



## BI 121 Lecture 5

- I. Announcements** Data + Flashdrive for Thursday's lab! Q? Thanks for recording dietary data on LM p 3-7 & finishing <https://www.supertracker.usda.gov/>. Sample Exam Questions.
- II. Nutritional Physiology in the News** Pondering Paleo Nutrition *Action Health Letter*, Marlene Zuk, U Minn. Animal sources, inflammation & disease? Drink Your Calories? *PEBB* Shake the salt habit! *UC Berkeley Newsletter*. Successful Dieting?
- III. Nutrition Primer** DC Module 2,Sizer & Whitney (S&W) Sci Lib
  - A. Dietary Guidelines: USDA, AICR, Eat Like the **Rainbow!**
  - B. Best path to weight loss? Diet or exercise or both? Dietary composition & endurance? Fasting? Zuti & Golding 1976; Sacks **AHA NPAM** 2009; AMDR?
  - C. *Nutrition Quackery, Balanced Approach* Kleiner, Monaco+
- IV. Digestion** LS 2012 ch 15, pp 437-9, DC Module 3 pp 17-23
  - A. Steps of digestion Dr. Evonuk + LS pp 437- 9; DC p 23
  - B. Hydrolysis + monomer to polymer: central linking themes! LS p 438, Fox 2009 +
  - C. What's missing? LS fig 15-1 p 438
  - D. GI-Donut analogy + Control mechanisms. Dr. Brilla @ WWU
  - E. Gut secretions LS p 438, 440-1
  - F. Organ-by-organ review LS tab 15-1 pp 440-1 + DC fig 3-1

# Lab 3: Nutritional Analyses via 2 Programs



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

***In Lab Thursday!***

# Sample Exam I Questions

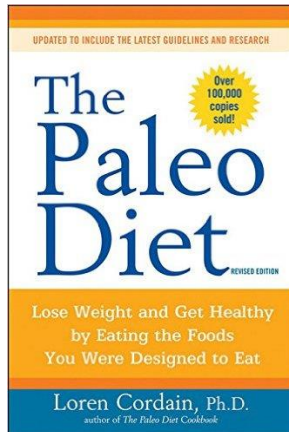
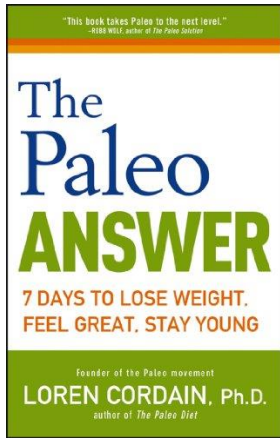
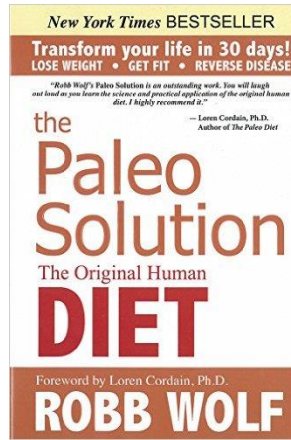
**Sample 1.** What is *human physiology*? (+2) How does it differ from *human anatomy*? (+2)

**Sample 2.** Give 2 *examples* of when *positive feedback* may occur normally in the human body. (+4)

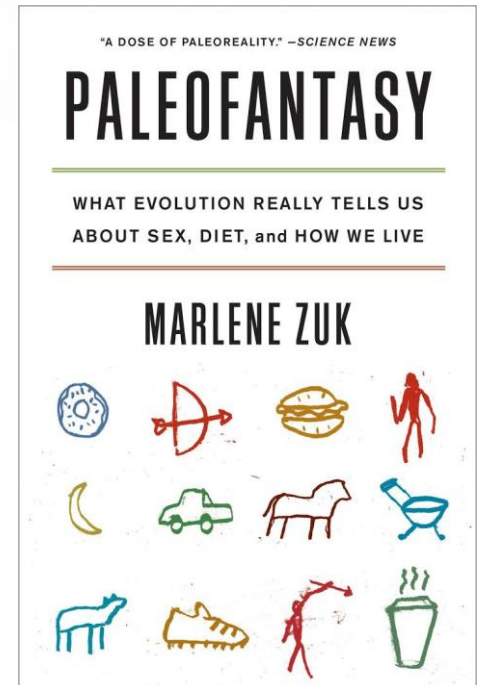
**Sample 3.** *Cells* are progressively organized into

- 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.

# Pondering Paleo?

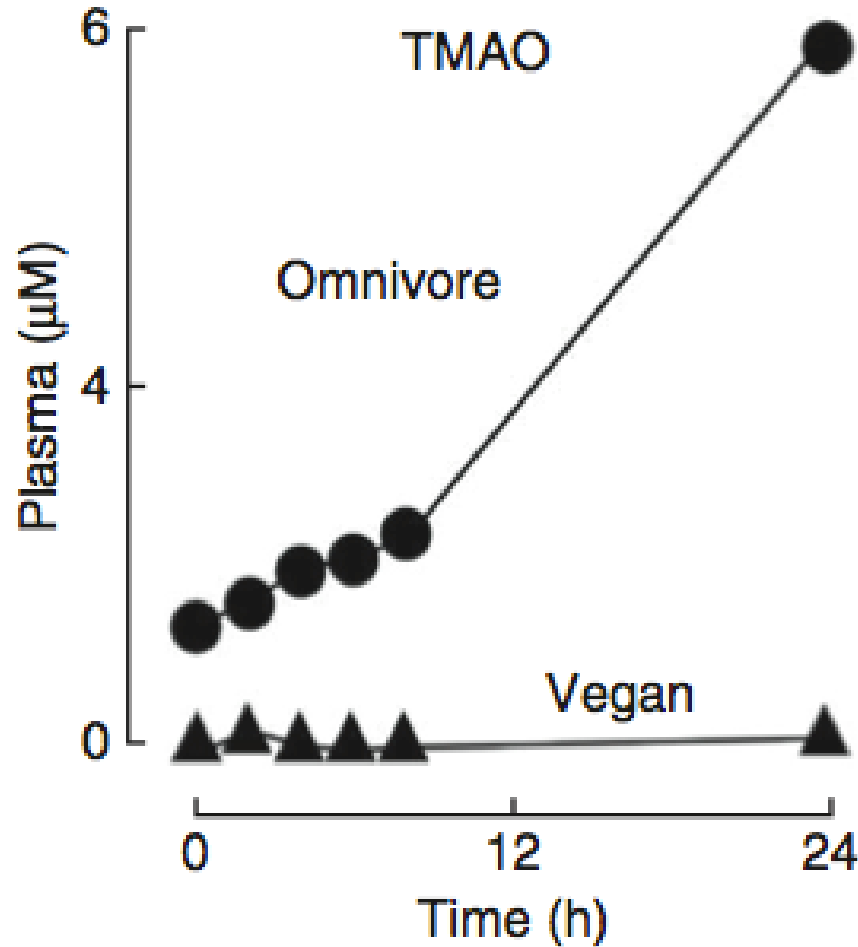


**Evolutionary Biologist  
Behavioral Ecologist  
U Minnesota**



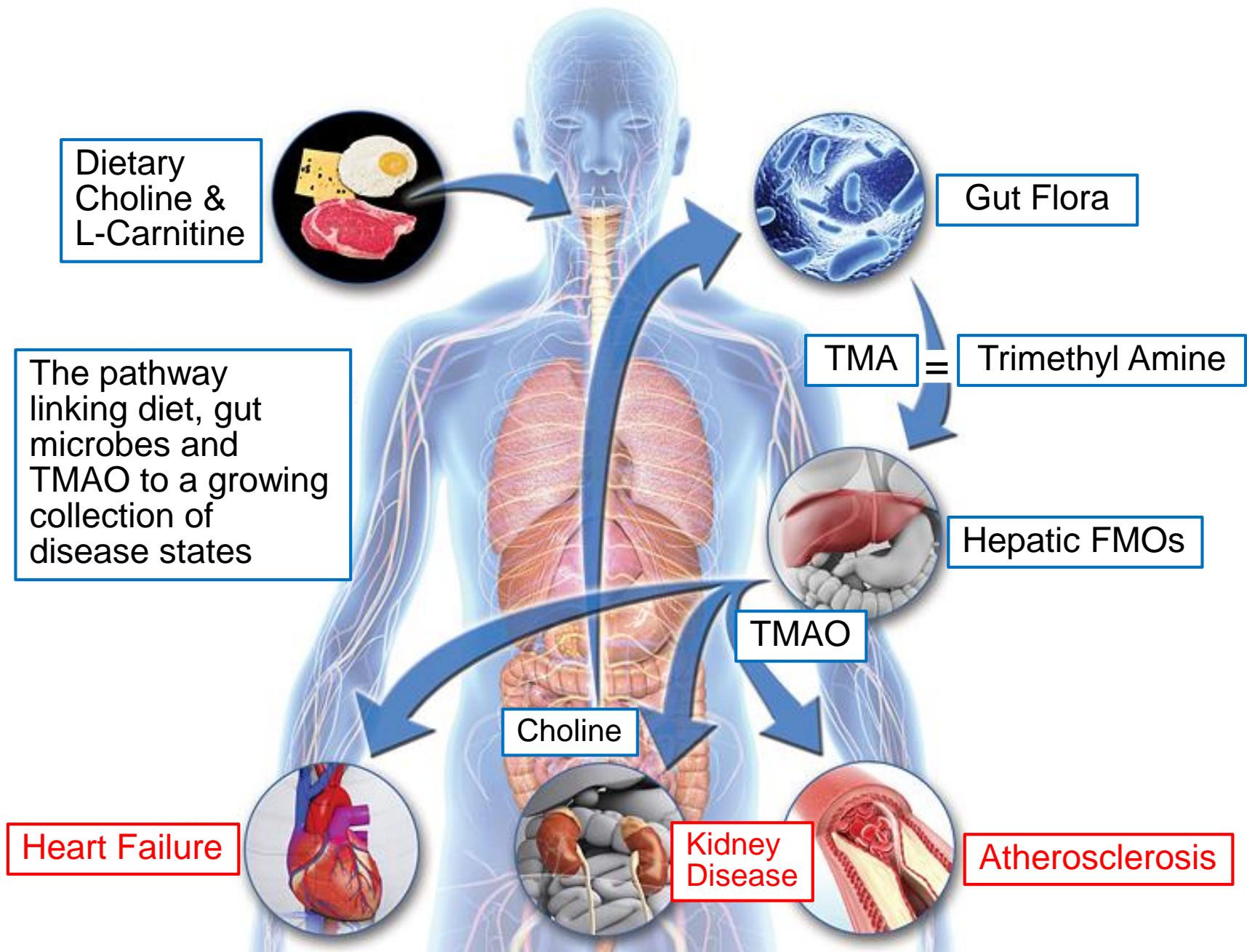
<http://www.nutritionaction.com/daily/how-to-diet/pondering-paleo/>

# Gut Bacteria Involved in **Inflammation & Atherosclerosis**?



Meat & Eggs → L-Carnitine & Choline → Trimethyl Amine (TMA) →  
TMAO → **Inflammation & Atherosclerosis**

<https://consultqd.clevelandclinic.org/2015/02/gut-flora-dependent-tmao-new-studies-extend-its-reach-beyond-the-arteries-to-the-heart-and-kidneys/>



# Nutrition Action

OCTOBER 2011 \$2.50

HEALTH LETTER®  
CENTER FOR SCIENCE IN THE PUBLIC INTEREST

## Eat Real, America!

"With the right food choices, physical activity, and not smoking, we could prevent about 80 percent of heart disease, about 90 percent of diabetes, and 70 percent of stroke," says Walter Willett, chair of the nutrition department at the Harvard School of Public Health in Boston. "Those are the three pillars. They really do make a difference."

The right food choices are simple: Eat less red meat, sweets, refined grains, and salt, and drink fewer sugary beverages. Replace unhealthy foods with vegetables, fruit, beans, and whole grains, and with smaller amounts of fish, poultry, and low-fat dairy. Those foods aren't just good for our health. They can also help protect the Earth.

Here's why—and how—to eat real.

*Continued on page 3.*

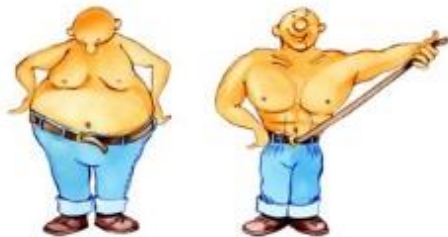
With the right food choices, physical activity, and not smoking, we could prevent about ~90% of diabetes, 80% of heart disease & 70% of stroke!

Photo: © Marisa at Beaudinmau/120

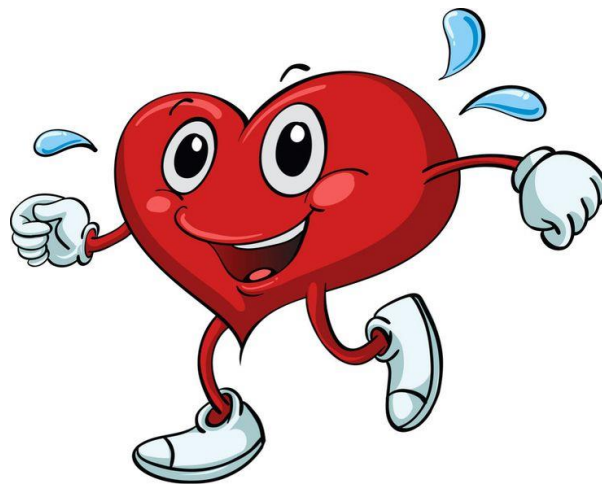
**FOOD DAY**  
OCTOBER 24, 2011  
JOIN US AT [FOODDAY.ORG](http://FOODDAY.ORG)

**40**  
CSPI • 1971-2011

# Can Lifestyle Modifications Alter Blood Pressure, Cardiovascular & Kidney Disease Risk?



↓ 5-20 mm Hg



↓ 4-9 mm Hg



↓ 2-8 mm Hg

**Do the  
DASH!**



↓ 8-14 mm Hg



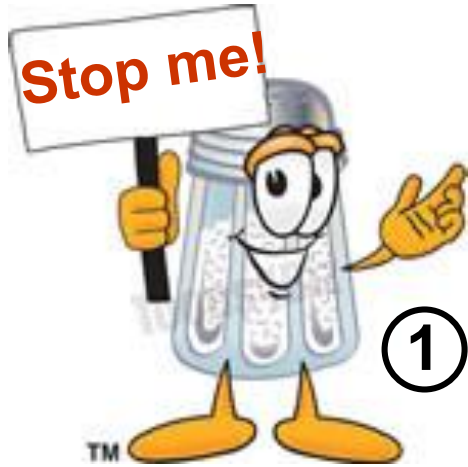
↓ 2-4 mm Hg



American  
Heart  
Association®  
2017



# More Reasons to Shake the Salt Habit



- ① ↓ blood vessel vasodilation w/in 30 min by ingesting 1500 mg Na+!
- ② ↑ Ca<sup>2+</sup> 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!**

# *MyPlate launched June 2, 2011*

2. Focus on fruits.  
Whole fruit preferable to juice, but any fruit counts!  
Fill  $\frac{1}{2}$  your plate with fruits & vegetables!



3. Make at least  $\frac{1}{2}$  of your grains whole grains!

5. Get your calcium-rich foods. Buy skim or 1% milk. Go easy on cheese!

1. Vary your veggies.  
Fill  $\frac{1}{2}$  your plate with fruits & vegetables!

4. Go lean with protein. Keep protein to  $< \frac{1}{4}$  plate! Nuts, beans, peas, seeds, poultry, lean meat, seafood,...

## *Diet & Health Guidelines for Cancer Prevention*

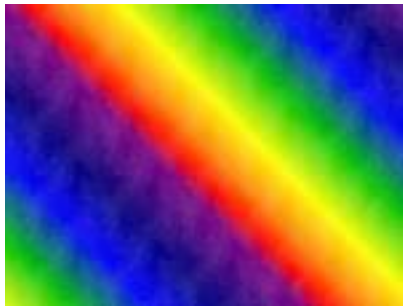
- 1. Choose a diet rich in variety of plant-based foods.**
- 2. Eat plenty of vegetables & fruits.**
- 3. Maintain a healthy weight & be physically active.**
- 4. Drink alcohol only in moderation, if at all.**
- 5. Select foods low in fat & salt.**
- 6. Prepare & store food safely.**

And always, remember...

**Do not smoke or use tobacco in any form.**



*American Institute for Cancer Research (AICR)*



# *Eating the Rainbow Hawaiian Style!!*



Your plate should be the size of a Frisbee, not a manhole cover.

When it comes to colorful foods, Fruit Loops don't count.

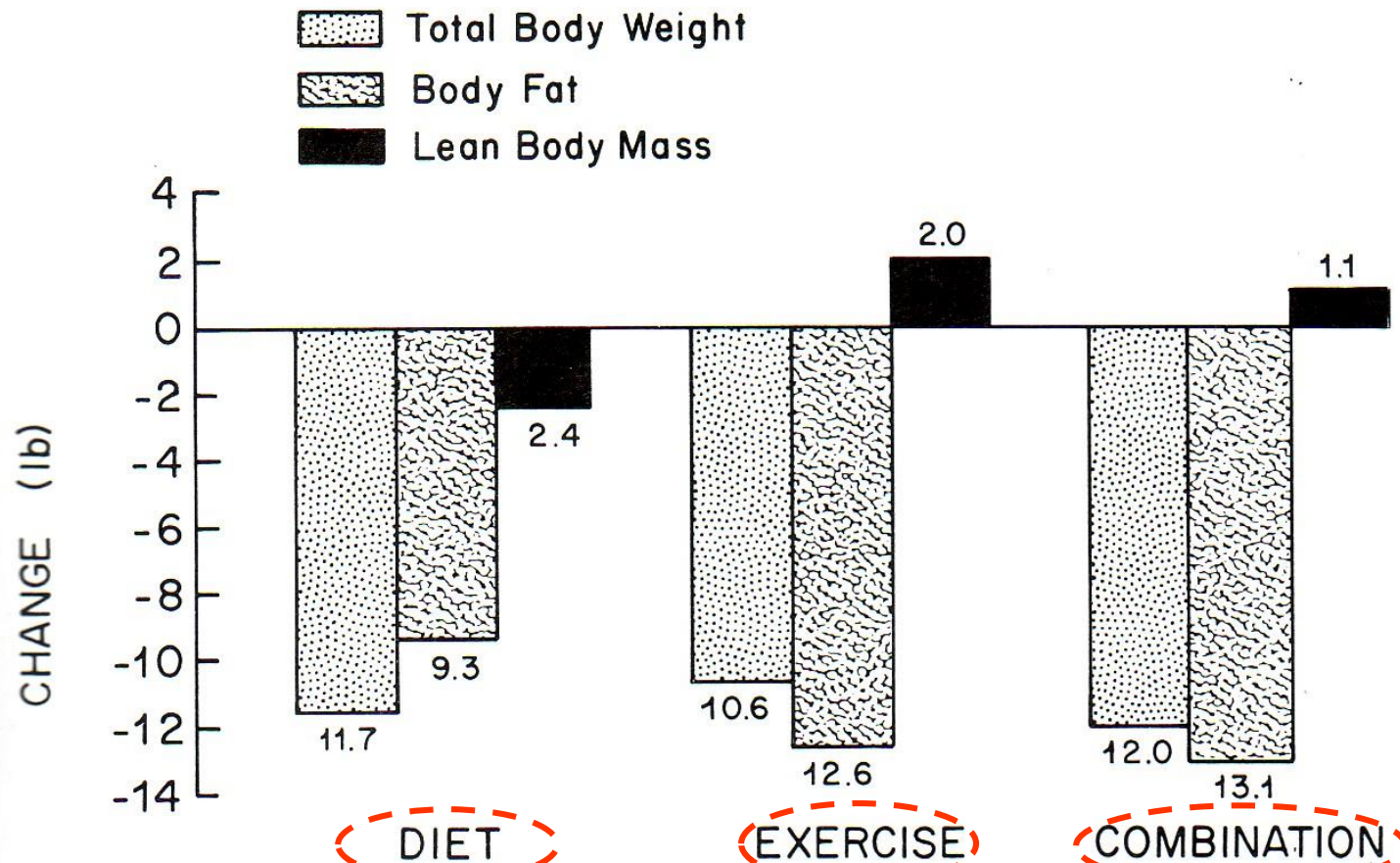
A surprising number of people get 1/5 of their calories from sodas or other liquids.

If you look at the label & need a chemistry degree to read it, put the item back on the shelf!



**SOURCE:** P. Rath, *Honolulu Advertiser*, Sept 11, 2008 citing D. Chong & N. Kerr.





**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!***



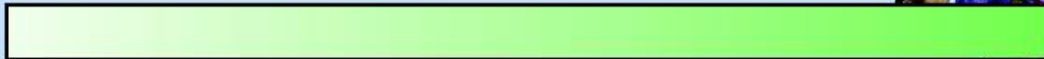
# Dietary Composition & Physical Endurance

eg, Atkins!

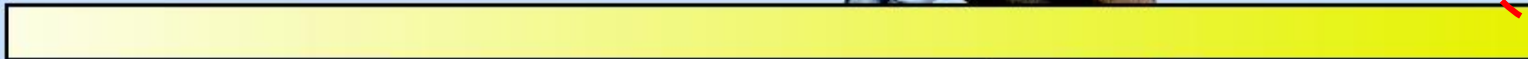
High-fat diet



Normal mixed diet



High-carbohydrate diet



**~ 1/3 endurance!**

Maximum endurance time:

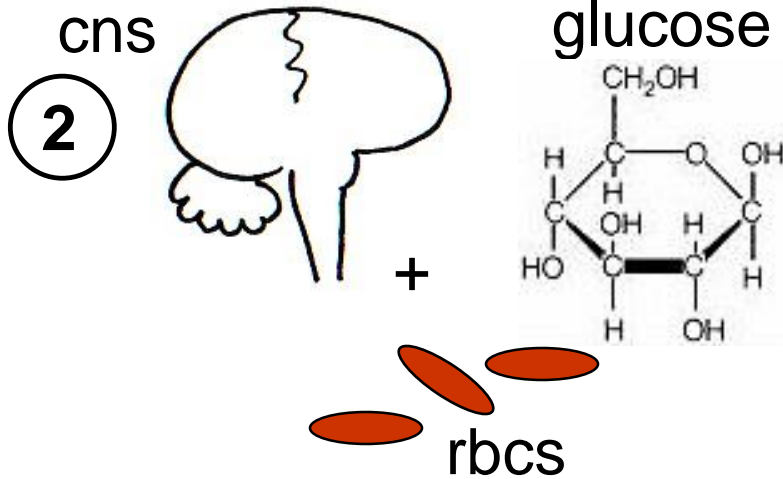
57 min

114 min

167 min







# Negative Effects of Low Carbohydrate

1



- 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.

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

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.**

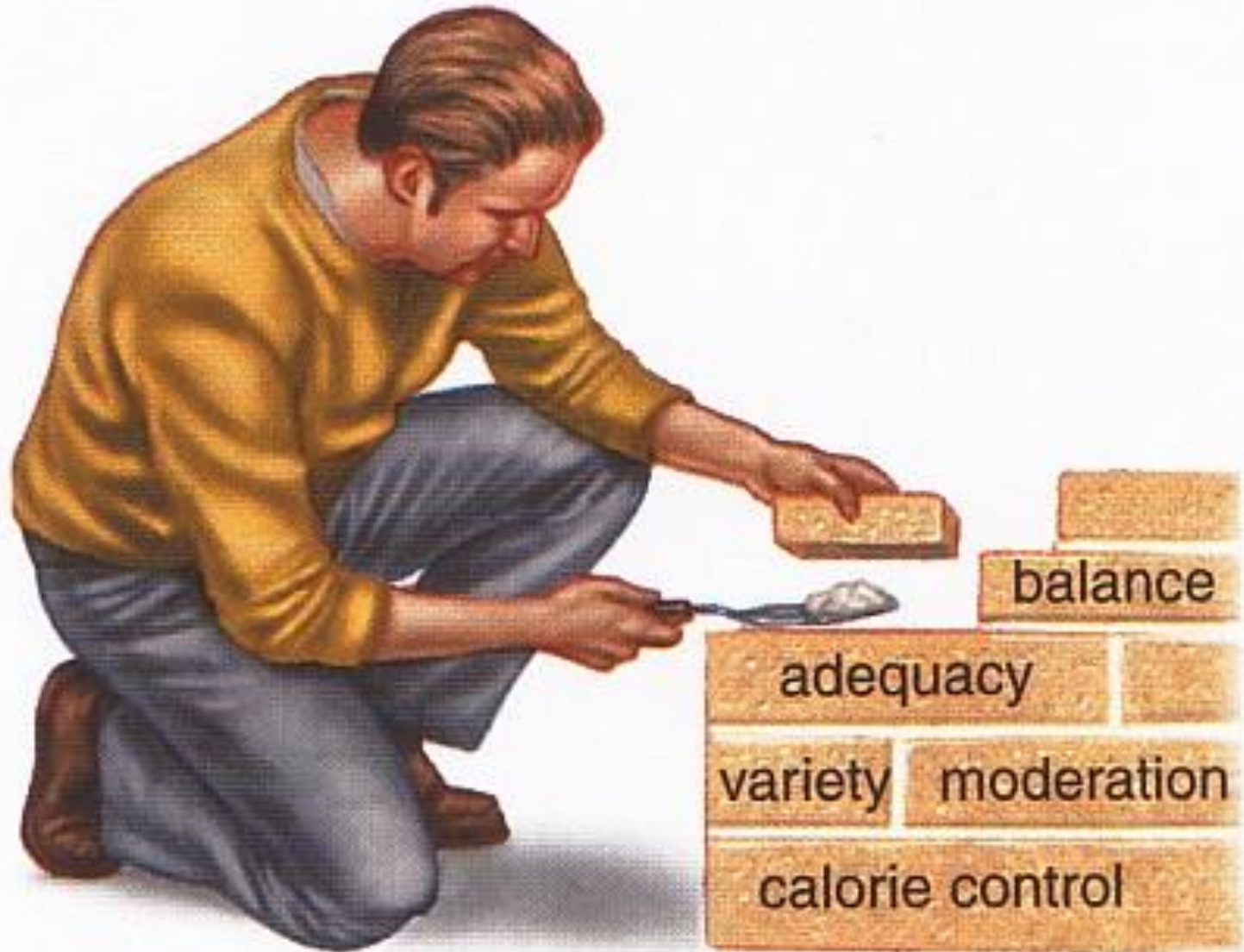
## **Positive Aspect??**

**General loss of appetite within  
first 2 days, maintained  
throughout fasting period.**

# Emphasize ABCs + Variety & Moderation!

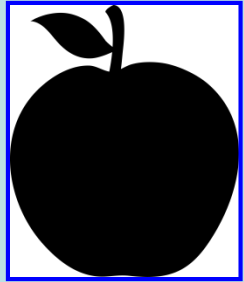


*All of these factors help to build  
a nutritious diet.*



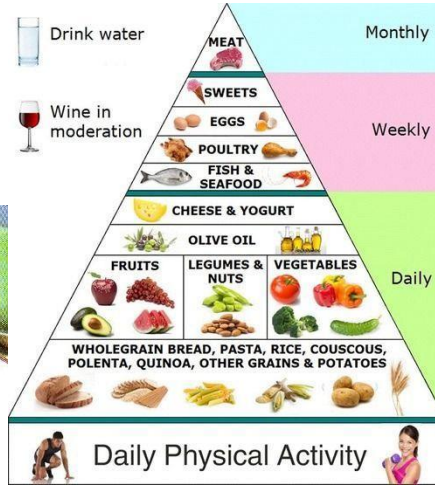
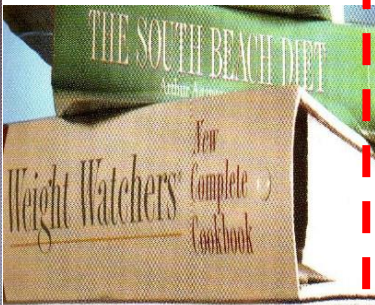
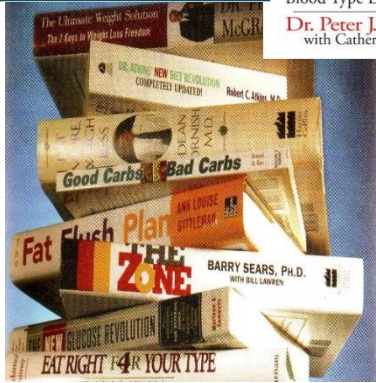
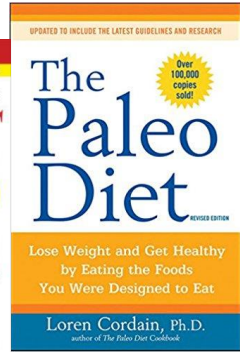
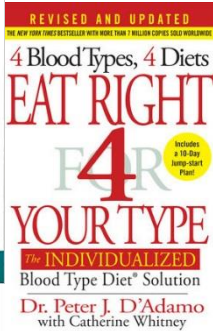
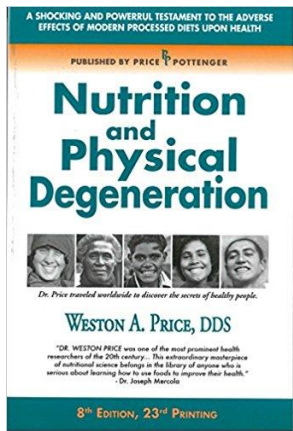
# Successful Dieting – National Weight Control Registry

- 5000 people,  $\geq 30$  lb weight loss,  $\geq 5$  yr
- High-carbohydrate (55-60%), low-fat (24%) diet with the rest ( $\sim 16$ -21%) from protein
- Wholesome vs. high-sugar carbohydrates including fruits, vegetables, high-fiber foods
- Conscious of calories knowing that total calories count, no matter what diet type
- Eight of 10 ate breakfast daily which may help better manage calories during the day
- Self-monitor, weigh themselves  $\geq 1$ x/wk & many still keep food dairies
- Much planned physical activity, 60-90 min/d, 1<sup>0</sup> walking + looked for other ways to be active

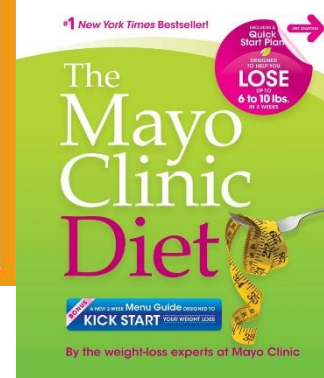
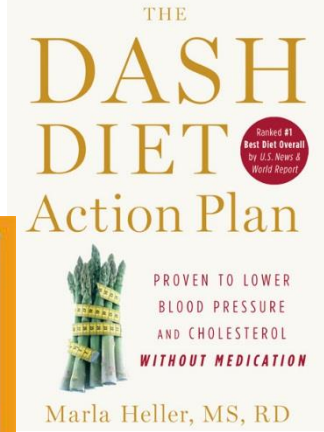
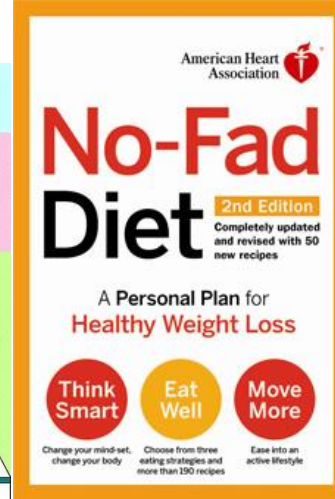


<http://www.nwcr.ws/Research/published%20research.htm>

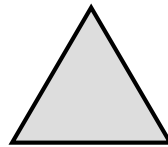
# Which Diets are Best?



Mediterranean Diet



**Not Plant-based**  
**Lower Carbohydrate**



**Plant-based**  
**Lower Fat**



**Not Peer-Reviewed = Trade Book**  
**→ Opinion**

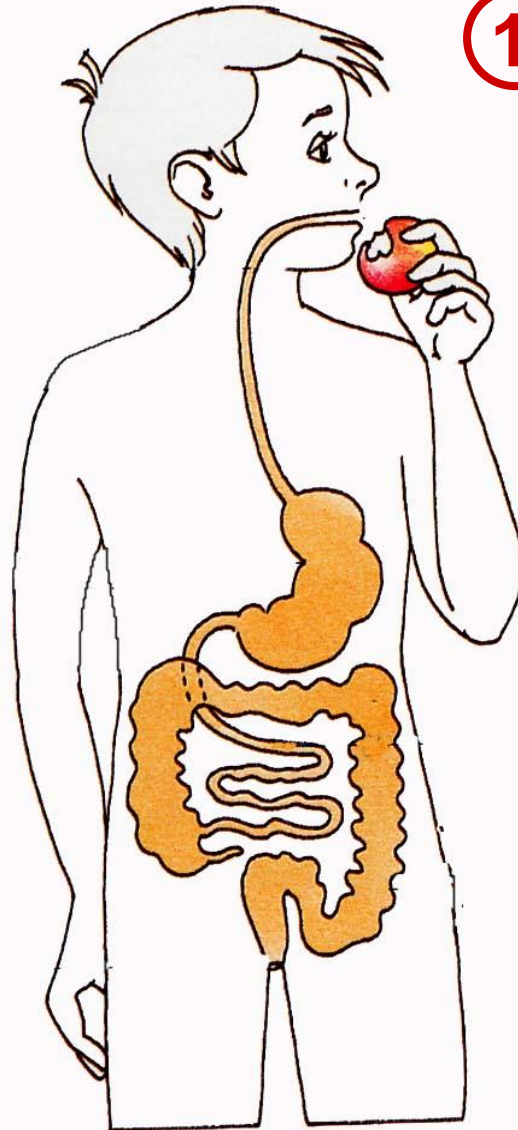


**Peer-Reviewed = Text Books**  
**→ Research**

# ***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.

# Digestion Steps



- ① Ingestion
- ② Mechanical Digestion
- ③ Chemical Digestion
- ④ Peristalsis
- ⑤ Absorption
- ⑥ Storage
- ⑦ Defecation

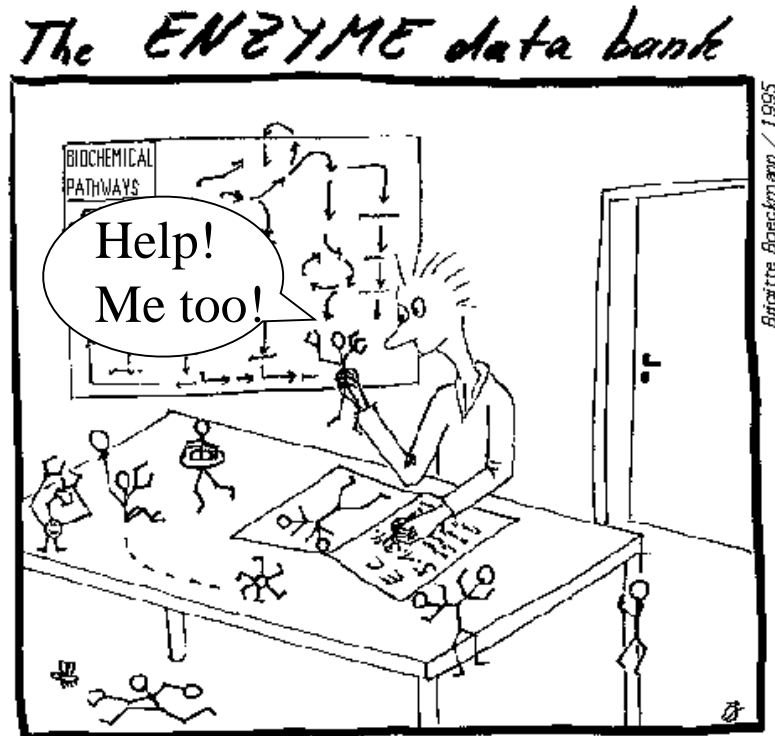
**SOURCE:** Dr. Eugene Evonuk, 1989. cf. L Sherwood, 2012 pp 437-8.

# Hydrolysis of Energy Nutrients

Hi gang!!  
You need me  
for digestion!!



+

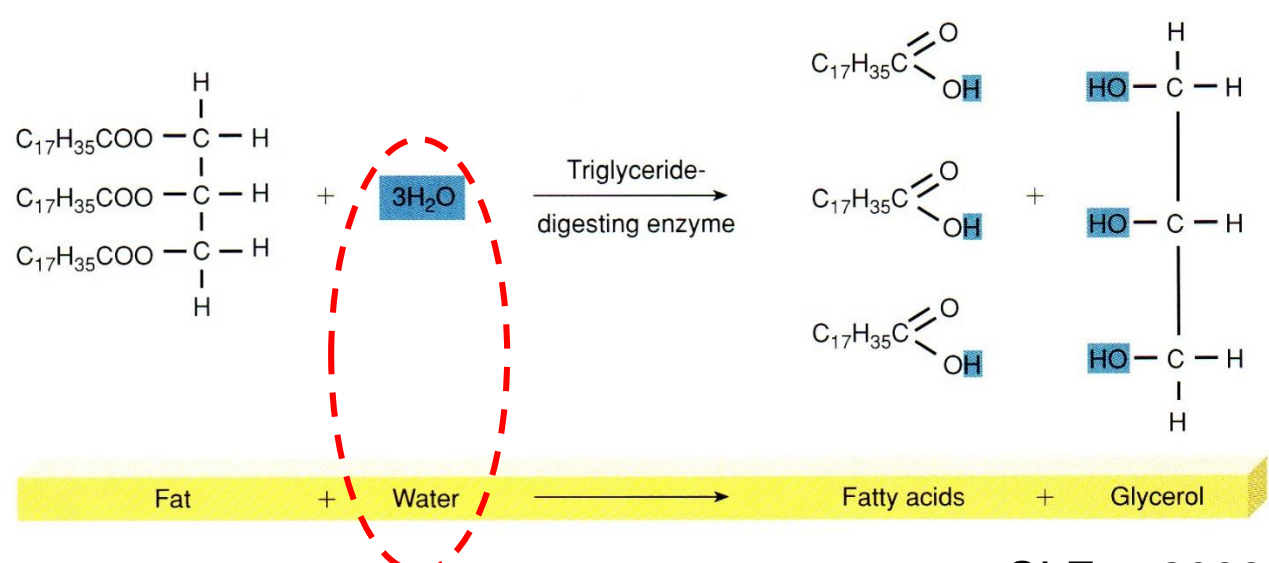
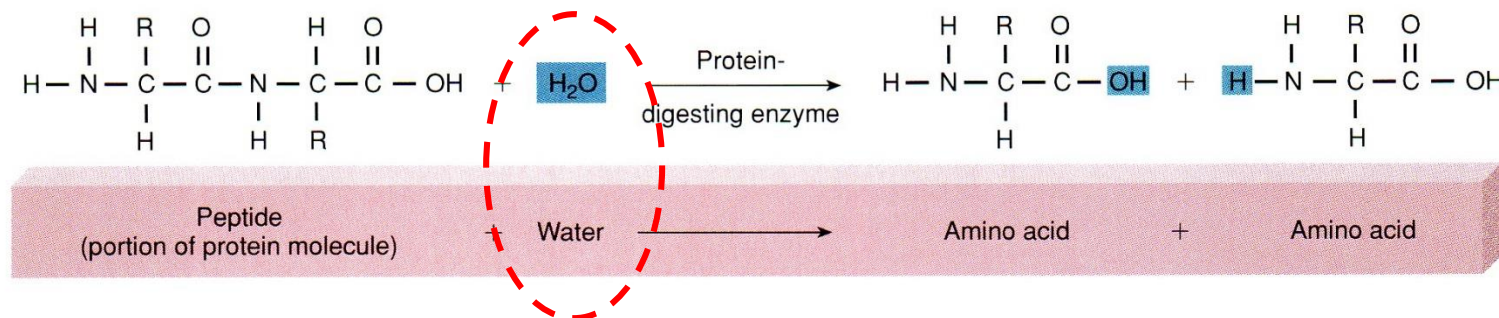
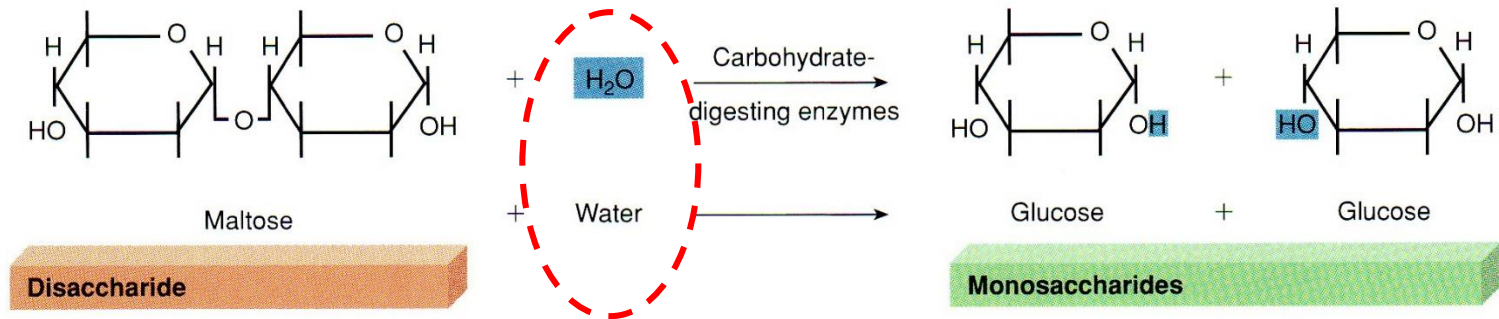


H<sub>2</sub>O

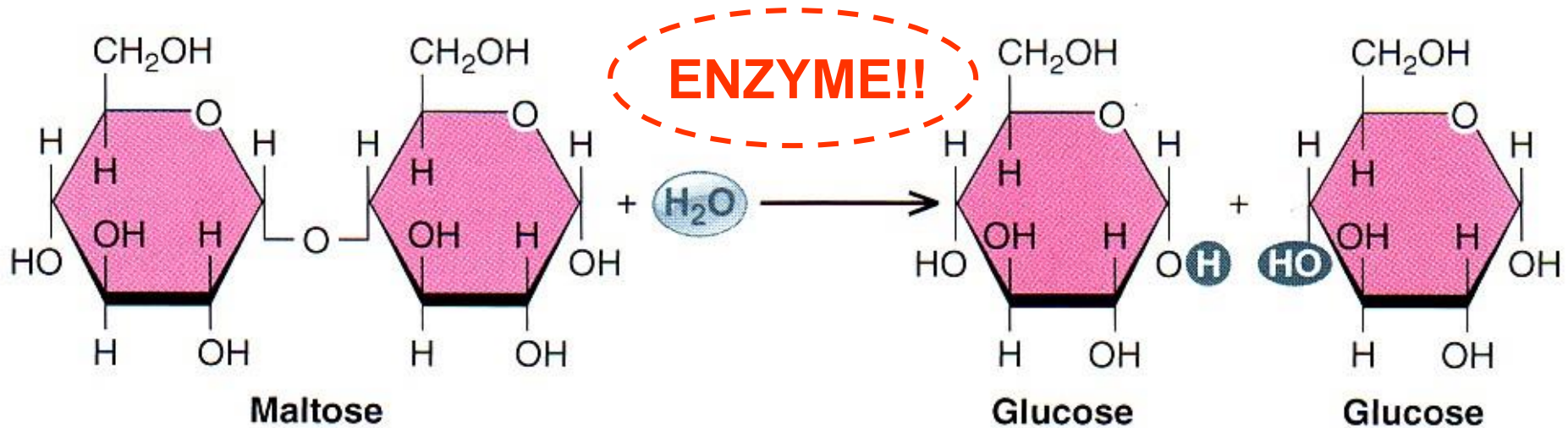
+

Enzyme





# What's missing?

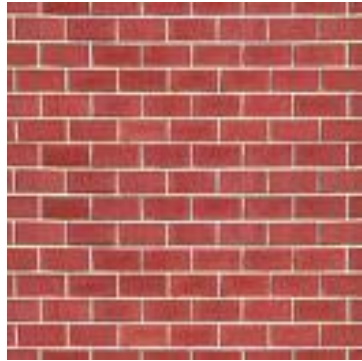


● **FIGURE 15-1** An example of hydrolysis. In this example, the disaccharide maltose (the intermediate breakdown product of polysaccharides) is broken down into two glucose molecules by the addition of  $H_2O$  at the bond site.

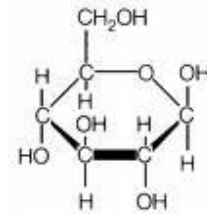
# Polymer to Monomer (Many to One)



...Central-linking theme!!

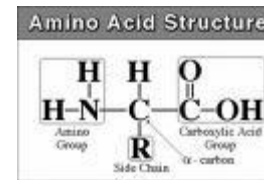


Carbohydrate

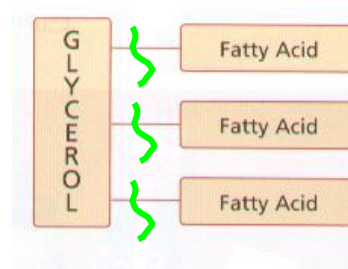


Glucose

Protein  
+  
Fat

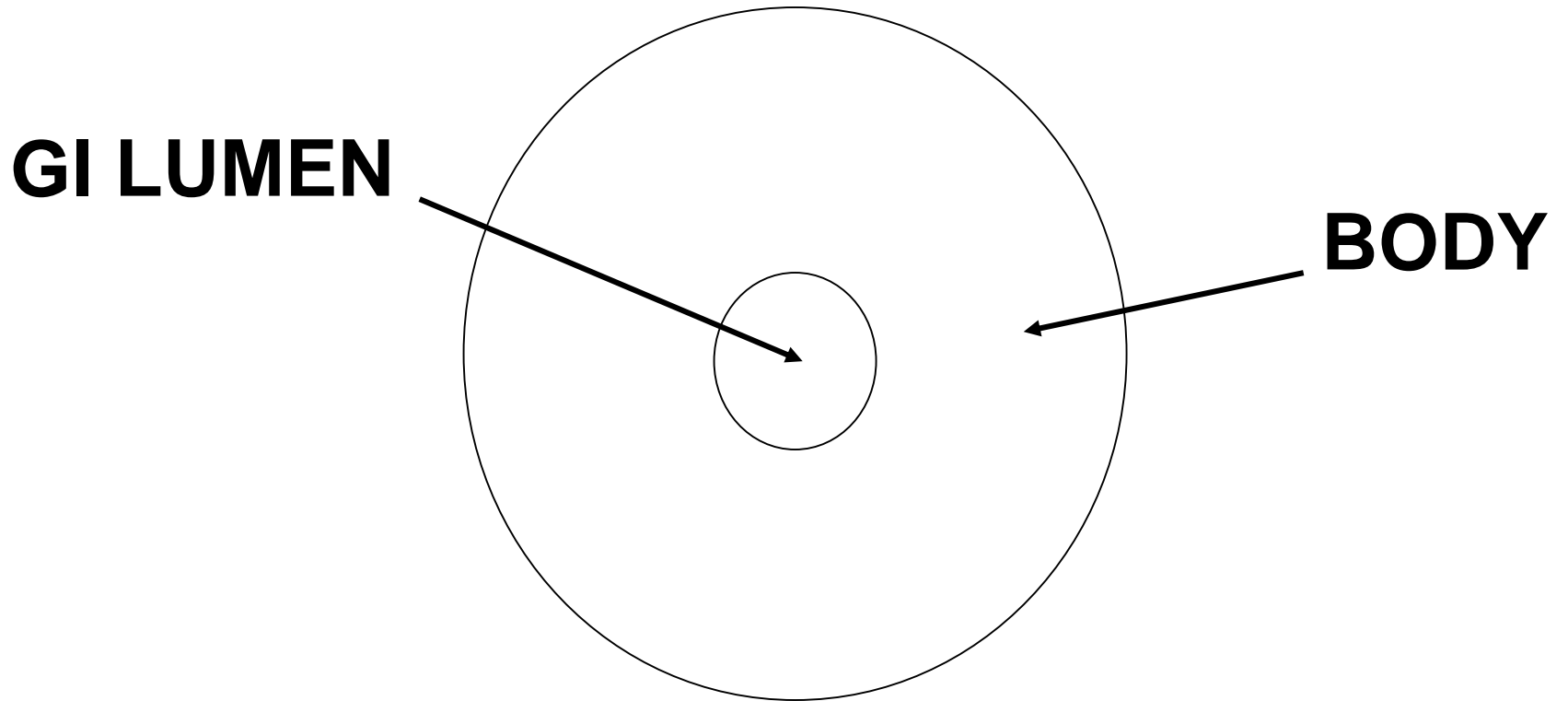


Amino Acids



Fatty Acids  
+  
Glycerol

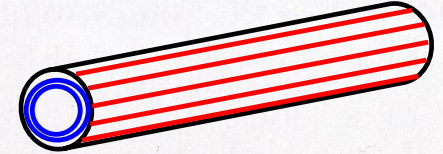
# GI-DONUT ANALOGY



# ***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

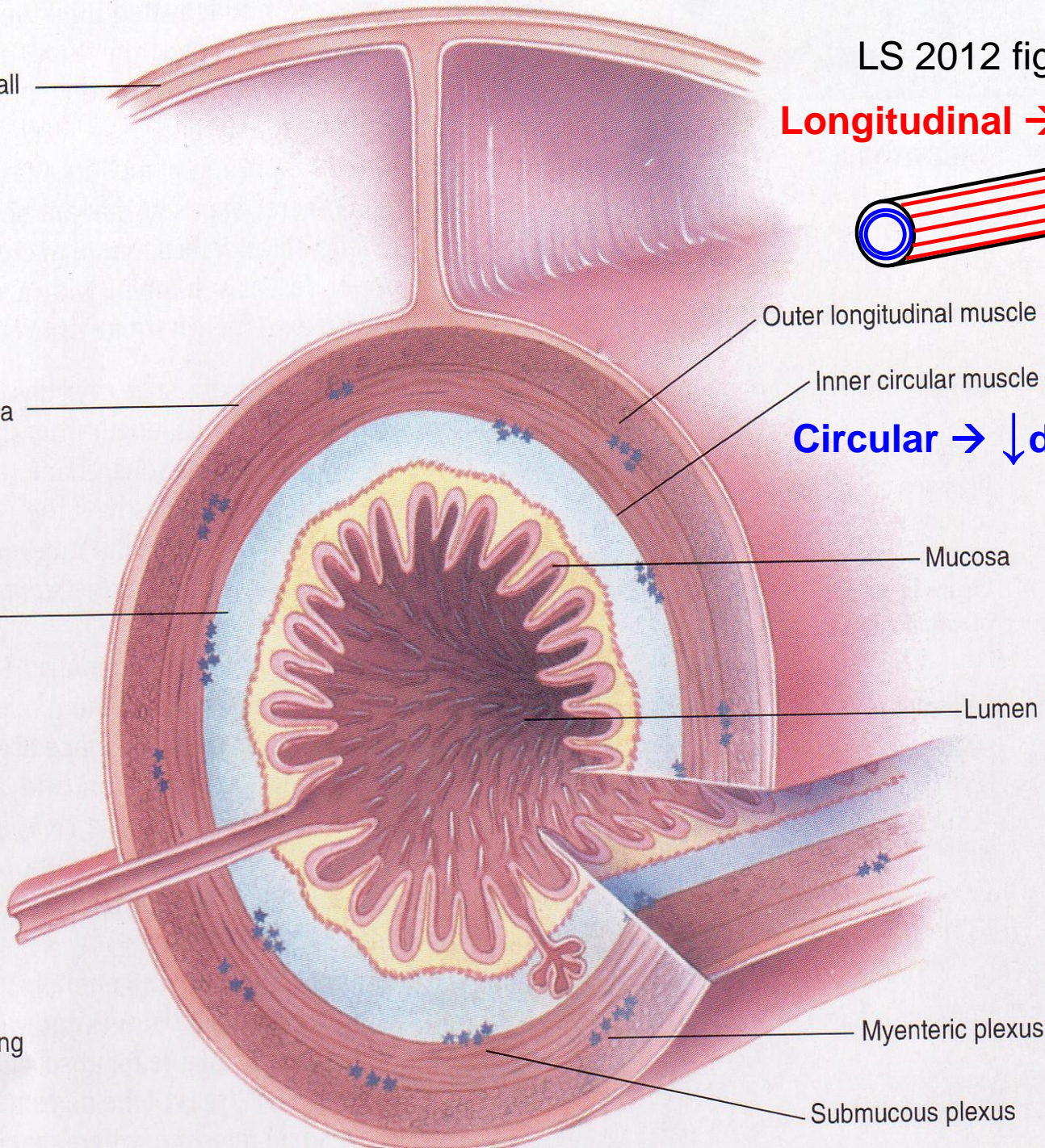
Muscularis externa

Mucosa

Lumen

Myenteric plexus

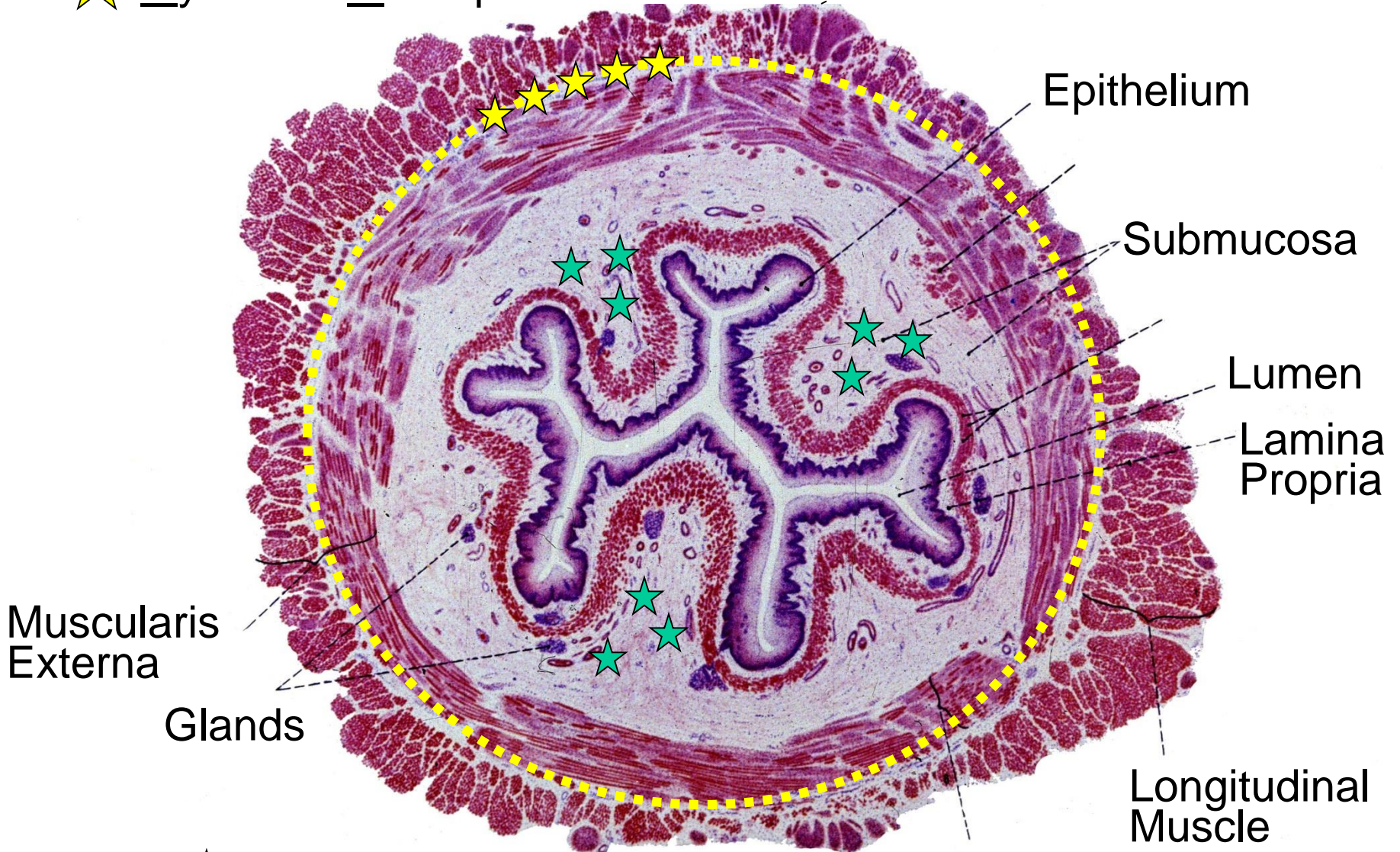
Submucous plexus



★ 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. H<sub>2</sub>O, acids, bases+**

**into GI Lumen**

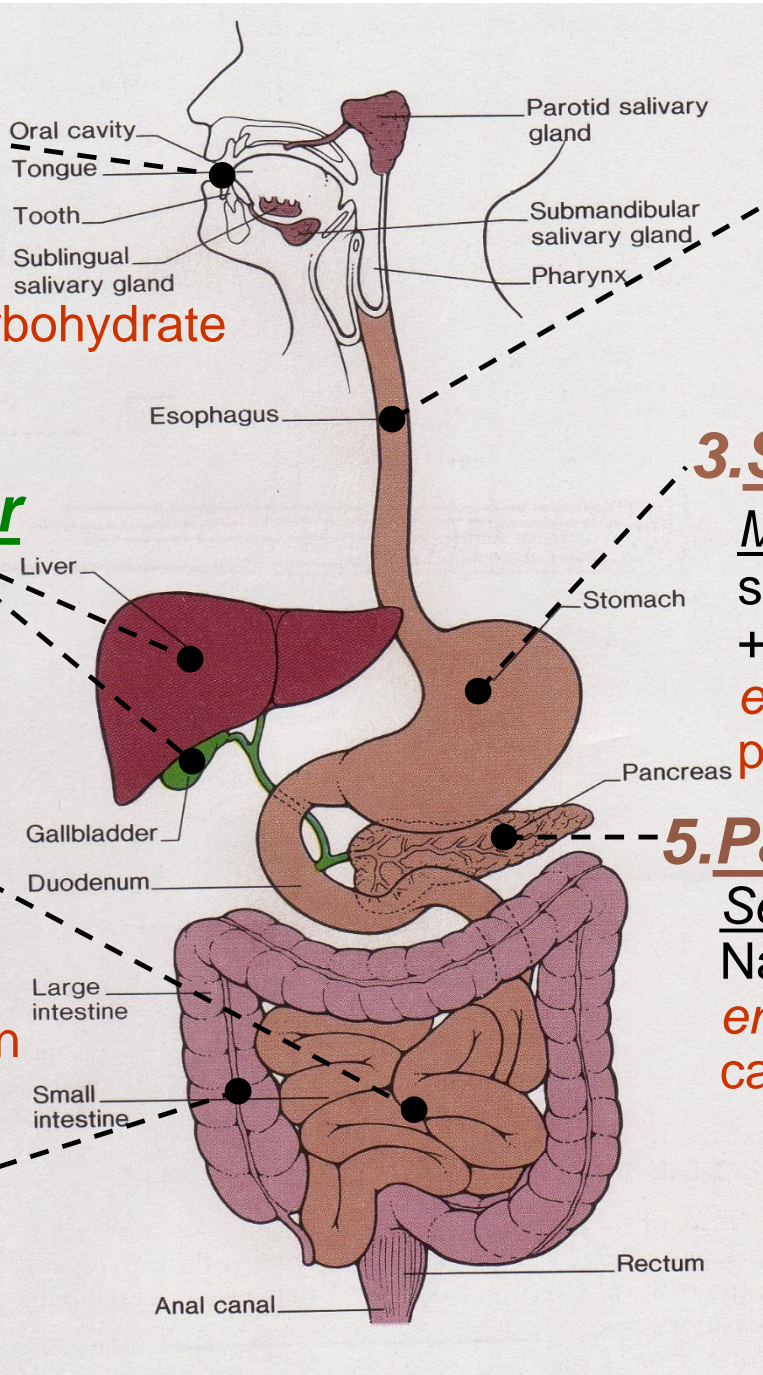
**4. Hormones**

**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 +  
 $\text{NaHCO}_3$  + 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