

## BI 121 Lecture 5

Yes, more fun!...



### I. Announcements Lab 3 tomorrow Nutritional Analyses.

Thanks for recording dietary data on LM p 3-7 & exploring <https://www.supertracker.usda.gov/>. Sample MT Questions.

### II. Nutritional Physiology in the News

UCB Wellness Letter, June 2011, Salt—beyond hypertension

### III. Nutrition Primer DC Module 2,Sizer & Whitney (S&W) Sci Lib

A. Essential Nutrients: H<sub>2</sub>O, 1<sup>o</sup> Carbohydrates, 2<sup>o</sup> Fats, 3<sup>o</sup> Proteins, Vitamins, Minerals; Macro- vs Micro-?

B. Dietary Guidelines: USDA, AICR, Eat Like the **Rainbow!**

C. Diet or exercise? Diet composition & endurance? Fasting? Zuti & Golding 1976; Sacks **AHA NPAM Council** 2009; AMDR? Adjusted Macronutrient Distribution Range!

D. *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: the central linking theme! LS p 438, Fox 2009

C. What's missing? LS fig 15-1 p 438

D. GI-Donut analogy? Dr. Lorraine Brilla WWU

E. Gut secretions: What? Where? Why? LS p 438, 440-1

F. Organ-by-organ review LS tab 15-1 pp 440-1 + DC fig 3-1

## Sample Midterm Questions

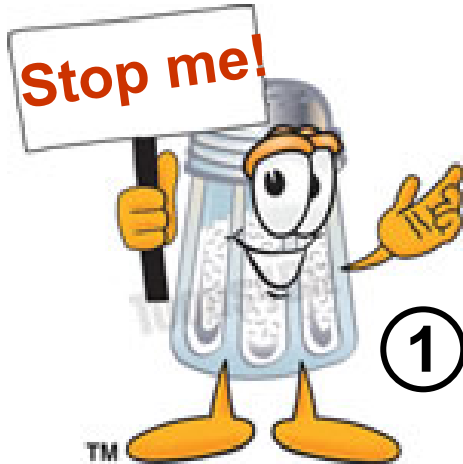
**Sample 1.** What is *human physiology*? (+2) How does it differ from *human anatomy*? (+2)

**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 ↑ 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!!



# Macronutrients & Micronutrients Essential for Life

## Macronutrients

H<sub>2</sub>O/Water

✓ 1<sup>o</sup> Carbohydrates

✓ 2<sup>o</sup> Fats/Triglycerides/Lipids

✓ 3<sup>o</sup> Proteins

## Micronutrients

Vitamins (A, D, E, K; C + B)

Minerals (K<sup>+</sup>, Na<sup>+</sup>, Ca<sup>2+</sup>, Mg<sup>2+</sup>,  
Fe<sup>2+</sup>, Zn<sup>2+</sup>,...)

## Sample Food Sources

Water, other drinks, fruits  
& vegetables

Grains, vegetables, fruits,  
dairy products

Meats, full-fat dairy  
products, oils

Meats, legumes, dairy  
vegetables

**NB: Need only minute quantities!**

Vegetables, vegetable oils,  
fruits, citrus, grains, dairy

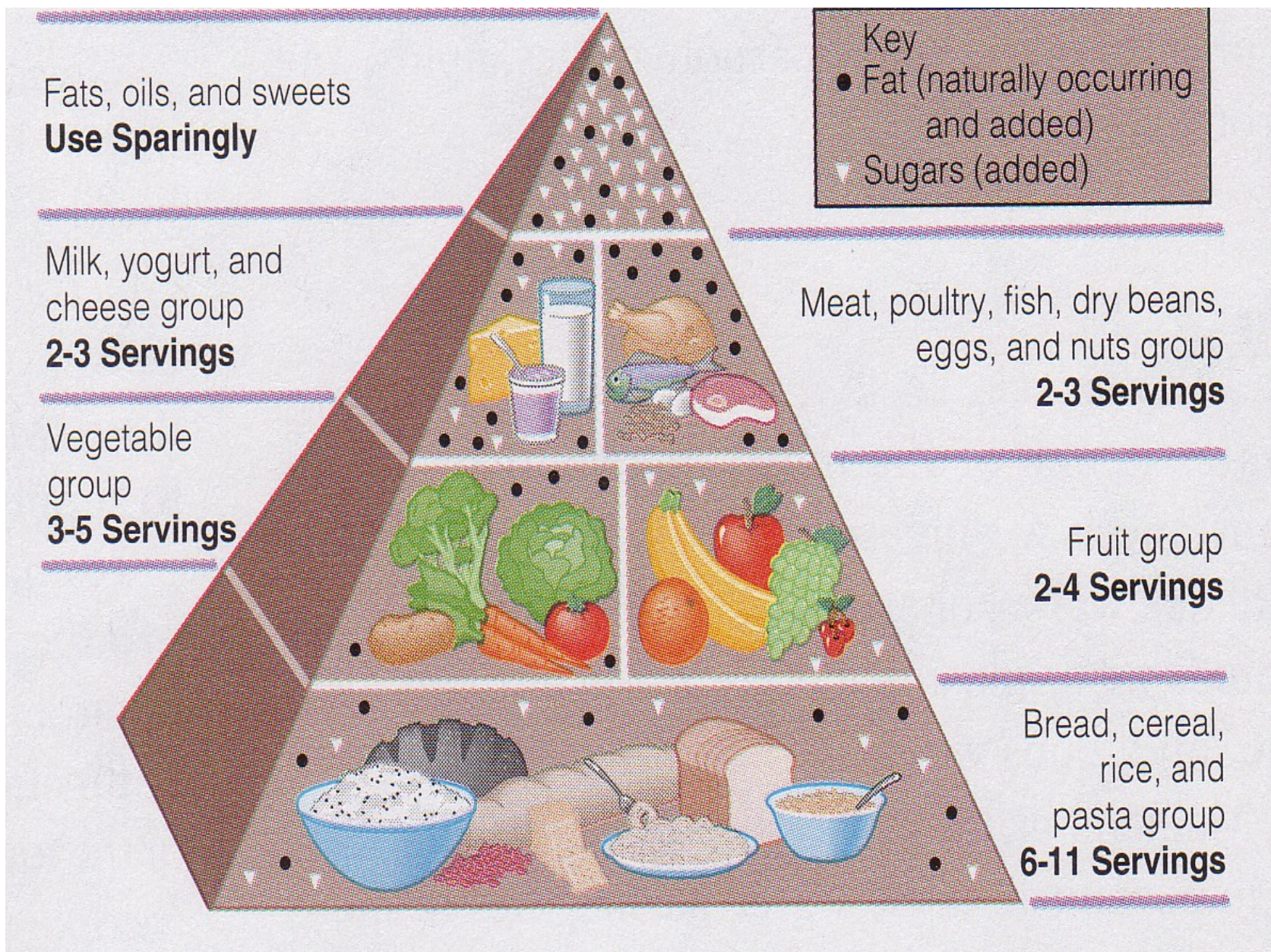
Fruits, vegetables, grains,  
nuts, dairy, meats,  
processed foods

✓ **Energy nutrients = yield ATP**



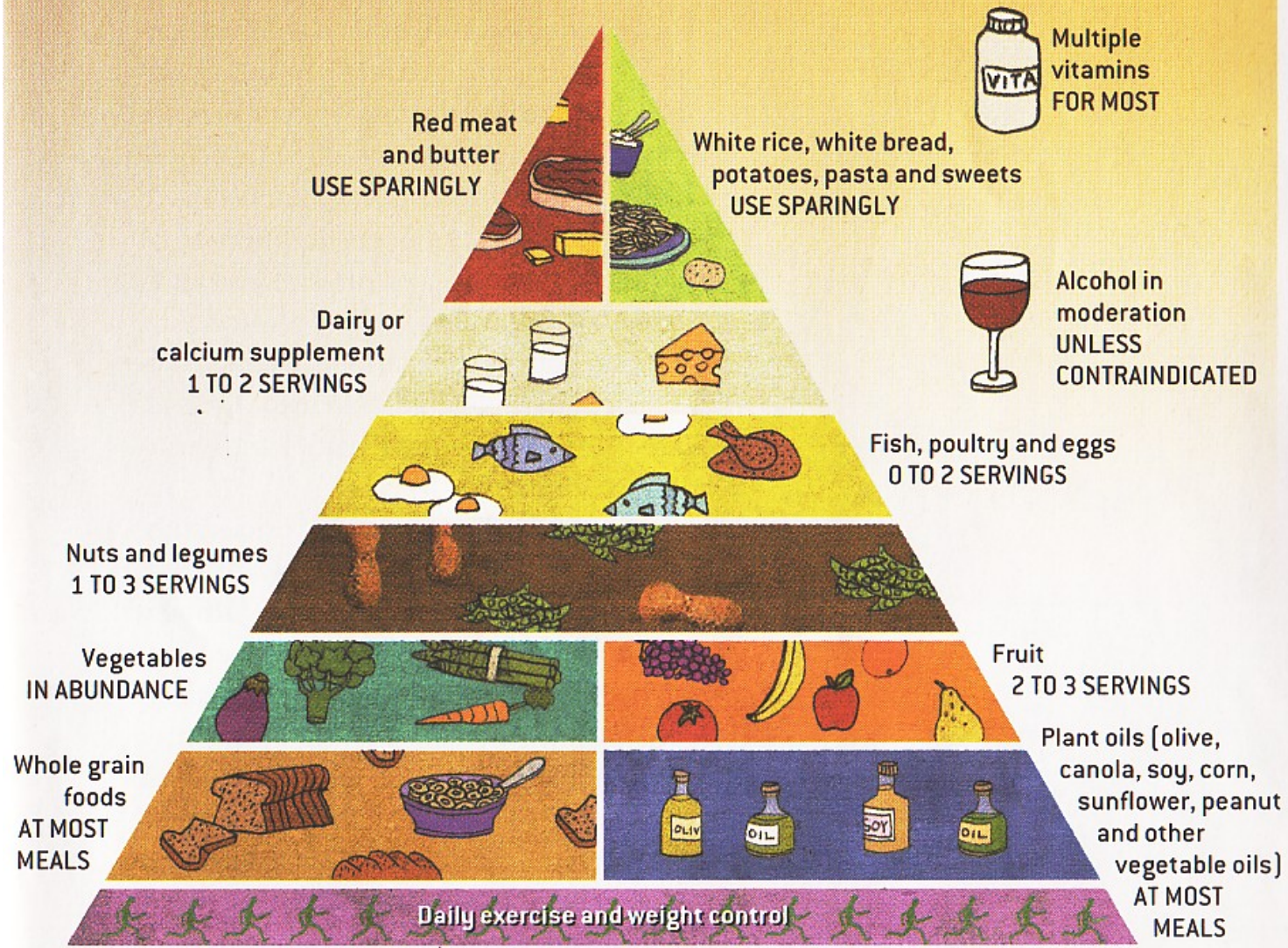


# USDA Food Pyramid 1992





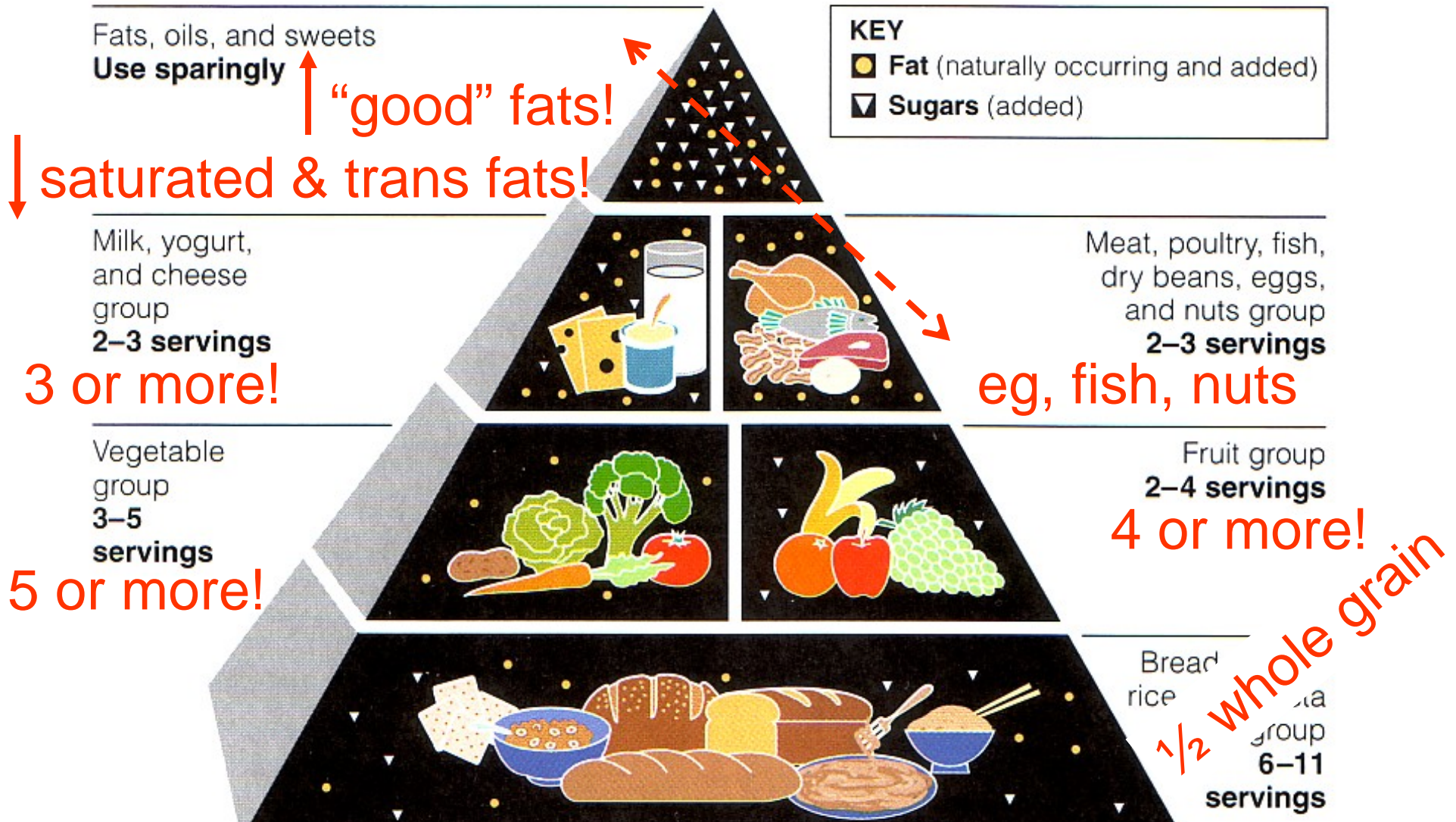
# Willett & Stampfer Suggestions 2003



## NEW FOOD PYRAMID



# US Modifications to 1992 Food Pyramid 2005



**Regular Physical Activity: Exercise! Exercise!!**

# *Dietary Guidelines for Americans 2005 Food Guidance System*

Hooray!



1. ↑ emphasis on ↓ kcal + ↑ exercise.
2. 9-A-Day! 4 fruit + 5 vegetable servings.
3.  $\geq 3$  of 6 whole grains  $\longrightarrow$   $\frac{1}{2}$  whole grains!
4. 3 servings of dairy, eg 3 c fat-free milk.
5. ↓ saturated + trans fats + ↑ unsaturated/  
“good” fats, eg  $\Omega$ -3 fish, walnuts.
6. Drink in moderation if at all.
7. Practice food safety.



# *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.**

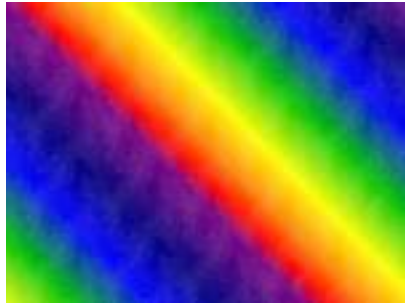
**And always, remember...**

**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.

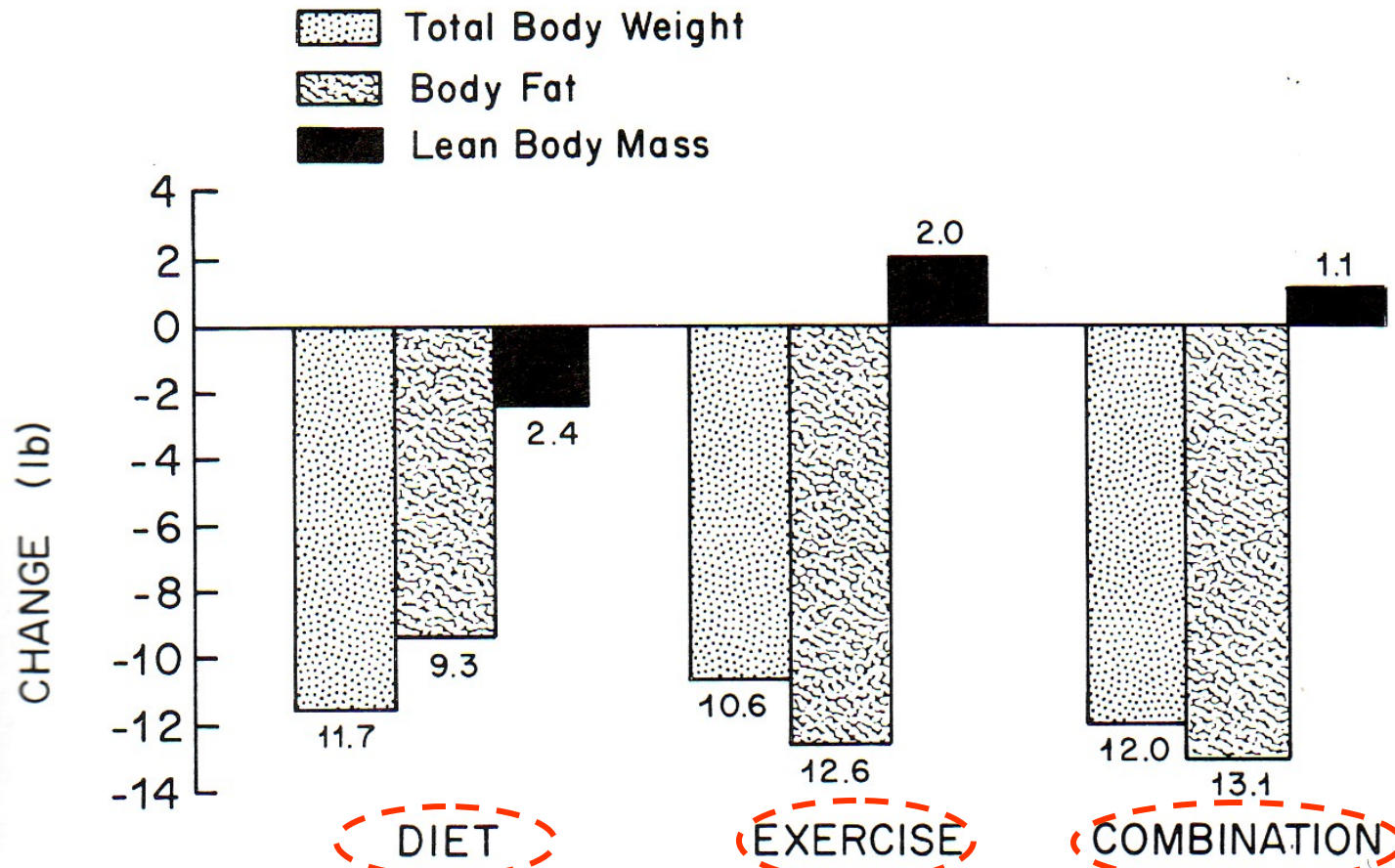
A surprising number of people get 1/5 of their calories from sodas or other liquids.

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.)

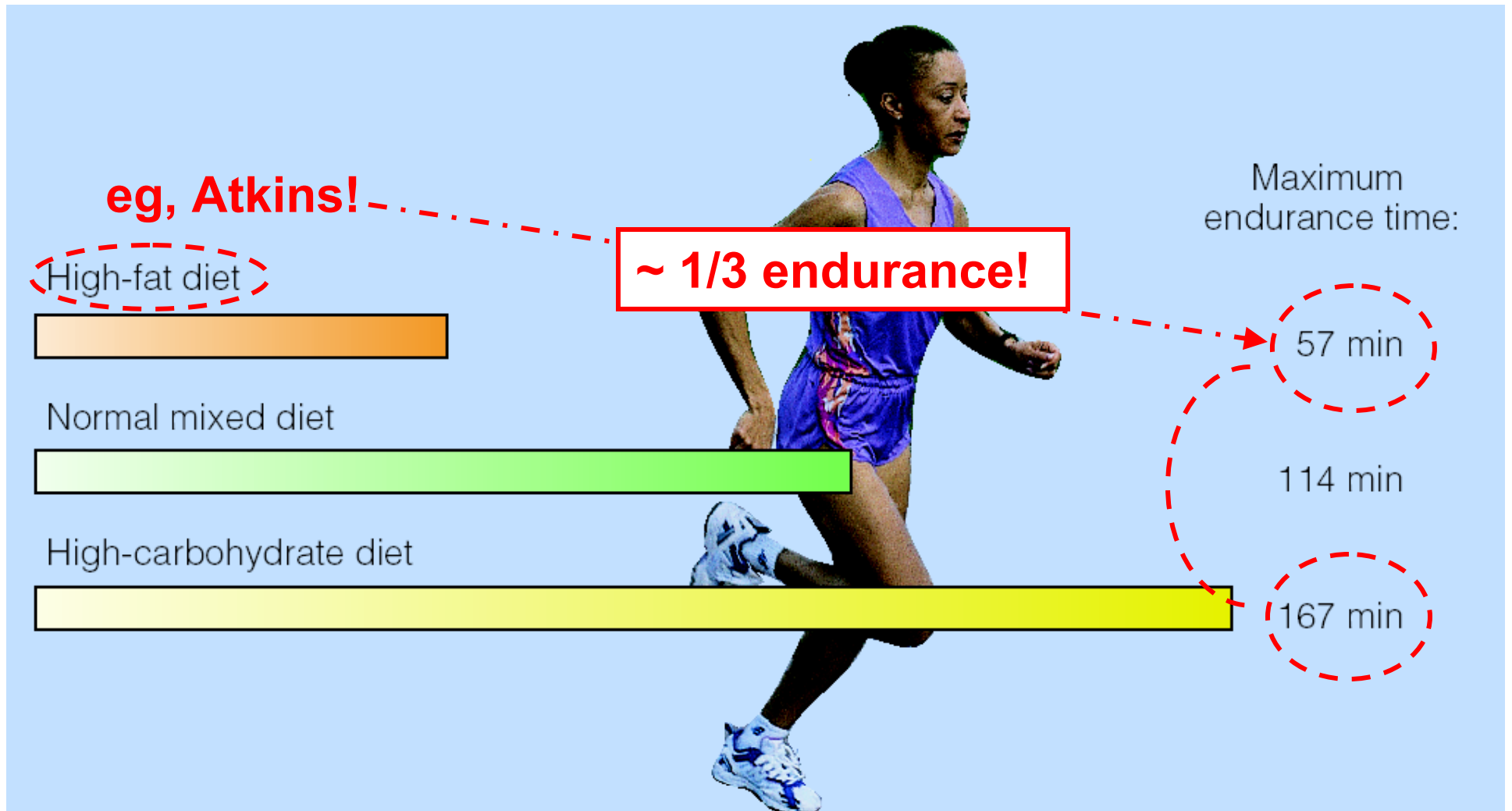
**NB: Each group 500 kcal deficit/day, 16 weeks**





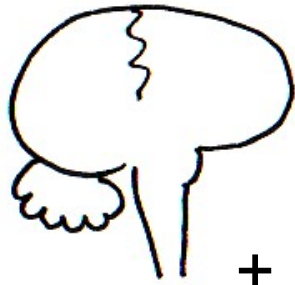
**Compared to dieting,  
*exercise is superior* in  
inducing % body fat  
reduction & preserving  
lean body mass!**

# Dietary Composition & Physical Endurance



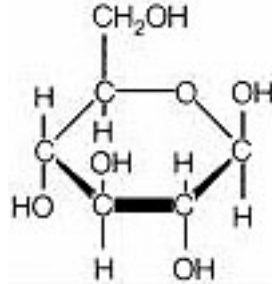


② cns



+

glucose



rbc's



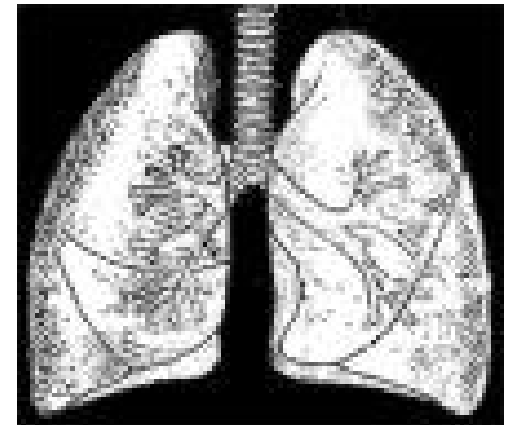
# Negative Effects of Low Carbohydrate

①



- ① ↑ fatigue/exhaustion central & peripheral!
- ② ↓ glucose – brain+spinal cord, rbc's 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**



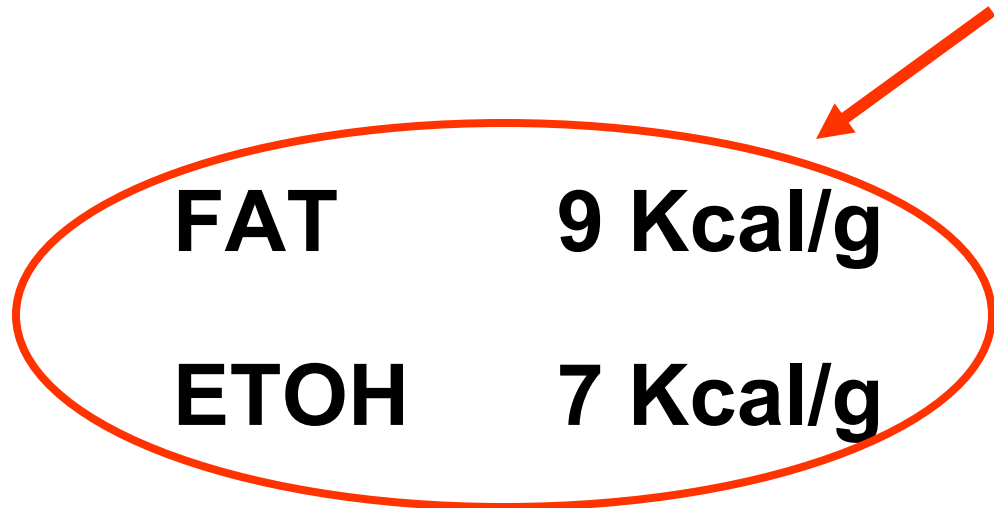
**23 % Kcal**

**Dietary  
Carbohydrate**





To Help Lower Body Wt & %Fat  
**EXERCISE!! +*Minimize* These!!**



**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

76.7% {  
26 lb Water  
20 lb Lean Body Mass  
14 lb Fat

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

***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

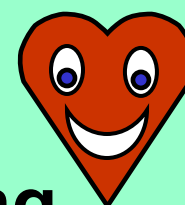
Frank M. Sacks, MD

**W**ell-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

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

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*



## ***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.**



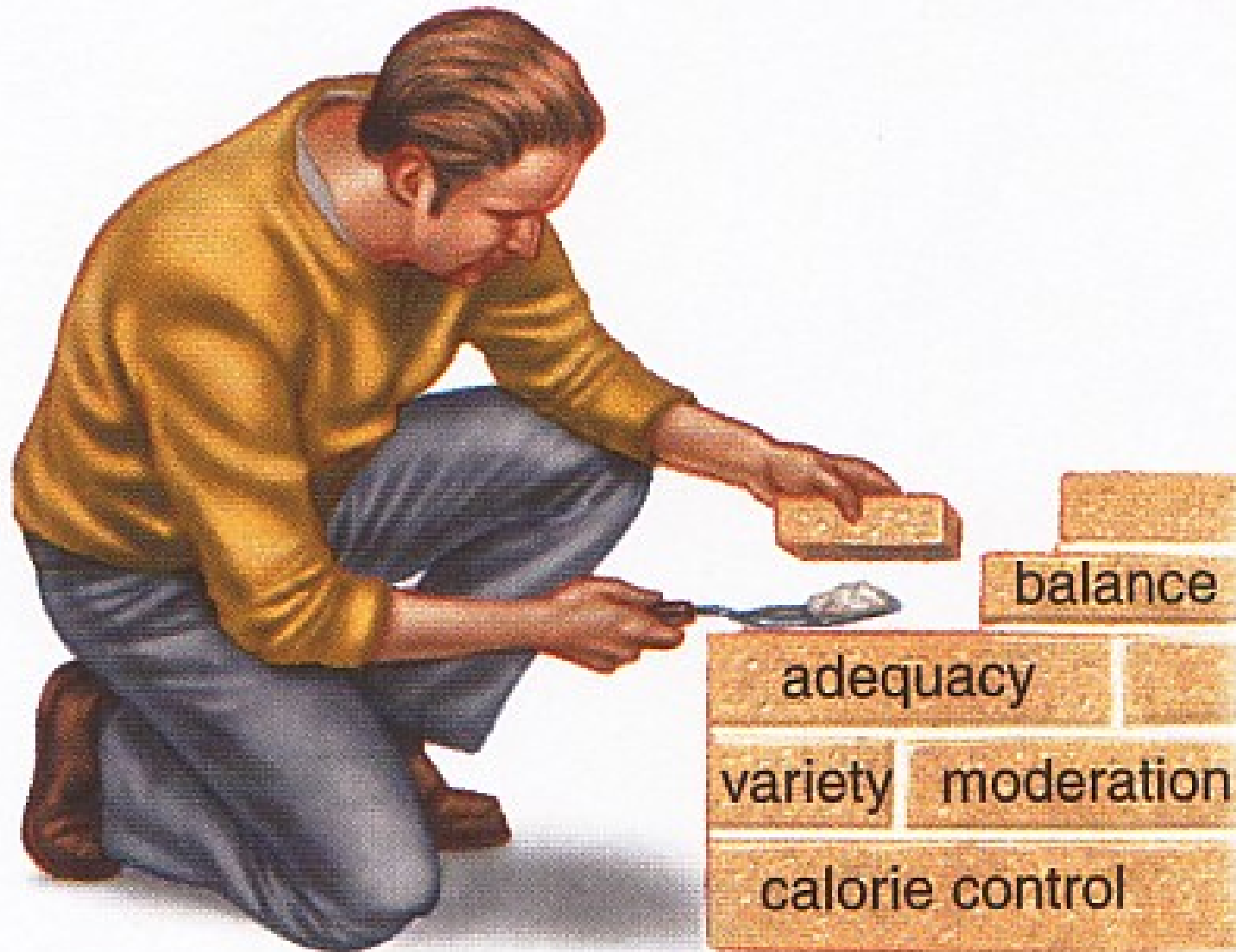
***US Dietary Recommended Intakes (DRI)  
Committee Acceptable Macronutrient  
Distribution Ranges (AMDR)!***

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

# Emphasize ABCs + Variety & Moderation!



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





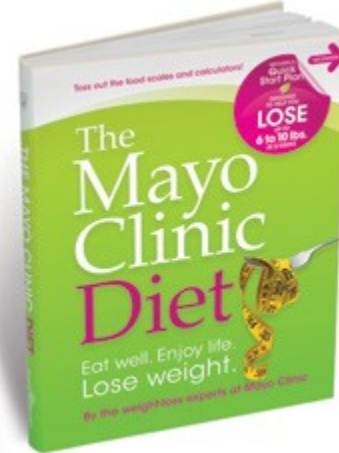
## ***Kleiner's & Monaco's Top 10 Hit List for Nutrition Quackery***

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.

**NOT PEER-REVIEWED =  
TRADE BOOKS**



**PEER-REVIEWED =  
TEXTS →  
RESEARCH**



**AHA + DASH +  
MAYO CLINIC** 



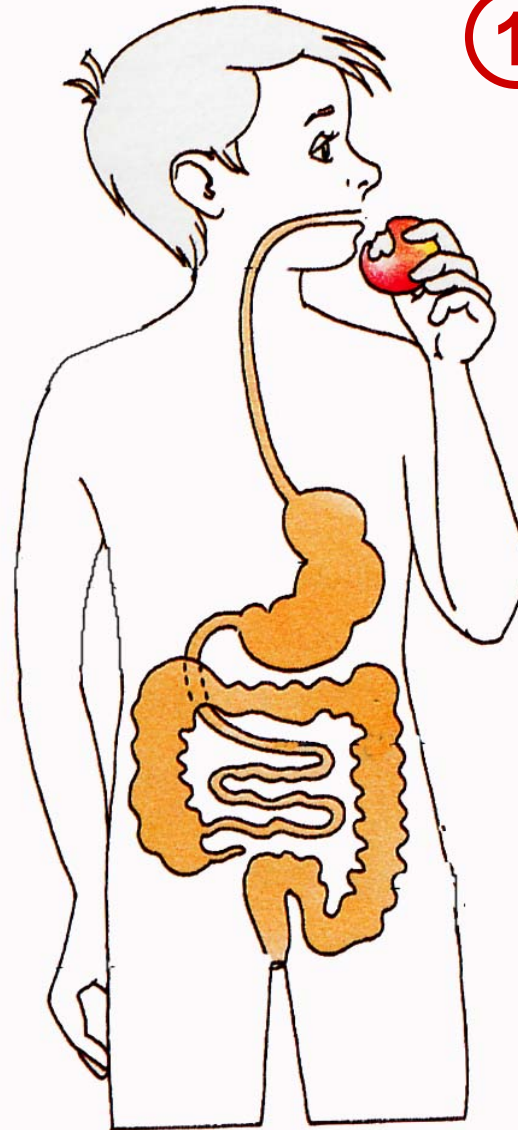
 **LOWER  
CARBOHYDRATE**

**ELIMINATE CALORIES  
or FOOD GROUPS  
ENCOURAGE FASTING**

**LOWER  
FAT** 

**ADEQUACY  
BALANCE  
CONSISTENCY  
& MODERATION**

# 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.

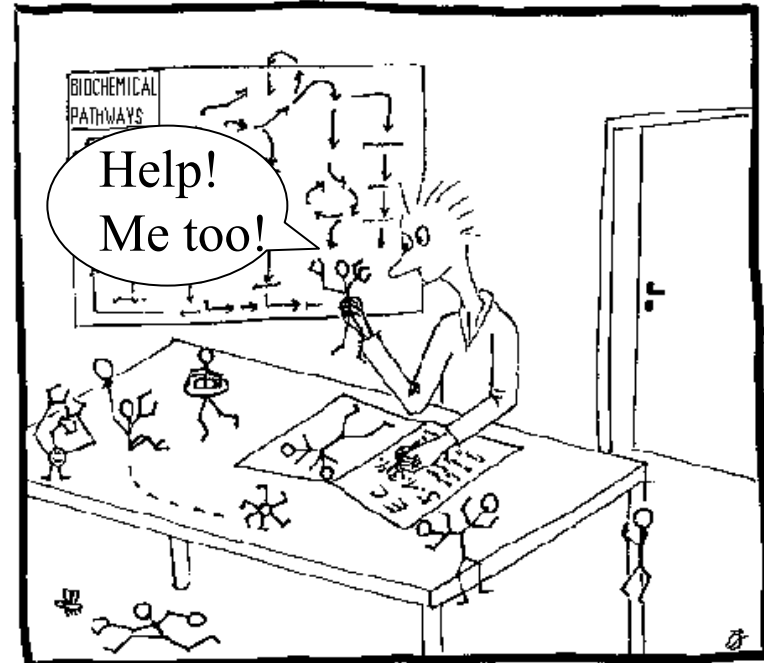
# Hydrolysis of Energy Nutrients

Hi gang!!  
You need me  
for digestion!!



+

*The ENZYME data bank*

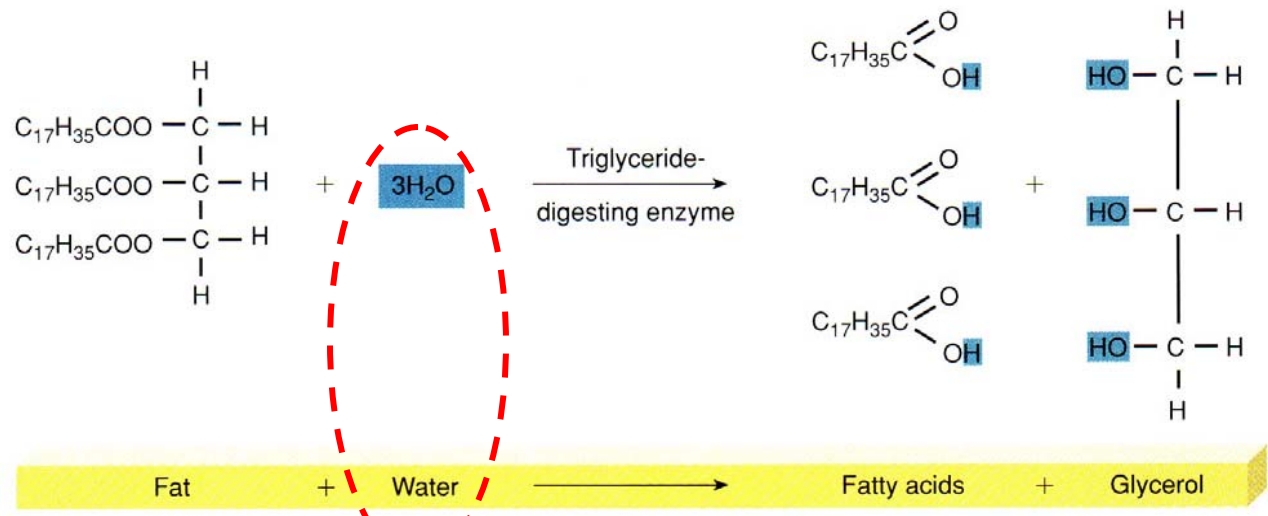
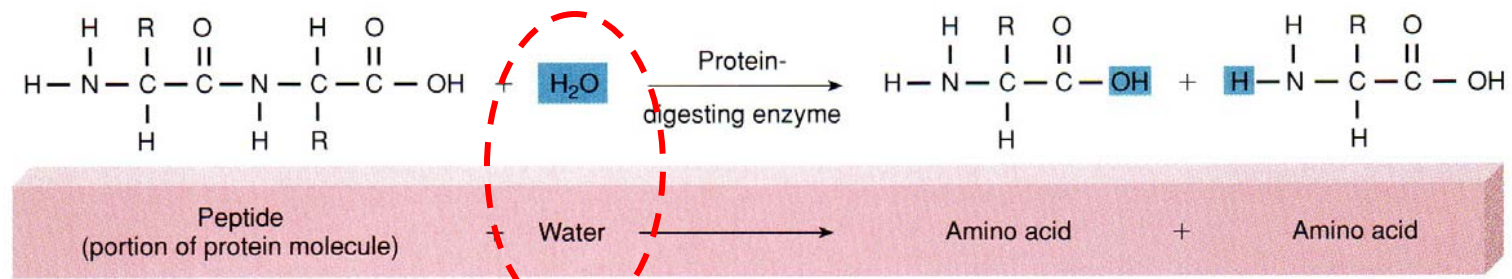
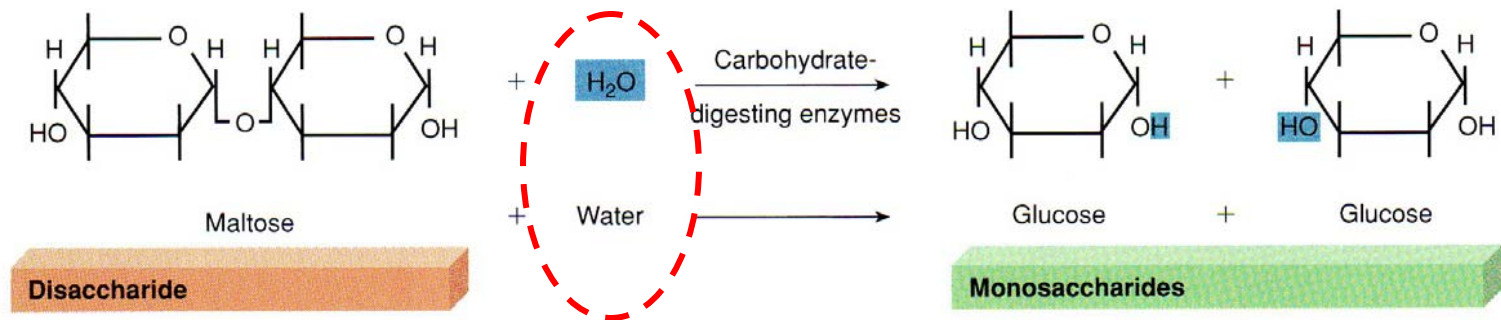


H<sub>2</sub>O

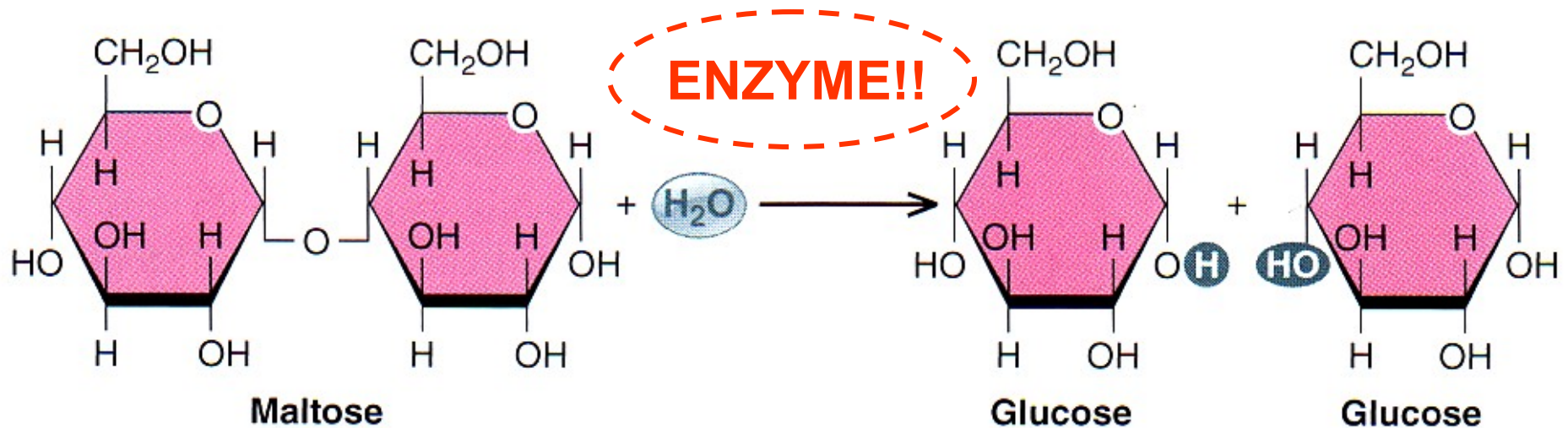
+

Enzyme





# What's missing?

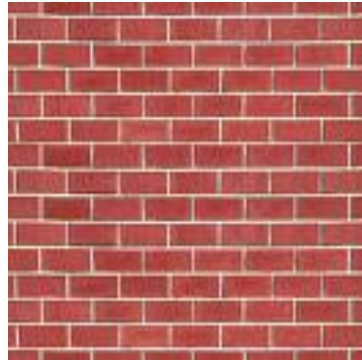


● **FIGURE 15-1 An example of hydrolysis.** In this example, the disaccharide maltose (the intermediate breakdown product of polysaccharides) is broken down into two glucose molecules by the addition of H<sub>2</sub>O at the bond site.

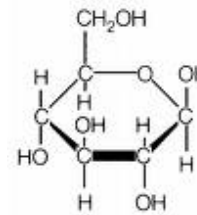
# Polymer to Monomer (Many to One)



...Central-linking theme!!

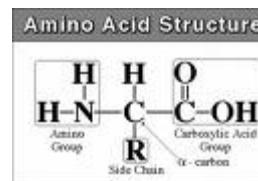


Carbohydrate

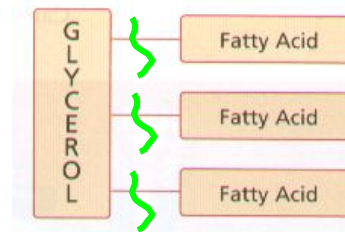


Glucose

Protein  
+  
Fat

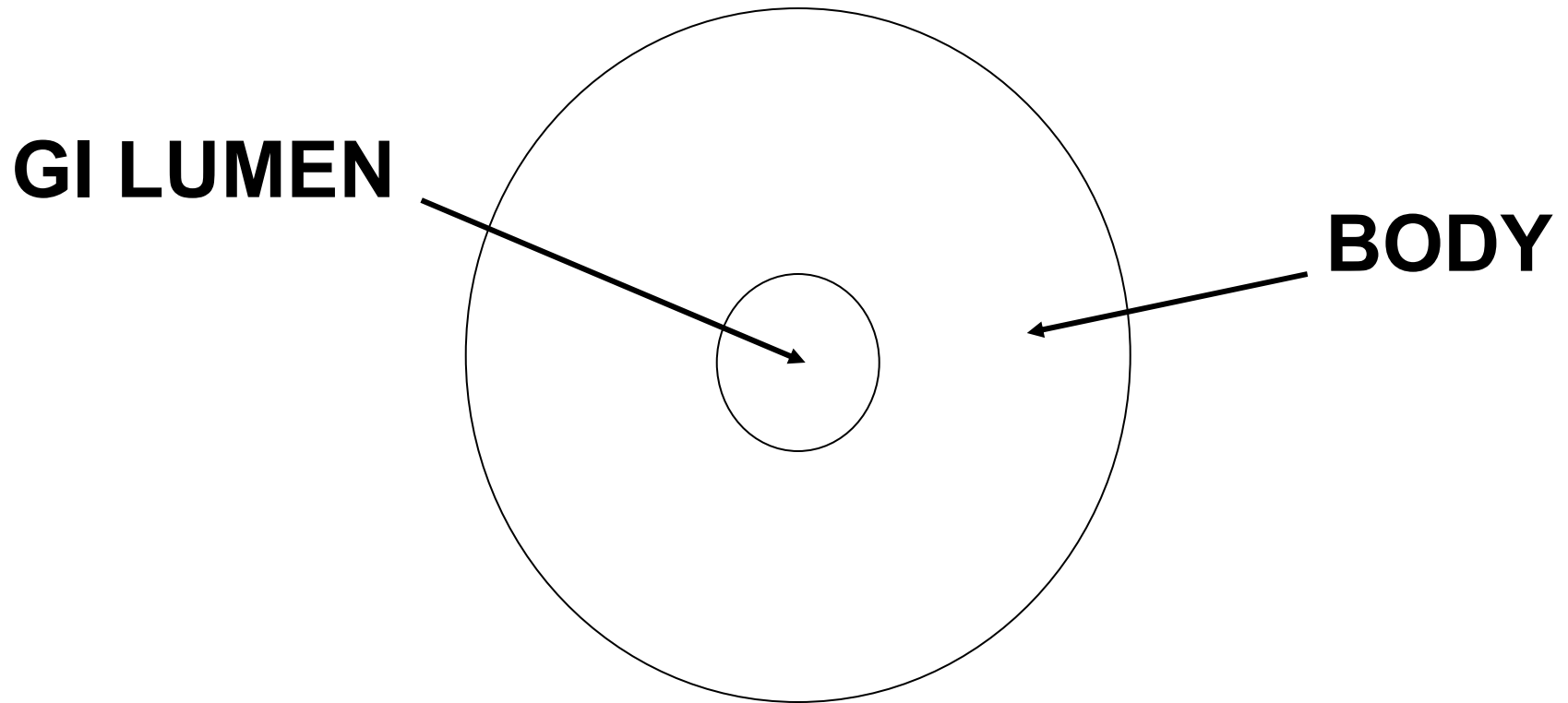


Amino Acids



Fatty Acids  
+  
Glycerol

# GI-DONUT ANALOGY





# ***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

# 4. Liver-Gall Bladder

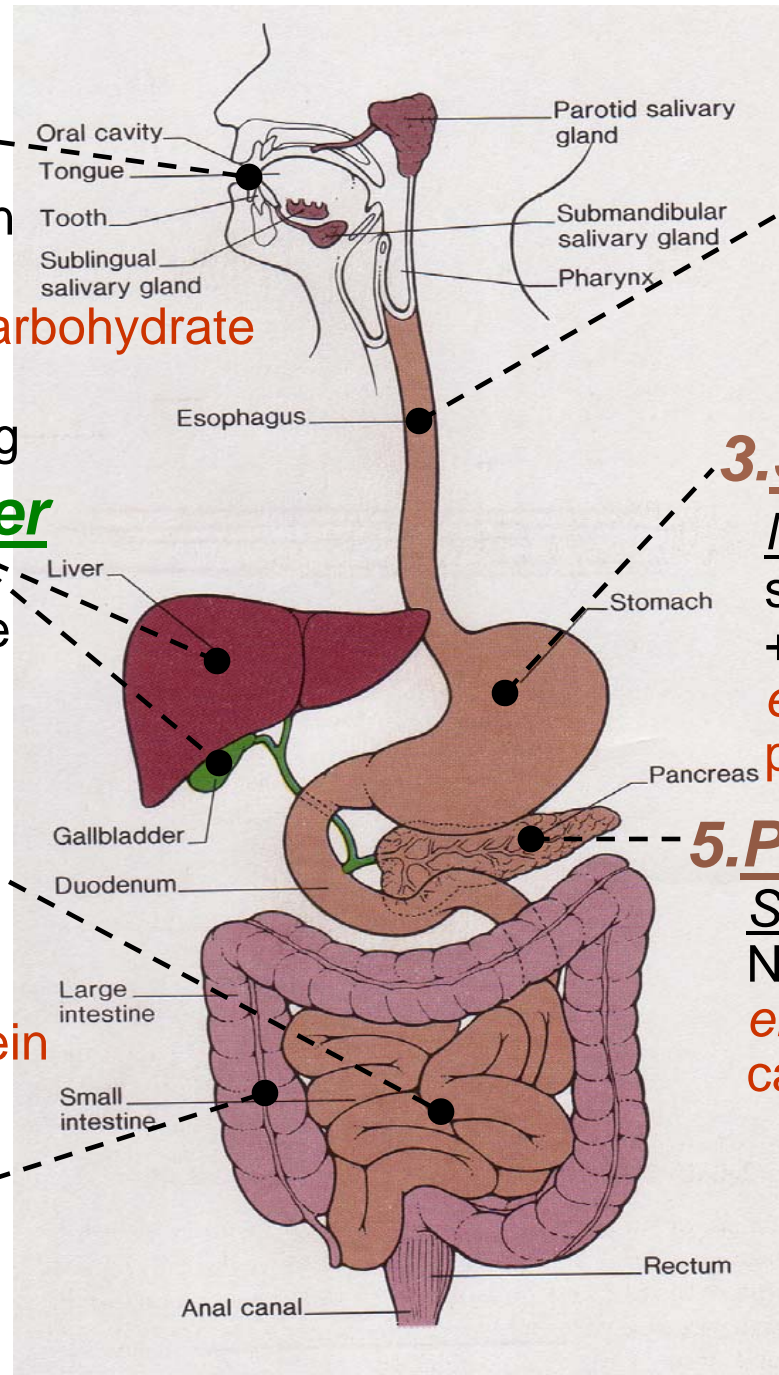
Emulsification =  
detergent action of bile  
+ secretion

# 6. Small Intestine

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

# 7. Large Intestine

Dehydration  
secretion + absorption  
storage + peristalsis



# 2. Esophagus

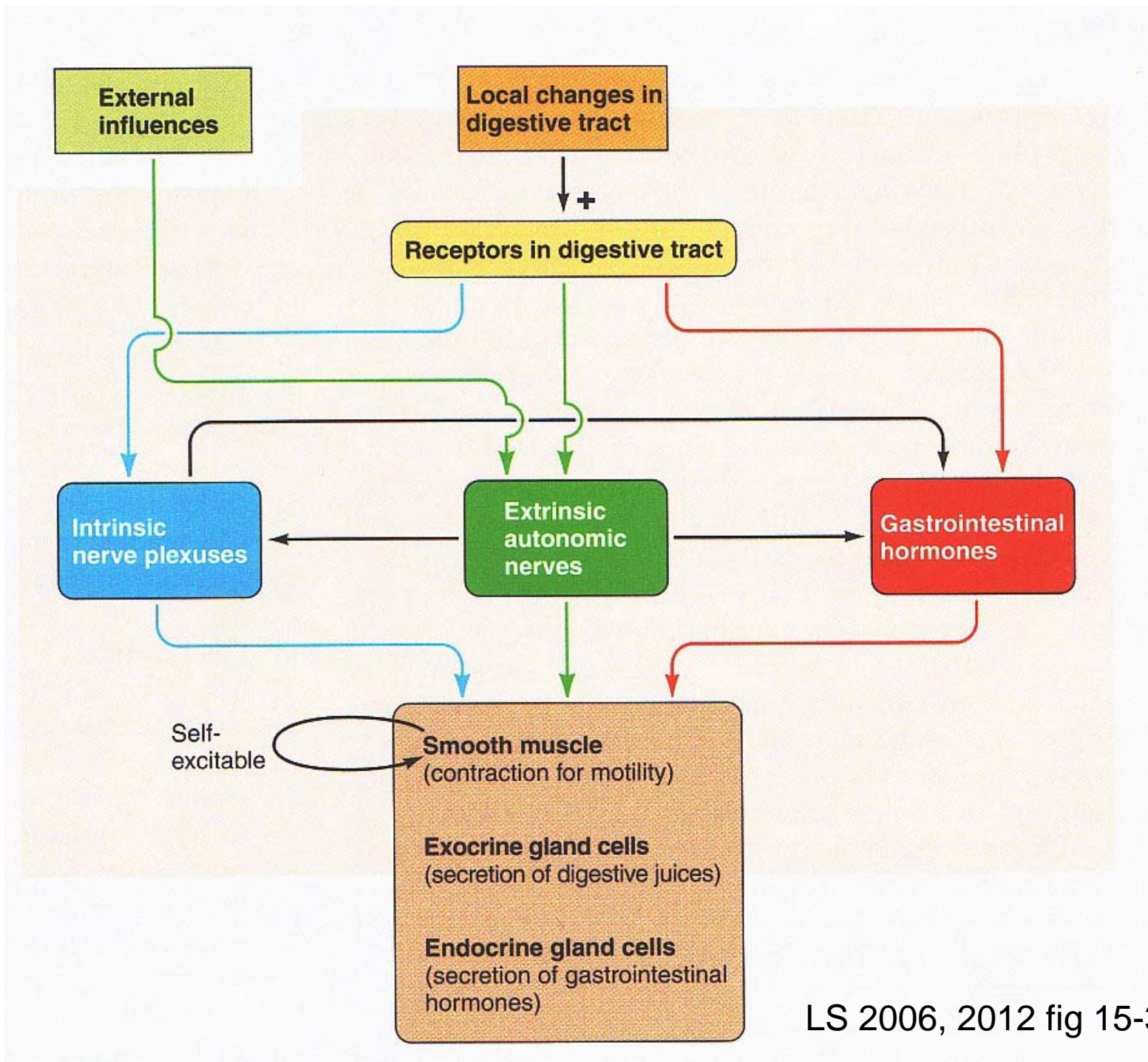
Rapid transit  
peristalsis  
secretion mucus

# 3. Stomach

Mixing peristalsis  
secretion mucus + HCl  
+ enzymes  
enzymatic digestion:  
protein + butter fat!

# 5. Pancreas

Secretion mucus +  
NaHCO<sub>3</sub> + enzymes  
enzymatic digestion:  
carbohydrate, fat, protein



LS 2006, 2012 fig 15-3 p 443

# ***Common Control Mechanisms***

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