

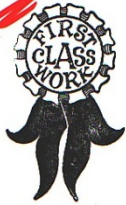
We're almost 1/5 finished! Learn & enjoy every moment!...



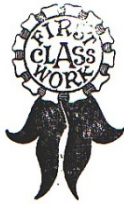
## BI 358 Lecture 4

- I. Announcements Updates on Outlines & Quiz 1? Quiz Key posted in the glass box near 112 HUE. Next T *Nutritional Analyses*; Record  $\geq 1$  day of your diet on p 4-8 of DLN.
- 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  $\mu$ -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 +  $\Delta$ 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

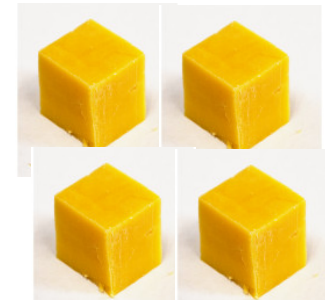


≡

4 oz → 3 oz



raw → cooked



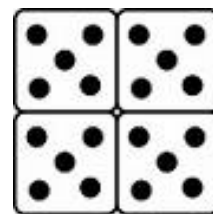
or



≡ 1 c



≡ 1/3 c



≡ 1 oz

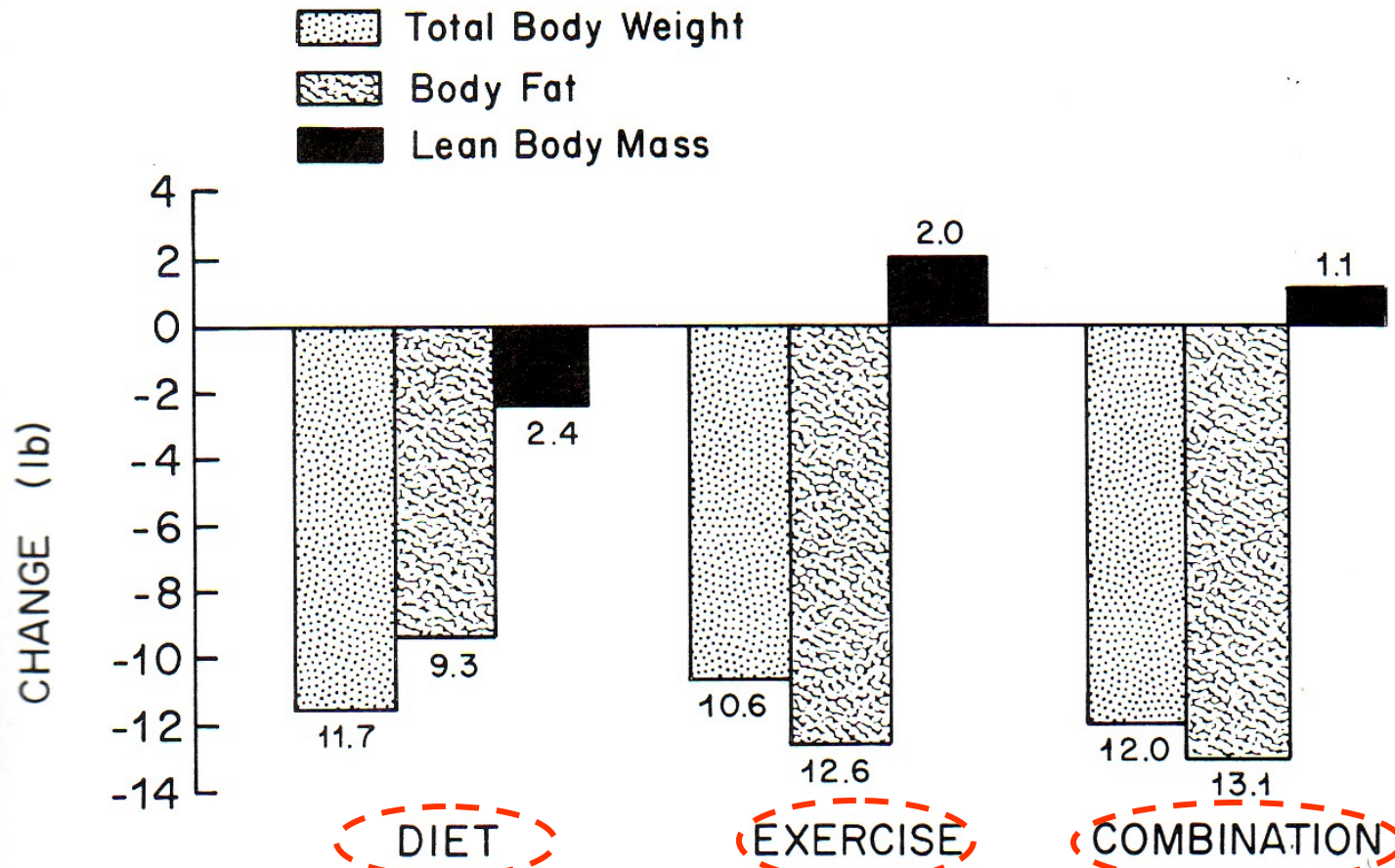


≡ 1/4 c



≡ 1.5 oz





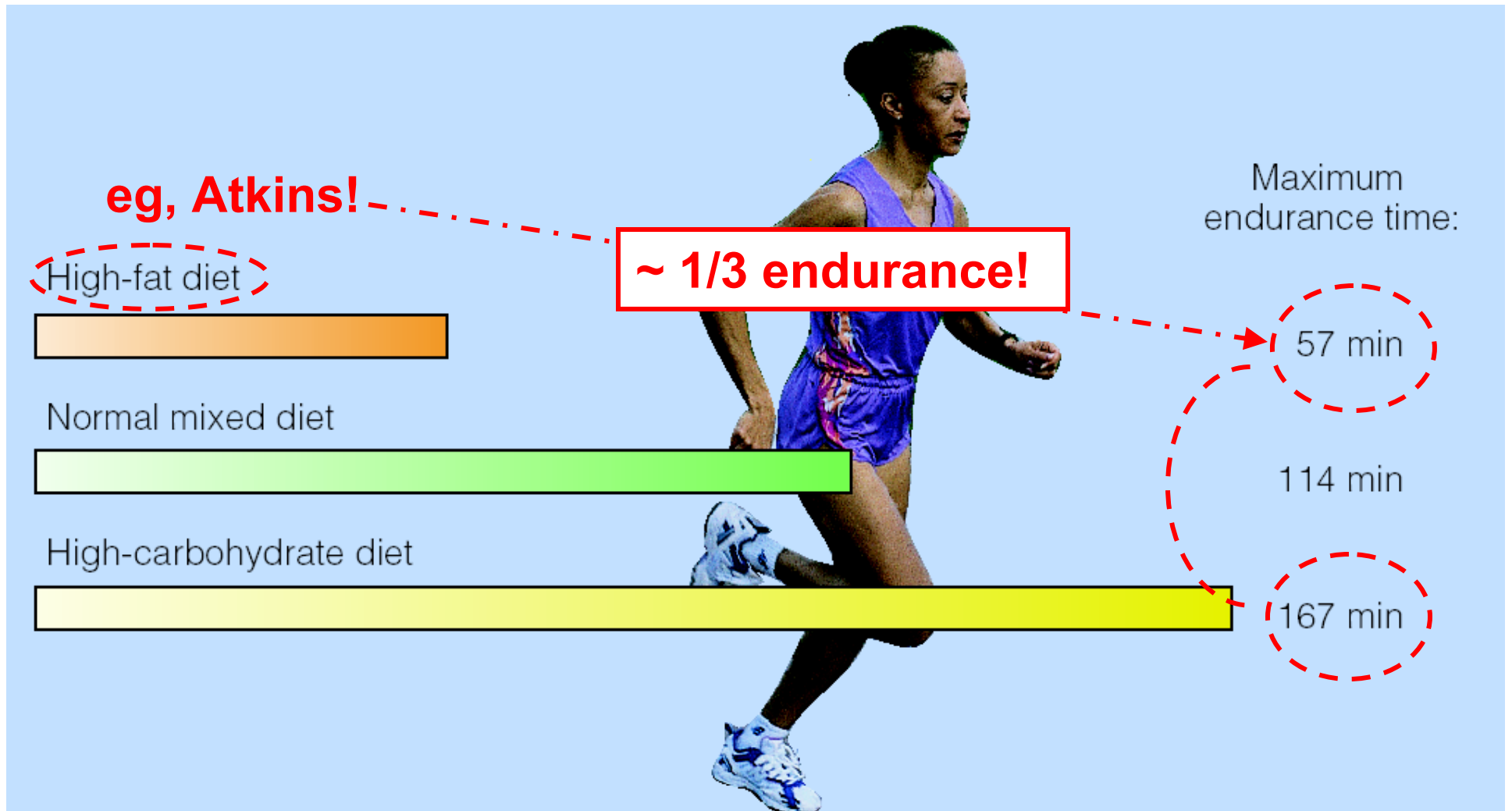
**Figure 4-9.** Changes in body weight, body fat, and lean body weight for diet, exercise, and combination groups. (From Zuti W. B., and Golding, L. A.: Comparing diet and exercise as weight reduction tools. *Phys. Sportsmed.* 4:49-53, 1976.)

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



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

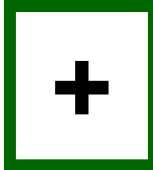
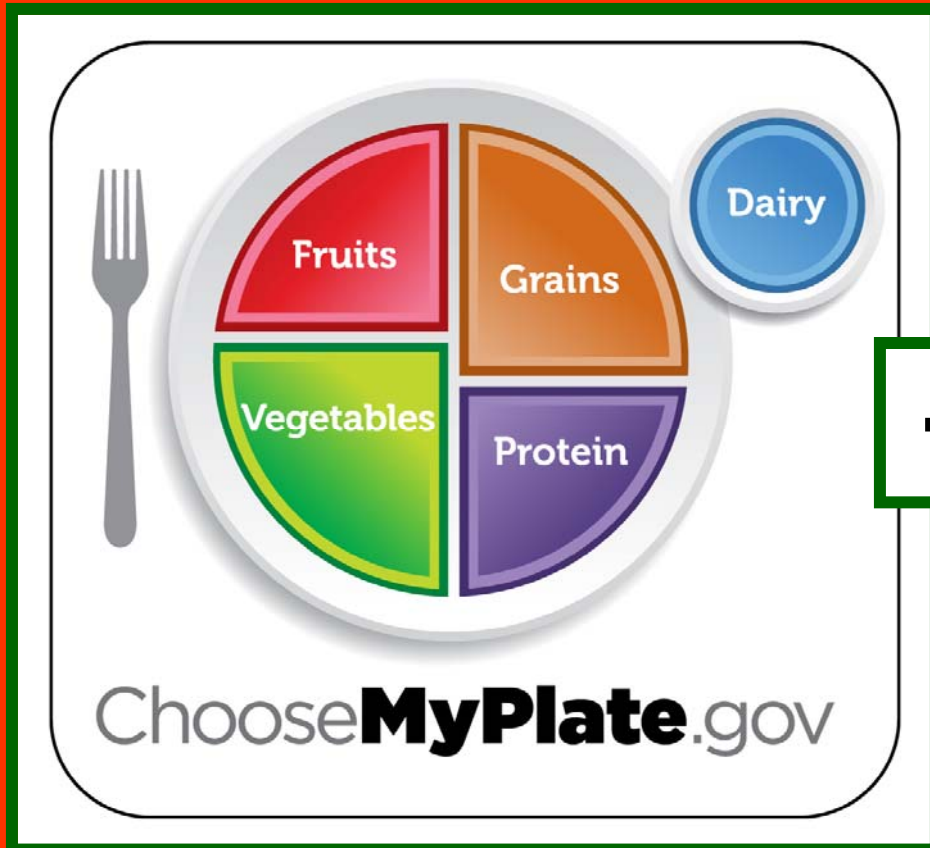
# Dietary Composition & Physical Endurance



# *Tedium of Metabolic Lab & Dietary Research*



## Discussion 4: Nutritional Analyses via 2 Programs

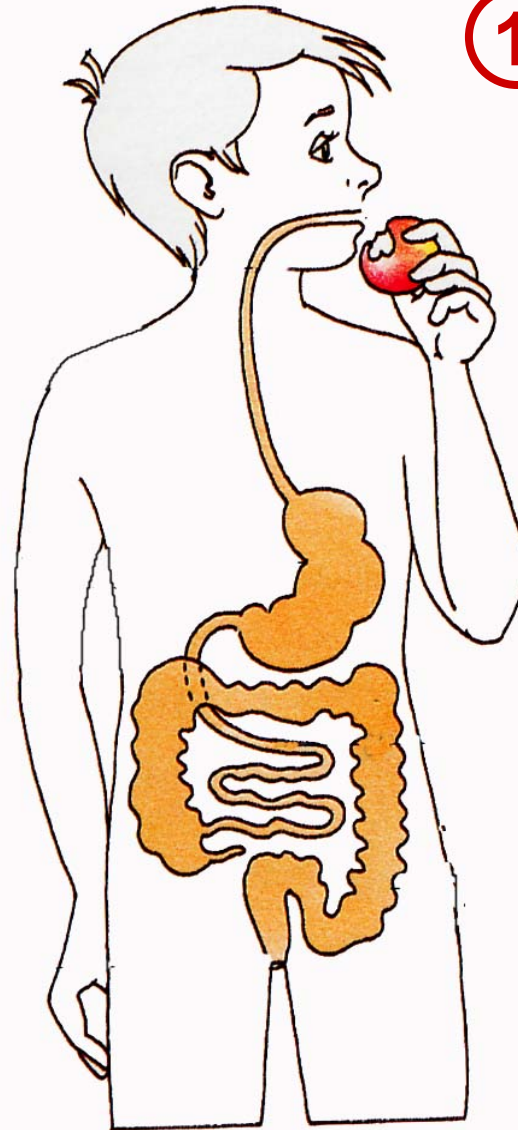


# Diet Analysis+

VERSION 8.0

- **The Most Extensive Database Ever** provides over 20,000 easy-to-find foods, including most common foods, popular brands, regional favorites, international foods, and vegetarian options.
- **“How Big Is a Serving” Tips**, based on the MyPyramid recommendations, are linked on the screen where students need help.
- **Trans fats** include the most up-to-date information available, and are displayed in all reports.
- **MyPyramid** values include the latest USDA updates, and show actual intake in all categories, including Discretionary calories.
- **The 3-Day Average Wizard** lets you print the most common assignment in one step.

# Digestion Steps



① Ingestion

② Mechanical Digestion

③ Chemical Digestion

④ Peristalsis

⑤ Absorption

⑥ Storage

⑦ Defecation

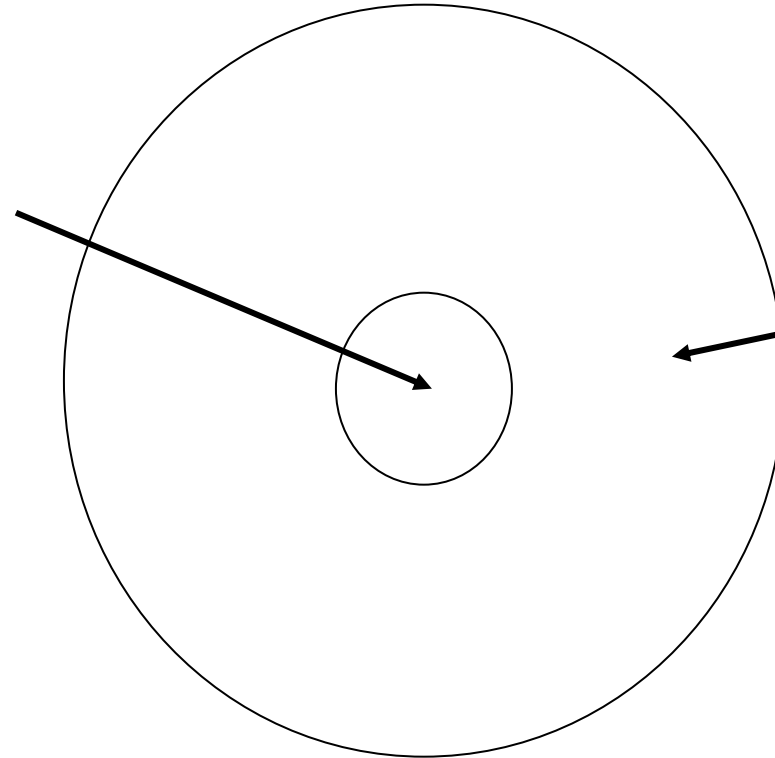
**SOURCE:** Dr. Eugene Evonuk, 1989. cf. L Sherwood, 2012 pp 437-8.



# GI-Doughnut Analogy



**GI Lumen**

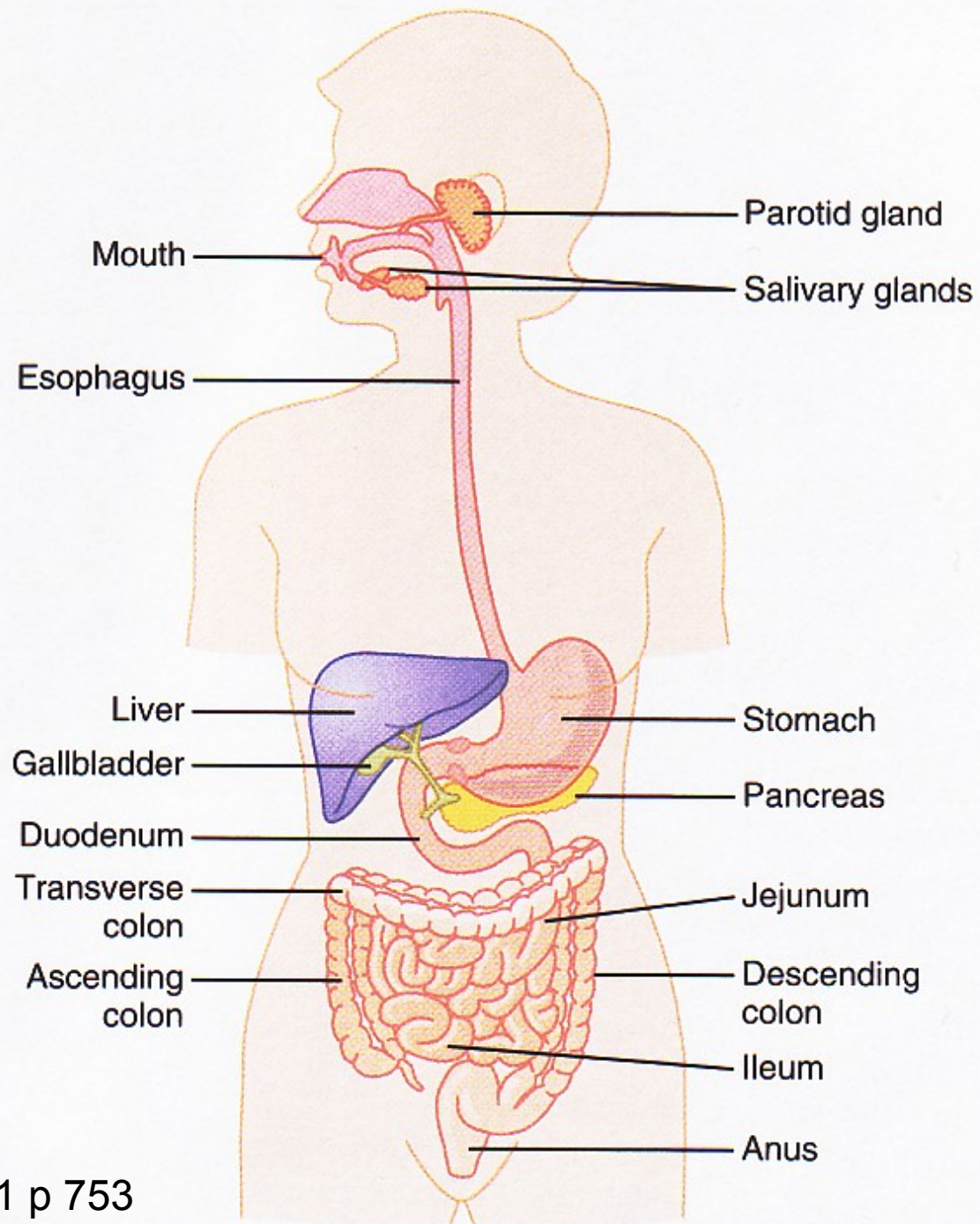


**Body**



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

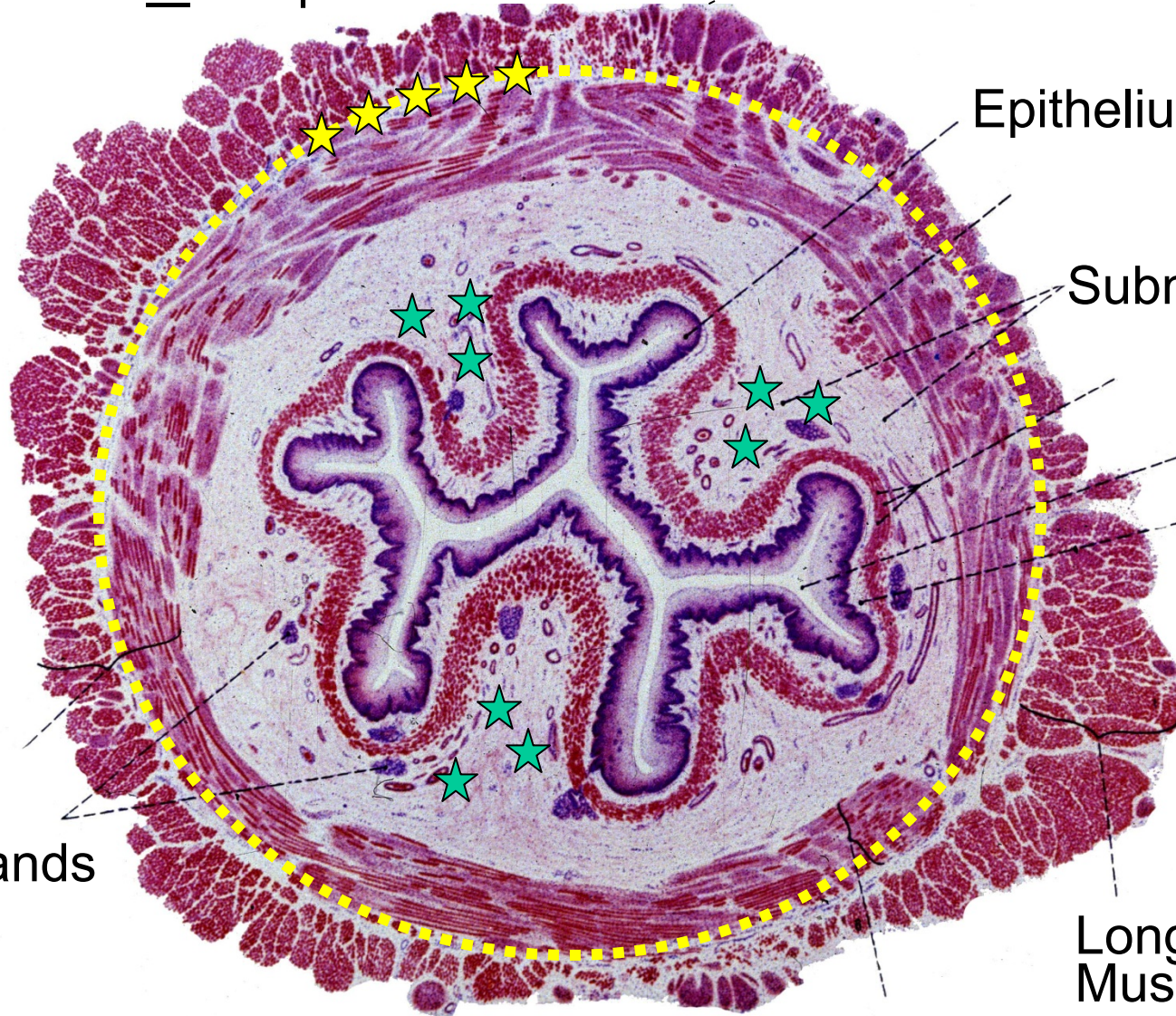
Glands

Longitudinal  
Muscle

★ Meissner's sensory & secretory plexus!

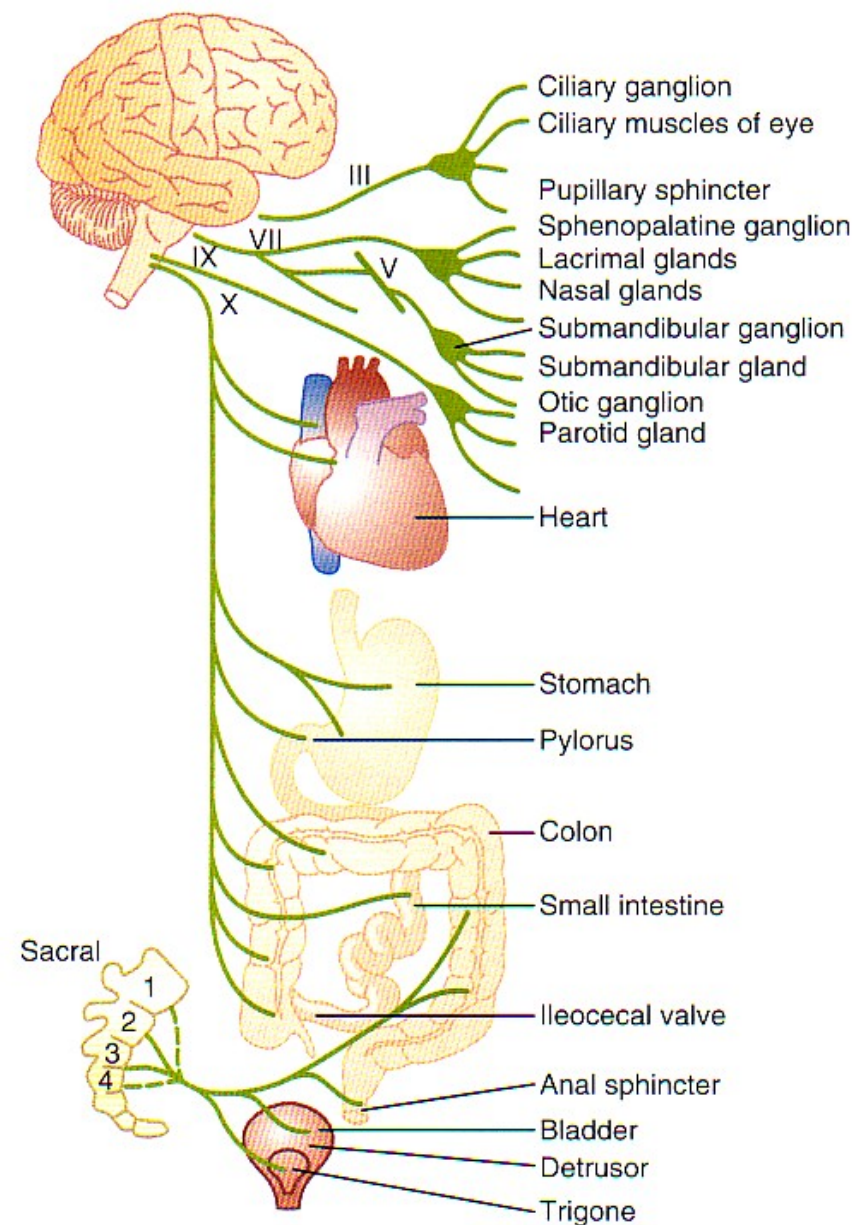
Circular  
Muscle

H Howard 1990



# Parasympathetic Branch Activates the Gut!

NERVOUS



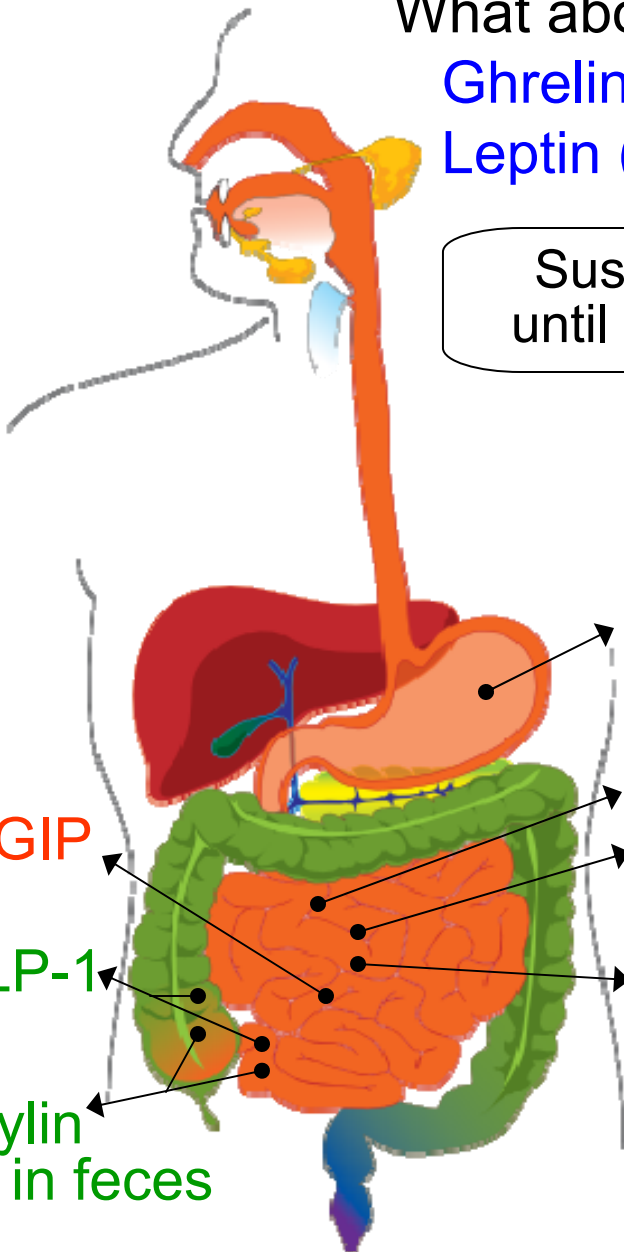
**HORMONAL**

What about feedback for hunger-satiety?

Ghrelin (stomach fundus, pancreas,...)

Leptin (adipocytes)

Suspense – until next time!



Gastrin → HCl, Pepsinogen by stomach

Motilin → ↑ Motility

Secretin → HCO<sub>3</sub><sup>-</sup>, H<sub>2</sub>O by pancreas

Cholecystikinin → Gallbladder contraction + Pancreatic enzymes

↓ Motility ← GIP  
↑ Insulin

↓ Motility ← GLP-1  
↑ Insulin

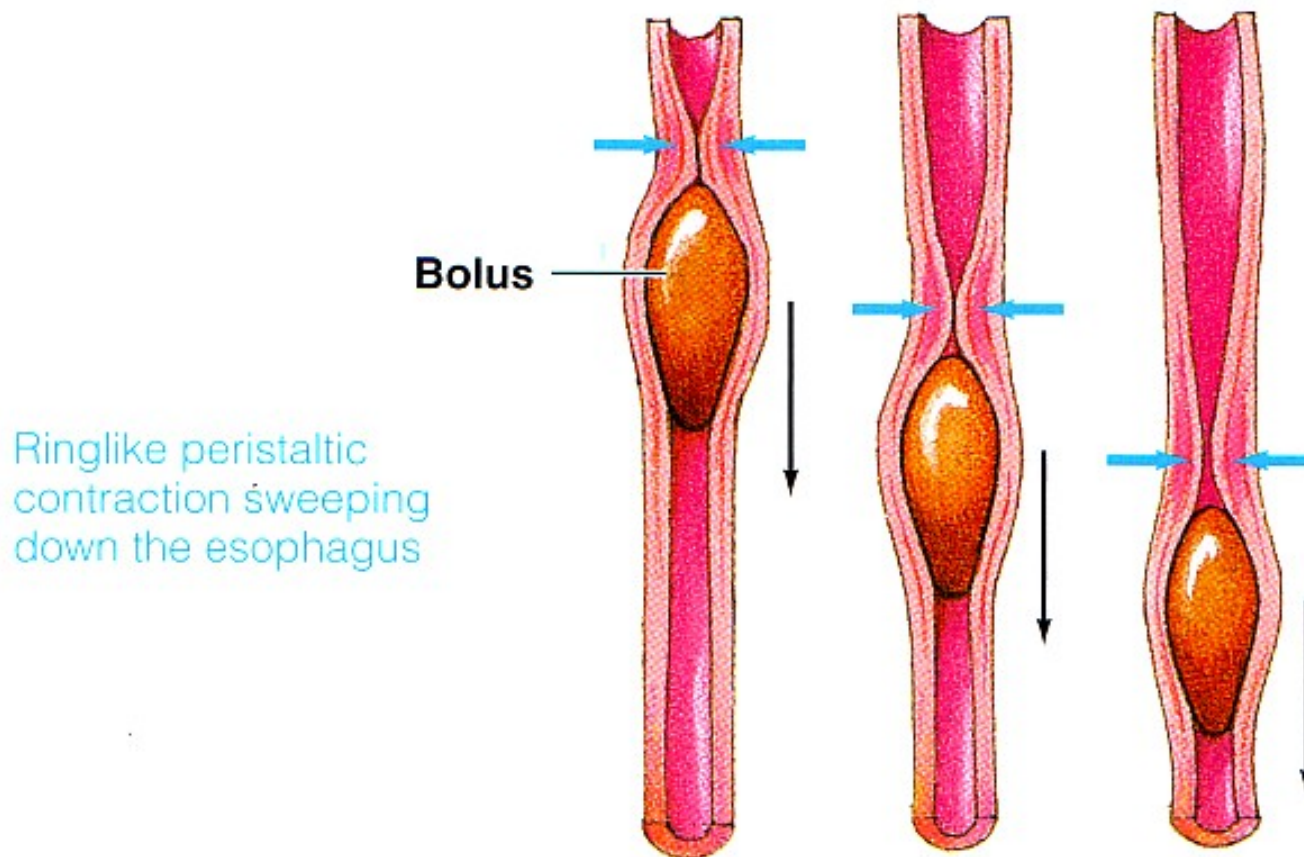
↑ Cl<sup>-</sup> ← Guanylin  
↑ NaCl + H<sub>2</sub>O in feces

● **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.



# ***Gut Secretions***

## ***Secretion***

## ***Release Site***

**1. Mucus**

**into GI Lumen**

**2. Enzymes**

**into GI Lumen**

**3. H<sub>2</sub>O, acids, bases+**

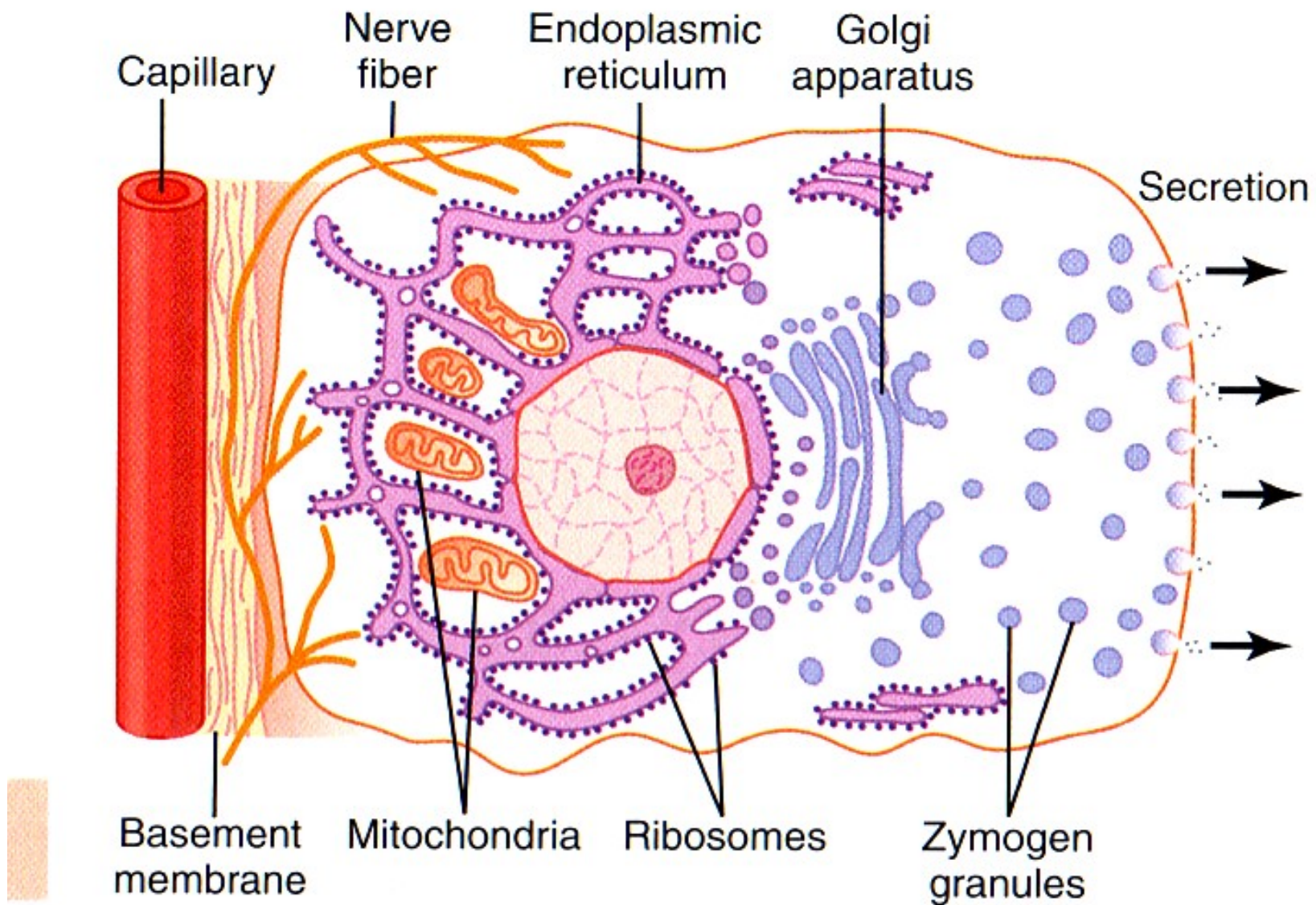
**into GI Lumen**

**4. Hormones**

**into Blood**

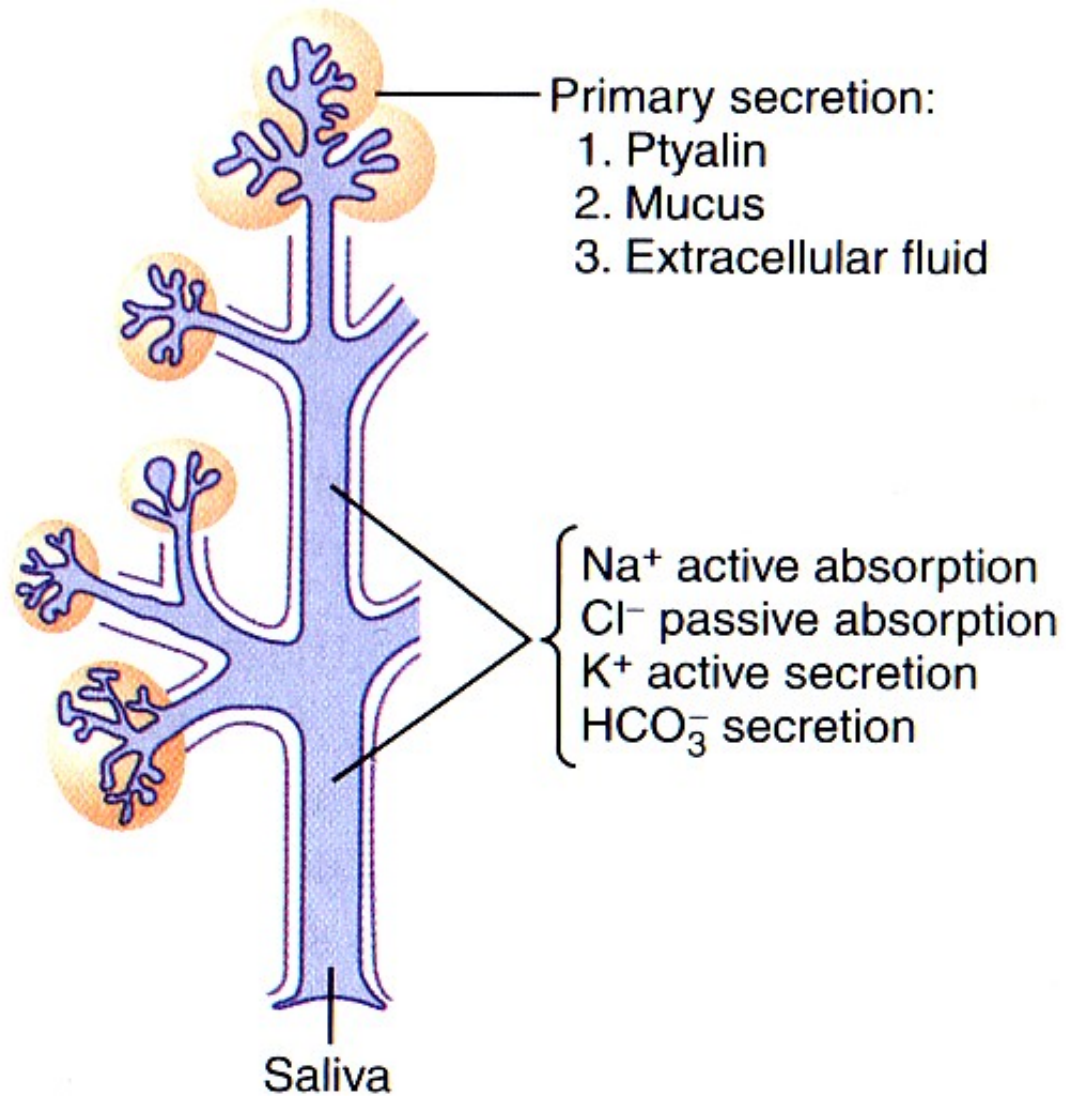
**Table 64-1** Daily Secretion of Intestinal Juices

	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	

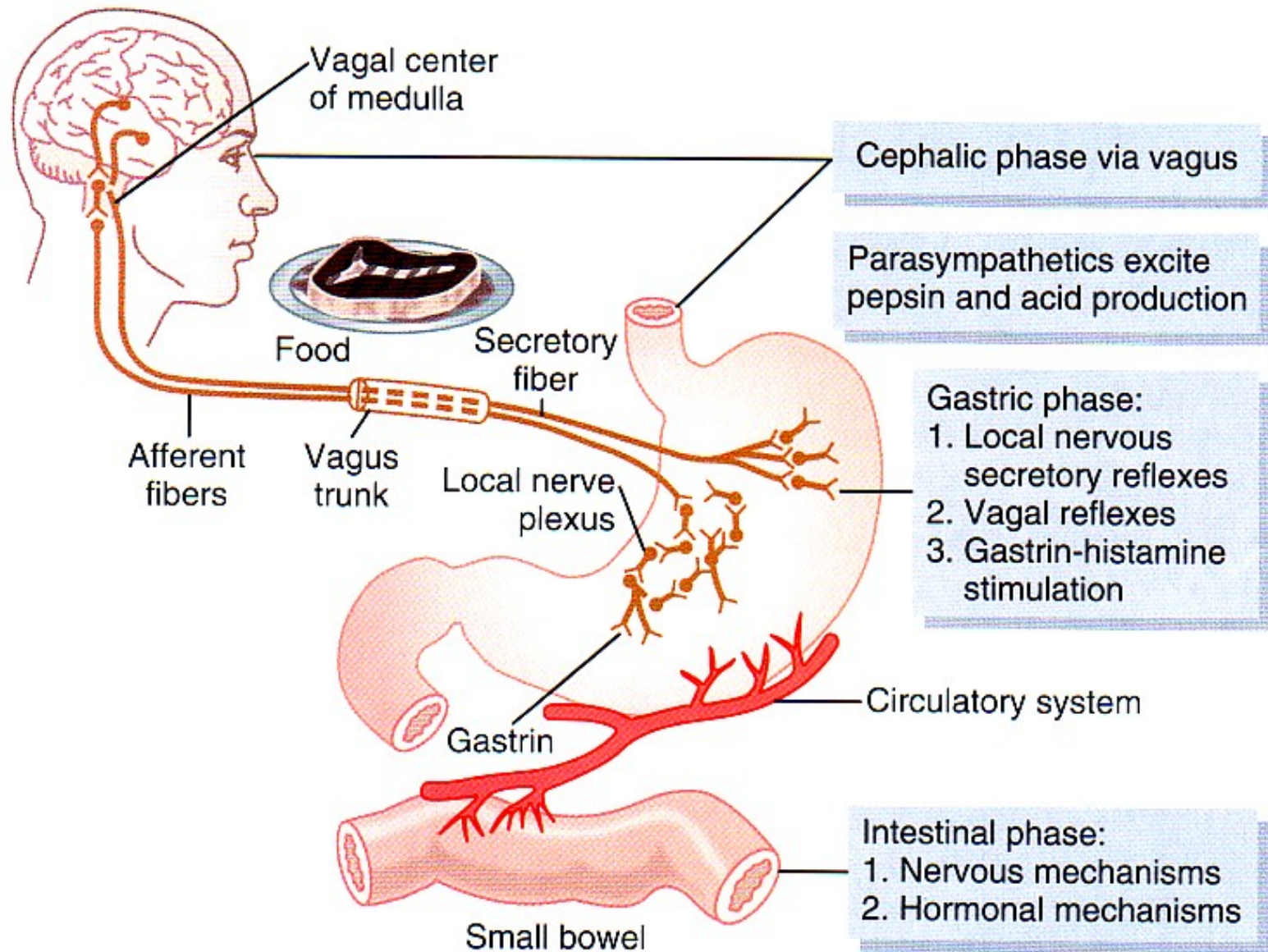


**Figure 64-1** Typical function of a glandular cell for formation and secretion of enzymes and other secretory substances.





**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!!

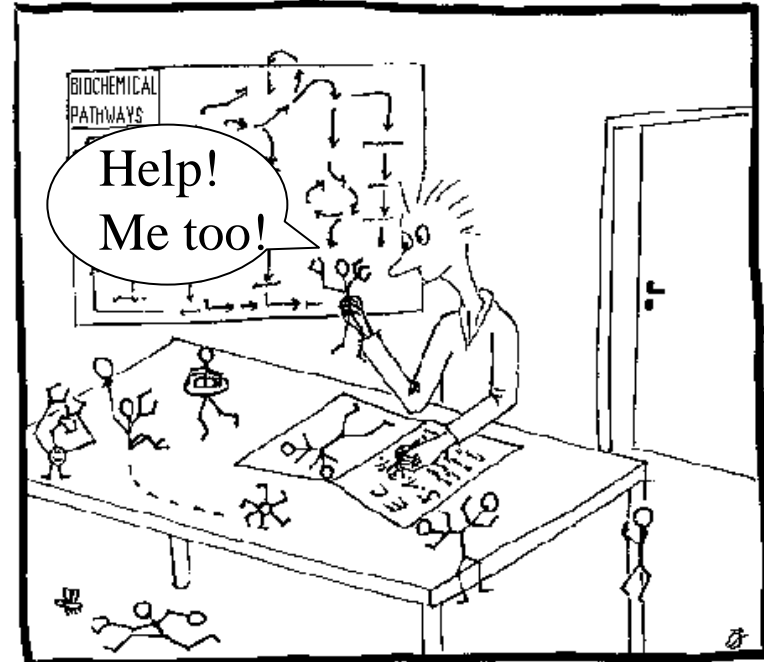


Hi gang!!  
You need me  
for digestion!!



+

*The ENZYME data bank*



H<sub>2</sub>O

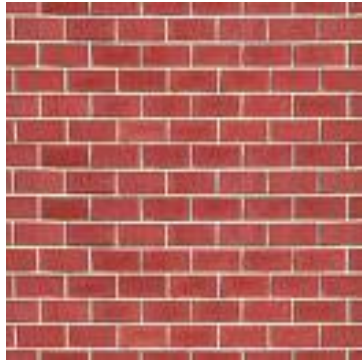
+

Enzyme

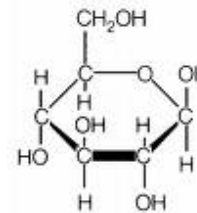
# Polymer to Monomer (Many to One)



...Central-linking theme, again!!

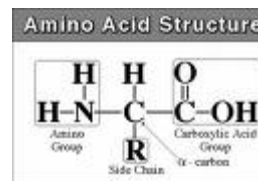


Carbohydrate

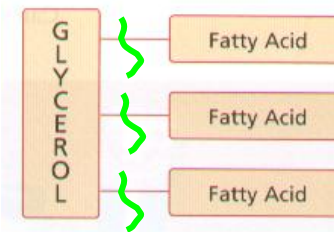


Glucose

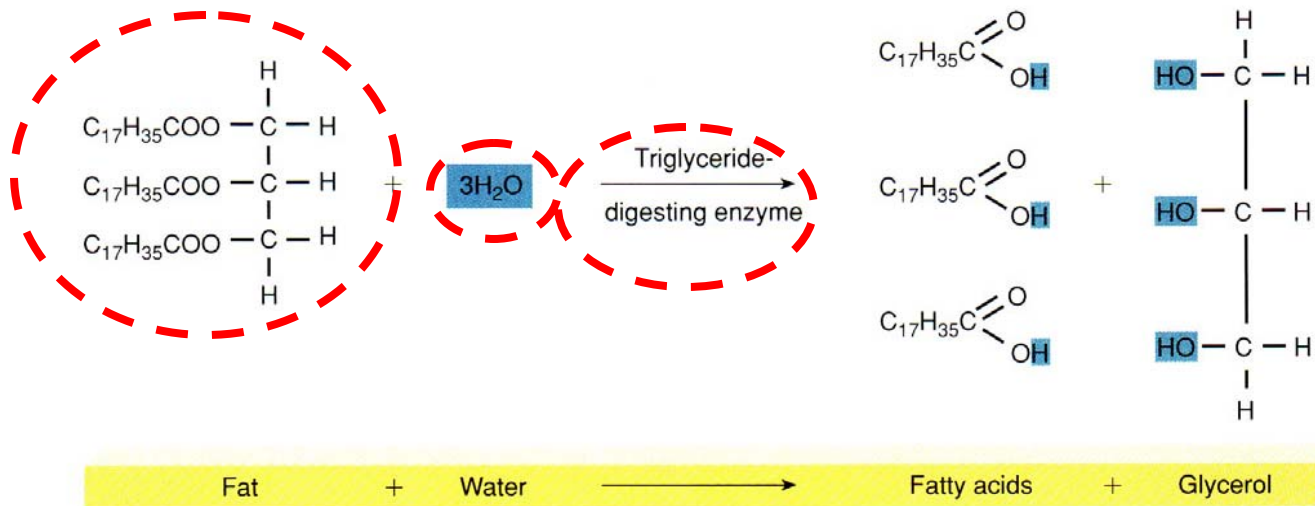
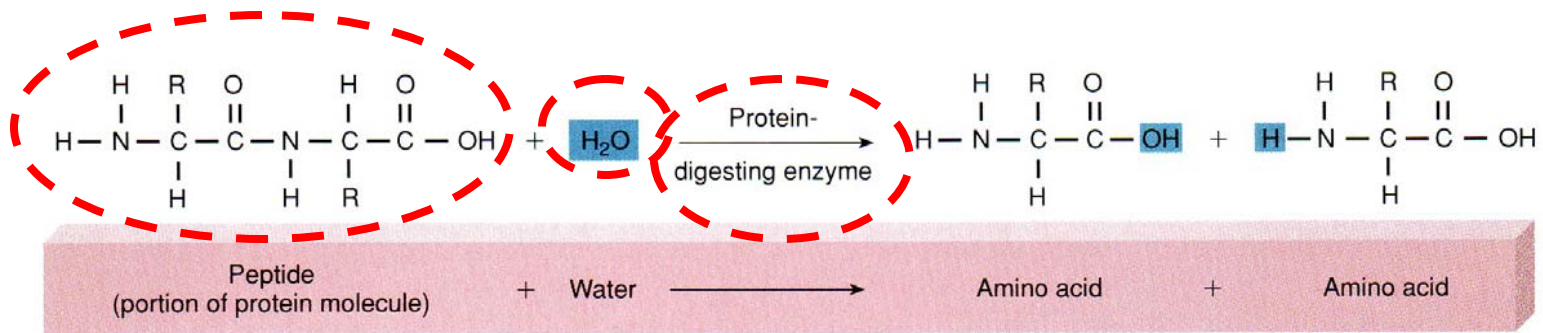
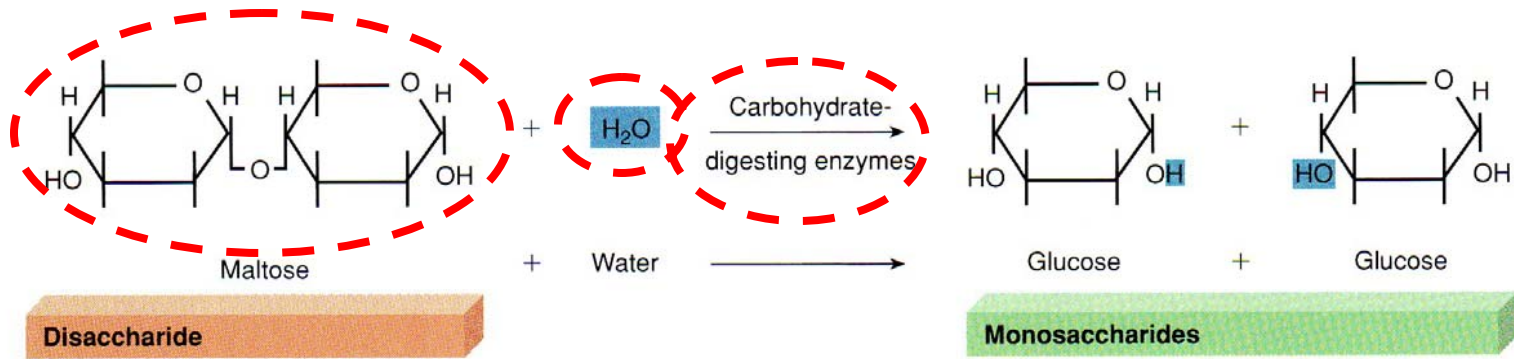
Protein  
+  
Fat



Amino Acids



Fatty Acids  
+  
Glycerol

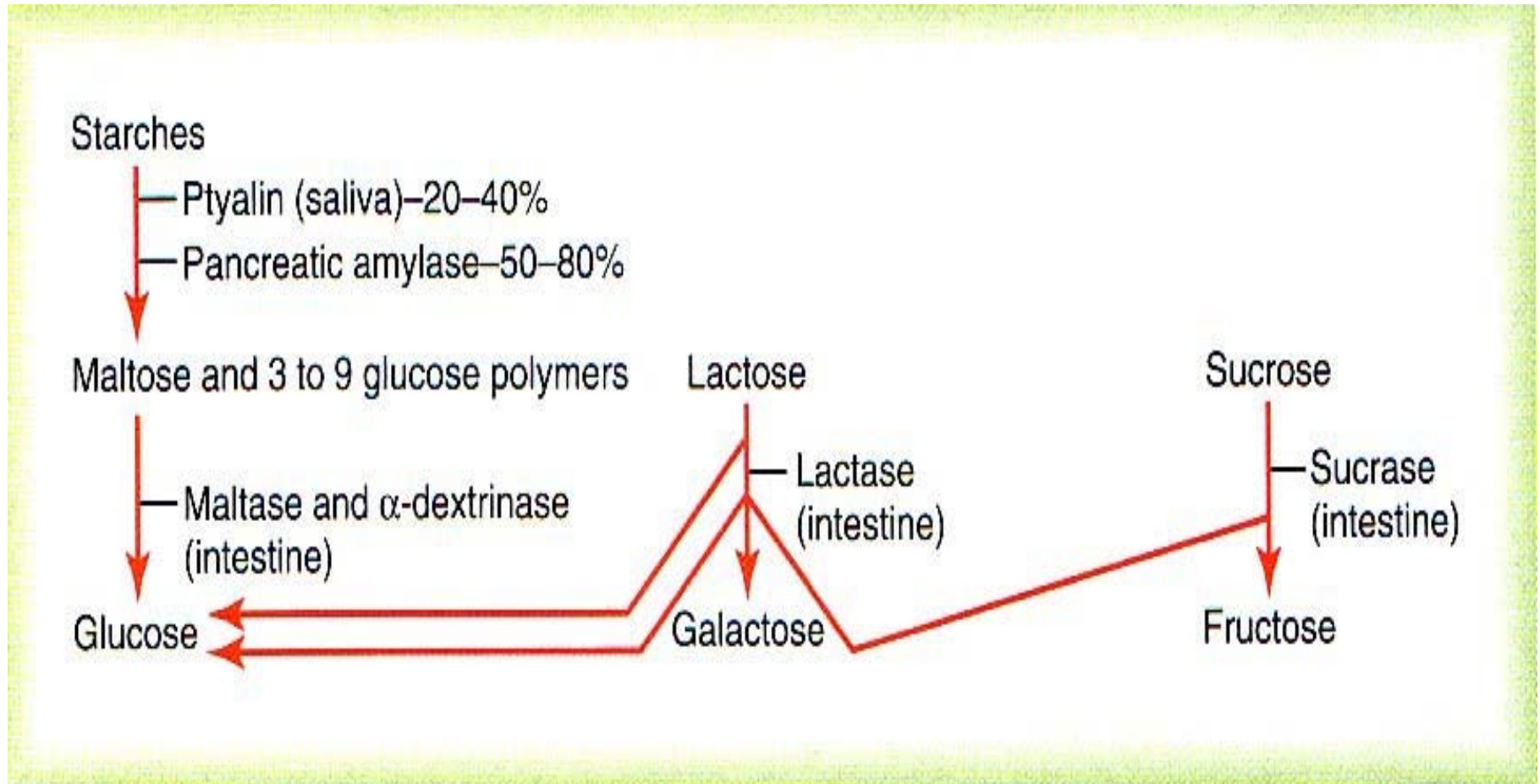


# *Carbohydrates in foods*



Sizer & Whitney 2011 p 136

# Carbohydrate Digestion = 1<sup>o</sup> Energy Nutrient

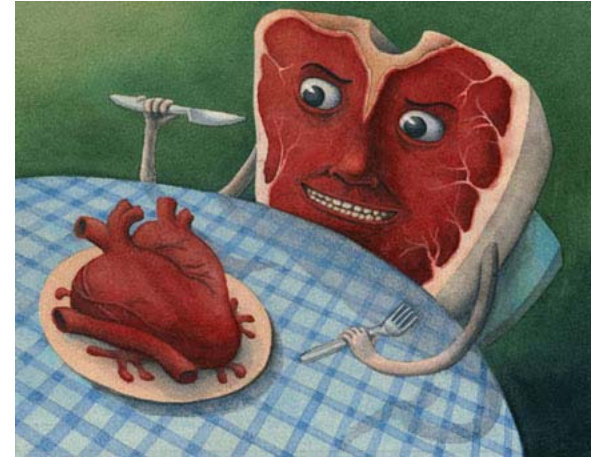


# *Why Do Some People Have Trouble Digesting Milk?*

- 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



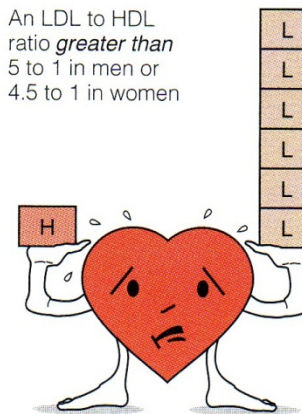




## HIGH FAT FOODS



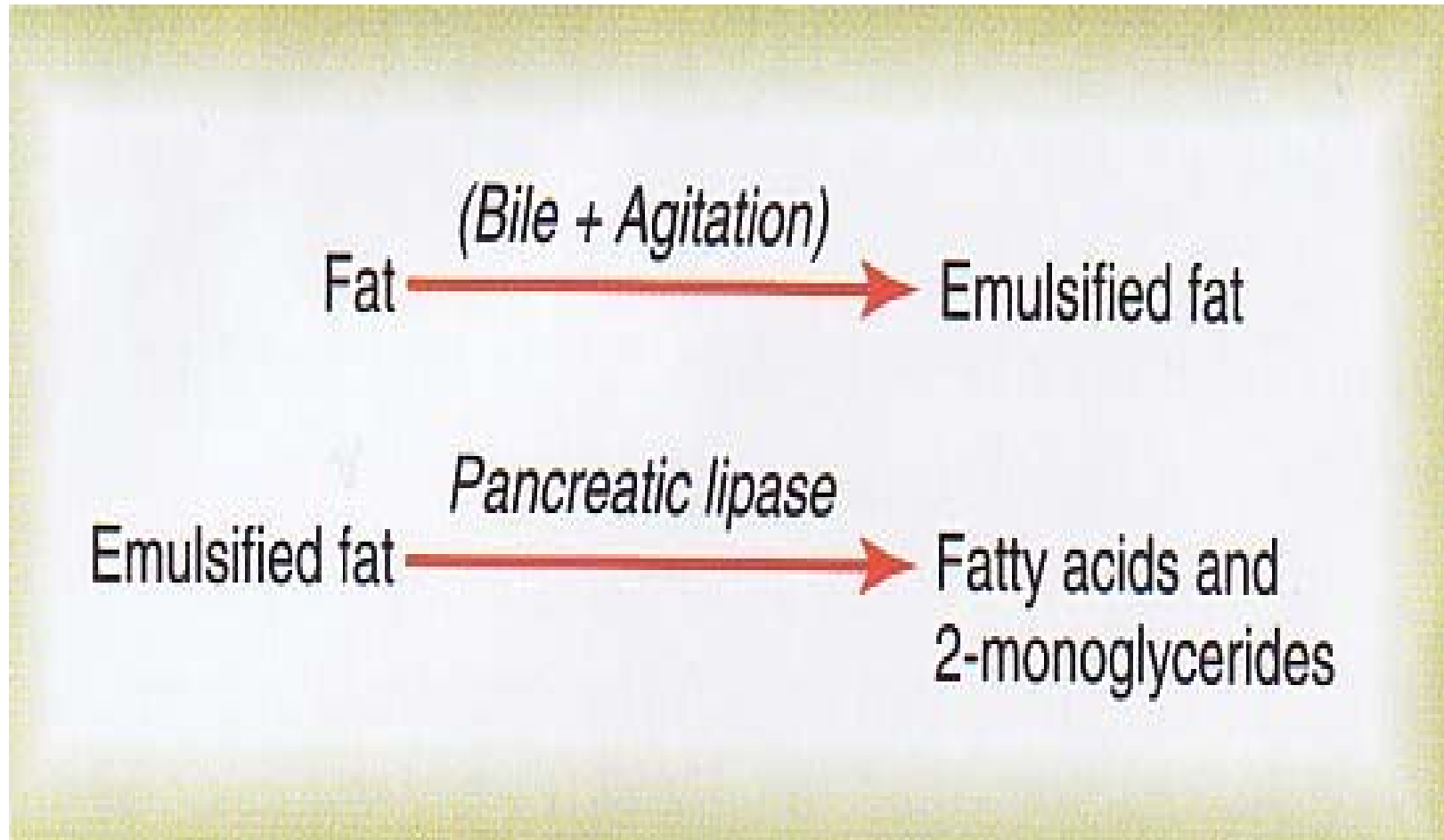
An LDL to HDL ratio *greater than* 5 to 1 in men or 4.5 to 1 in women

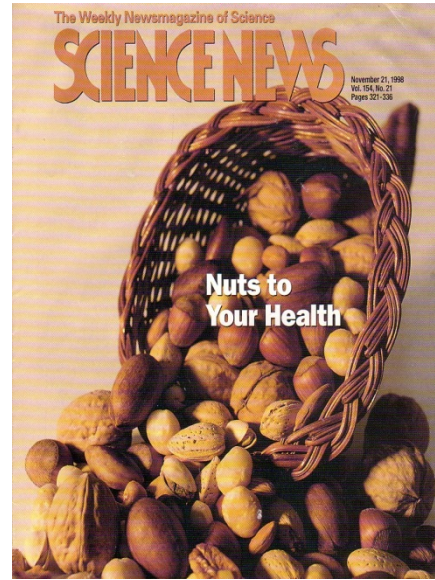


Increased risk of heart disease

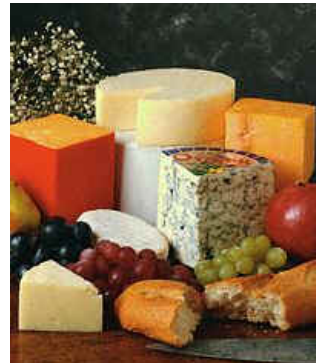


# Fat Digestion = 2<sup>0</sup> Energy Nutrient

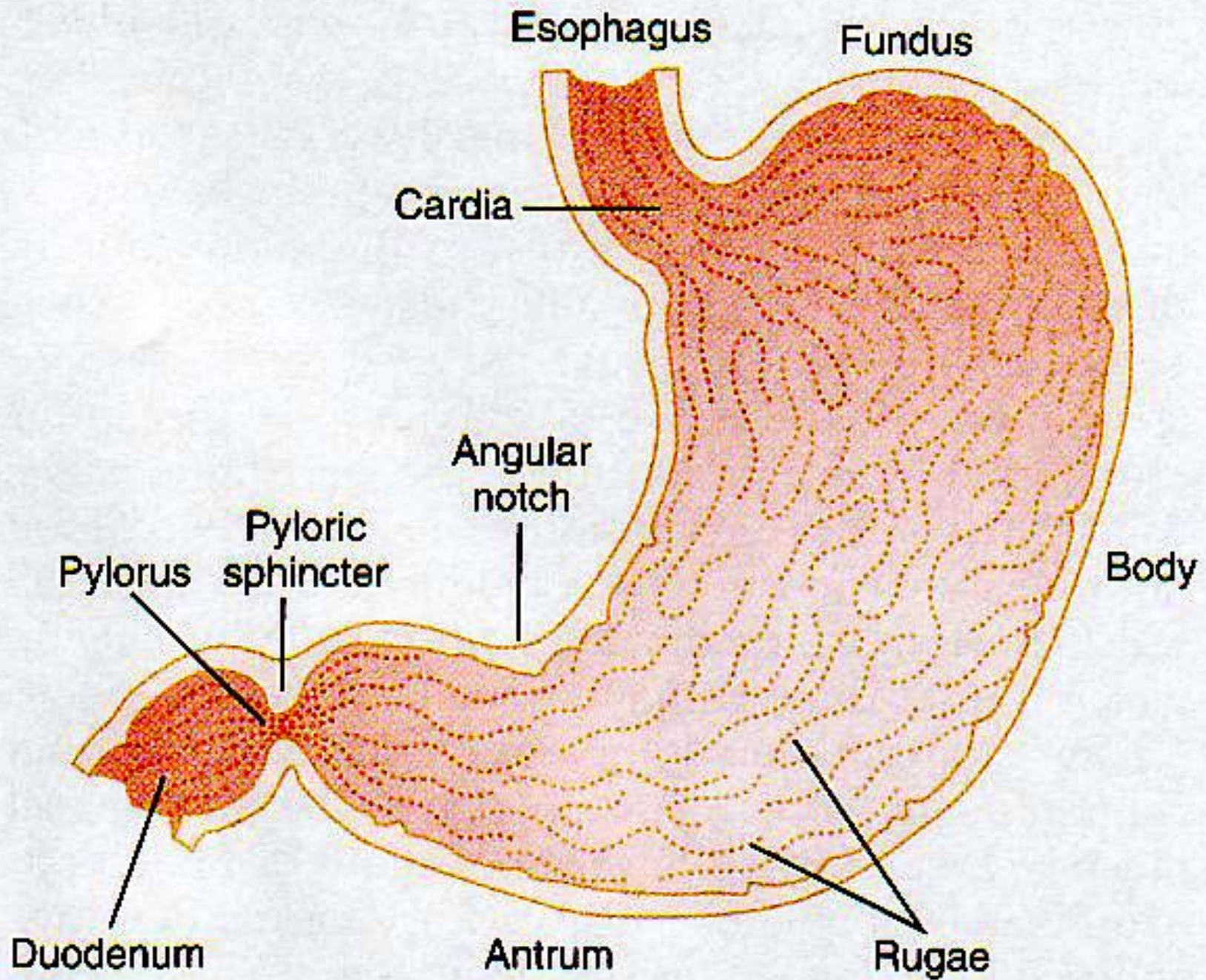




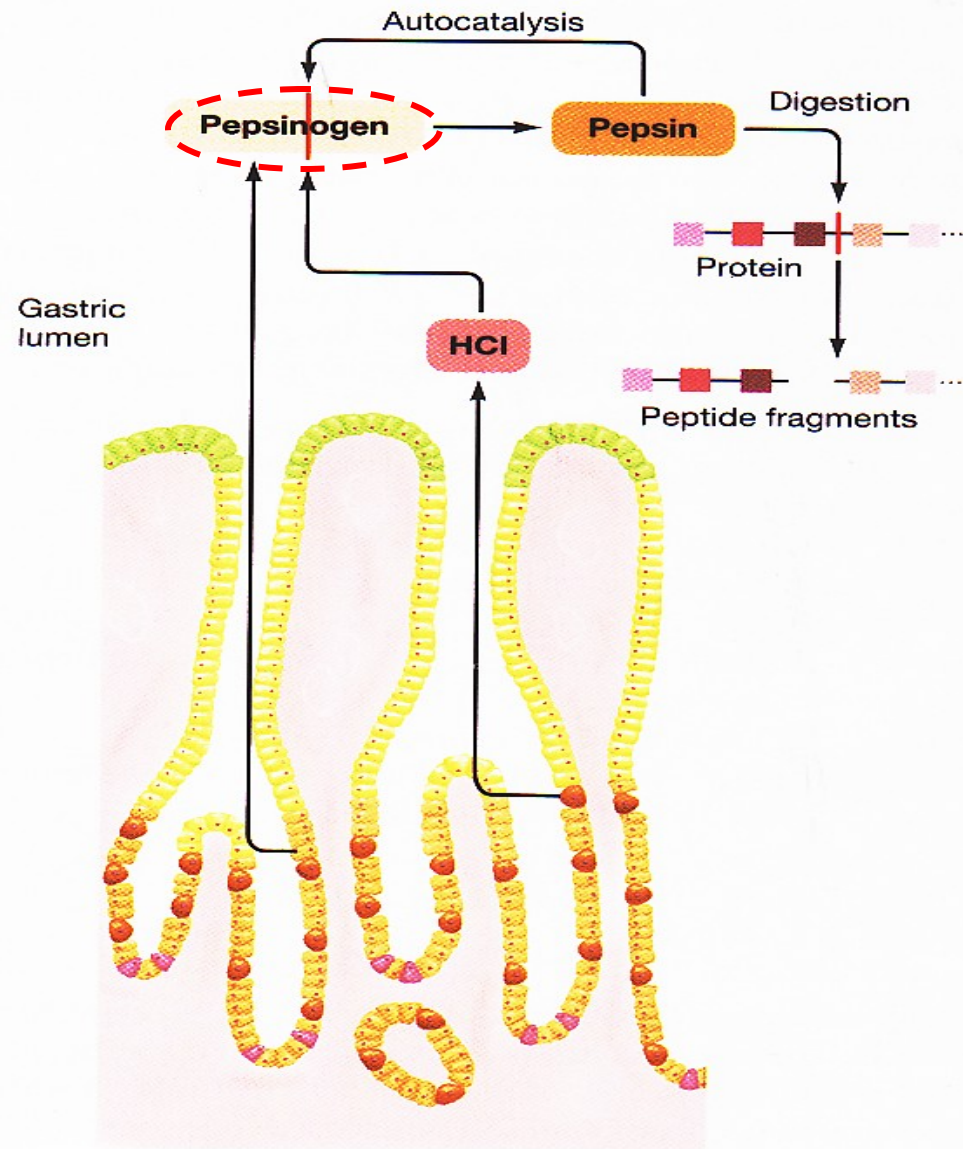
# HIGH PROTEIN (FAT?) FOODS?



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



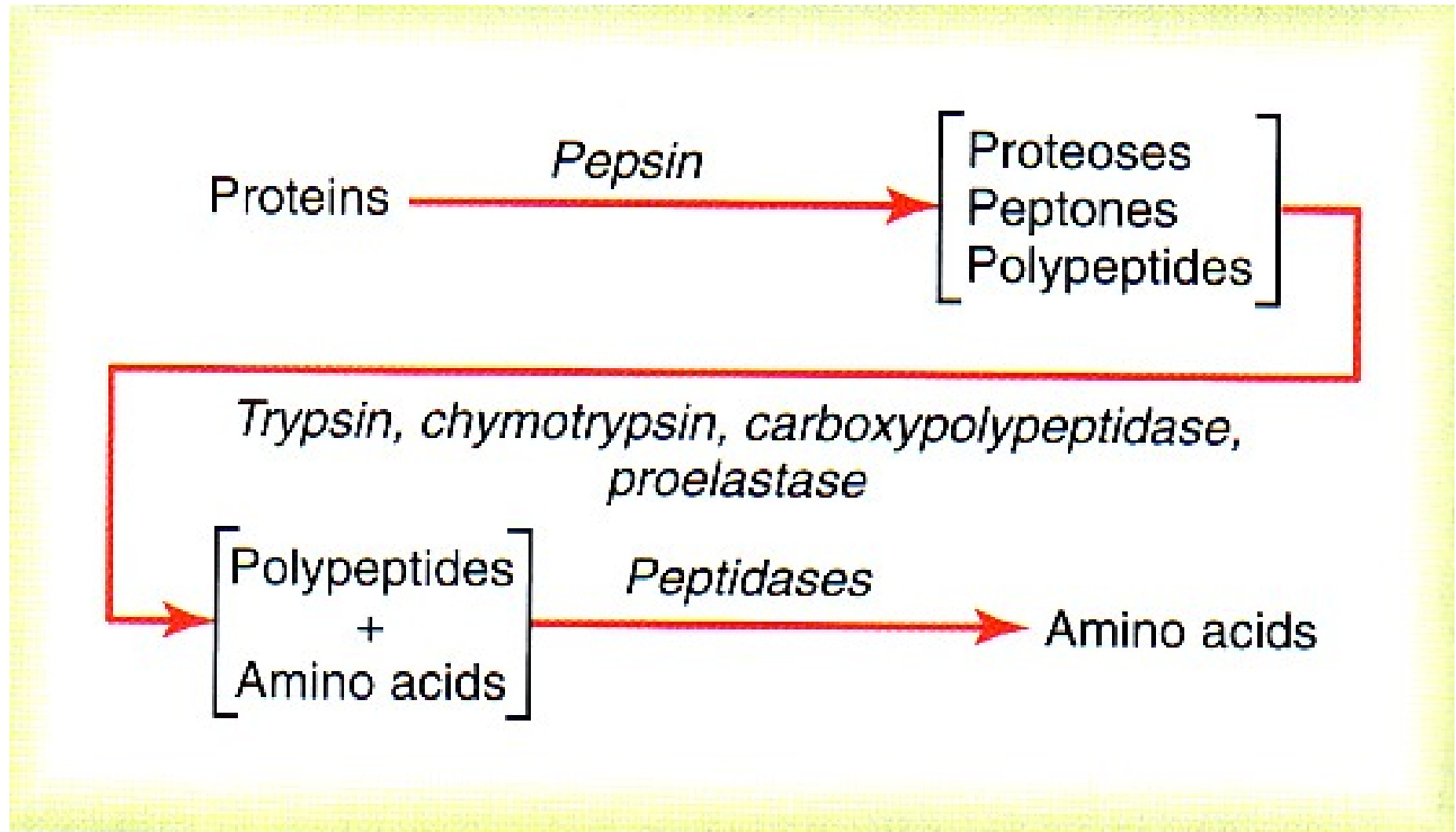
**Zymogen**  
= *inactive precursor*



■ ■ ■ = Various amino acids

| = Enzymatic splitting of a chemical bond

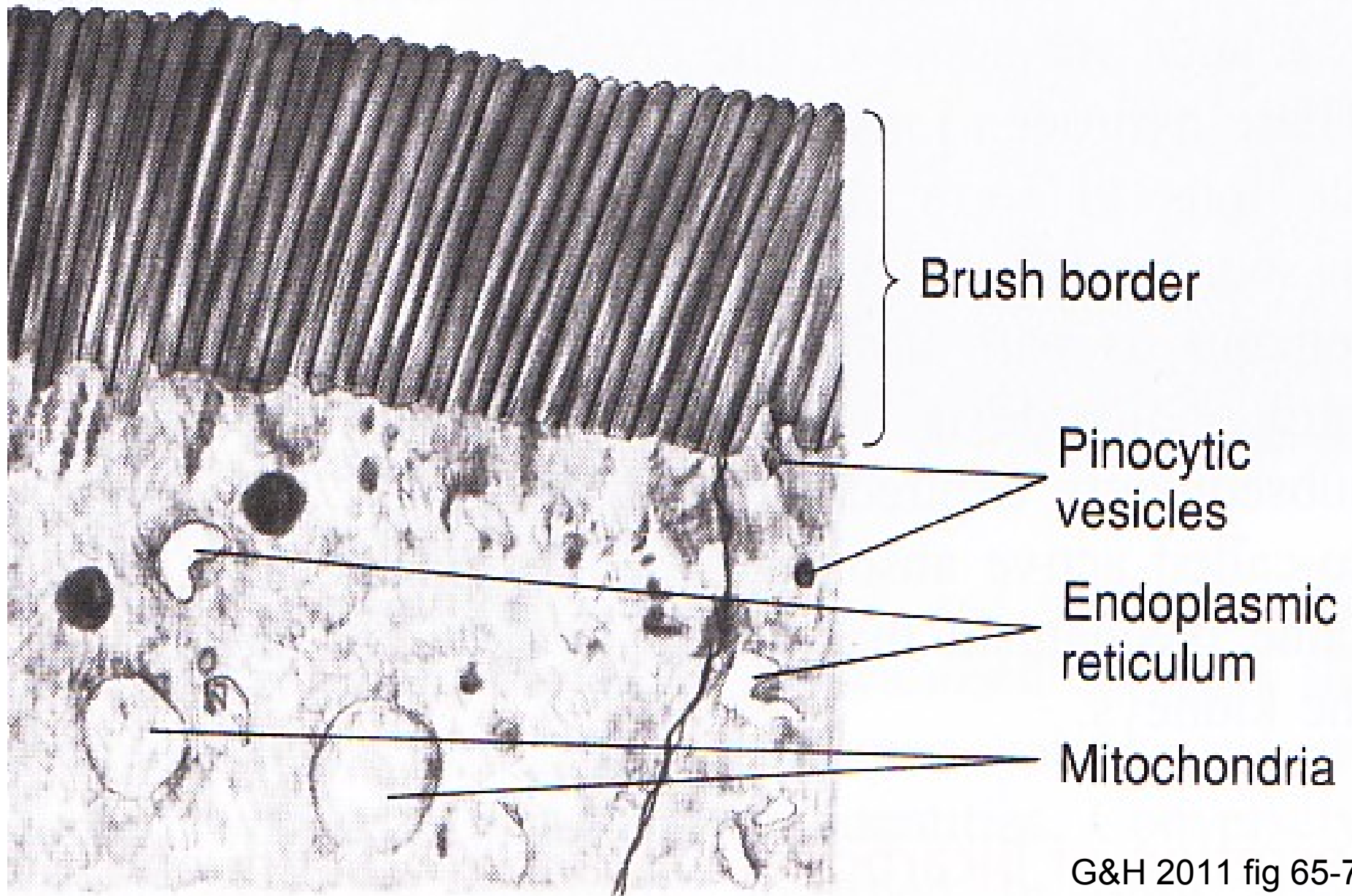
# Protein Digestion = 3<sup>0</sup> Energy Nutrient

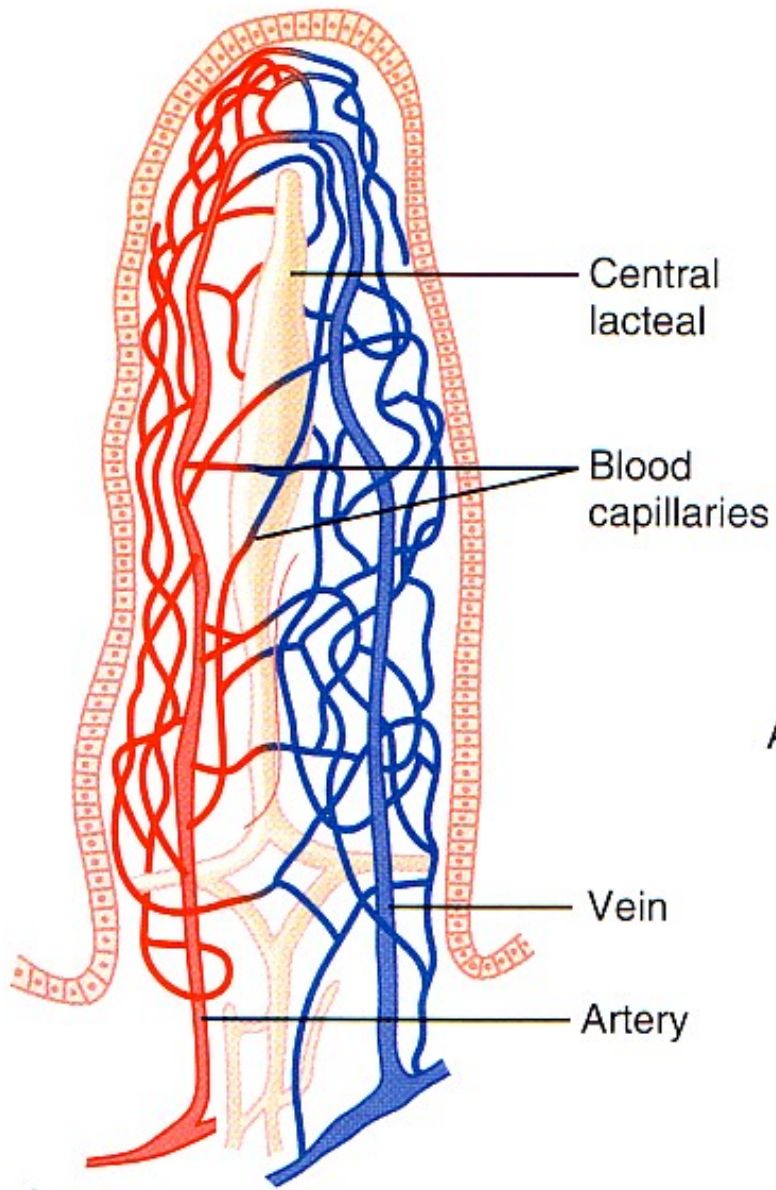




What is the major  
function of the  
small intestine?

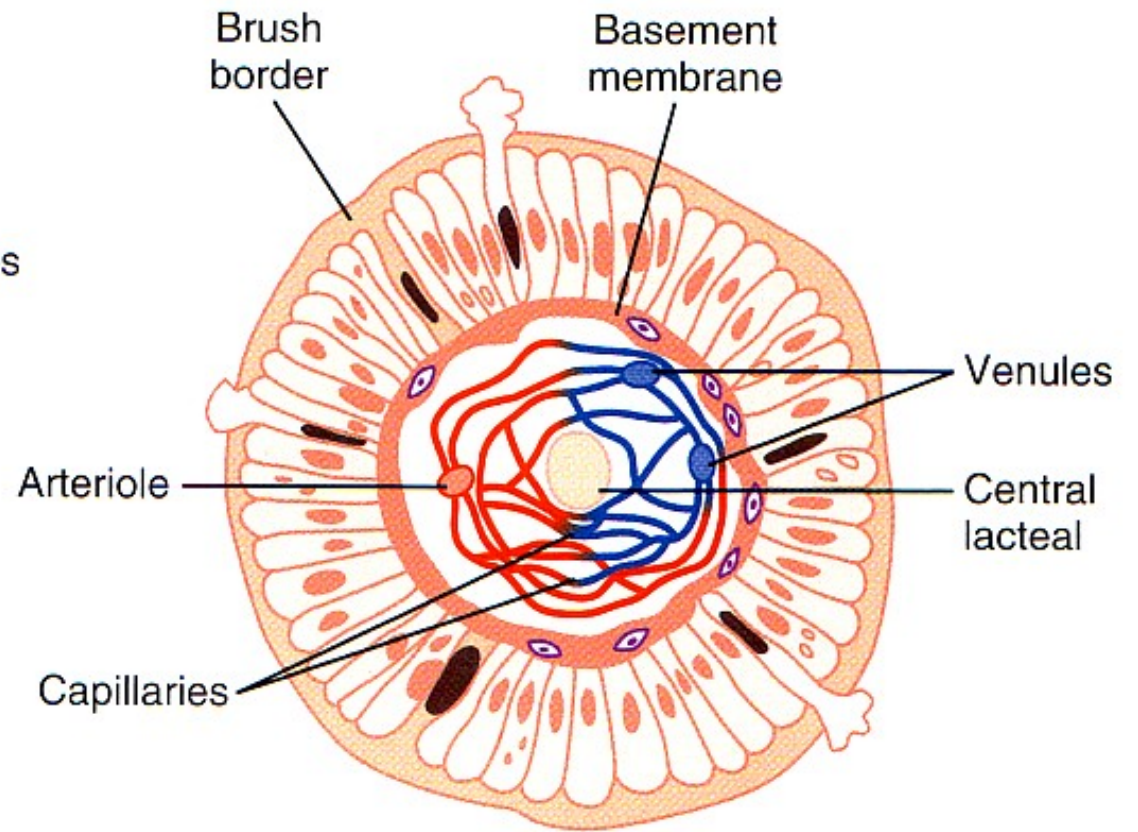
***Absorption!!***





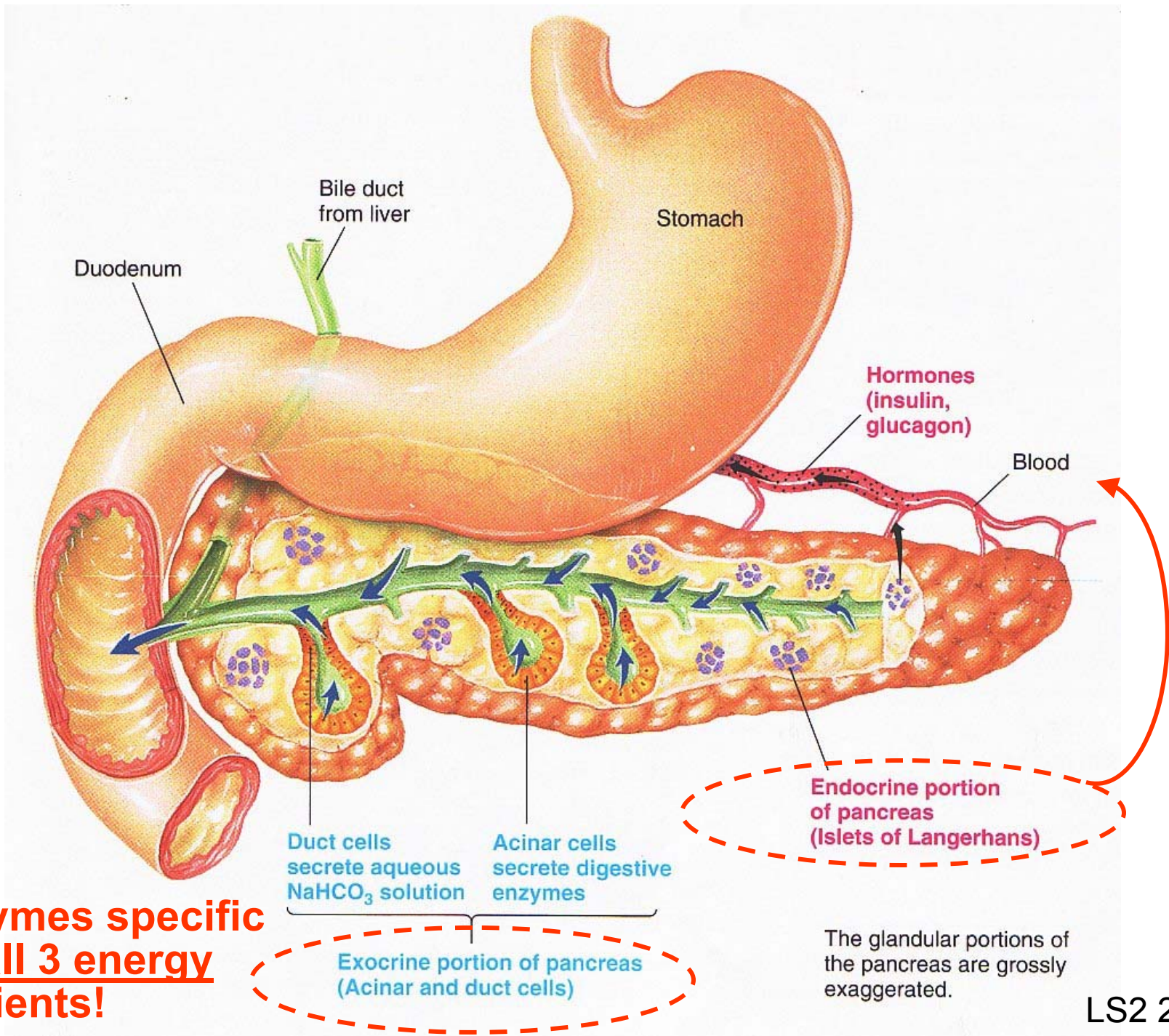
A

G&H 2011 fig 65-6



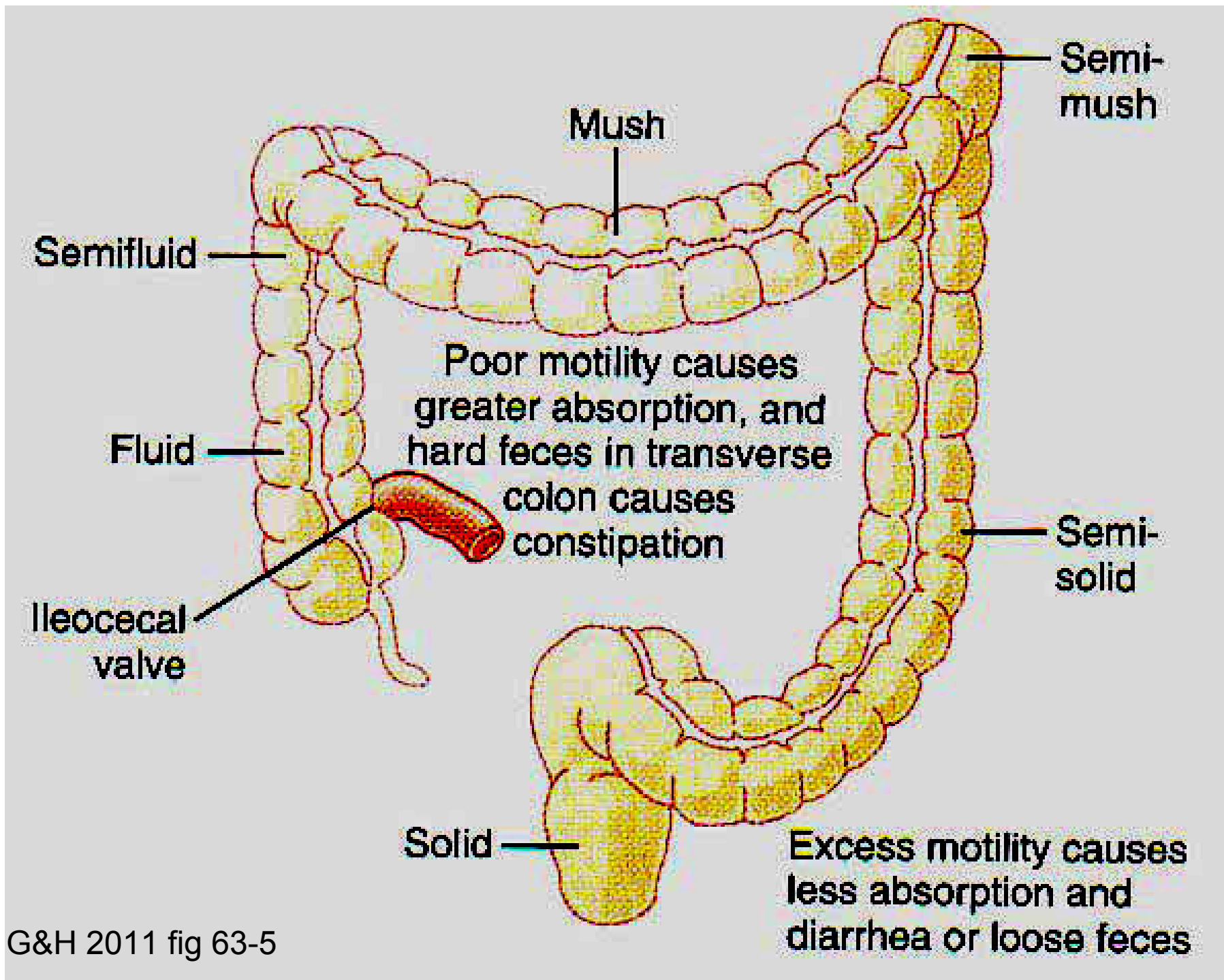
B

**Why is the  
*pancreas* so  
unique?**



**Enzymes specific for all 3 energy nutrients!**

The glandular portions of the pancreas are grossly exaggerated.



# Questions Discussion?

