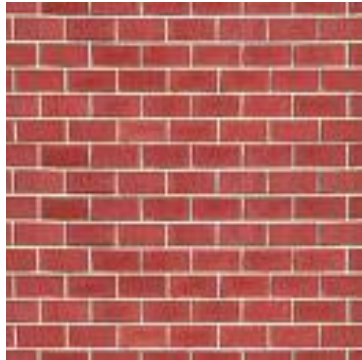
+

Enzyme

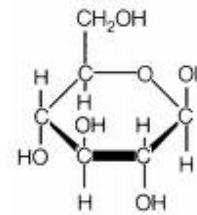
Polymer to Monomer (Many to One)



...Central-linking theme, again!!

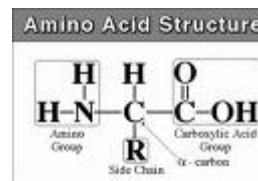


Carbohydrate

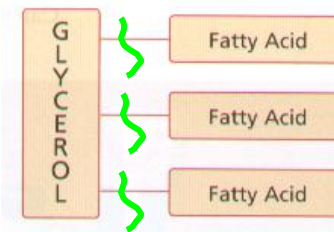


Glucose

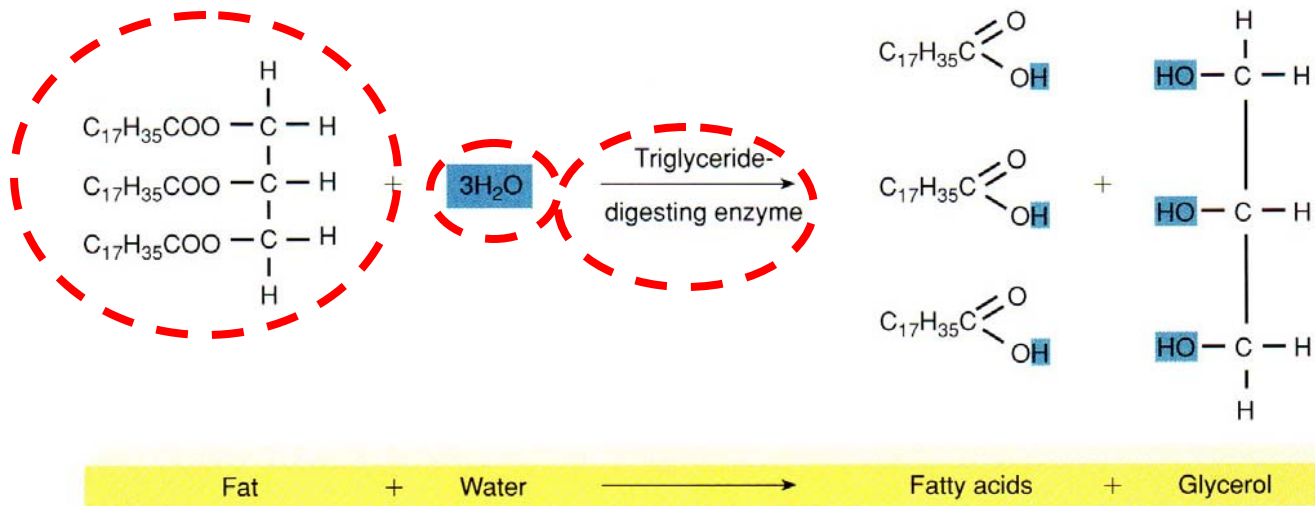
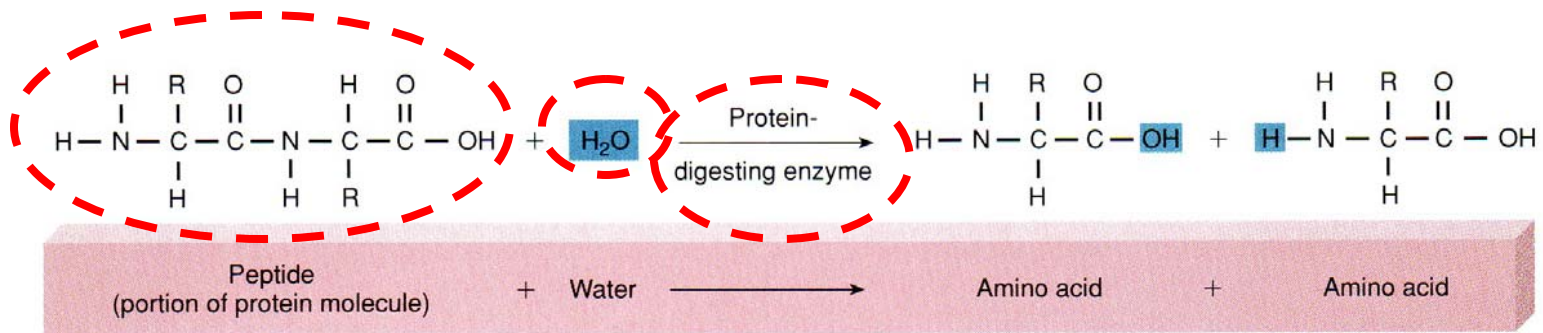
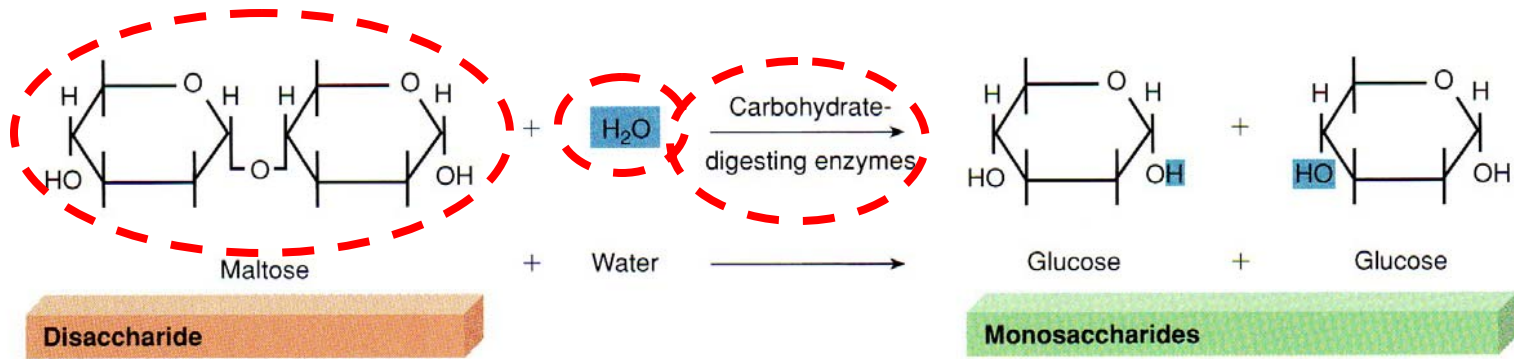
Protein
+
Fat



Amino Acids



Fatty Acids
+
Glycerol

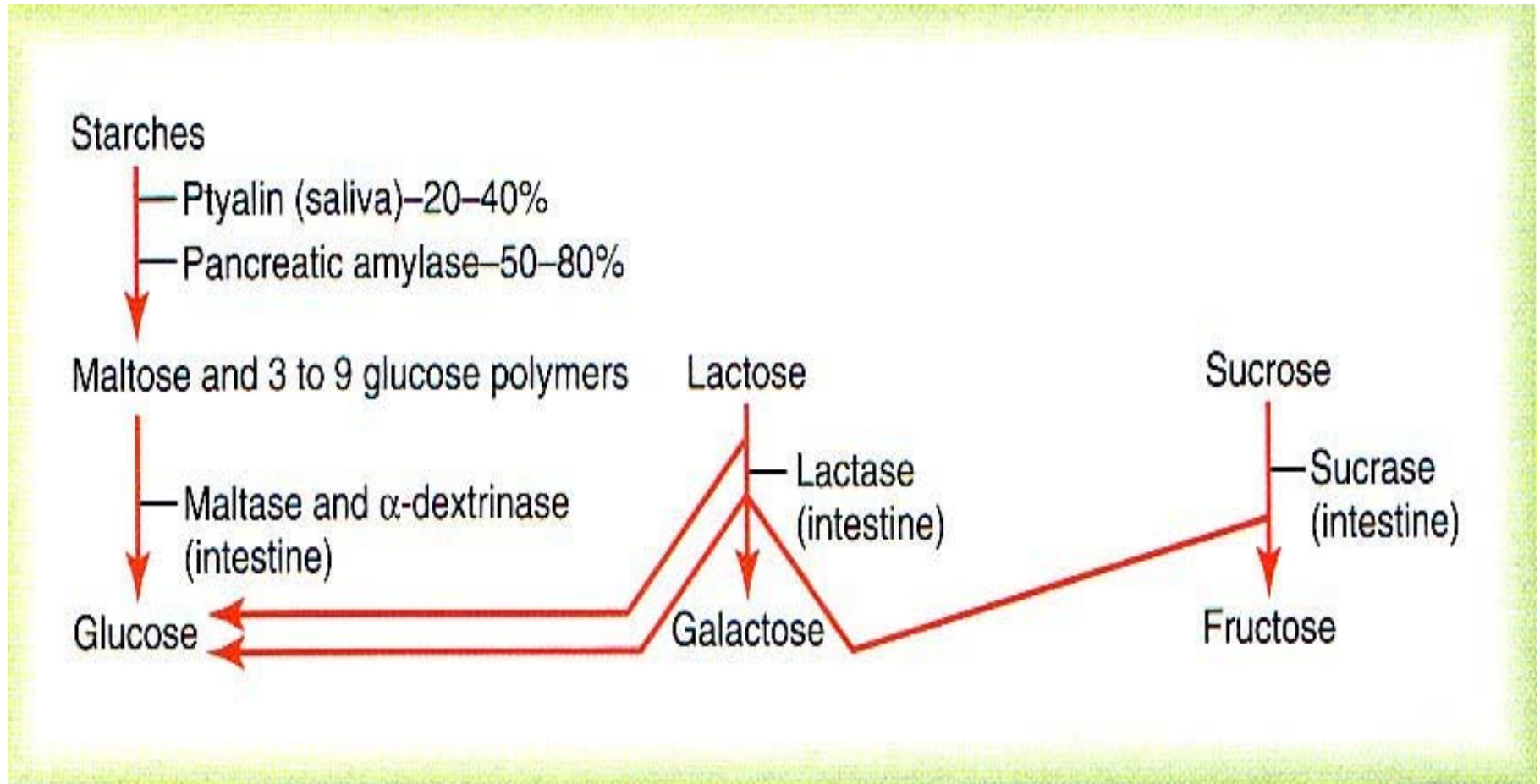


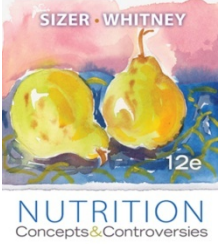
Carbohydrates in foods



Sizer & Whitney 2011 p 136

Carbohydrate Digestion = 1^o Energy Nutrient

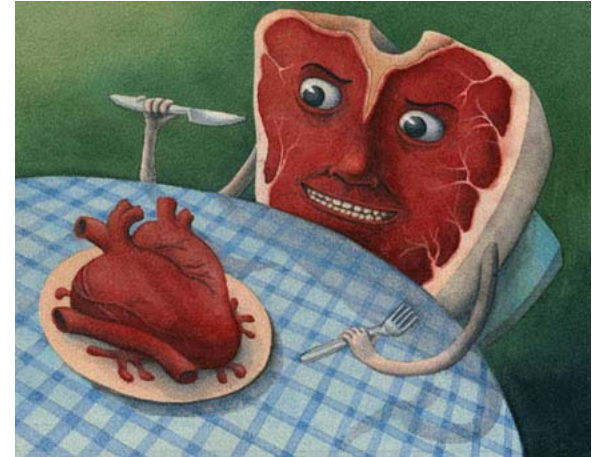




Why Do Some People Have Trouble Digesting Milk?

- 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

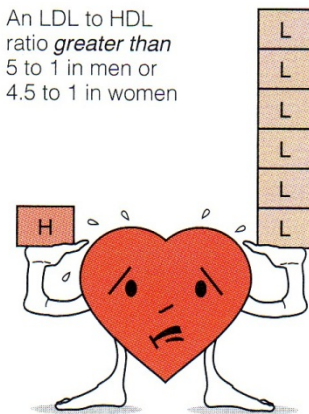




HIGH FAT FOODS



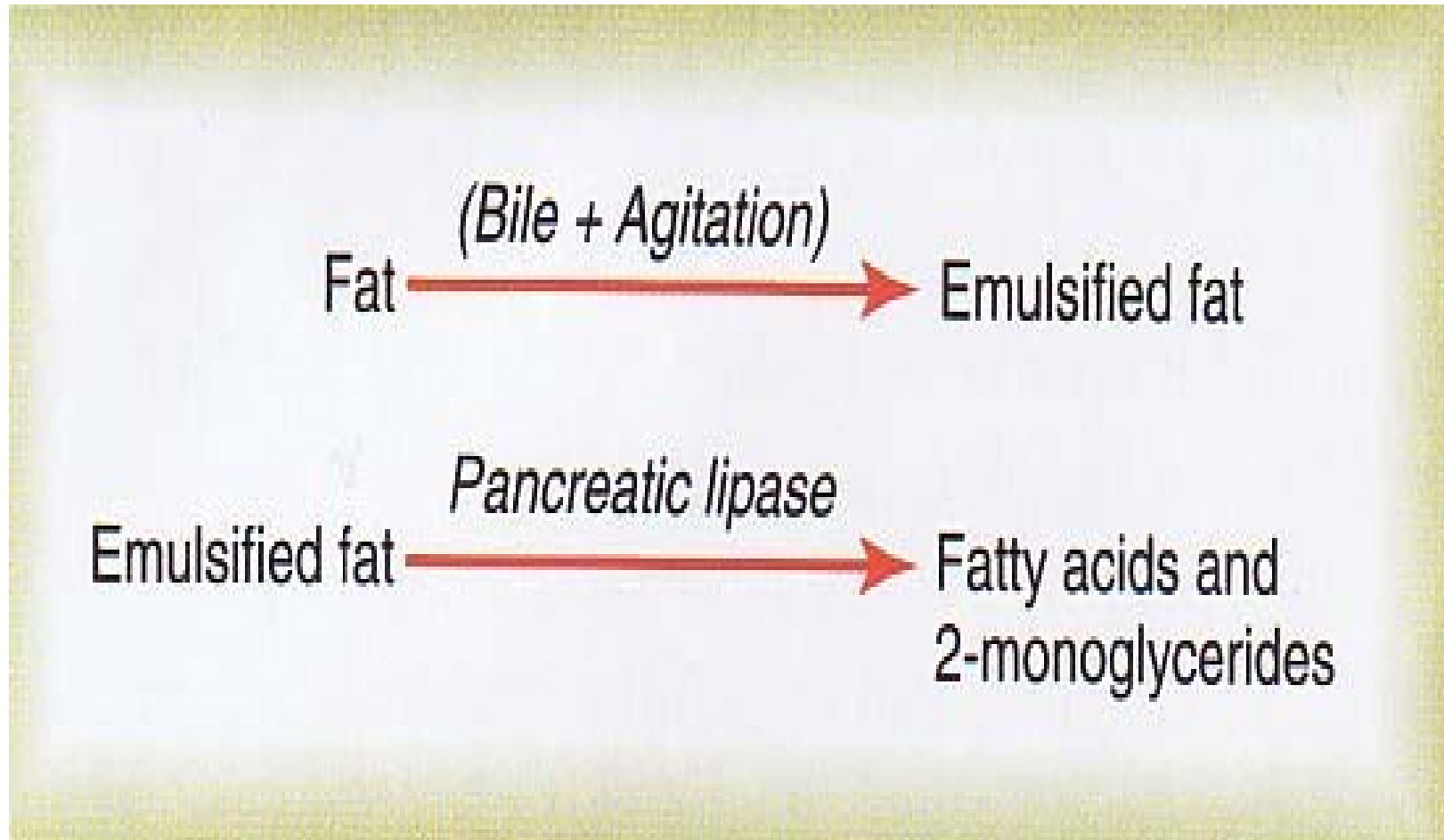
An LDL to HDL ratio *greater than* 5 to 1 in men or 4.5 to 1 in women

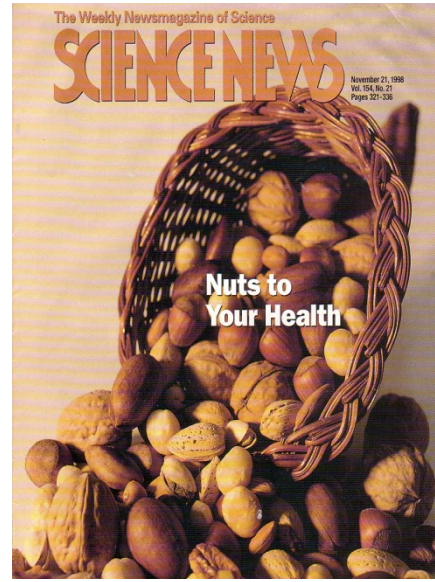


Increased risk of heart disease

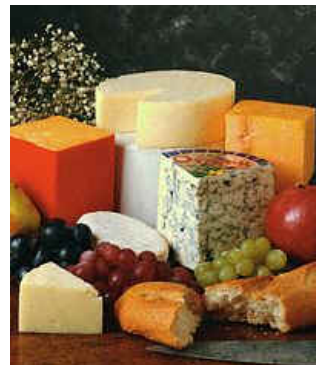
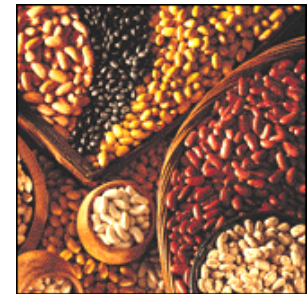


Fat Digestion = 2⁰ Energy Nutrient

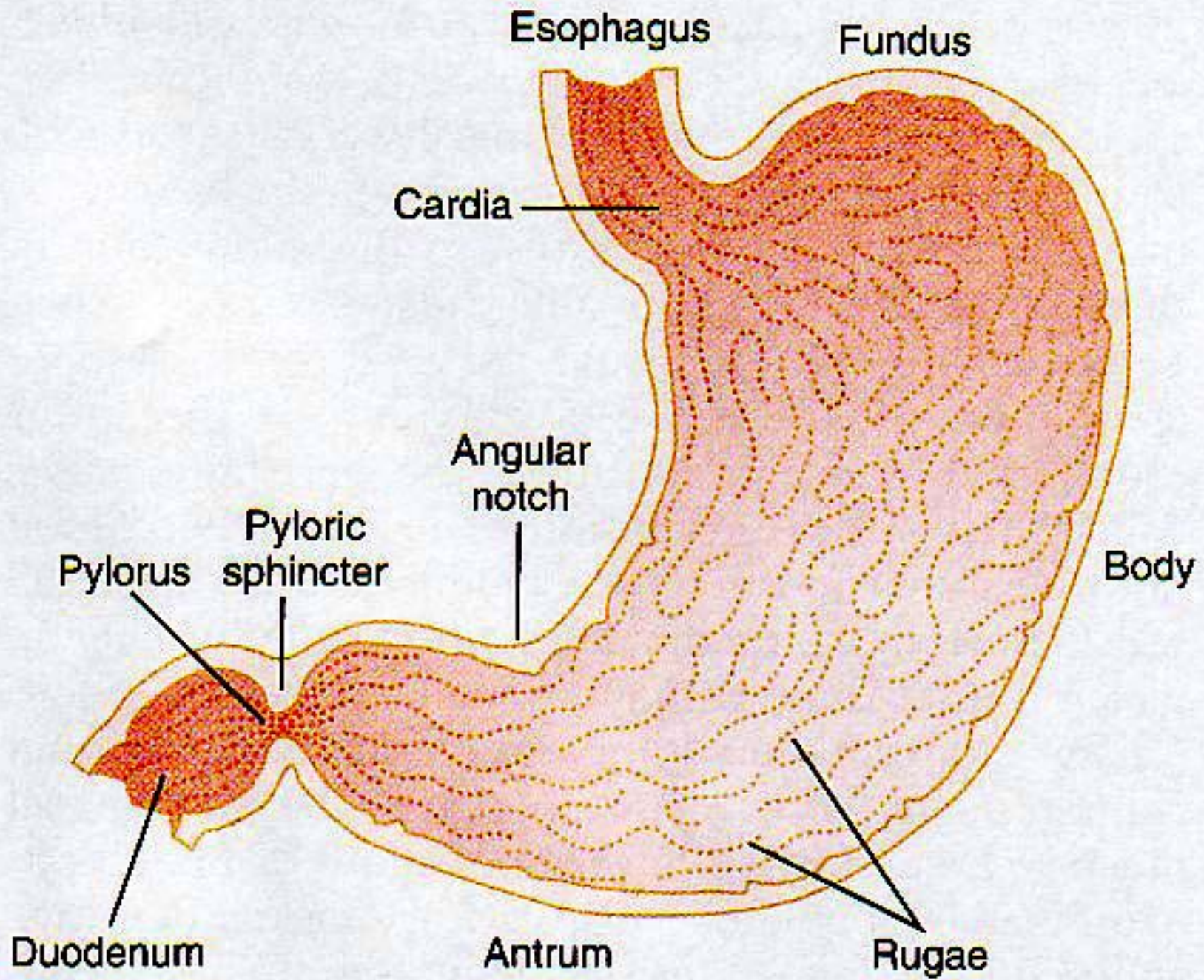




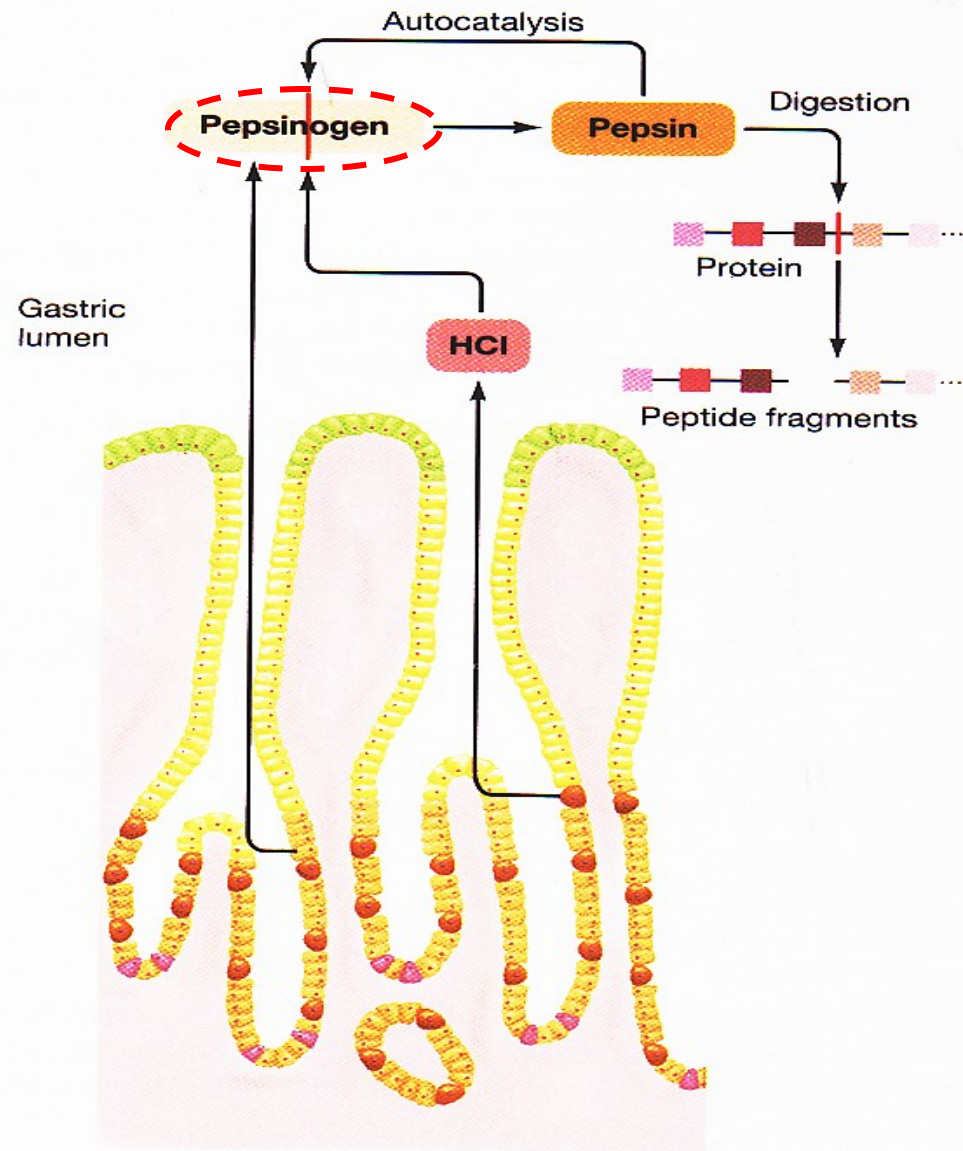
HIGH PROTEIN (FAT?) FOODS?



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



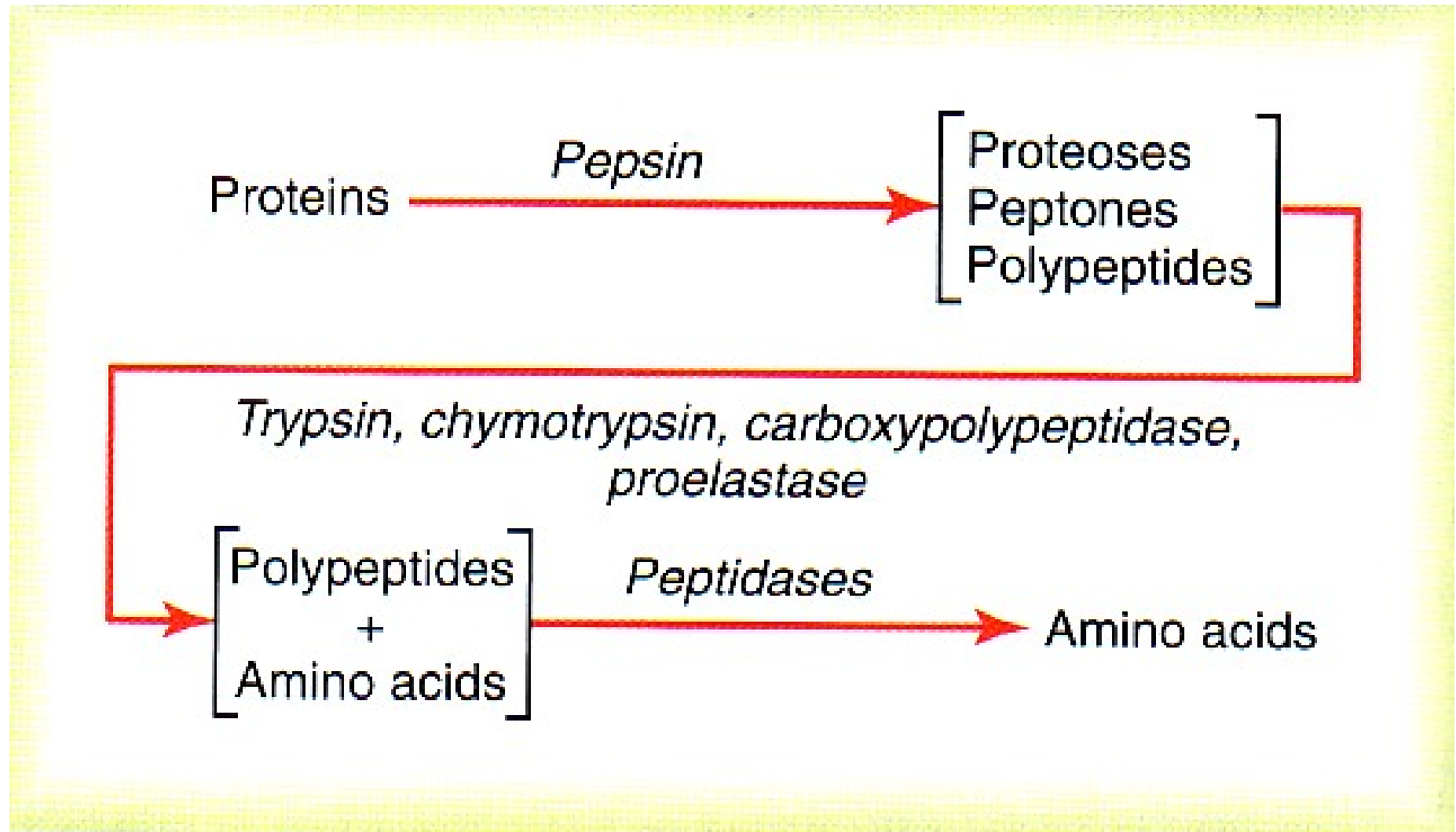
Zymogen
= *inactive precursor*



■ ■ ■ = Various amino acids

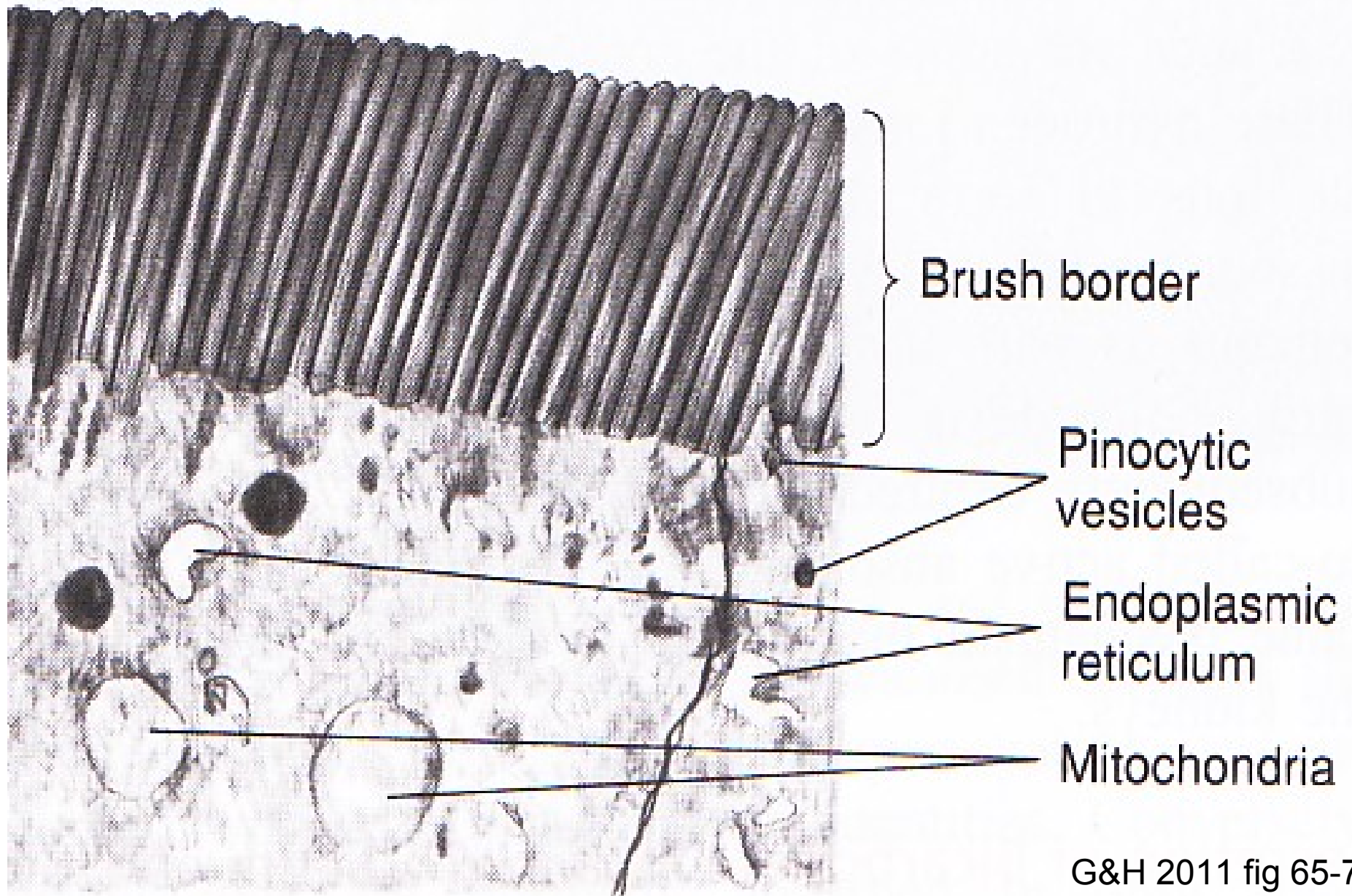
| = Enzymatic splitting of a chemical bond

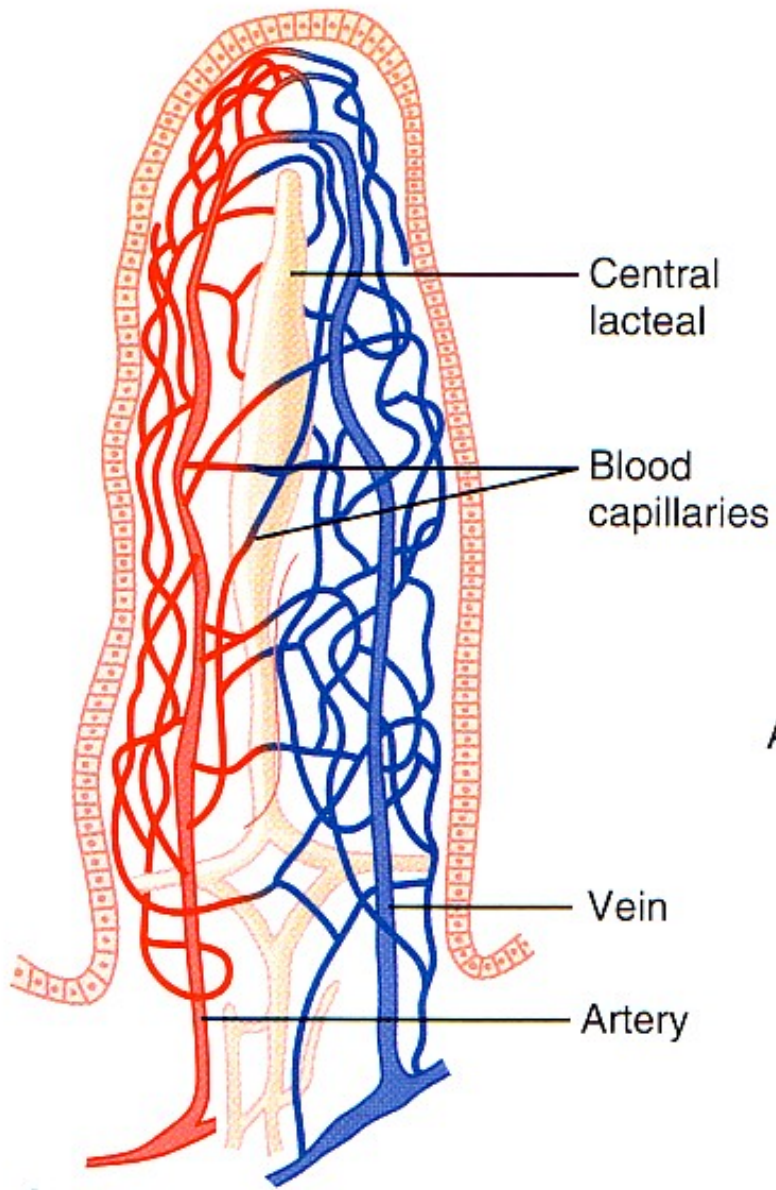
Protein Digestion = 3⁰ Energy Nutrient



What is the major
function of the
small intestine?

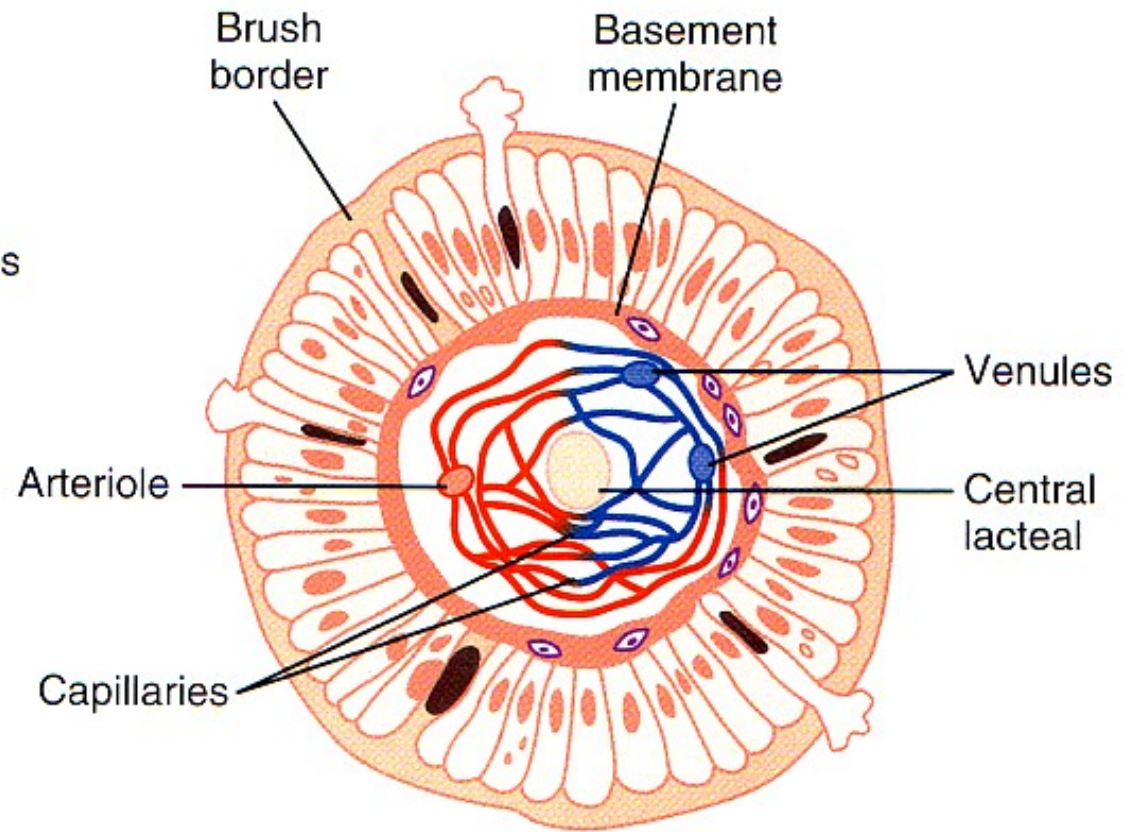
Absorption!!





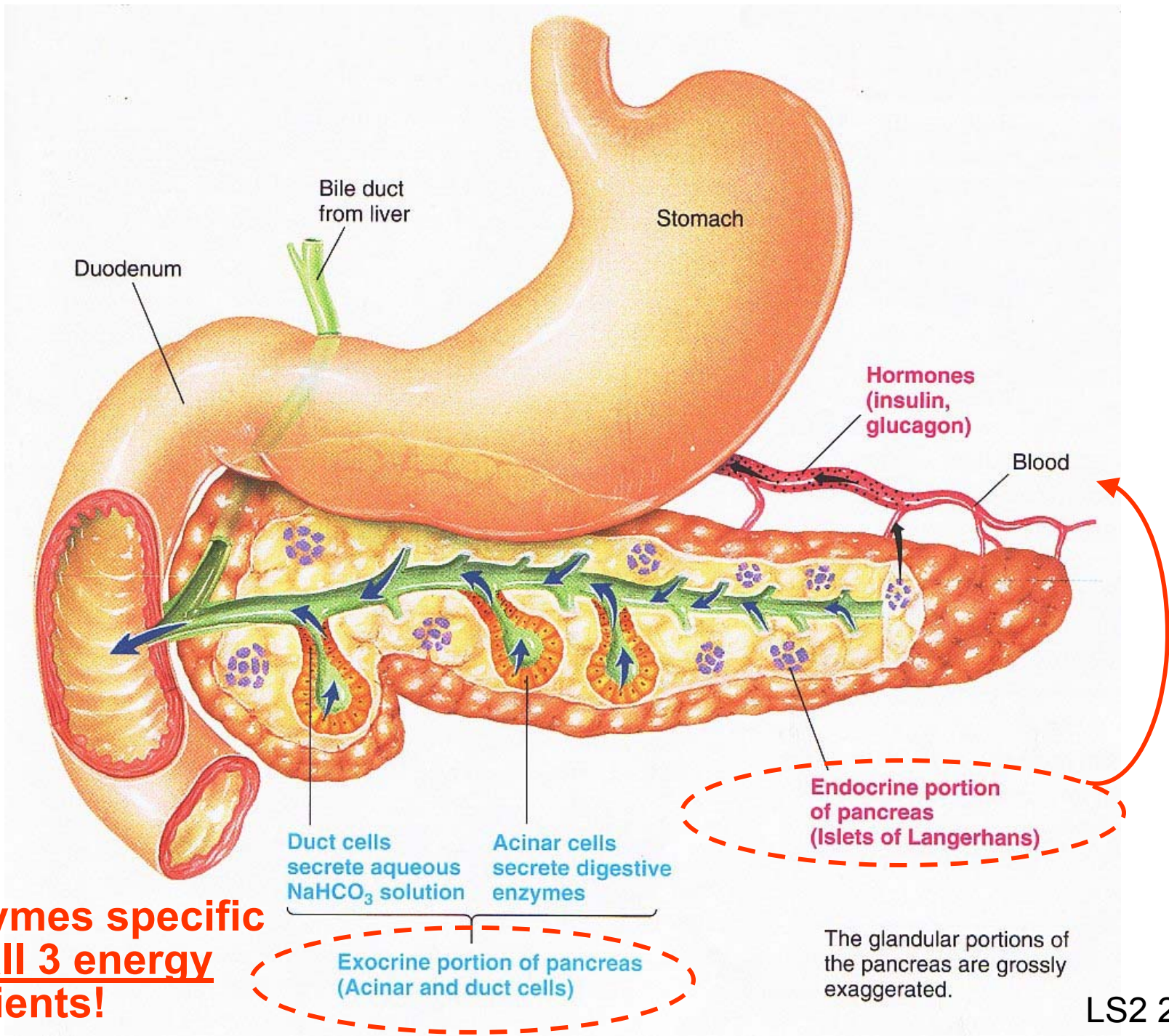
A

G&H 2011 fig 65-6



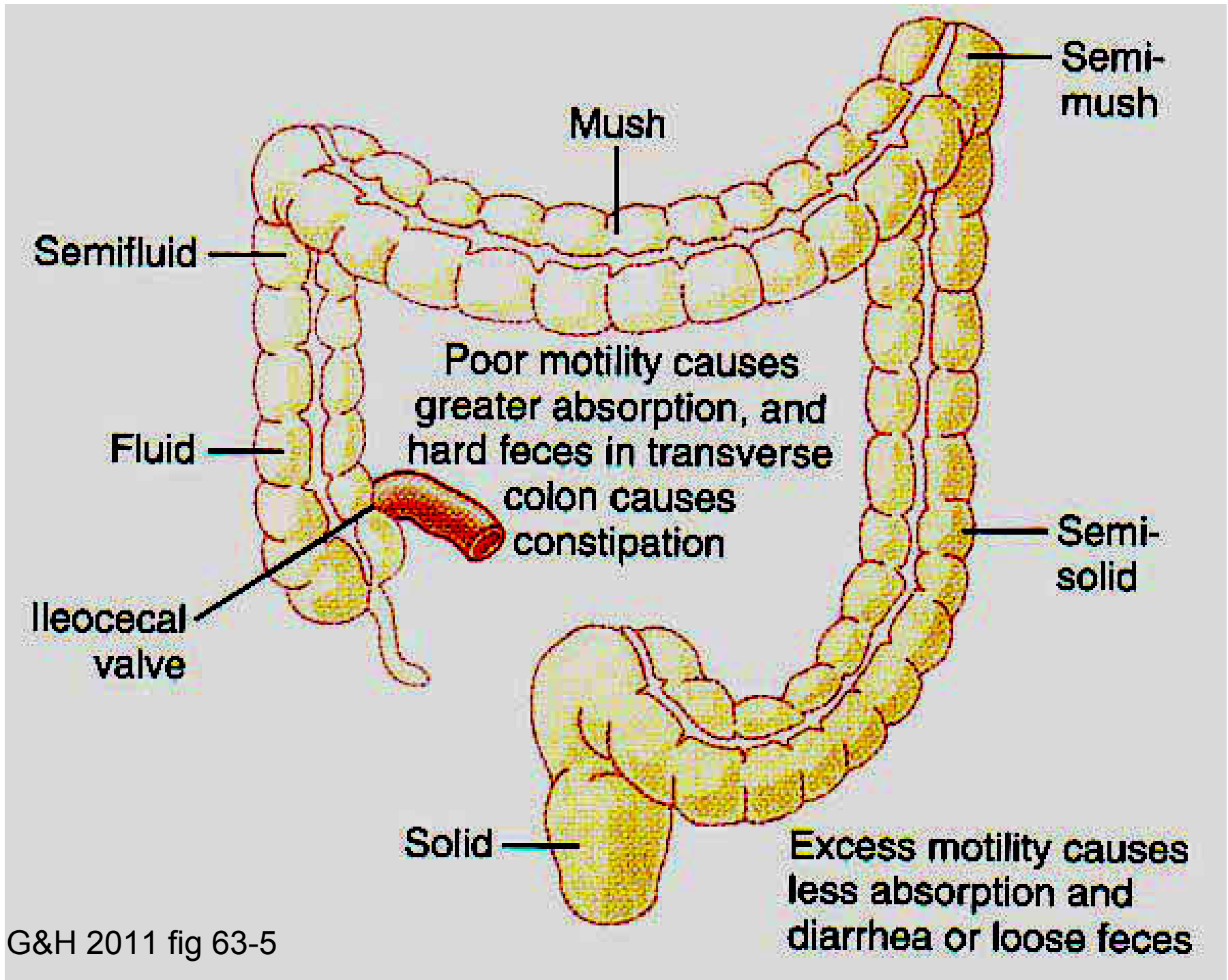
B

**Why is the
pancreas so
unique?**



Enzymes specific for all 3 energy nutrients!

The glandular portions of the pancreas are grossly exaggerated.



G&H 2011 fig 63-5

Questions Discussion?

