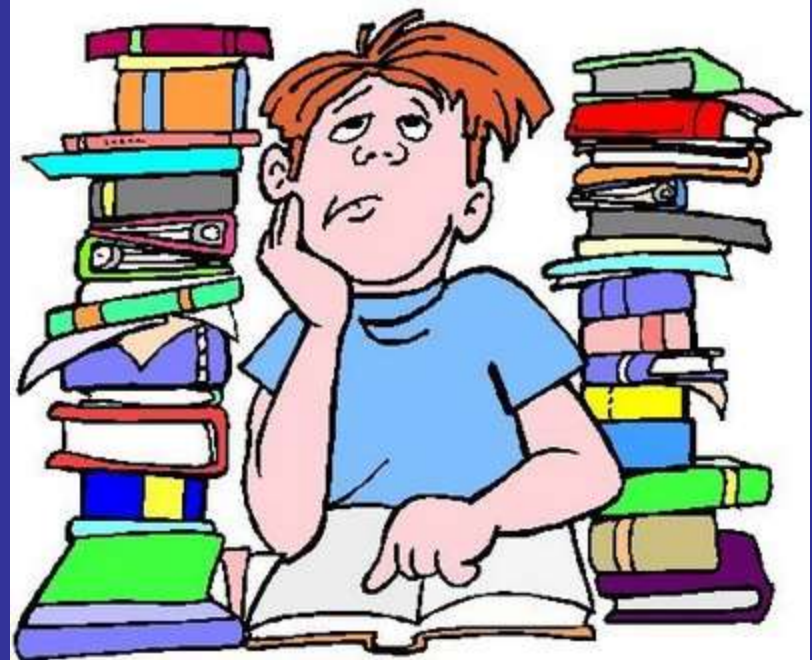


# Exam I Review Slides





*G. Waples*

## BI 121 Lecture 1

- I. Announcements**: Please check & sign attendance roster. Not on list? See Pat during break/> class. *Lab 1 Histology* Thursday in 130 HUE: 10 am → 5 pm sections. Much fun!!
- II. Introduction**: Staff, office hr, required sources, overview, grading, expectations & success. Anything goes Q?
- III. Human Physiology** LS ch 1, DC Module 1
  - A. What? cf: Anatomy LS p 1
  - B. Where? Body Levels of Organization LS pp1-6, DC pp1-5
  - C. How? Different Study Approaches LS p 1
  - D. Why? Security+Decision-Making Power LS p xxi, DC p v
- IV. Homeostasis** LS ch 1, DC Module 1
  - A. What? Maintenance of ECF LS p 8
  - B. Where? ECF = Plasma + Interstitium LS fig 1-4 p 8
  - C. How? Simplified Homeostatic Model cf: LS fig 1-7 p 14  
Balances LS p 9, DC pp 5-6
  - D. Why? Cell survival! LS fig 1-5 p 9, DC p 5

**ANATOMY**  
**STRUCTURE**  
**WHAT?**  
**WHERE?**

**VS**

**PHYSIOLOGY**

**VS**

**FUNCTION**

**VS**

**HOW?**

**VS**

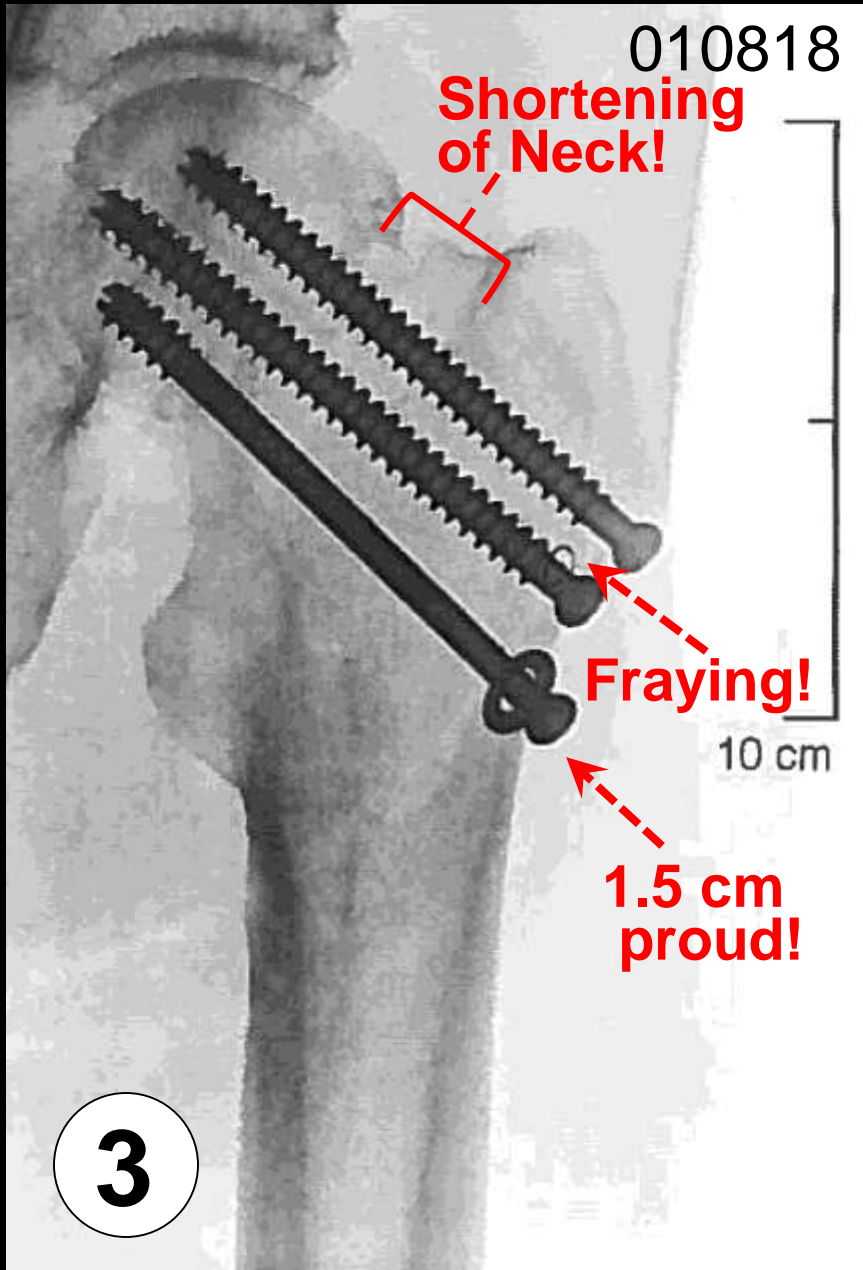
**WHY?**



**VS**



# L Hip Osteonecrosis & L Hip Replacement



# Body Levels of Organization

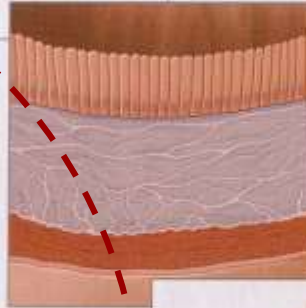
1. Molecular



2. Cellular



3. Tissue



4. Organ

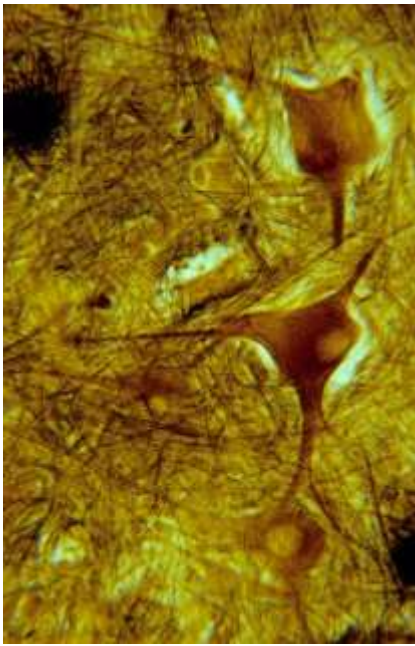


5. System

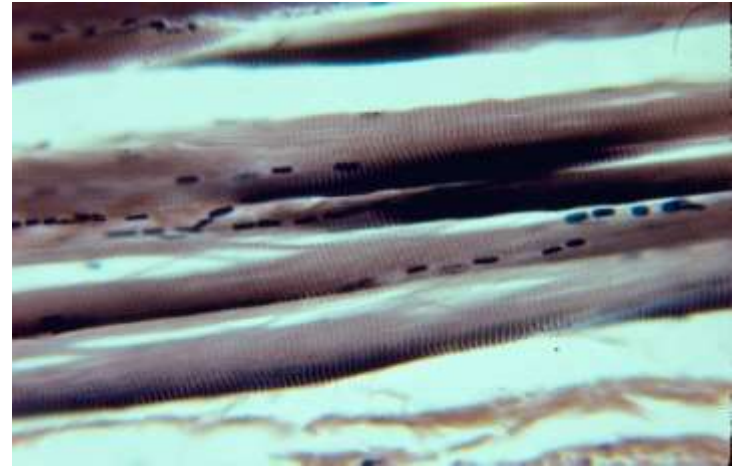


Entire Organism,  
like you & me!

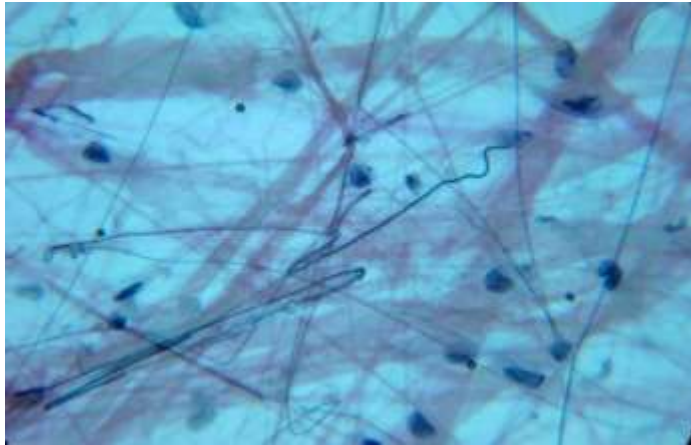




**Nerve conducts**



**Muscle contracts**

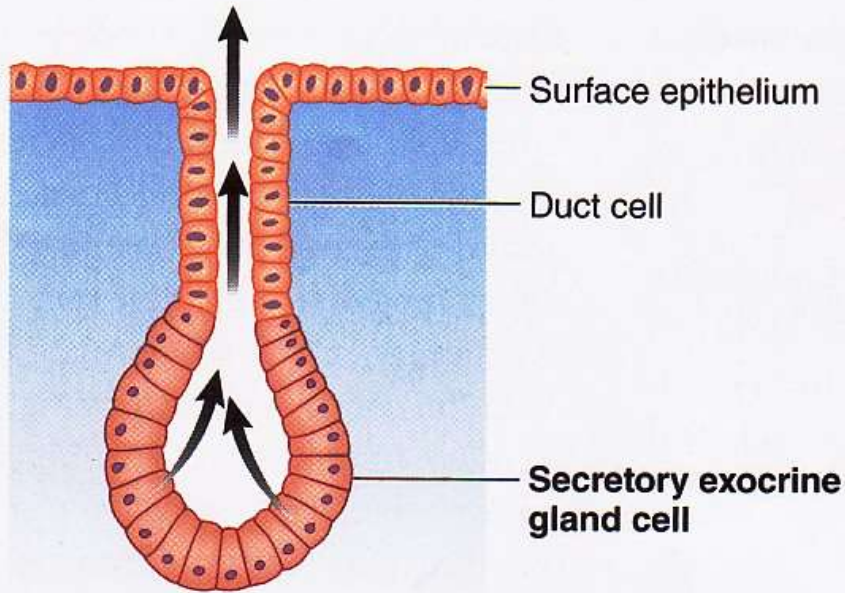


**Connective connects!!**

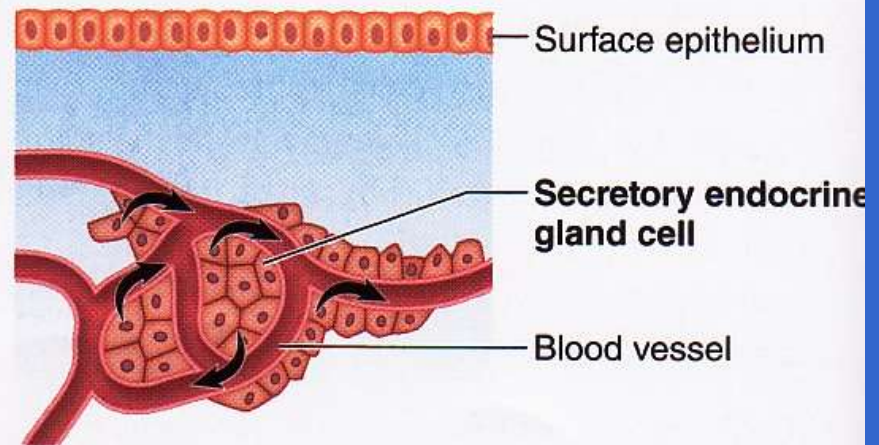


**Epithelial covers**

# ***Epithelial tissue gives rise to glands: (a) exocrine & (b) endocrine***

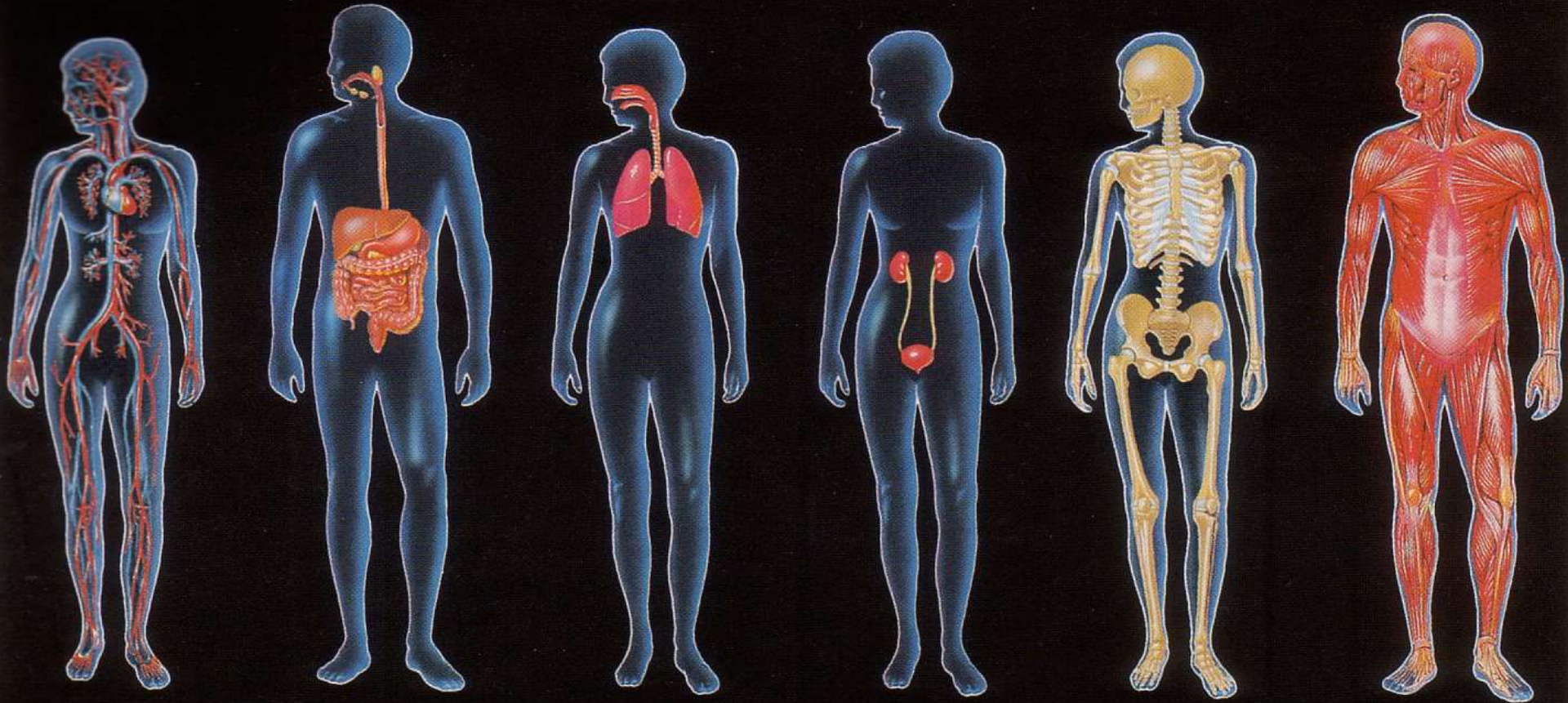


**(a)** Exocrine gland



**(b)** Endocrine gland

# *Which body systems?*





***Maintenance of a relative constancy in the Internal environment = ECF = fluid outside of cells***

**milieu  
interieur?**



**Claude Bernard**

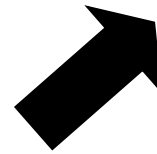


**100 trillion  
cells working  
intimately**



**Walter B. Cannon**

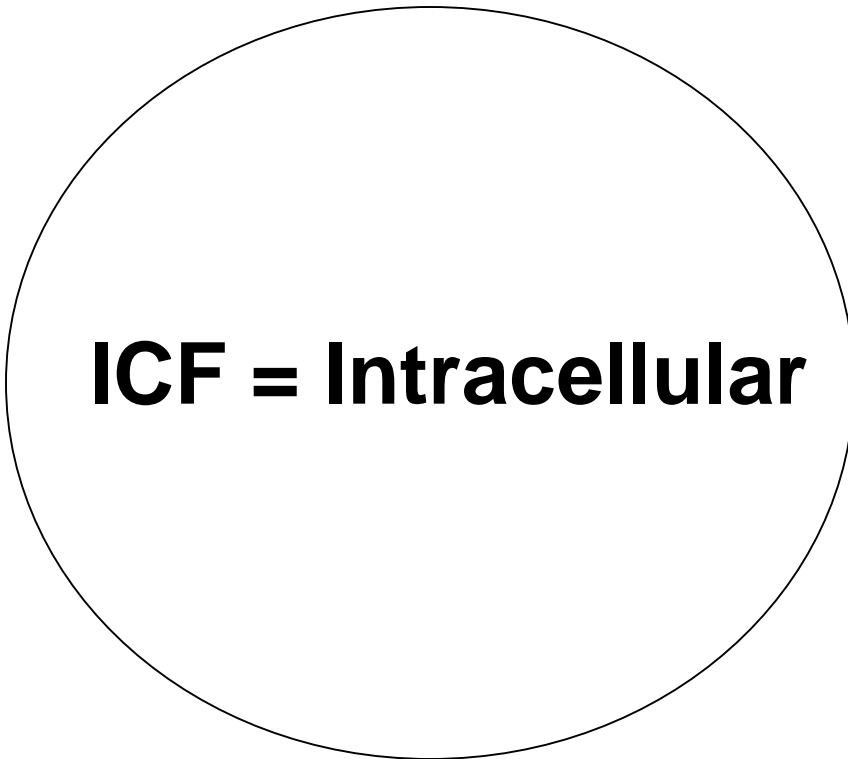
**ECF = Extracellular**



**Plasma**   
(within CV System)



**Interstitium**  
(eg, between  
muscle cells)



**ICF = Intracellular**



\*\*\* Thanks for signing attendance roster & noting late arrival or early departure time!



## BI 121 Lecture 2

**I. Announcements** Lab 1 Histology today! 130 Huestis (HUE) Fun! Worksheets. Readings: DC, LS, LM? **NB**: UO Biology blog vs. Canvas <http://blogs.uoregon.edu/bi121/fall-2019/>

**II. Homeostasis** LS ch 1, DC Module 1

A. What? Maintenance of ECF LS p 8

B. Where? ECF = Plasma + Interstitium + ? LS fig 1-4 p 8

C. Homeostatic Balances? LS p 9, DC pp 5-6

D. Why? Cell survival! LS fig 1-5 p 9, DC p 5

E. Physiology in the News H<sub>2</sub>O? Are we like watermelons?

F. How are balances maintained? Simplified Homeostatic Model cf: LS fig 1-7 p 14; T°C + BP balance e.g. + vs. - FB

**III. Cell Anatomy, Physiology & Compartmentalization** LS ch 2

A. How big? What boundaries? Why compartments? pp 19-21

B. Basic survival skills LS ch 1 p 3

C. Organelles ≡ Intracellular specialty shops

Endoplasmic Reticulum (ER), Golgi, Lysosomes,

Peroxisomes & Mitochondria, LS fig 2-1, 2-2, 2-3 pp 20-3

*Homeostasis  
or  
Homeokinesis?*

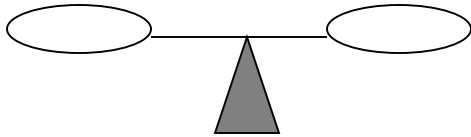


<https://www.khanacademy.org/partner-content/mit-k12/chem-and-bio/v/homeostasis>

# Metabolic

ANA-

CATA-



# H<sub>2</sub>O



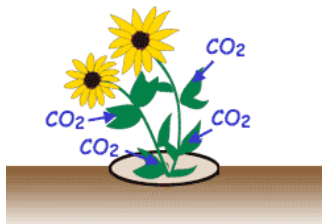
# T<sub>o</sub>C



## Dr. Evonuk's 6 Balances

# O<sub>2</sub>/CO<sub>2</sub>

Carbon Dioxide



# Ion<sup>+/-</sup>

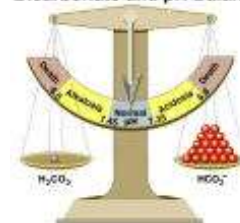


Captain Calcium



# pH

Bicarbonate and pH Balance



**Drink about 1 L per 1000 calories energy expenditure!!**

**Human ~ 2/3 H<sub>2</sub>O  
~ 60 – 70 %**



**150 lb /68 kg**

**NB: So 2000 kcal →  
drink 2000 mL  
≡ 67.63 fl oz  
≡ ~ 8 cups!**

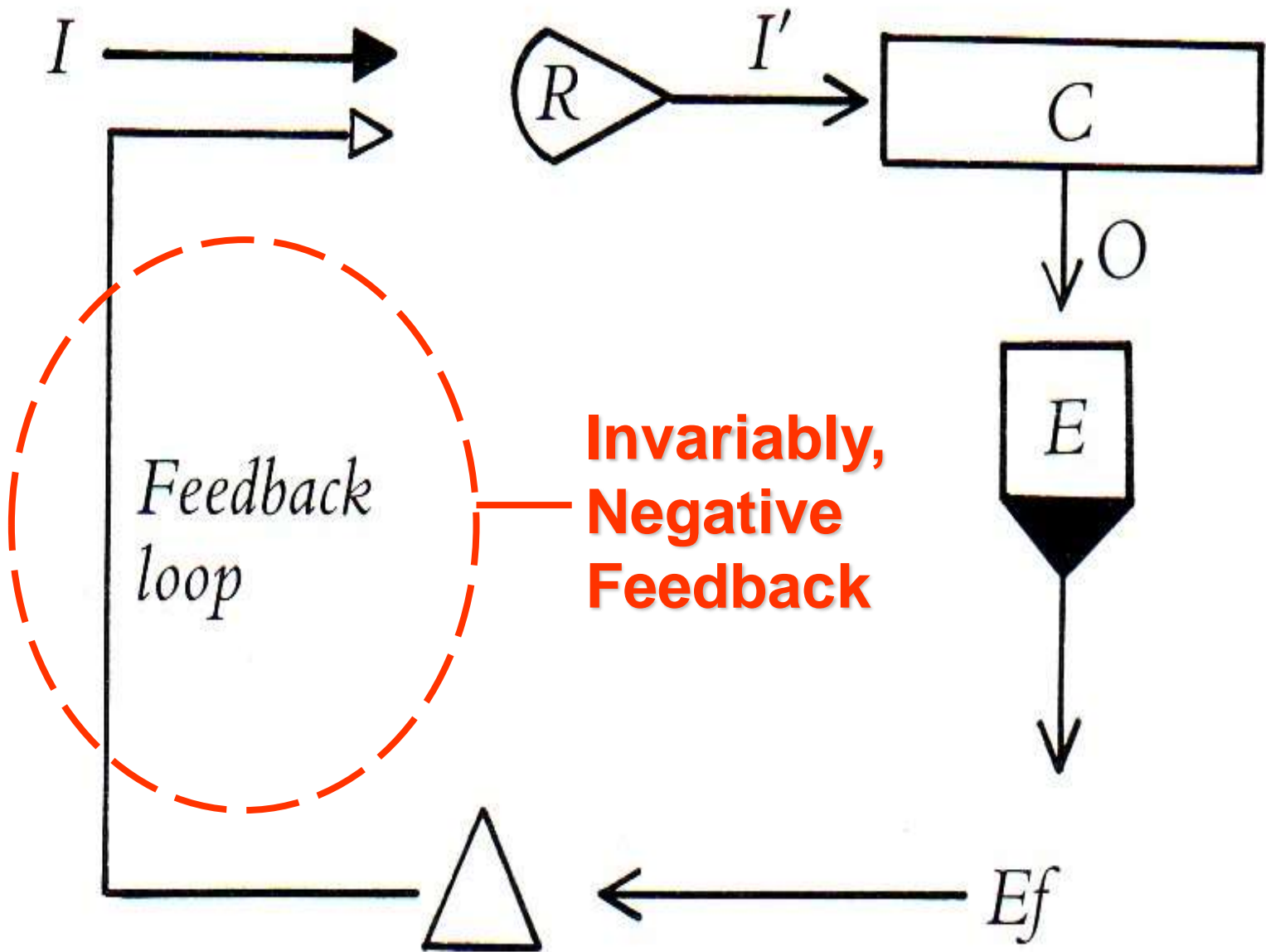
**= ~40 – 48 kg H<sub>2</sub>O**

***National Academy of Medicine 2018***  
**~9 ½ cups of fluid per day for women**  
**~12 cups per day for men**



***That includes all fluids:***  
**water, coffee, tea, juice,**  
**milk, but doesn't**  
**include the 2-3 cups of**  
**liquid you get from**  
**your food!**

**SOURCE:** Dow C. Bodies of water. *Nutrition Action HealthLetter*, Sep 2018, 7-9.





**NB:** Though most often **negative** feedback, there are exceptions:

**Selected +FB eg:**

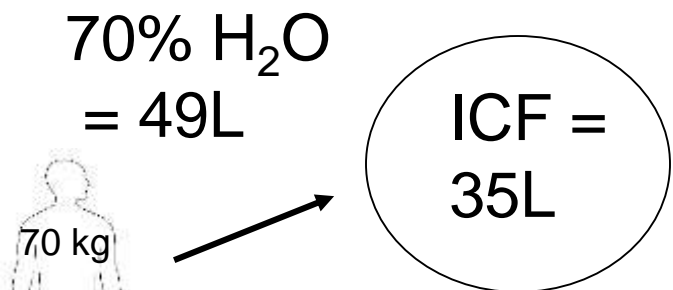
**LH Surge + Ovulation**

**Oxytocin + Uterine Contraction**

**Blood Clotting Cascade**

**cAMP Cascade**

**Na<sup>+</sup> influx during AP**



+

ECF = 14L

[ Interstitium = 11L  
Plasma = 3L ]

INPUT

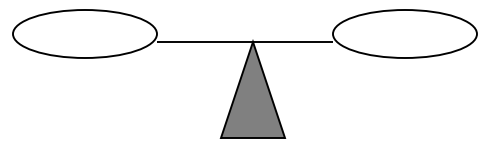
Dietary Drink	1200 mL
Dietary Eat	400 mL
Oxidation	400 mL
Total	= 2000 mL ✓



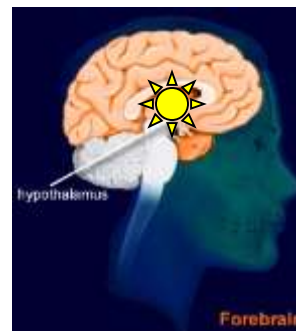
BALANCE!

OUTPUT

Urine	1000 mL
Sweat + Insensible	900 mL
Feces	100 mL
Total	= 2000 mL ✓



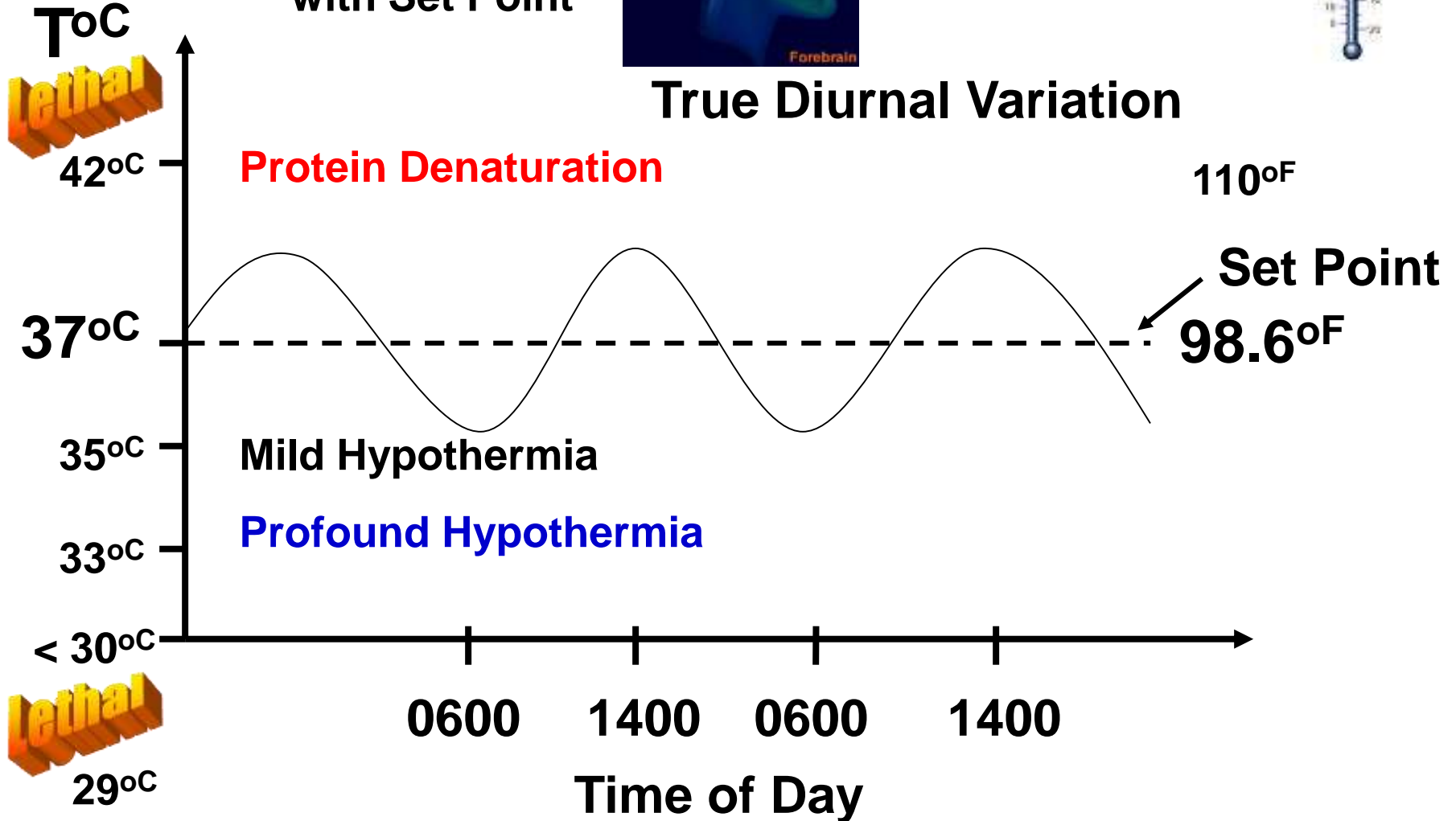
Controller =  
Hypothalamus  
with Set Point



$T_{oC}$

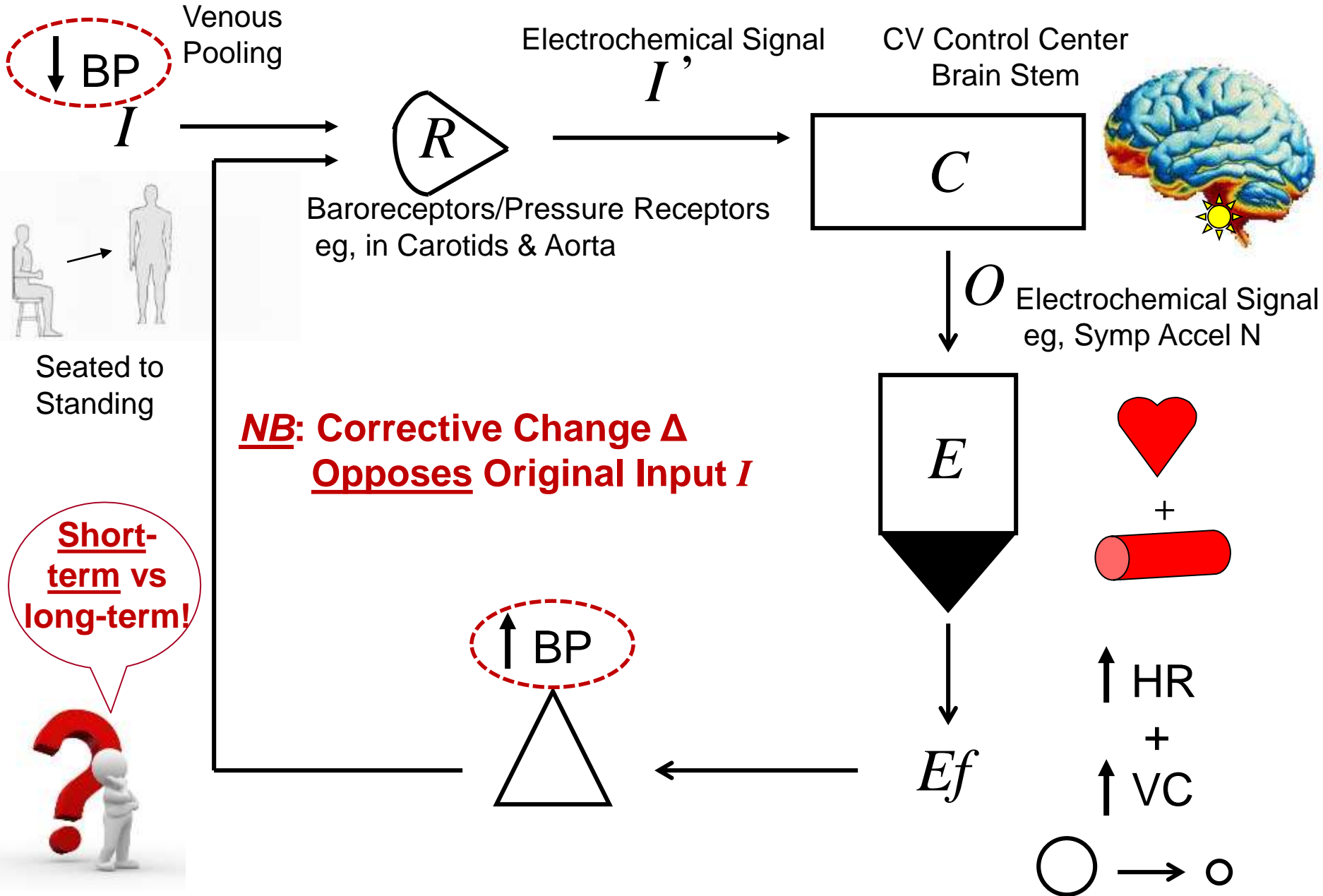


True Diurnal Variation



<https://www.khanacademy.org/partner-content/mit-k12/chem-and-bio/v/homeostasis>

# Blood Pressure Homeostasis





...Anatomy & Physiology Lab Thurs! Fun again!

## BI 121 Lecture 3

**I. Announcements** Q from last time? **Come to office hr!**

**II. Connections** Homeostatic model: BP regulation

**III. Cell Anatomy, Physiology & Compartmentalization** LS ch 2

A. How big? What boundaries? Why compartments? pp19-21

B. Basic survival skills ch 1 p 3

C. Organelles ≡ Intracellular specialty shops LS pp 21-34

1. Endoplasmic reticulum (ER) fig 2-1, 2-2, 2-3

2. Golgi complex fig 2-3, 2-4

3. Lysosomes fig 2-5, 2-6

4. Peroxisomes fig 2-6

5. Mitochondria fig 2-8 LS 2012 pp 20-34, tab 2-1 p 36

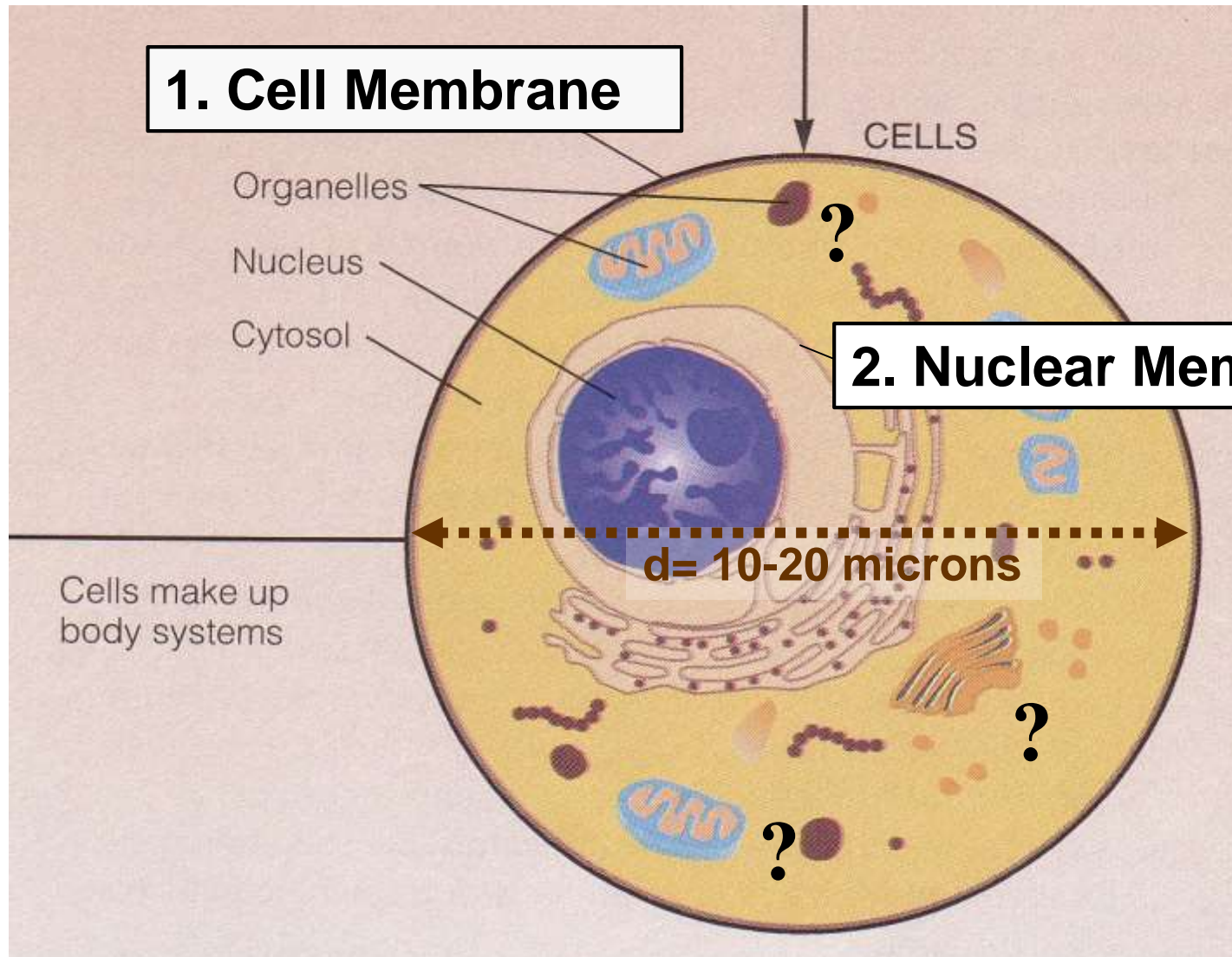
D. **Physiol News** Moms eggs execute Dad's mitochondria?

**IV. Anaerobic vs Aerobic Metabolism Overview** Many sources!

Mathews & Fox 1976...LS 2012 pp 26-33, fig 2-15 p 33

A. ATP-PC Immediate, Glycolytic & Aerobic Energy Systems

# How Big? 100 Cells Lengthwise = 1 mm!!

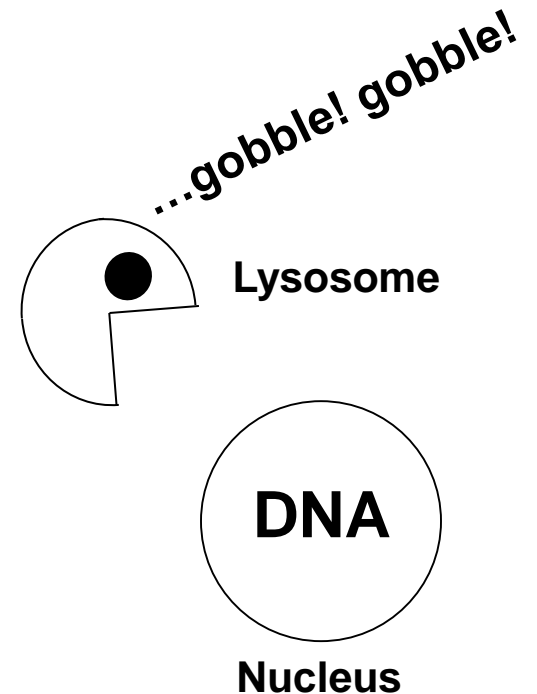


<http://opb.pbslearningmedia.org/resource/tdc02.sci.life.cell.nucleus/nucleus-cytoplasm-membrane/>

# Why Compartments? Advantage?

**Incompatible reactions can  
take place**

**Simultaneously!!**



# 1 Sample Cartoon of 100 Trillion ( $100 \times 10^{12}$ ) Cells!

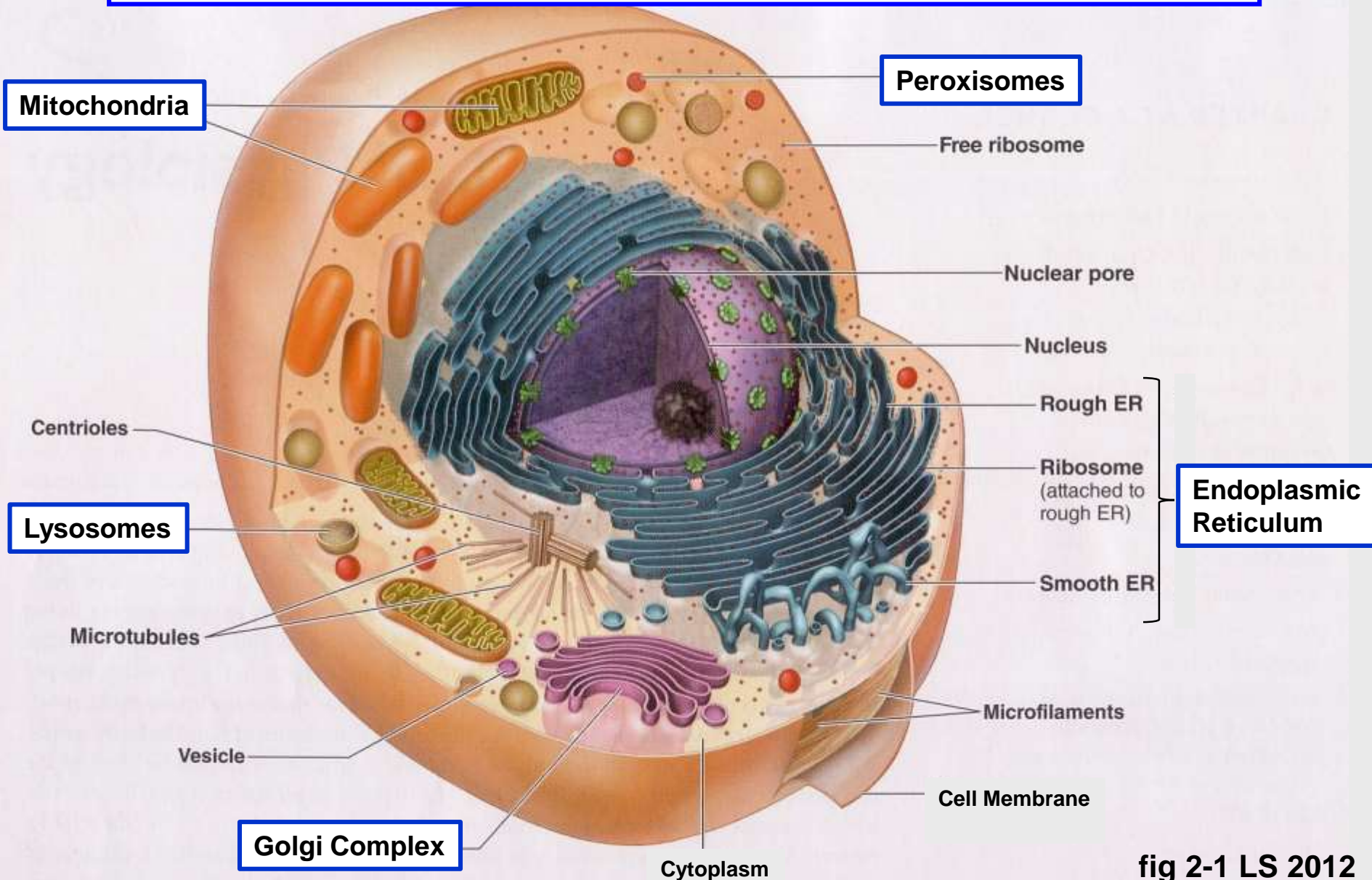


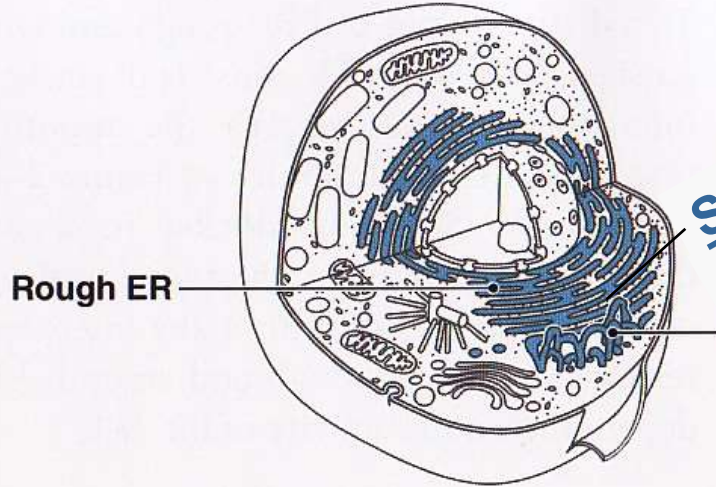
fig 2-1 LS 2012

<http://opb.pbslearningmedia.org/resource/tdc02.sci.life.cell.organelles/organelles-in-the-cytoplasm/>



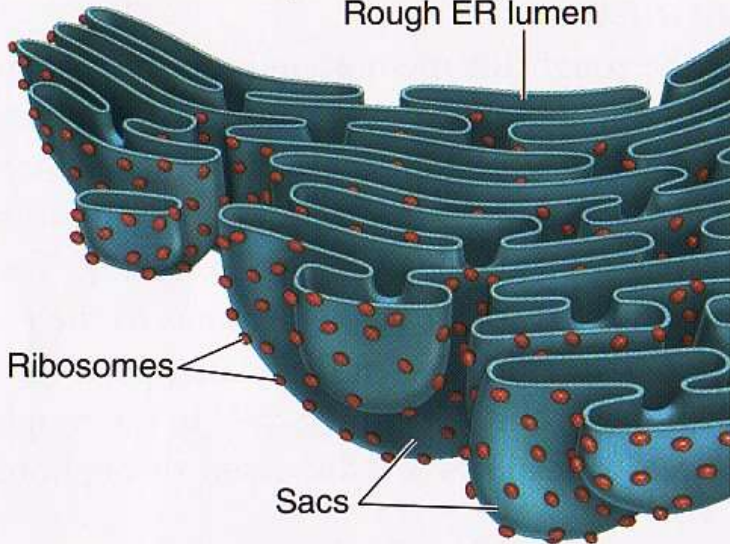
# Rough & Smooth Endoplasmic Reticulum (ER): Protein & Lipid Synthesizing Factories

**Smooth ER:**  
1. packages new proteins in transport vesicles  
2. stores calcium in muscles



Rough ER

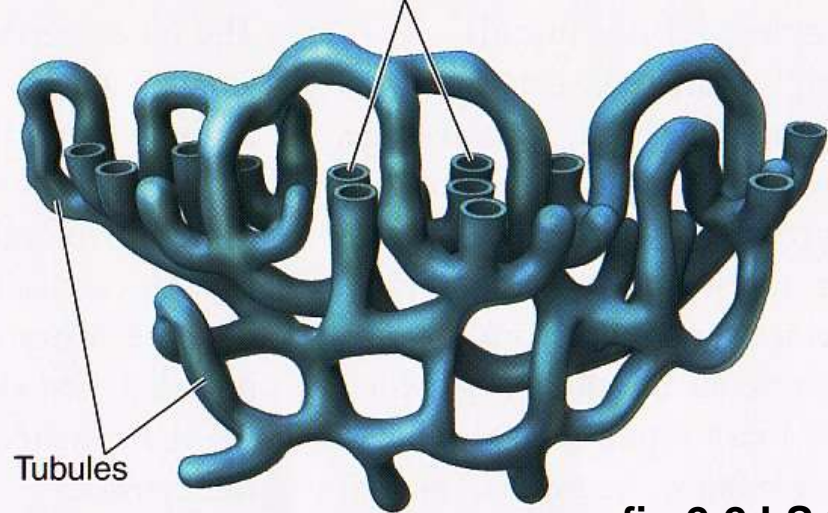
Rough ER lumen



Ribosomes

Sacs

Smooth ER lumen



Tubules

fig 2-2 LS 2012

# Secretion of Proteins Produced by ER

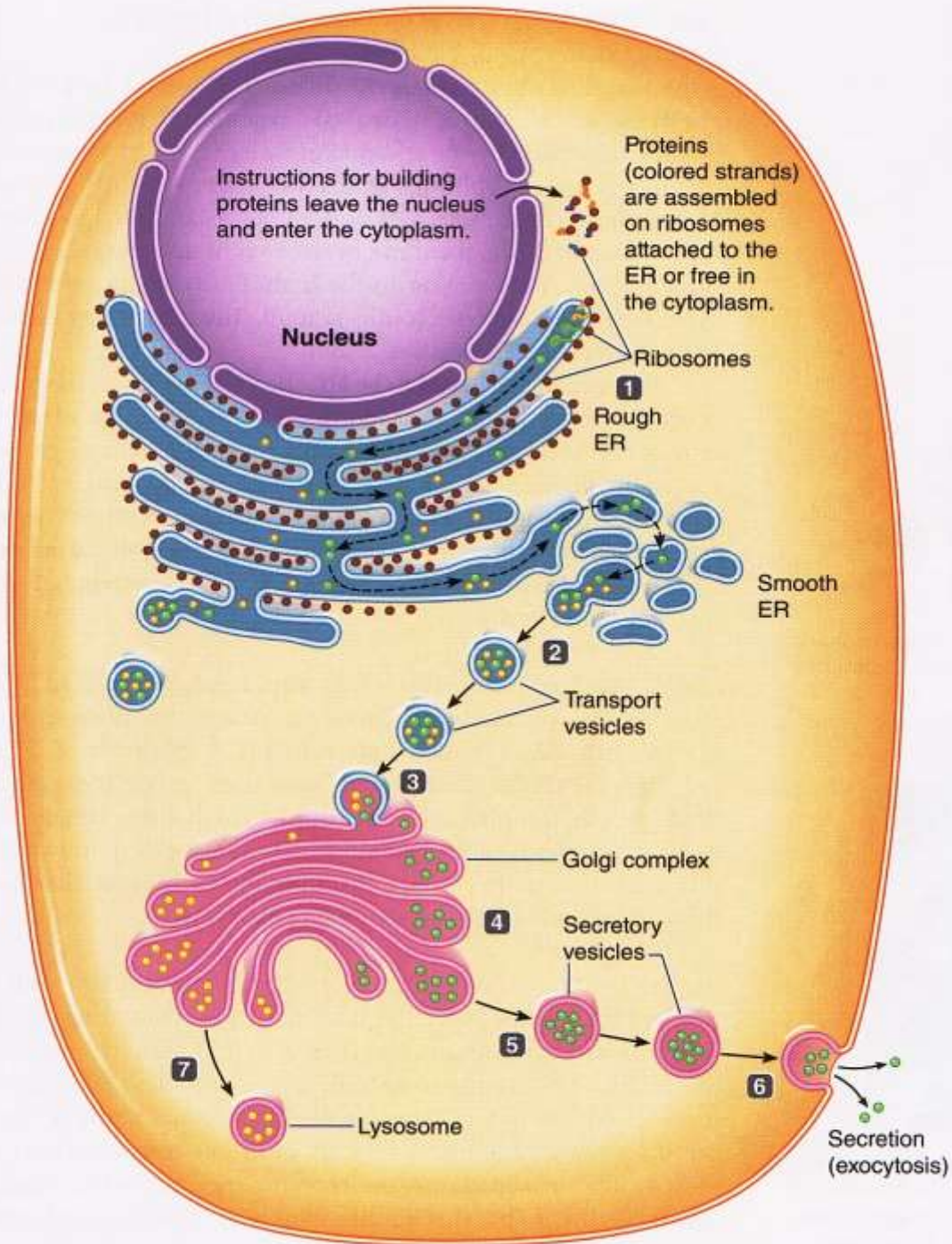
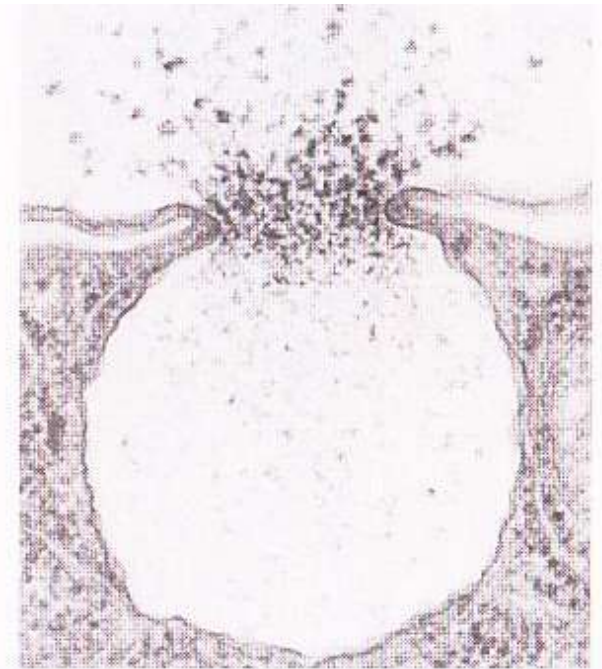
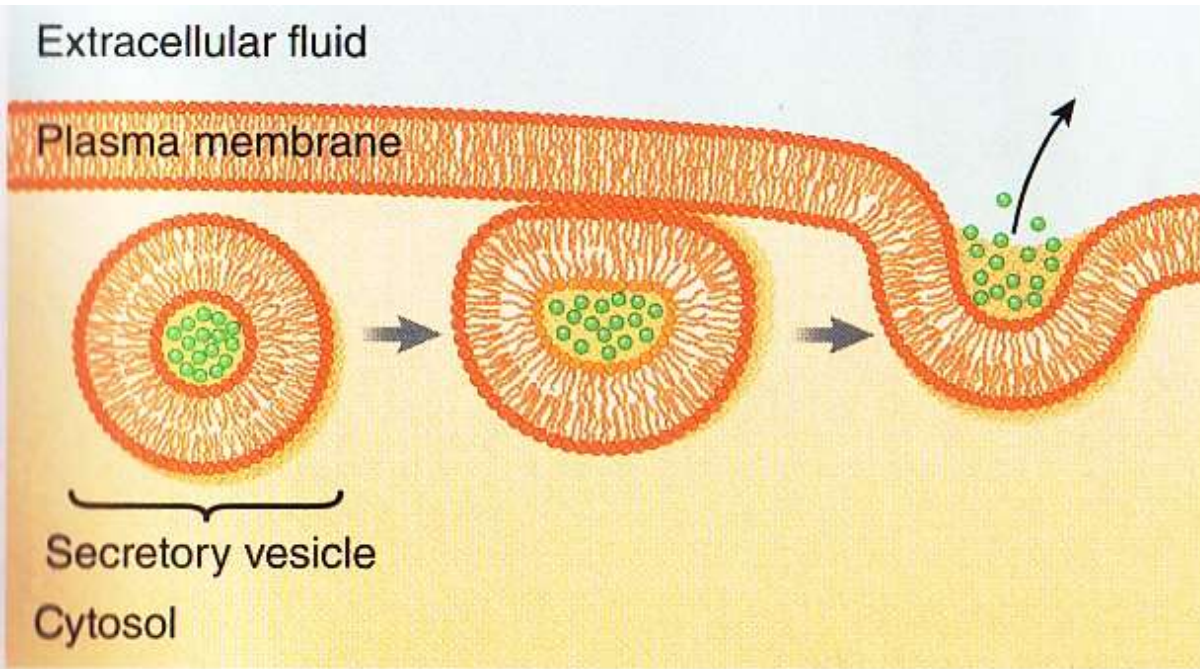


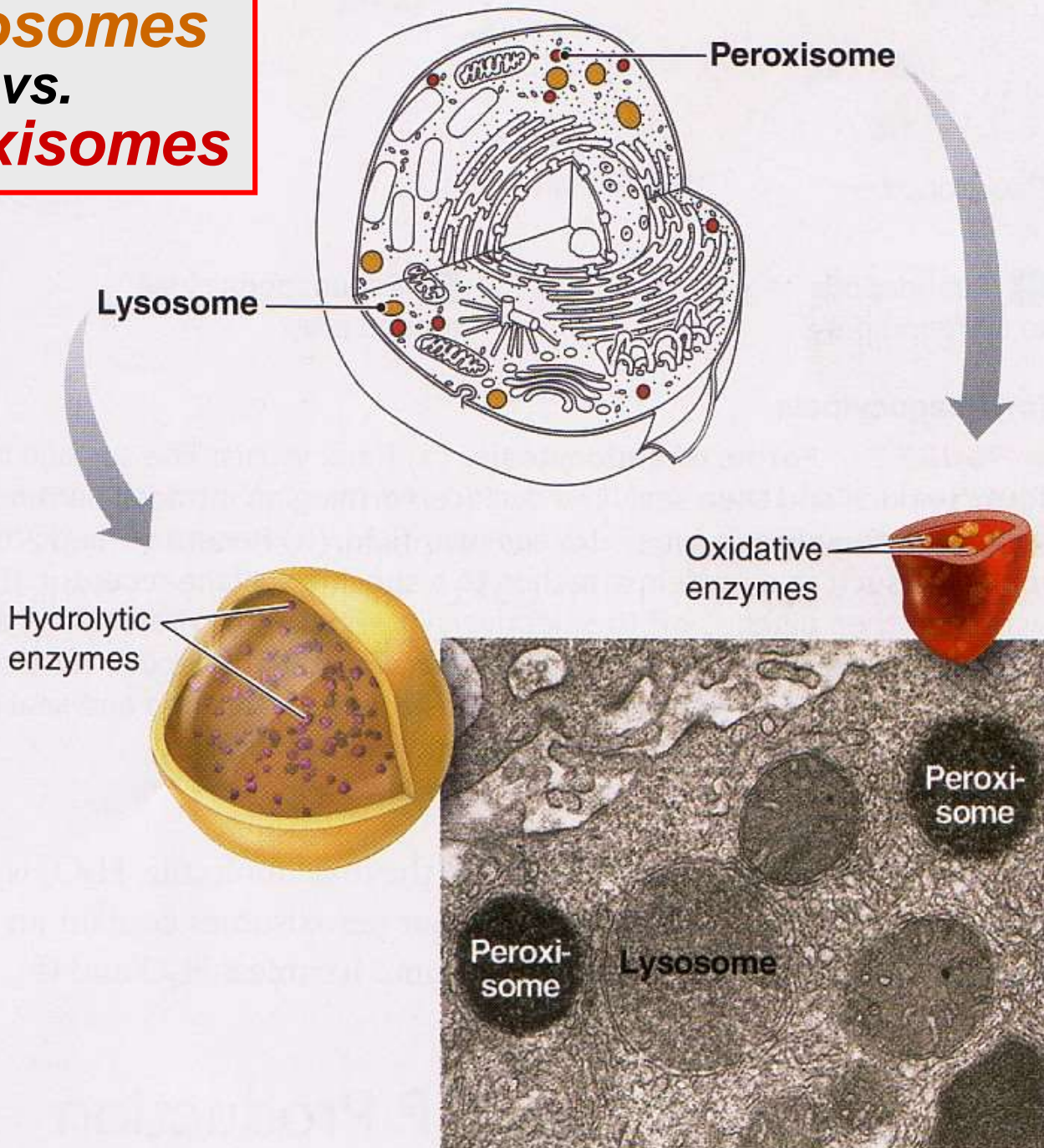
fig 2-3 LS 2012

# Exocytosis: Primary Means of Secretion



(a) Dr. Birgit Satir, Albert Einstein College of Medicine

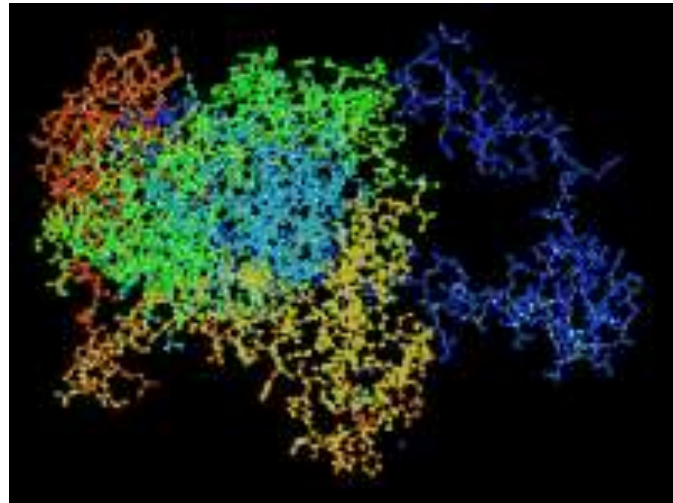
# Lysosomes vs. Peroxisomes



© Don W. Fawcett/Photo Researchers, Inc.

fig 2-6 LS 2012

# ***Catalase Enzyme Reaction in Peroxisomes Neutralize Toxin at Production Site!***



# Mitochondria: Energy Organelles

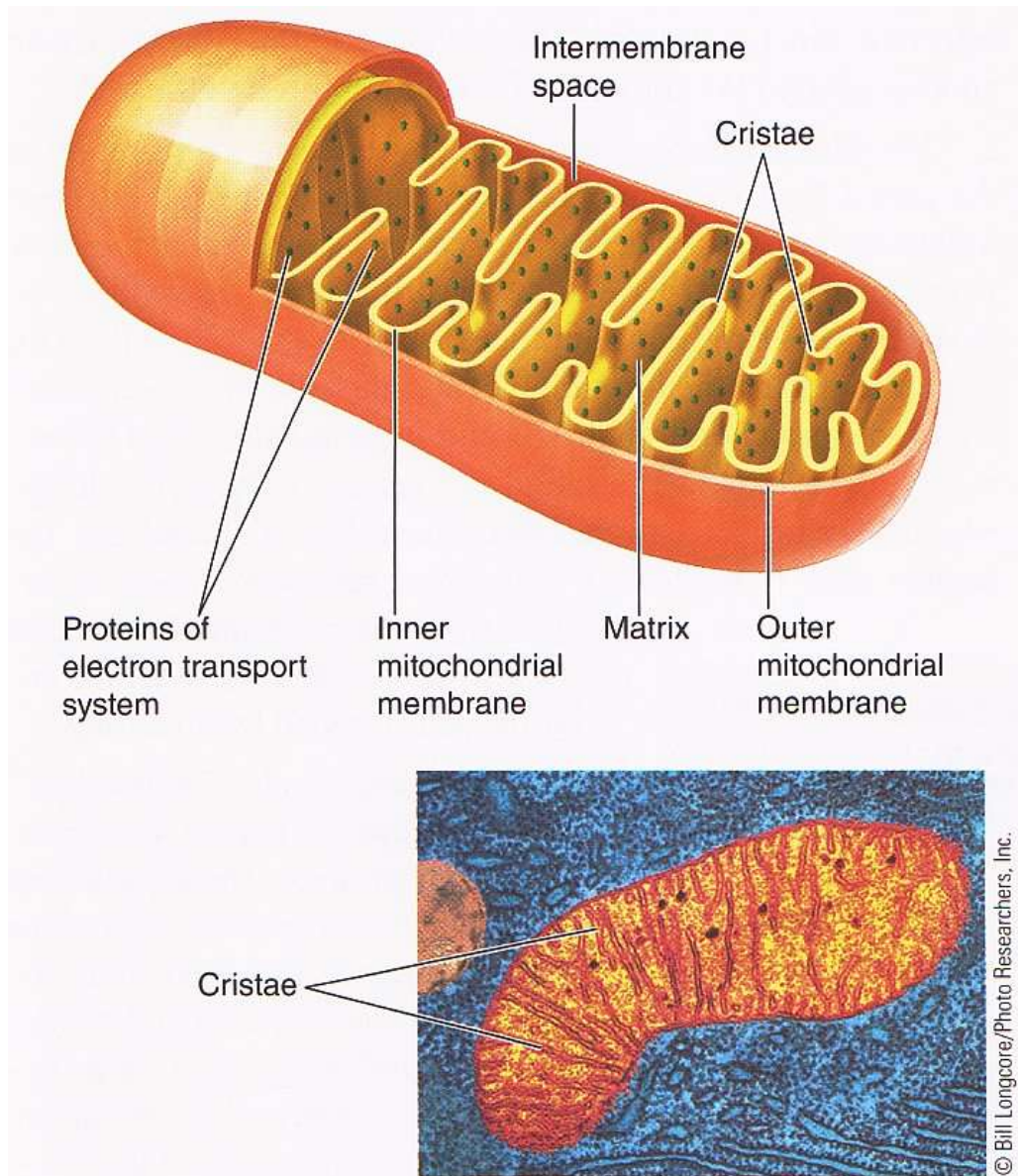


fig 2-8 LS 2012

---

# Mom's eggs execute Dad's mitochondria

---

In "Hamlet," Rosencrantz and Guildenstern deliver a letter to the rulers of England that carries the ill-fated duo's own death sentence. Perhaps Shakespeare knew a bit about reproductive biology.

Scientists have now found that during a sperm's creation, its mitochondria—energy-producing units that power all cells—acquire molecular tags that mark them for destruction once the sperm fertilizes an egg. This death sentence, a protein called ubiquitin, may explain why mammals inherit the DNA within mitochondria only from their mothers, a bio-

species mitochondrial inheritance. Sperm mitochondria sometimes avoid destruction when two different species of mice mate, and Schatten's team has shown this also holds true in cattle. It's hard to understand how an egg distinguishes between paternal mitochondria of closely related species, says Schon.

When paternal mitochondria escape destruction in normal mating, the resulting embryo may suffer. Schatten notes that a colleague has found sperm mitochondria in some defective embryos from infertility clinics.

**AEROBIC**

w/O<sub>2</sub>

=

MITOCHONDRION

**ANAEROBIC**

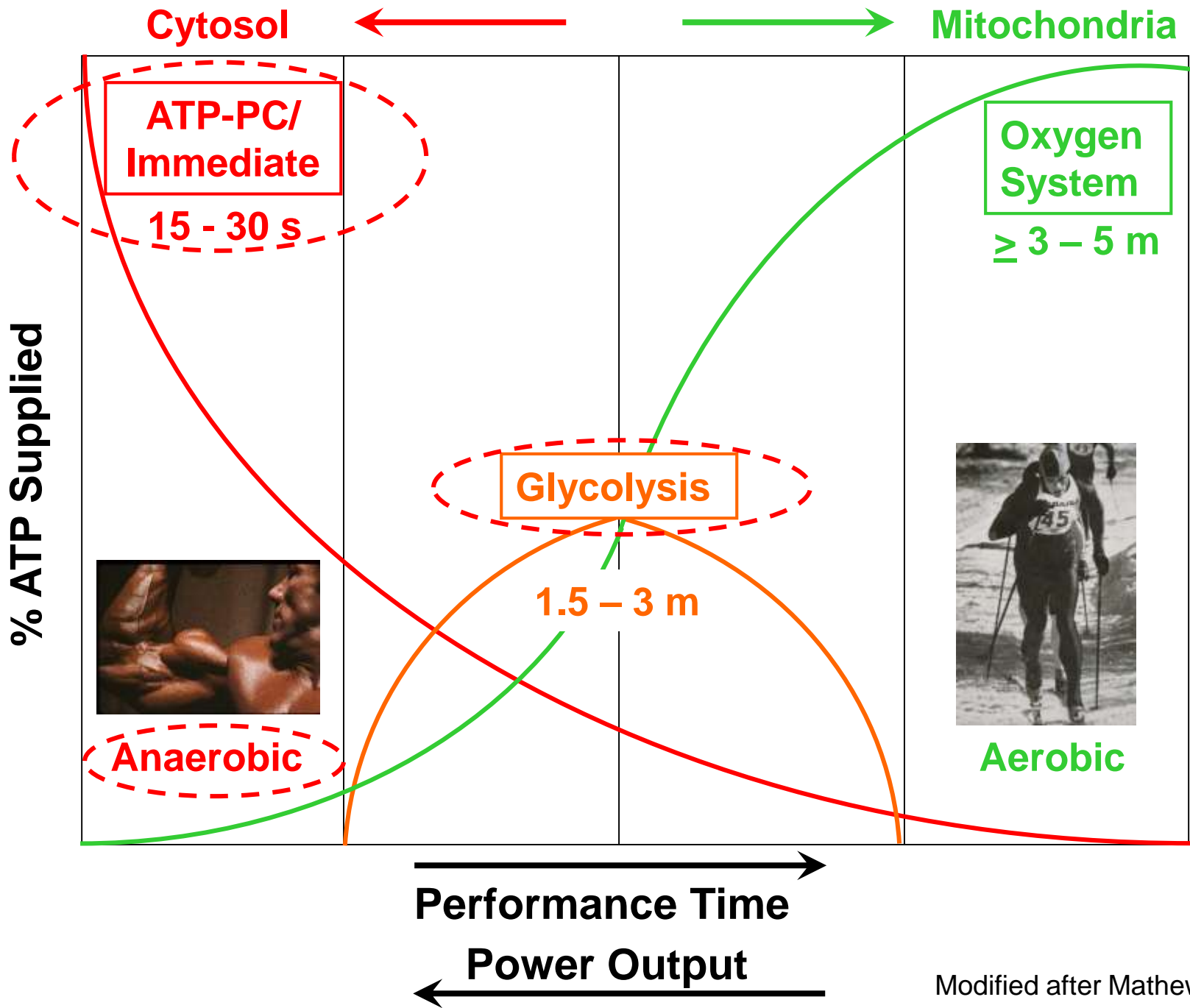
without O<sub>2</sub>

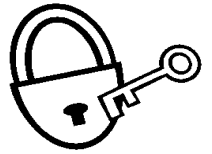
= CYTOSOL



1. Immediate/ATP-PC
2. Glycolysis







- I. Announcements** Anatomy & Physiology Lab today! Fun! Remember to complete p 3-7 dietary record in LM before Lab 3 next Thursday! Estimating serving sizes. Q?
- II. Adenosine Triphosphate (ATP)** ATP parts? Uses/functions?
- III. Anaerobic vs. Aerobic Metabolism** LS ch 2 pp 26-33, fig 2-15+
  - A. Cytosol vs. Mitochondria
  - B. Anaerobic: ATP-PC, Glycolysis
  - C. Aerobic: Mitochondrial matrix vs. cristae  
Citric acid cycle vs. ETC purpose
- IV. Genetics Introduction** LS 2012 ch 2 pp 20-1 + Appendix C
  - A. What's a gene? Where located? p A-18, fig C-2, C-3
  - B. Why are genes important? p A-18
  - C. What's DNA & what does it look like? pp A-18 thru A-20
  - D. How does information flow in the cell? fig C-6
  - E. How does DNA differ from RNA? pp A-20 thru A-22
  - F. Code word, codon, anti-codon? pp A-22, A-23
  - G. How are proteins made? Class skit! LS Appendix C

4 oz → 3 oz



# Deck of Cards



or

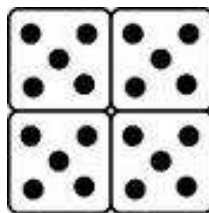


≡ 1 c

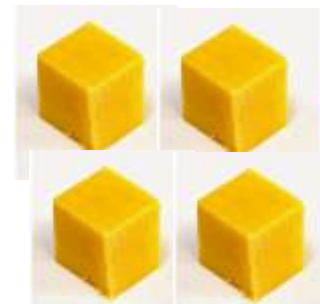
raw → cooked



≡ 1/3 c



≡ 1 oz



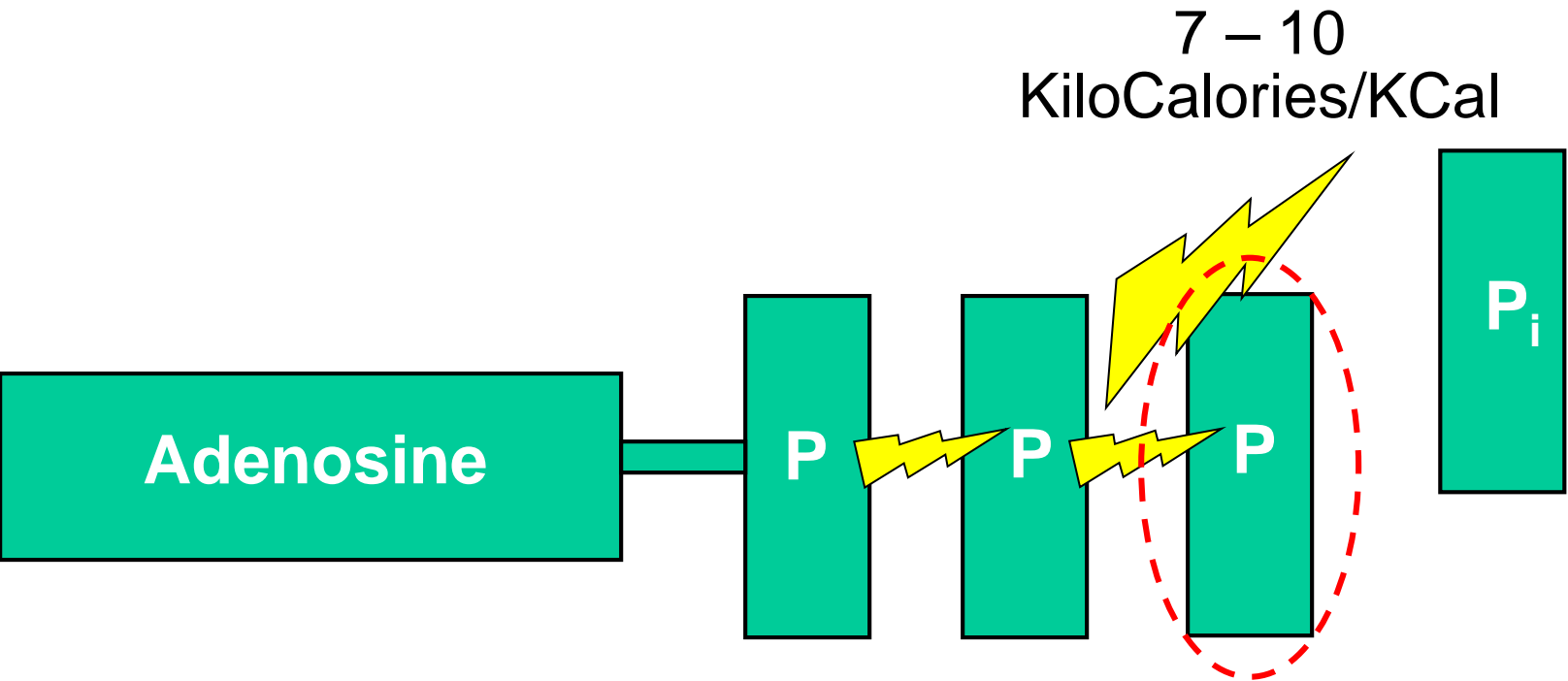
≡ 1/4 c



≡ 1.5 oz



# Cleave One High Energy Phosphate Bond To Do Work!!



① *Synthesis of Macromolecules*

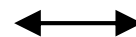
Make big things from little things!

② *Membrane Transport*

Move things!  
Microscopic!

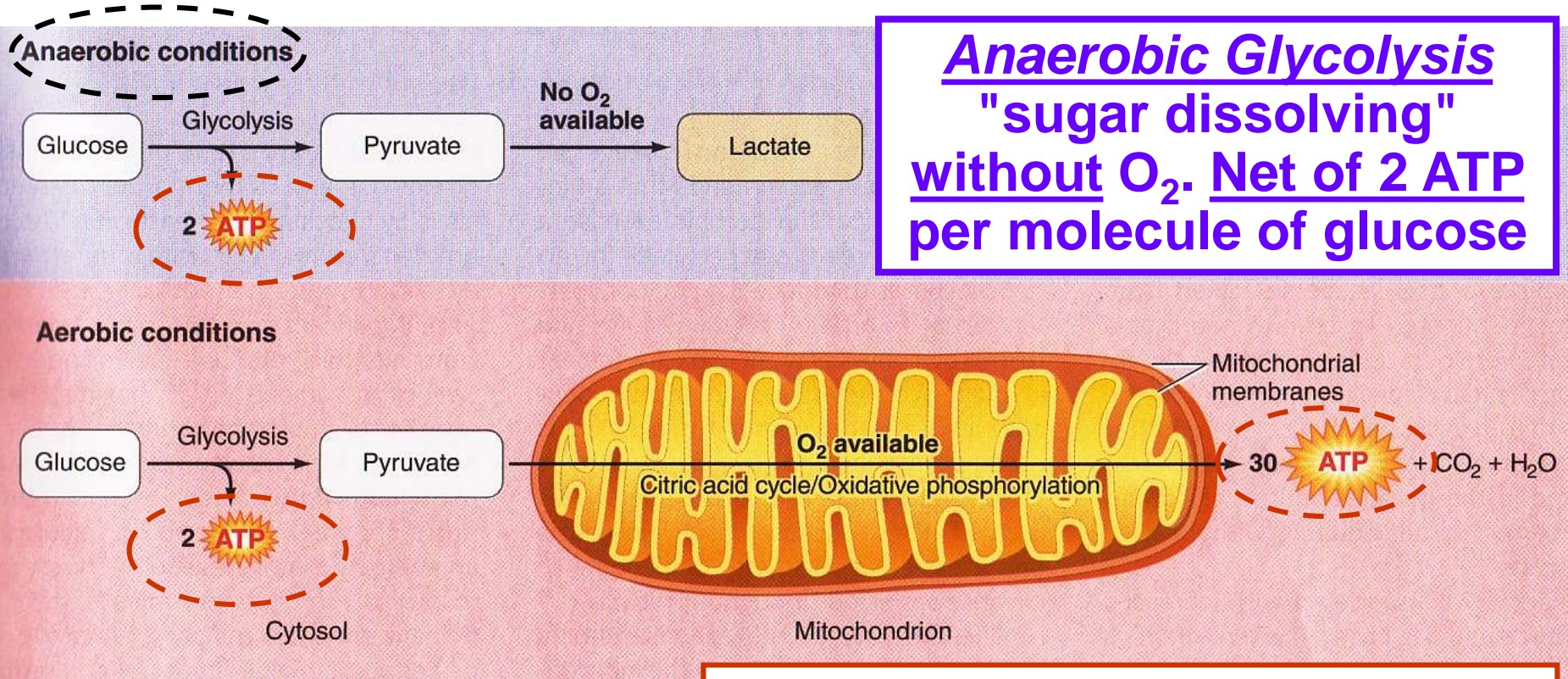
③ *Mechanical Work*

Move things!  
Macroscopic!



# Anaerobic vs. Aerobic Metabolism

**NB: ATP-PC also anaerobic, also in cytosol!**



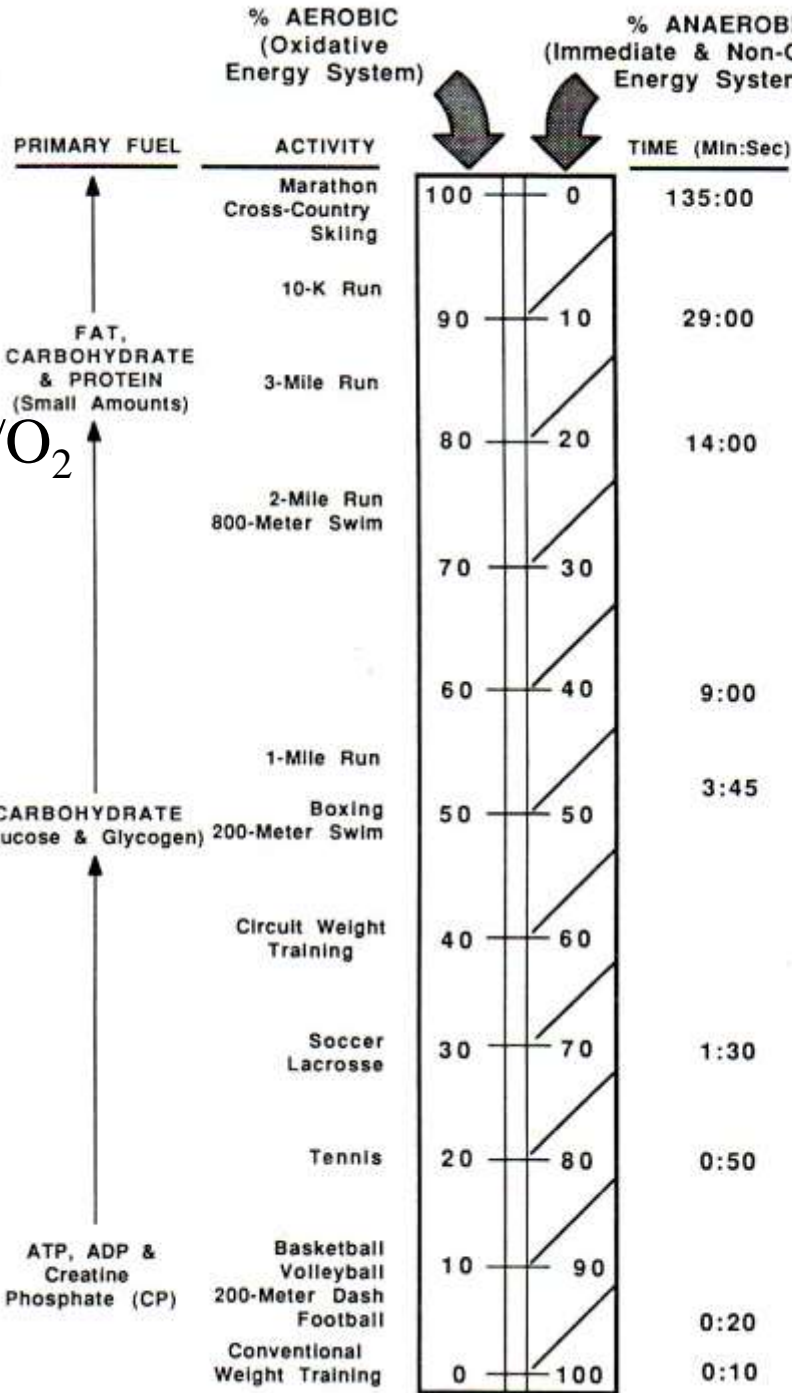
**Anaerobic Glycolysis**  
"sugar dissolving"  
without O<sub>2</sub>. Net of 2 ATP  
per molecule of glucose

**Aerobic Metabolism**  
+mitochondrial processing of  
glucose with O<sub>2</sub>. Net of 32 ATP  
per molecule of glucose



**AEROBIC**

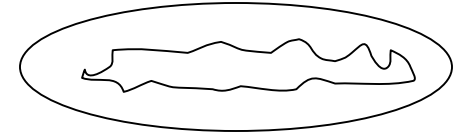
w/O<sub>2</sub>



FAT,  
CARBOHYDRATE  
& PROTEIN  
(Small Amounts)

CARBOHYDRATE  
(Glucose & Glycogen)

ATP, ADP &  
Creatine  
Phosphate (CP)



**MITOCHONDRIA**

**CYTOSOL**

Glycolysis



Immediate/ATP-PC

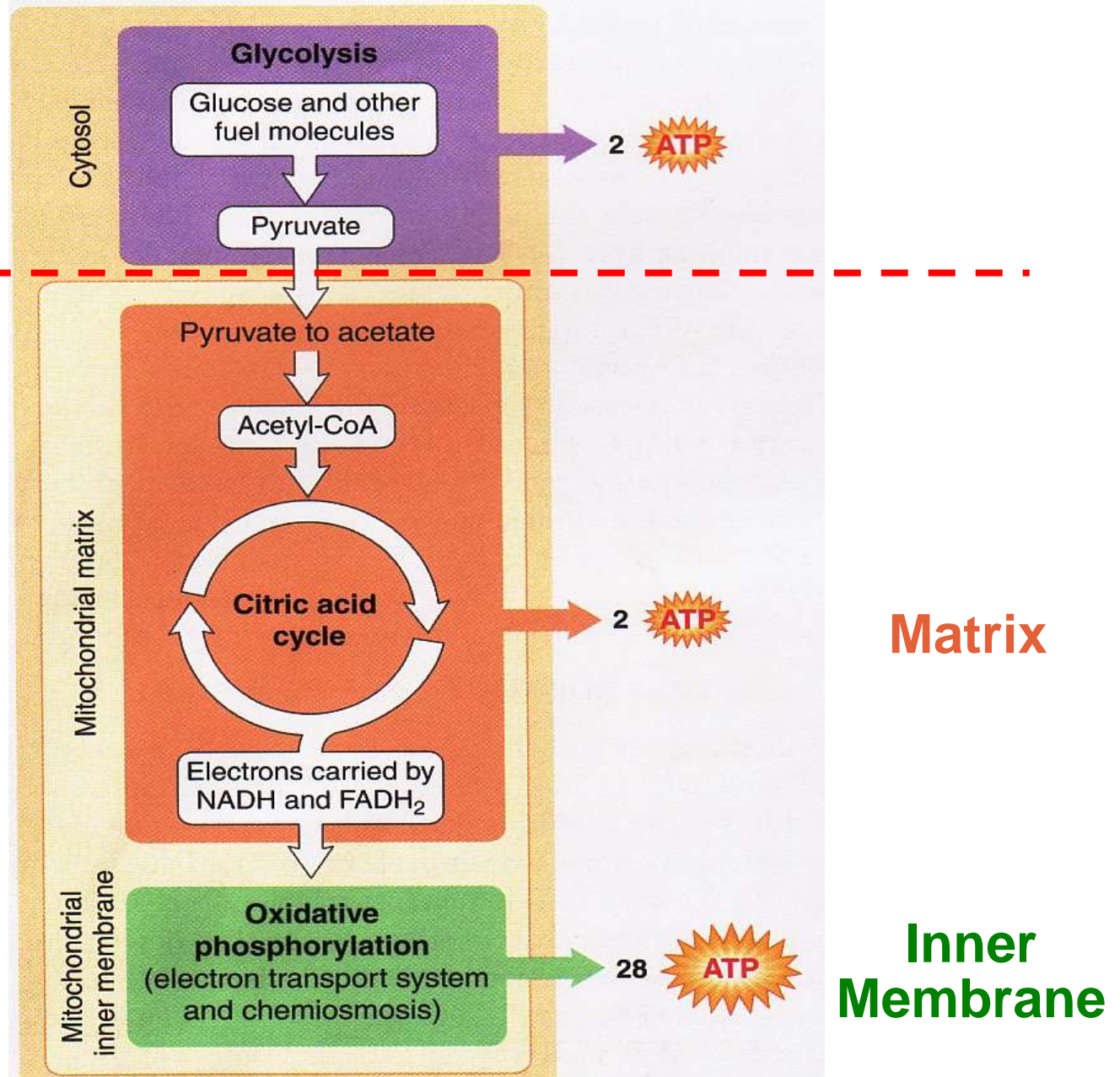


**ANAEROBIC**

# Stages of Cellular Metabolism/Respiration

**Anaerobic  
Glycolysis  
Cytosol**

**Aerobic  
Metabolism  
Mitochondria**



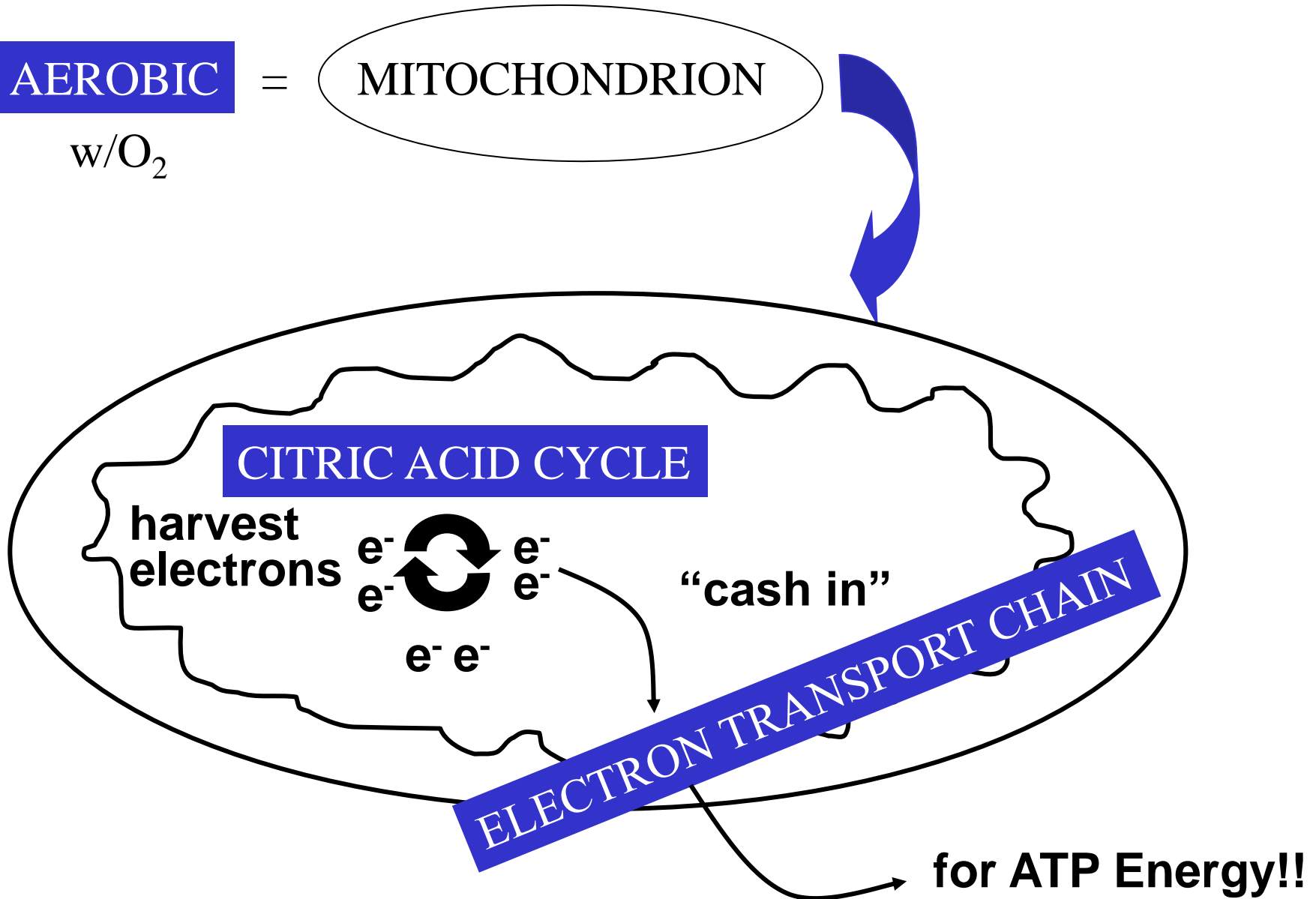
# Goals of Aerobic Metabolism

**AEROBIC**

=

MITOCHONDRION

w/O<sub>2</sub>

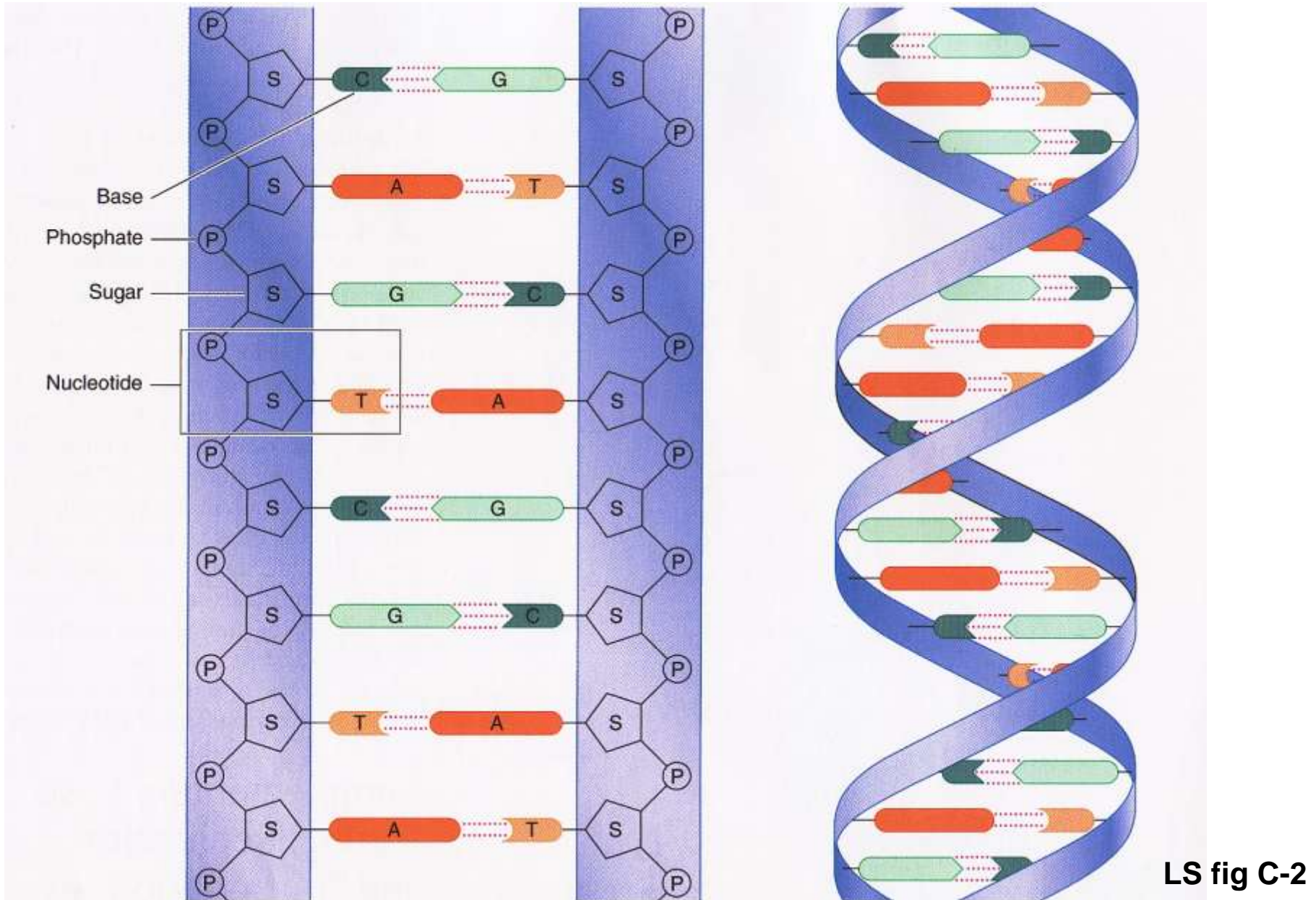




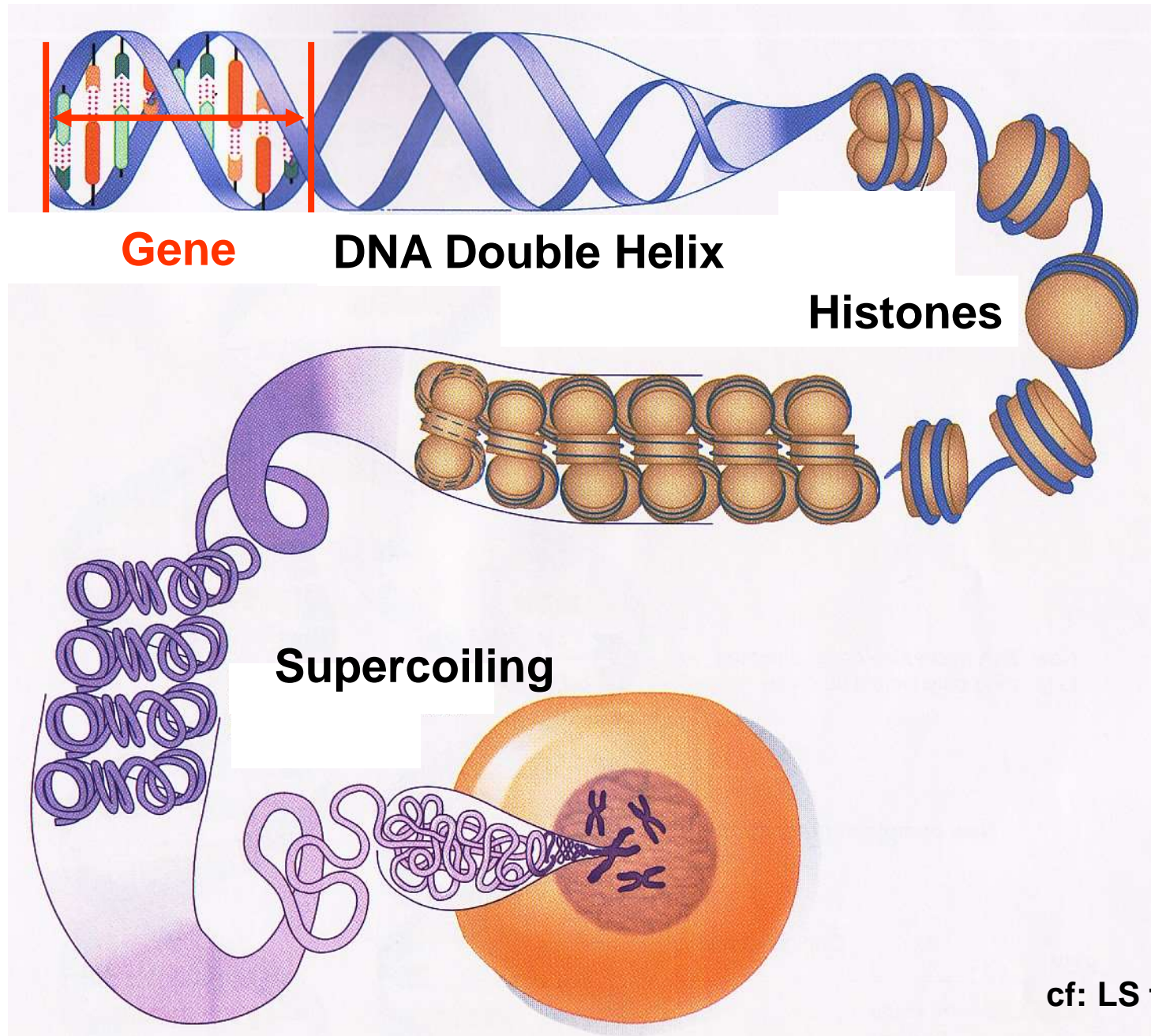
# *What are DNA's major functions? Heredity + Day-to-Day Cell Function*



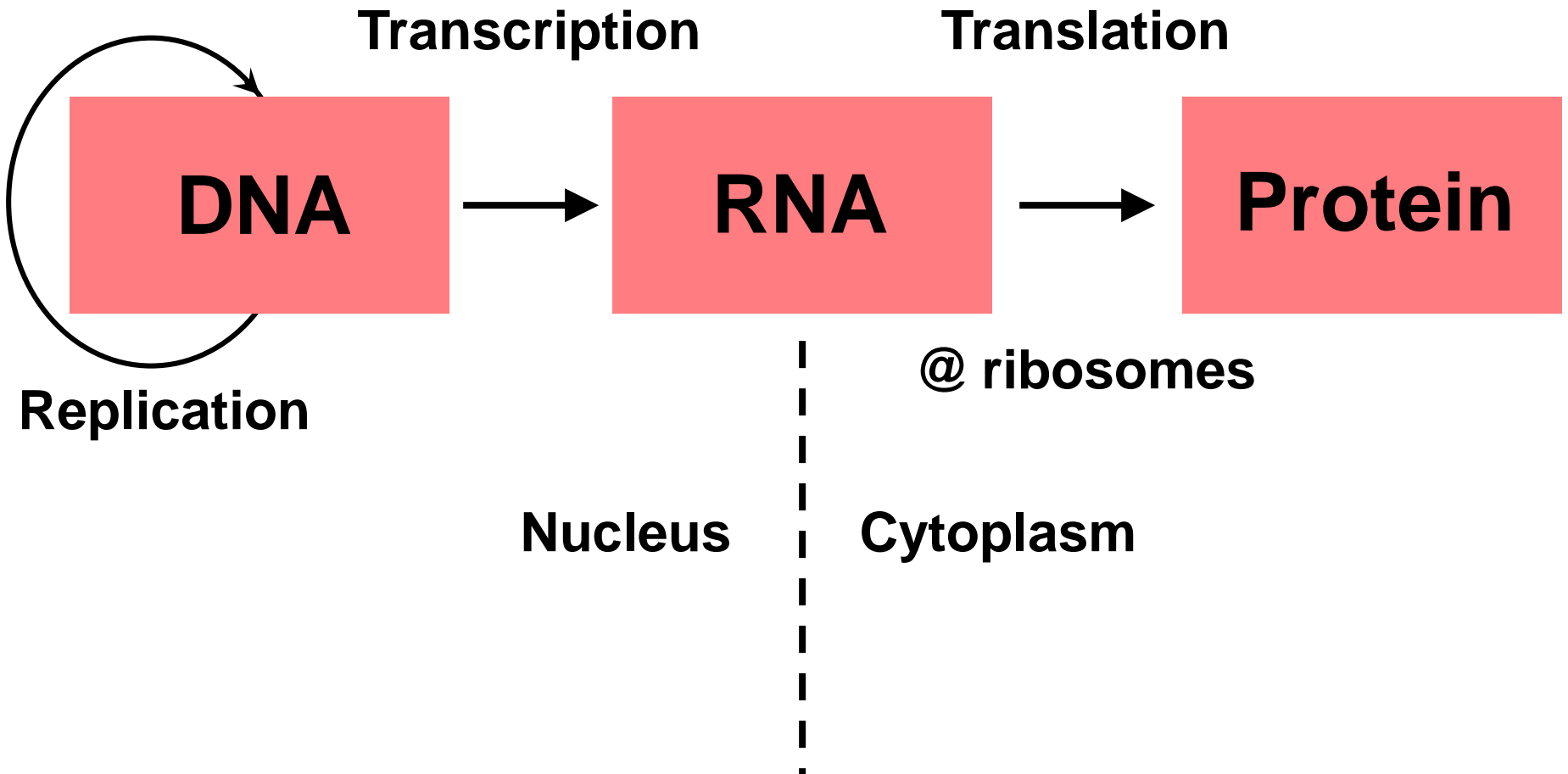
# What does DNA look like? Double-helix!!



**Gene** = *Stretch of DNA that codes for a protein*



# *What does DNA do, day-to-day?*



# DNA vs RNA?

1. Double-stranded

2. Deoxyribose  
(without oxygen)

3. A, T, C, G  
Thymine

4. Self-replicative  
(can copy itself)

5. Nucleus  
(+mitochondria)

1. Single-stranded

2. Ribose  
(with oxygen)

3. A, U, C, G  
Uracil

4. Needs DNA as  
template

5. 1<sup>o</sup> Cytoplasm  
(but Nucleus origin)

6. mRNA, rRNA, tRNA

*Triplets of bases code for amino acids,  
the building blocks of proteins*

DNA

mRNA

tRNA

code word

codon

anti-codon

TAT

AUA

UAU

ACG

UGC

ACG

TTT

AAA

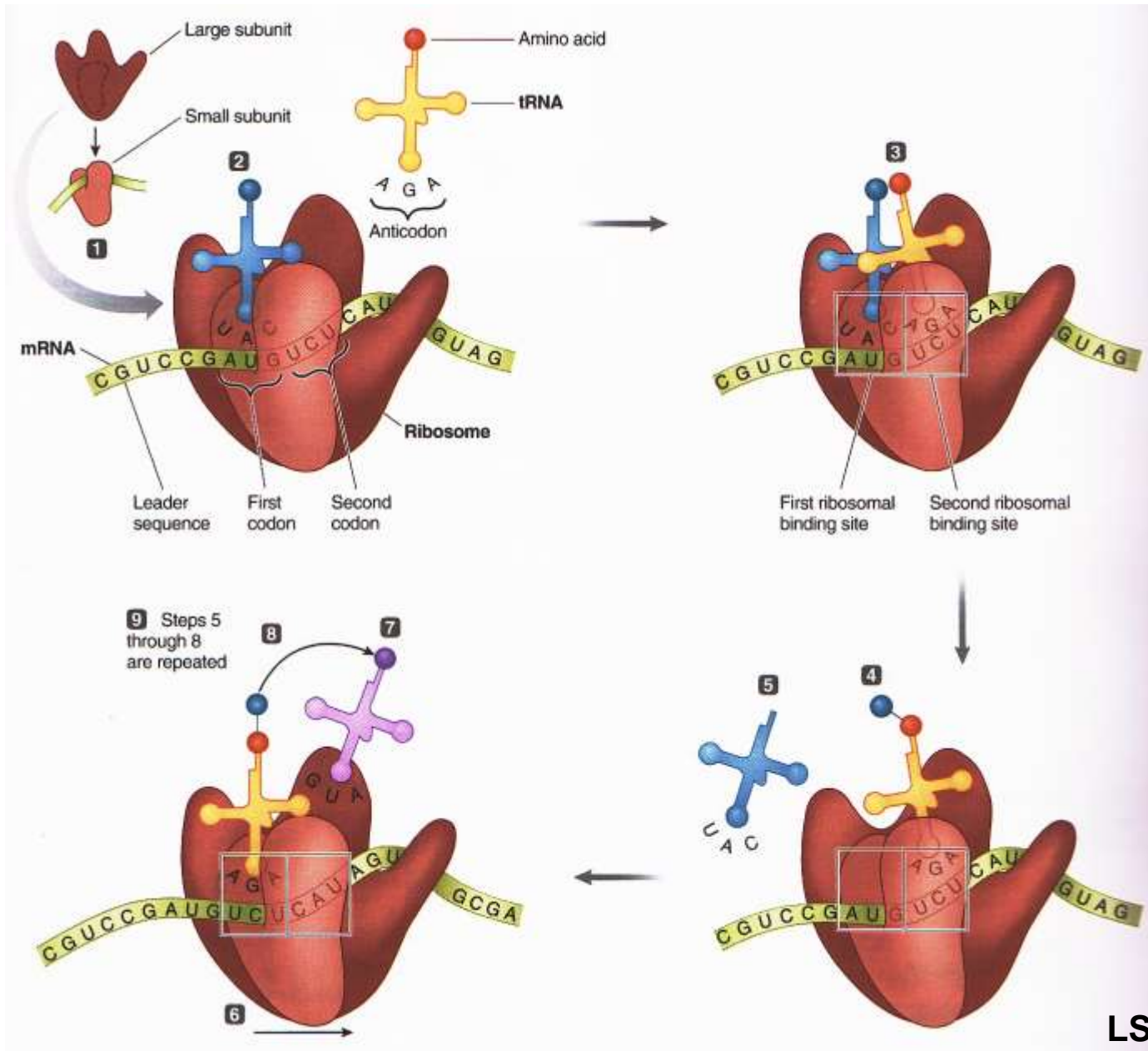
UUU

TAC

AUG

UAC

# Translation? Ribosomes Make Proteins



# BI 121 Lecture 5



...DietController!  
More fun in Lab!!



**I. Announcements** Nutrition Analyses this Thursday!  
Please record diet on p 3-7 LM. Bring flash drive. Q?

**II. Genetics Connections** LS 2012 ch 2 p 20-1 + Appendix C

A. How & where are proteins made? fig C-7, C-9

B. Class skit: Making proteins @ ribosomes!

**III. Nutrition Primer** DC Module 2, S&W Price Science Library

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: HHS-USDA, AICR, Eat the **Rainbow!**

**C. Blue Zones?** Habits of longest-lived people?

D. Okinawan Longevity Diet?

E. Pondering Paleo, Marlene Zuk, U Minn

F. How much protein? Protein & disease?

G. TMAO, Neu5GC & inflammation?

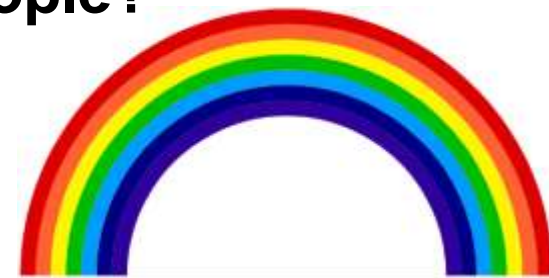
H. Carbohydrate confusion. Why plants & whole grains?

I. Exercise, carbohydrates & fats

J. Fasting? Intermittent fasting?

K. Successful dieting? National Weight Control Registry

L. Exercise vs. Diet vs. Combination, Zuti & Golding





# 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>,...)

✓ *Energy nutrients = yield ATP*

## 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



# *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,...

# ***Dietary Guidelines for Americans 2015-2020***

**Released January 7, 2016**

## **A healthy eating pattern includes:**

- **Variety of vegetables** from all subgroups: dark green, red & orange, legumes, starchy & other
- **Fruits**, especially whole fruits
- **Grains**, at least half of which are whole grains
- **Fat-free or low-fat dairy**, including milk, yogurt, cheese &/or fortified soy beverages
- **Variety of protein foods** including seafood, lean meats & poultry, eggs, legumes & nuts, seeds & soy products
- **Oils** (healthy)

## **A healthy eating pattern limits:**

- **Saturated fats** & **trans fats**, added **sugars** & **sodium**
- **Balance calories with physical activity** to manage weight.

**<http://health.gov/dietaryguidelines/2015/>**

## *Diet & Health Guidelines for Cancer Prevention*

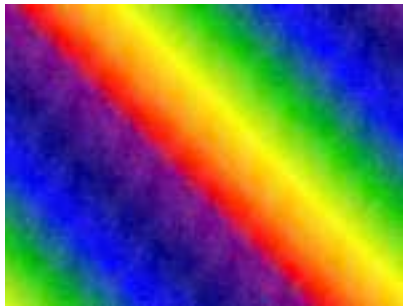
- 1. Choose a diet rich in variety of plant-based foods.**
- 2. Eat plenty of vegetables & fruits.**
- 3. Maintain a healthy weight & be physically active.**
- 4. Drink alcohol only in moderation, if at all.**
- 5. Select foods low in fat & salt.**
- 6. Prepare & store food safely.**

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.



# The World's Longest-Lived People!

## ○ Blue Zones! ○



<https://www.cbsnews.com/news/blue-zones-do-people-who-live-in-certain-areas-live-longer/>, Aug 2013.

Buettner, D. *National Geographic*, Nov 2005.

M Poulain & Coworkers. *Experimental Gerontology*, Sep 2004

# Loma Linda, United States

**Plant-based!**

1. Eat a little bit better!
2. Move a little bit more!
3. Socialize more!
4. Strong sense of purpose!



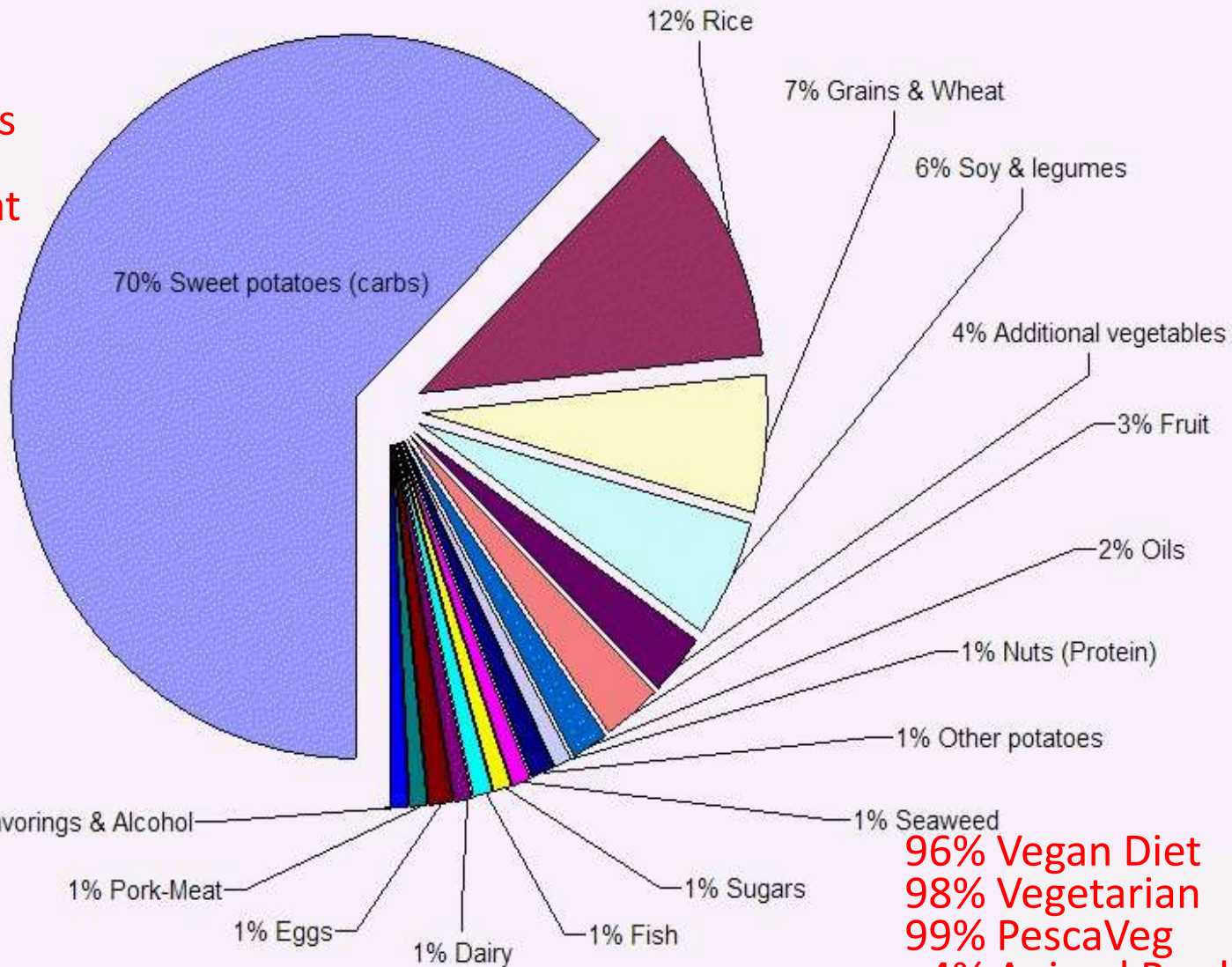
[https://en.wikipedia.org/wiki/Blue\\_Zone](https://en.wikipedia.org/wiki/Blue_Zone)

<https://bluezones.com/>

<http://www.sciencedirect.com/science/article/pii/S0531556504002141>

# OKINAWA LONGEVITY DIET

- 70% Sweet Potatoes
- 12% Rice
- 7% Grains & Wheat
- 6% Soy & legumes
- 4% Additional vegetables
- 3% Fruit
- 2% Oils
- 1% Nuts (Protein)
- 1% Other potatoes
- 1% Seaweed
- 1% Sugars
- 1% Fish
- 1% Dairy
- 1% Eggs
- 1% Pork-Meat
- 1% Flavorings & Alcohol



85% Carbohydrates  
 9% Protein  
 6% Fat  
 85-10-5  
 1785 Calories

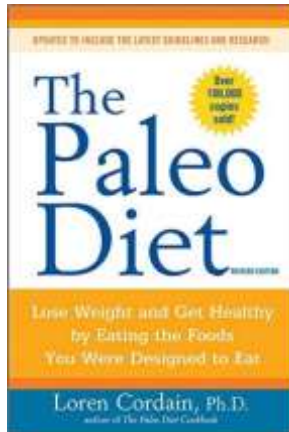
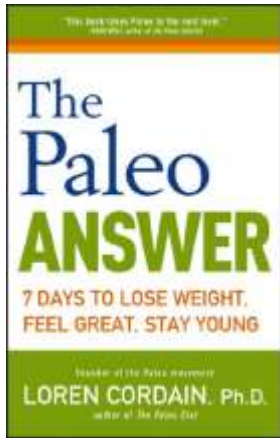
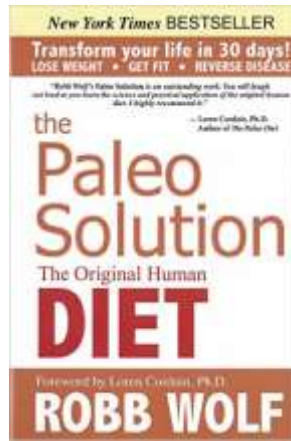
96% Vegan Diet  
 98% Vegetarian  
 99% PescaVeg  
 <4% Animal Prod  
 <1% Fish  
 <1% Meat-Pork

SCIENTIFIC STUDY: "The Diet of the World's Longest-Lived People and Its Potential Impact on Morbidity and Life Span"  
 JOURNAL: Annals of the Academy of Sciences - Volume 1114: 434-455 (2007).

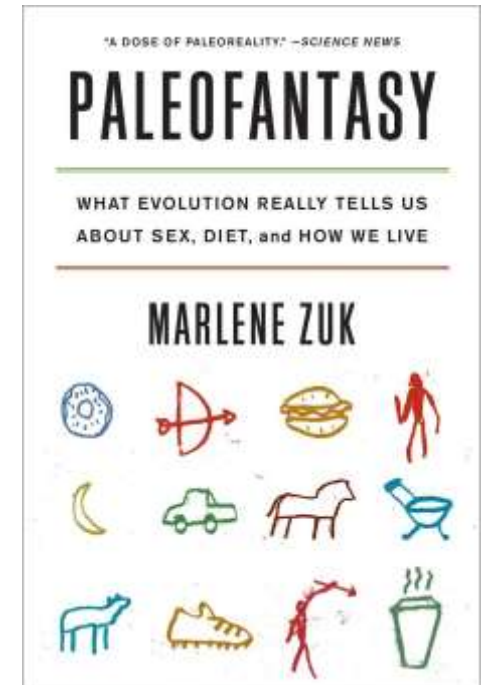
Note: These are the Actual Food Measurements of the Centenarians, not the diet of All island Okinawans or the ones who died, but the ones who lived.



# Pondering Paleo?



**Evolutionary Biologist  
Behavioral Ecologist  
U Minnesota**



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

# ***How much protein do you need?***

**Not much! 0.8 g/kg or 0.36 g/lb of body wt/d**

**50 kg or 110 lb female ? ~ 40 g/d**

**80 kg or 176 lb male ? ~ 64 g/d**



**Boneless,  
skinless,  
cooked  
chicken  
breast 6-8 oz,  
53 -70 g of  
protein!**

**Average US woman gets 35% > RDA!  
Average US man 65% >RDA!**

# Red Meat, Processed Meat & Cancer Incidence

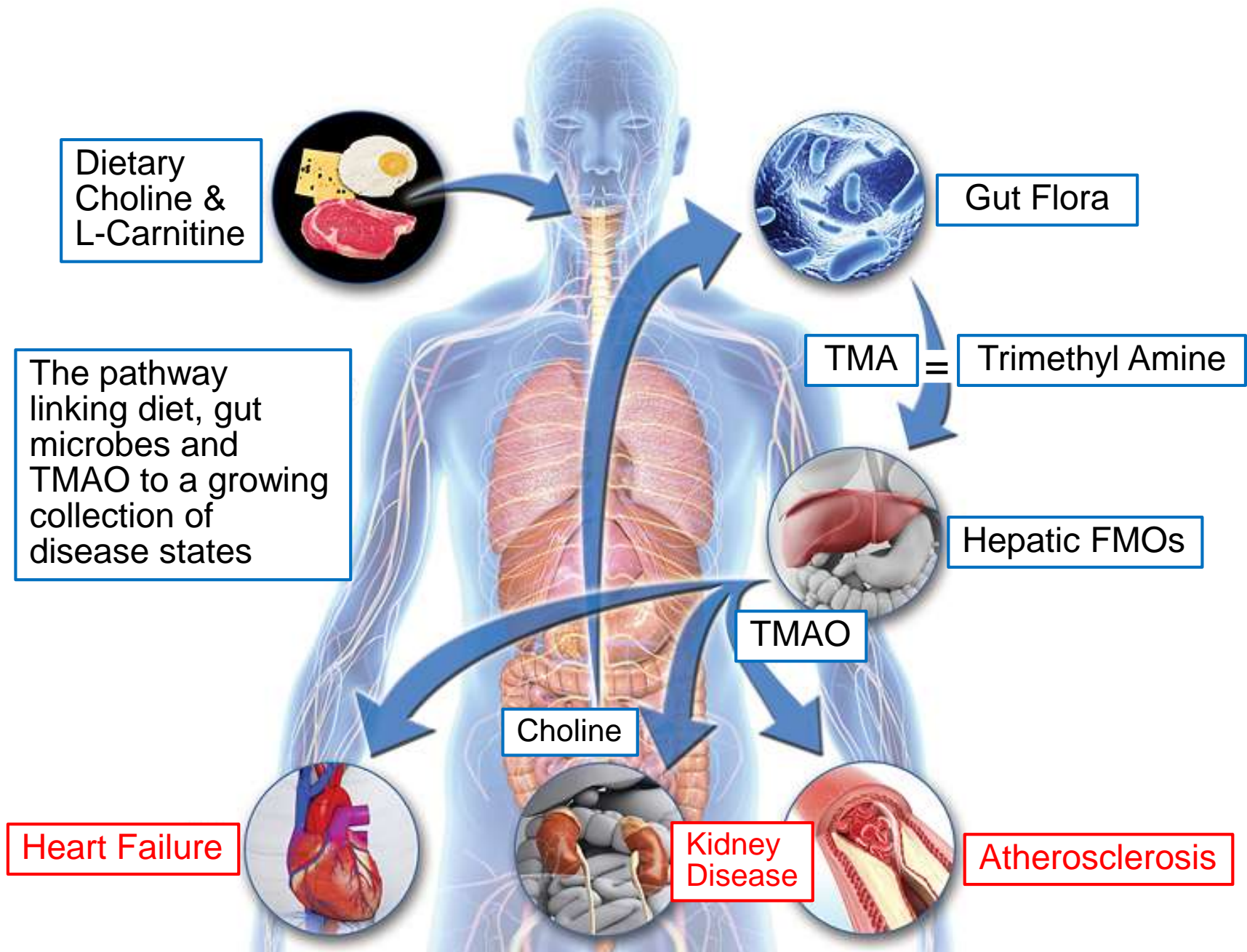


Total cancer mortality & cancers of:

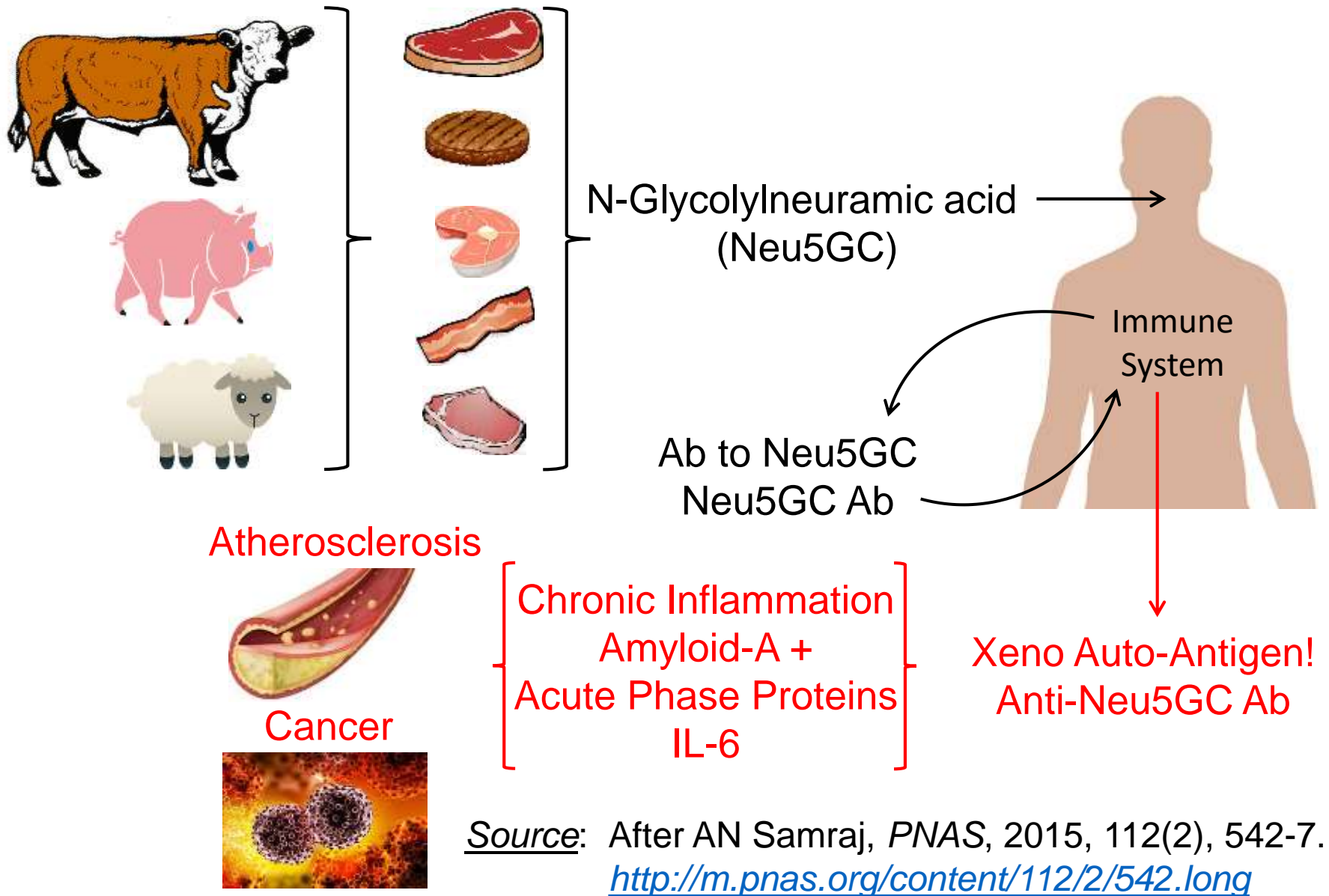
Colon & rectum  
Esophagus  
Liver  
Pancreas  
Kidney  
Prostate  
Lung  
Breast



**SOURCES:** Rodriguez Hernandez 2015, Abid 2014, Larsson 2014, Pericleous 2014, Zhu 2014, Aune 2013, Ferlay 2013, Kim 2013, Freedman 2010, Alexander 2010, Alexander 2009



# Red Meat-Derived Glycan Promotes Inflammation & Disease



Source: After AN Samraj, *PNAS*, 2015, 112(2), 542-7.  
<http://m.pnas.org/content/112/2/542.long>

## BI 121 Lecture 6      **Nutrition Lab 3 today! More personal data...**



- I. Announcements** Data + flash drive/e-mail for today's lab!  
To have your notebook returned to study for Exam I on Tues Oct 29<sup>th</sup>, best to submit prior to lecture next Tues Oct 22<sup>nd</sup>.  
Review Session Sunday Oct 27<sup>th</sup>, 6-7:30 pm. Sample Exam Q?  
Be sure to see *Active Learning Questions!* Drink your calories?
- II. Nutrition Connections** Plants, Whole Grains, Exercise, Dieting?
- III. GI (Gut) Structure & Function** DC Module 3, LS 2012 ch 15
  - A. Gut Doughnut Analogy + Secretions L Brilla WWU
  - B. Digestion Steps Dr. Evonuk + LS pp 437- 439; DC p 23
  - C. Hydrolysis + Polymer → Monomer: Central Themes!  
LS p 438, SI Fox 2009 + ...
  - D. Gut control mechanisms
  - E. Histology of the gut LS fig 15-2, 15-3 p 442-3
  - F. Organ-by-organ review
  - G. Stomach protein digestion + zymogens? LS fig 15-7, 15-9
  - H. Pancreas & Liver: Accessory organs! Recycling! LS pp457-63
  - I. Small intestine? Ulcers? LS fig 15-20,15-22 pp 467-8  
Beyond the Basics LS p 456, Mayo Clinic on Ulcers
  - J. Summary of chemical digestion LS tab 15-5 p 466
  - K. Large intestine? LS fig 15-24 pp 472-4

**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!**

# Nutrition Action

OCTOBER 2018 \$2.50

HEALTH LETTER<sup>SM</sup>  
CENTER FOR SCIENCE IN THE PUBLIC INTEREST

## Carbohydrate Confusion

Should you avoid carbs  
at all costs? ←

No, ↑ *complex*  
↓ *simple!*  
Emphasize a  
plant-based  
diet!

Our Planet  
AT RISK

The Best  
SPREADS

3 Veggie  
Dips

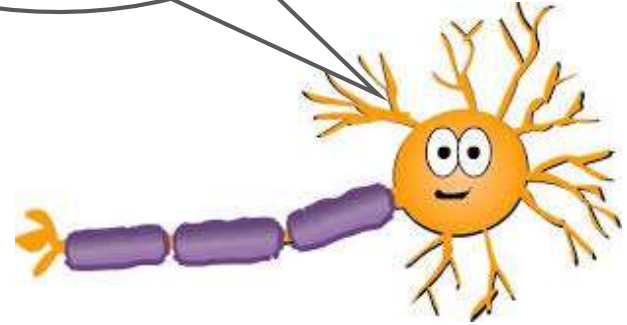
Actor Halle Berry "wears by the ketogenic diet,"  
according to *Women's Health* magazine.



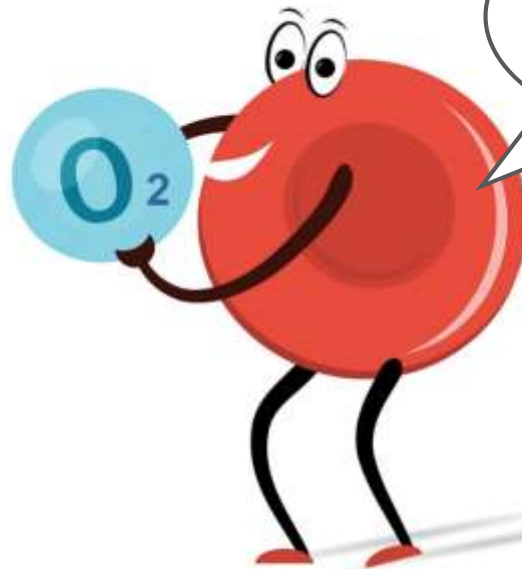
I prefer  
glucose!



Me three!



Me too!



Potential regulators  
of health!

10s of thousands!

① Anti-oxidants  
protect DNA from  
oxidative damage

② Protein synthesis  
regulation/control

③ Hormone-like  
action  
endocrine mimicry

④ Blood effects  
modify blood chemistry

***Phytochemicals ≡ Plant chemicals***

aroma, color, taste



# Why Eat Whole Grains?



**Based on existing evidence, eating whole grains is definitely good for our health.**

*Shengmin Sang, Professor of Food Science & Human Health North Carolina A&T*

**Fiber** ↑ fullness, motility, beneficial bacteria, wt control  
↓ cholesterol, insulin response, inflammation, diabetes and CVD risk...



**B-vitamins** thiamin, niacin, riboflavin ↑ energy metabolism

**Folate** ↑ red blood cells, ↓ neural tube defects

**Iron** ↑ O<sub>2</sub> carrying, ↓ iron-deficiency anemia in women

**Magnesium** ↑ bone building & muscle energy release

**Selenium** an anti-oxidant, protects body cells & ensures a healthy immune system...



**<https://www.choosemyplate.gov/eathealthy/grains>**



# 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 and 70% of strokes!

**FOOD DAY**

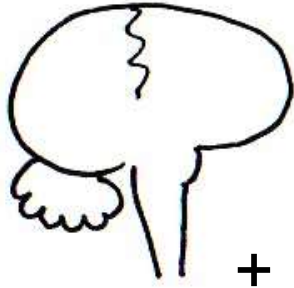
OCTOBER 24, 2011

JOIN US AT [FOODDAY.ORG](http://FOODDAY.ORG)

**40**

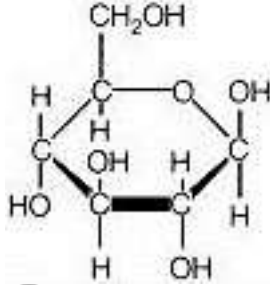
CSPI • 1971-2011

2



+

glucose



rbcs



1

# Negative Effects of Low Carbohydrate

4



- 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.



+ gall stones,  
↓ thermoregulation...

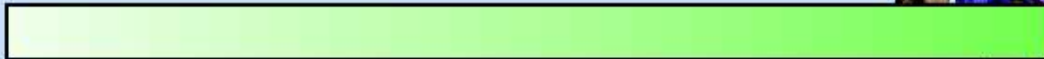
# Dietary Composition & Physical Endurance

eg, Atkins!

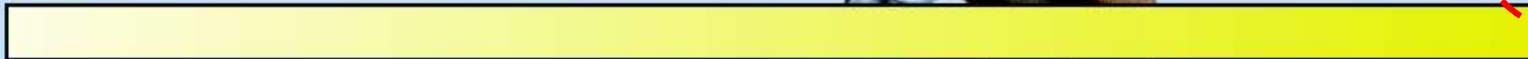
High-fat diet



Normal mixed diet



High-carbohydrate diet



~ 1/3 endurance!

Maximum endurance time:

57 min

114 min

167 min



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



<b>FAT</b>	<b>9 Kcal/g</b>
<b>ETOH</b>	<b>7 Kcal/g</b>

**CARB**      **4 Kcal/g**

**PRO**        **4 Kcal/g**

**DIETFITS (2018)  
+ Pounds Lost  
Trial (2009)  
indicate that  
reducing overall  
calories is more  
important than  
macronutrient  
composition of  
the diet!**

**NB: Minimize not Eliminate!  
Moderation not Abstinence!!**

**<https://www.ncbi.nlm.nih.gov/pubmed/29466592>  
<https://www.ncbi.nlm.nih.gov/pubmed/19246357>**

# 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!

>  $\frac{3}{4}$



# Human Intermittent Fasting Studies

- ~100 overweight or obese women
- ½ cut 25% kcal every day
- ½ ate normally 5 d, but only 650 kcal/d for 2 d/wk
- After 3 – 6 mo, each group lost ~ same amount of wt but women on 5:2 diet had better insulin function!
- Likely easier for most humans to restrict for only 2 d/wk!

The Nightingale Centre  
Wythenshawe Hospital  
Southmoor Rd  
Manchester  
M23 9LT



UHSM  
Your Hospital

Harvie M, Wright C, Pegington M and coworkers. *Br J Nutr* 2013 Oct,110(8): 1534-47. <https://www.ncbi.nlm.nih.gov/pubmed/23591120>

Harvie M, Peginton M, Mattson M and coworkers. *Int J Obes* (London), 2011 May, 35(5):714-27. <https://www.ncbi.nlm.nih.gov/pubmed/20921964>

# 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

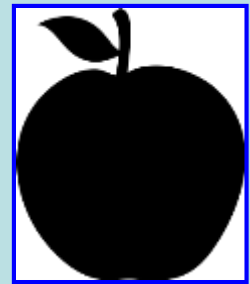
- Eight of 10 ate breakfast daily which may help better manage calories during the day

- Self-monitor, weigh themselves  $\geq 1$ x/wk & many still keep food dairies

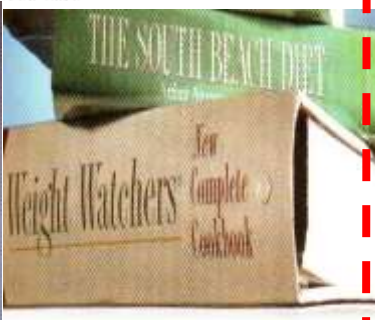
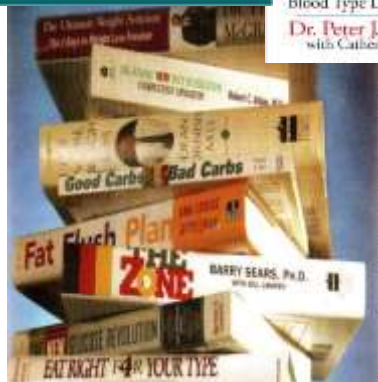
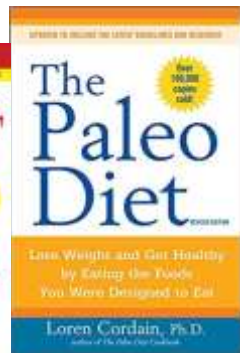
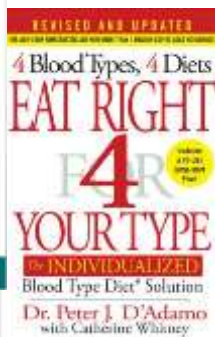
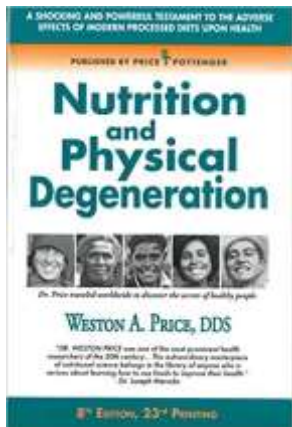
- Much planned physical activity, 60-90 min/d, 1<sup>0</sup> walking + looked for other ways to be active

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

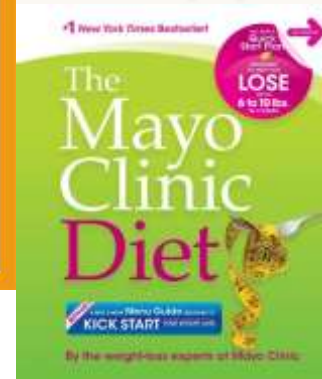
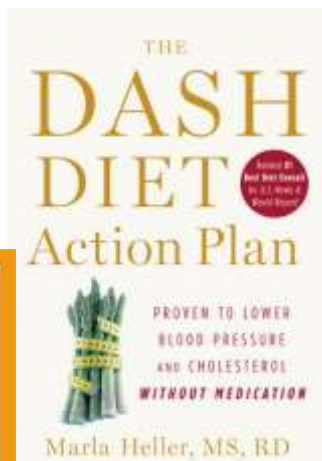
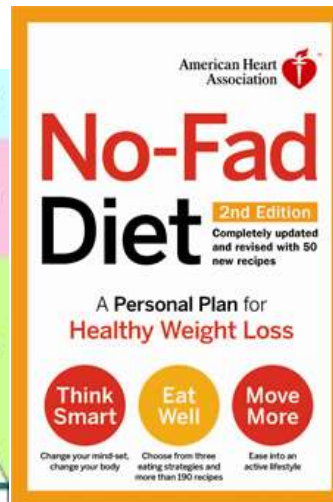
UC Berkeley Wellness Engagement Calendar, September 2013



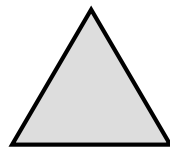
# Which Diets are Best?



Mediterranean Diet



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



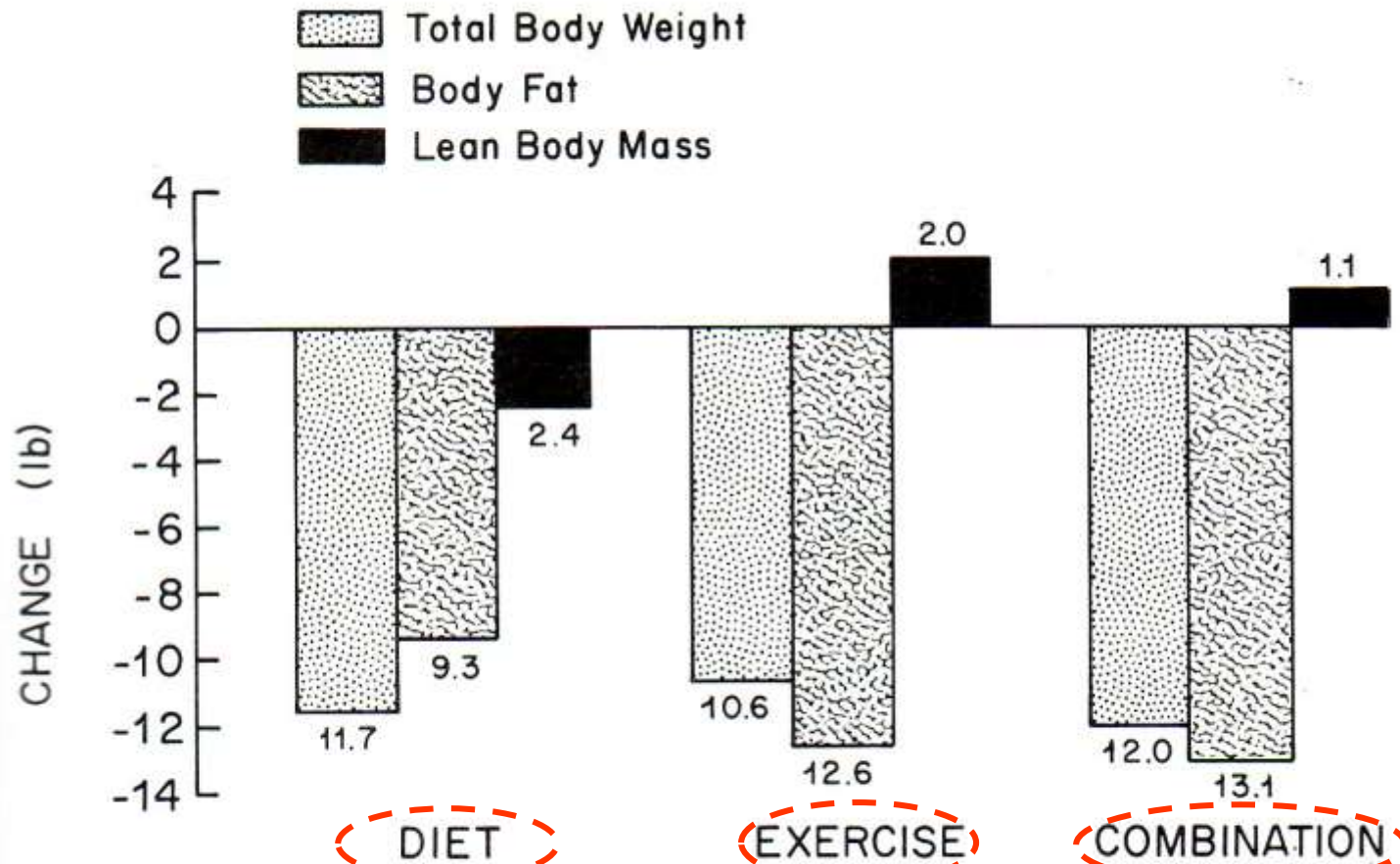
**Plant-based**  
**Lower Fat**



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



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



**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.)

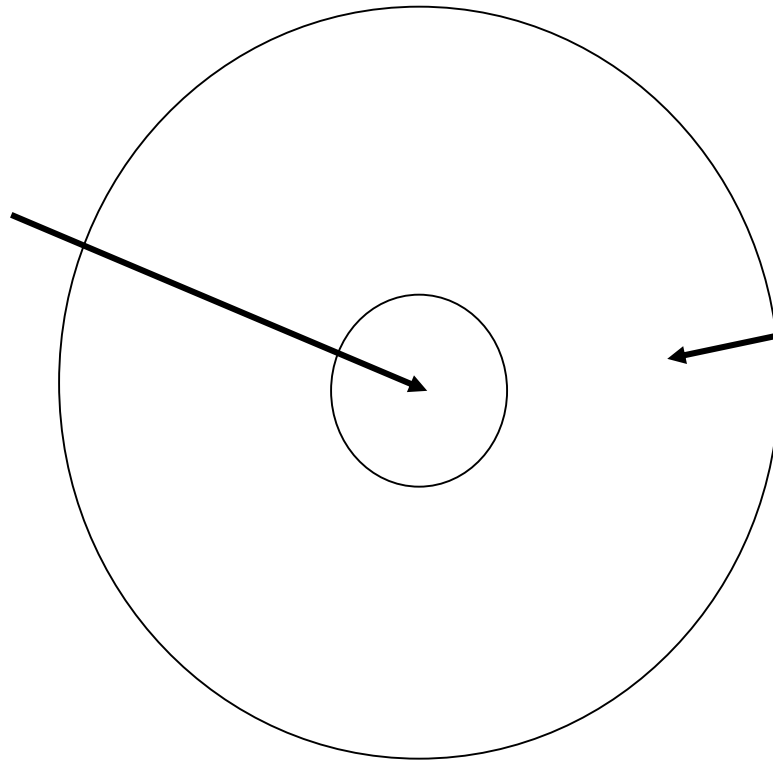
**NB: Each group 500 kcal deficit/day, 16 weeks**



# GI-Doughnut Analogy



**GI Lumen**



**Body**



Me?



# ***Gut Secretions***

## ***Secretion***

## ***Release Site***

**1. Mucus**

**into GI Lumen**

**2. Enzymes**

**into GI Lumen**

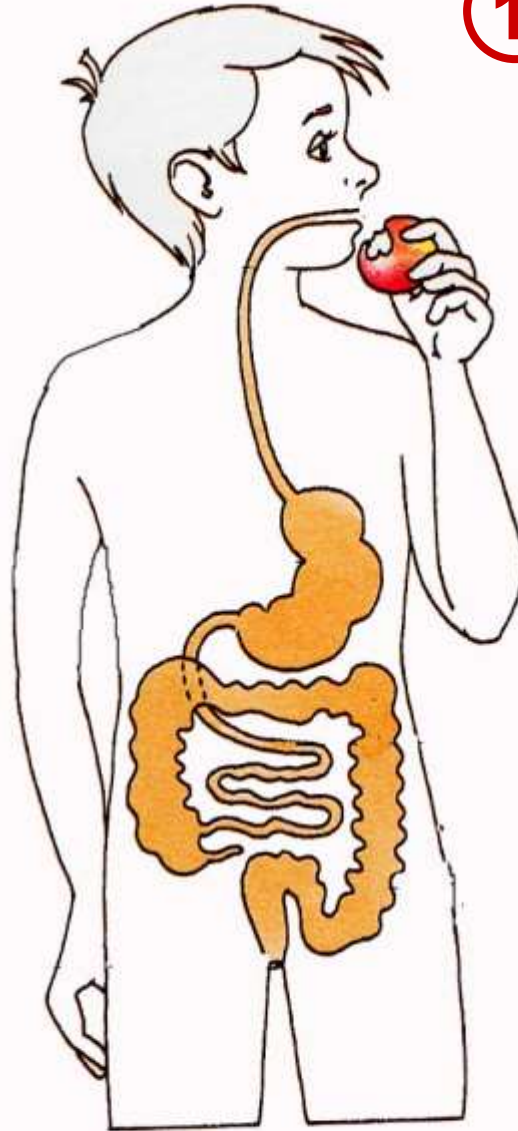
**3. H<sub>2</sub>O, acids, bases+**

**into GI Lumen**

**4. Hormones**

**into Blood**

# 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.

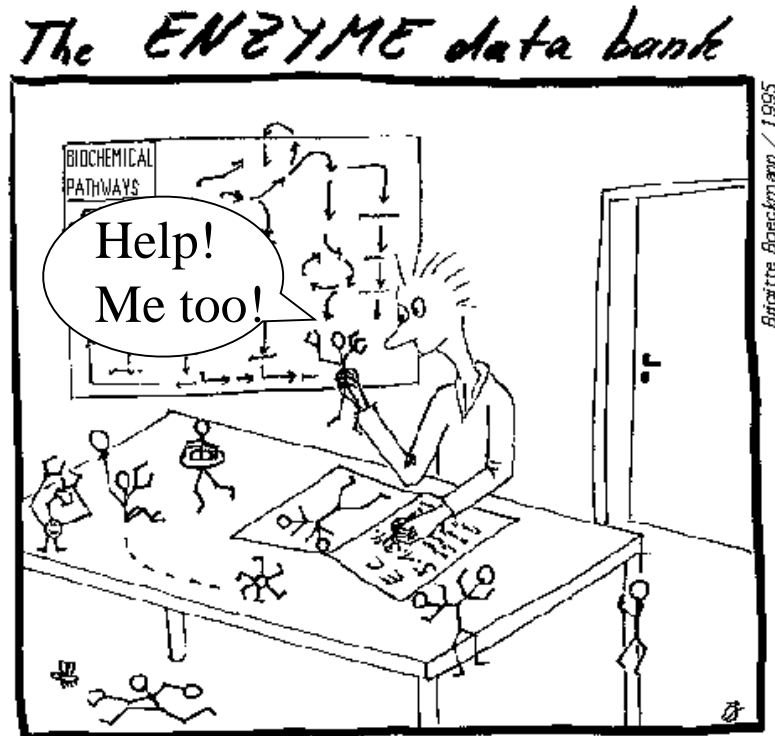
<https://www.youtube.com/watch?v=Oq5xAdC8EUI>

# Hydrolysis of Energy Nutrients

Hi gang!!  
You need me  
for digestion!!



+



H<sub>2</sub>O

+

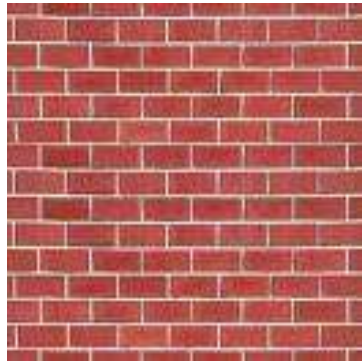
Enzyme



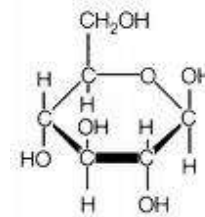
# Polymer to Monomer (Many to One)



...Central-linking theme!!

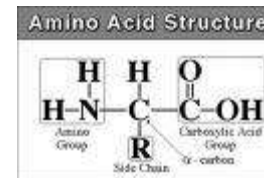


Carbohydrate

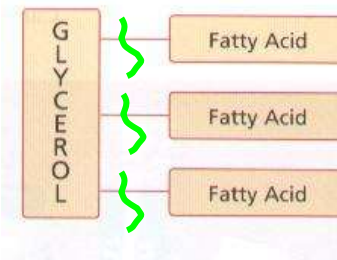
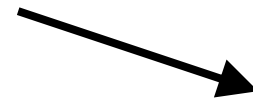


Glucose

Protein  
+  
Fat



Amino Acids



Fatty Acids  
+  
Glycerol



...Put Lab Notebook in box based on your lab time. Thanks!!

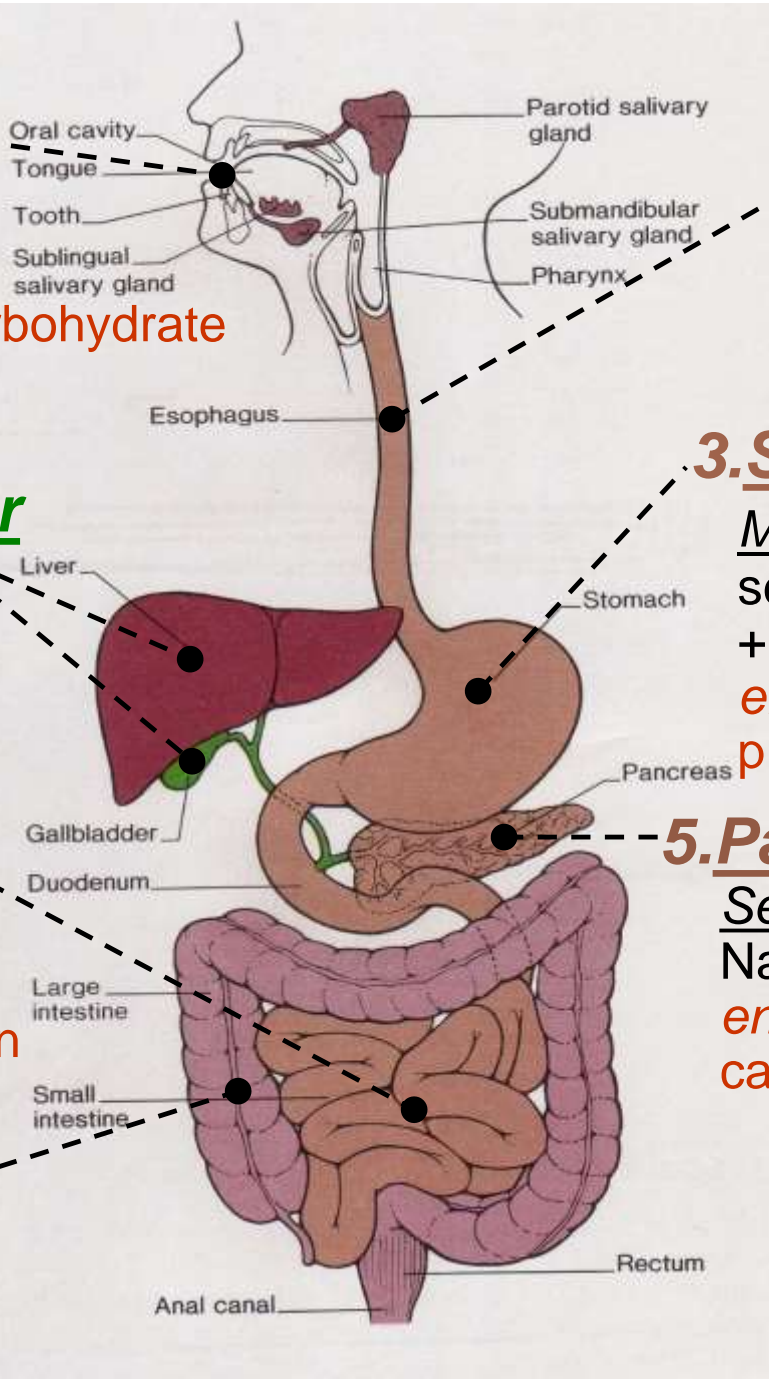


## BI 121 Lecture 7

- I. Announcements** Exam I one week from today, Oct 29<sup>th</sup>!  
10 am Lab → 5 KLA, 11 am → 129 HUE, AEC, All others here!  
Discussion + Review, Sunday Oct 27<sup>th</sup>, 6-7:30 pm, here! Q?
- II. Gastrointestinal Physiology** DC Mod 3 pp 17-23, LS ch 15+
  - A. Organ-by-organ review LS tab 15-1 pp 440-1 +...
  - B. Zymogen? = Inactive precursor LS fig 15-9 p 452...
  - C. Accessory organs? Pancreas, Liver, Recycling! pp 457-63
  - D. Small intestine? Ulcers? Energy nutrient digestion LS  
*Beyond the Basics*, fig 15-20,15-22 pp 456, 467-8, Mayo Clinic
  - E. Large intestine? LS fig 15-24 pp 472-4
- III. Cardiovascular System** DC Mod 4, LS ch 9, Torstar, G&H+...
  - A. Circulatory vs. Cardiovascular (CV)? CV vs. Lymphatic  
CV Pulmonary & Systemic circuits DC pp23-31+LS p229+  
DC fig 4-1 p 24, LS fig 9-2b p 231
  - B. Arteries, capillaries, veins, varicosities? G&H, Torstar, DC
  - C. ♥ layers, box, chambers, valves, inlets, outlets  
LS fig 9-4 p 233, fig 9-2a p 231; DC pp 23-6
  - D. Normal vs. abnormal blood flow thru ♥ & CVS LS, Fox+...

# 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

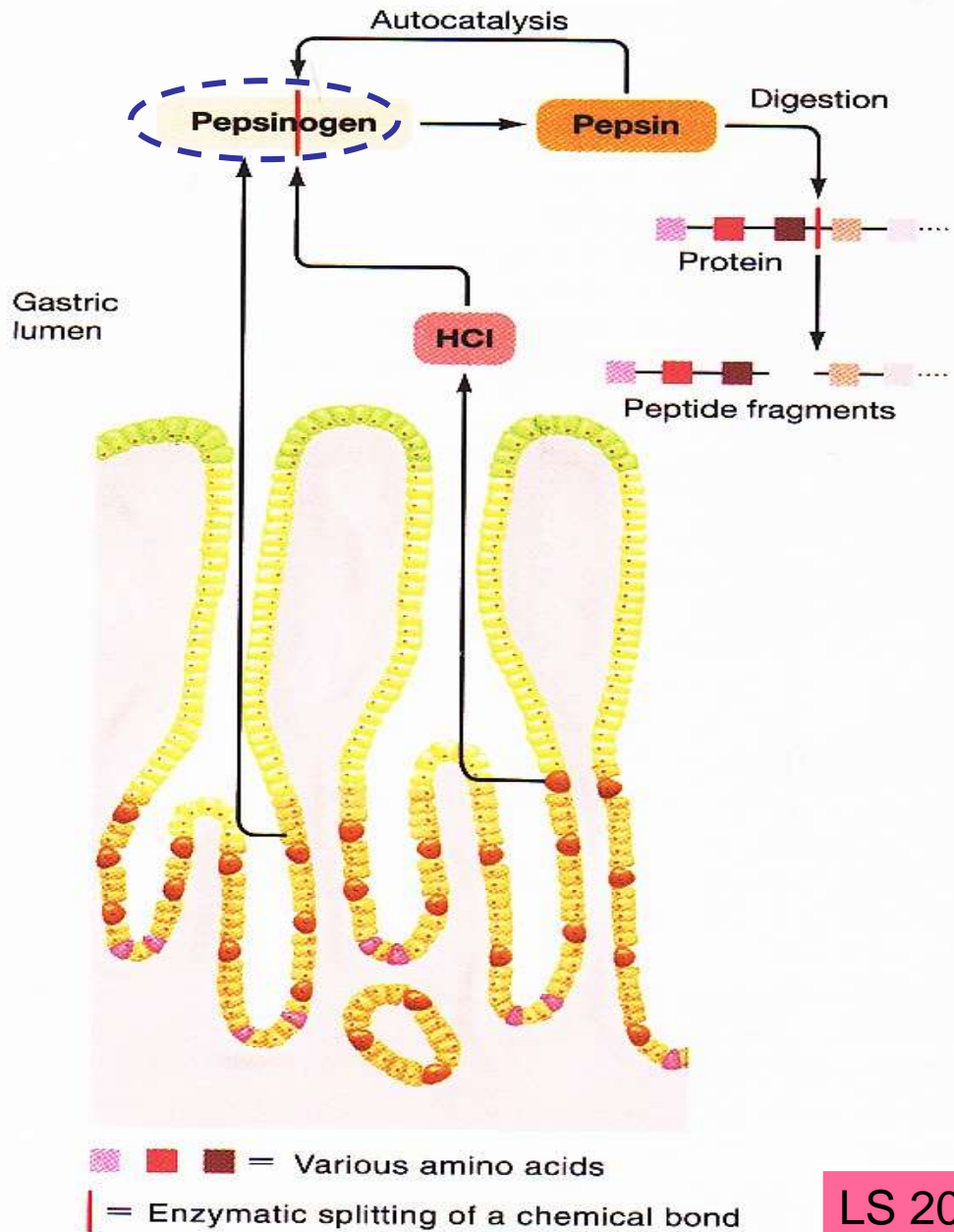
# 6. Small Intestine

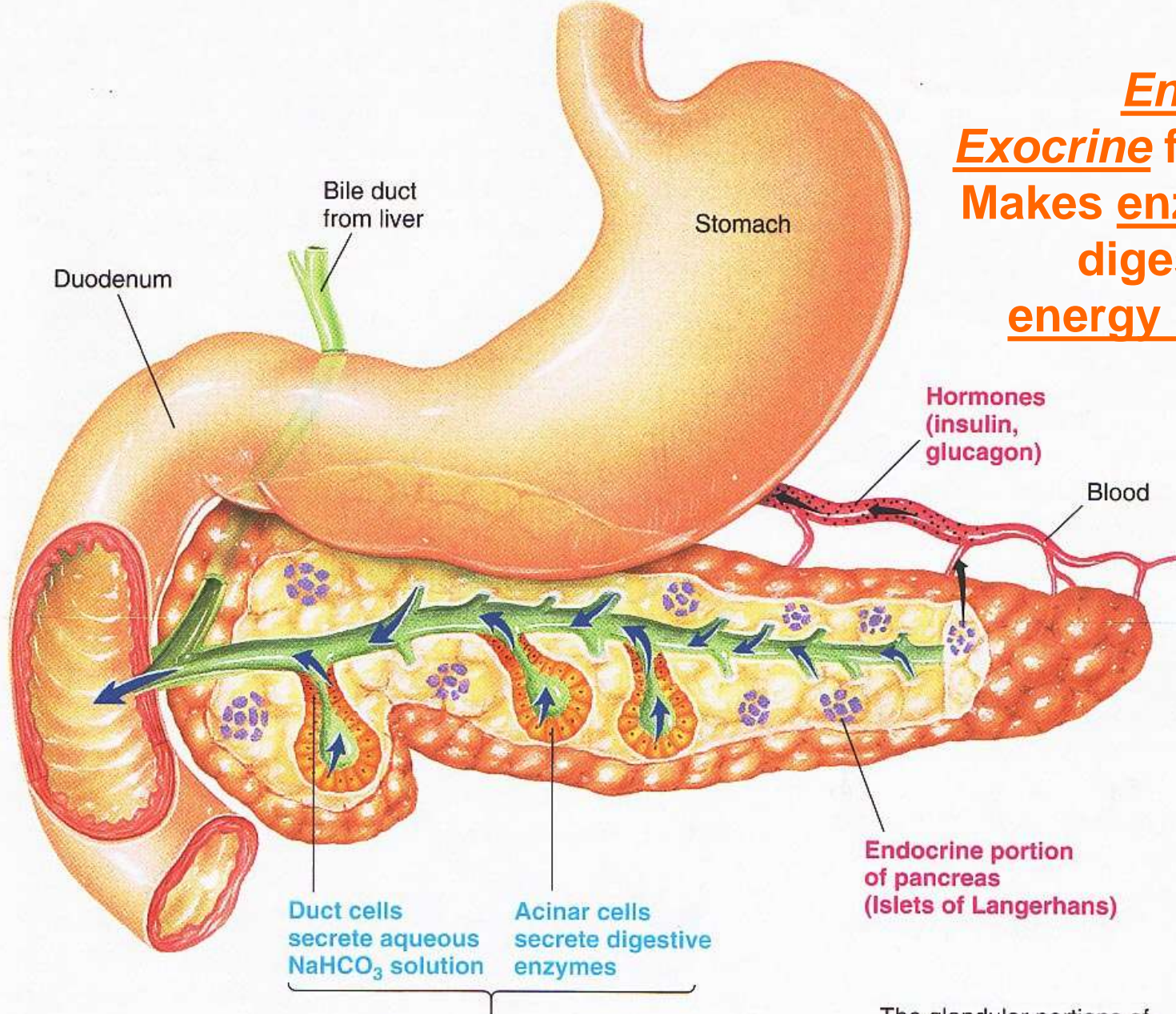
Absorption  
Secretion mucus  
+ enzymes  
enzymatic digestion:  
carbohydrate, fat, protein  
Peristalsis

# 7. Large Intestine

Dehydration  
secretion + absorption  
storage + peristalsis

**Zymogen =  
an inactive  
precursor**





**Endocrine + Exocrine functions; Makes enzymes for digesting all 3 energy nutrients!**

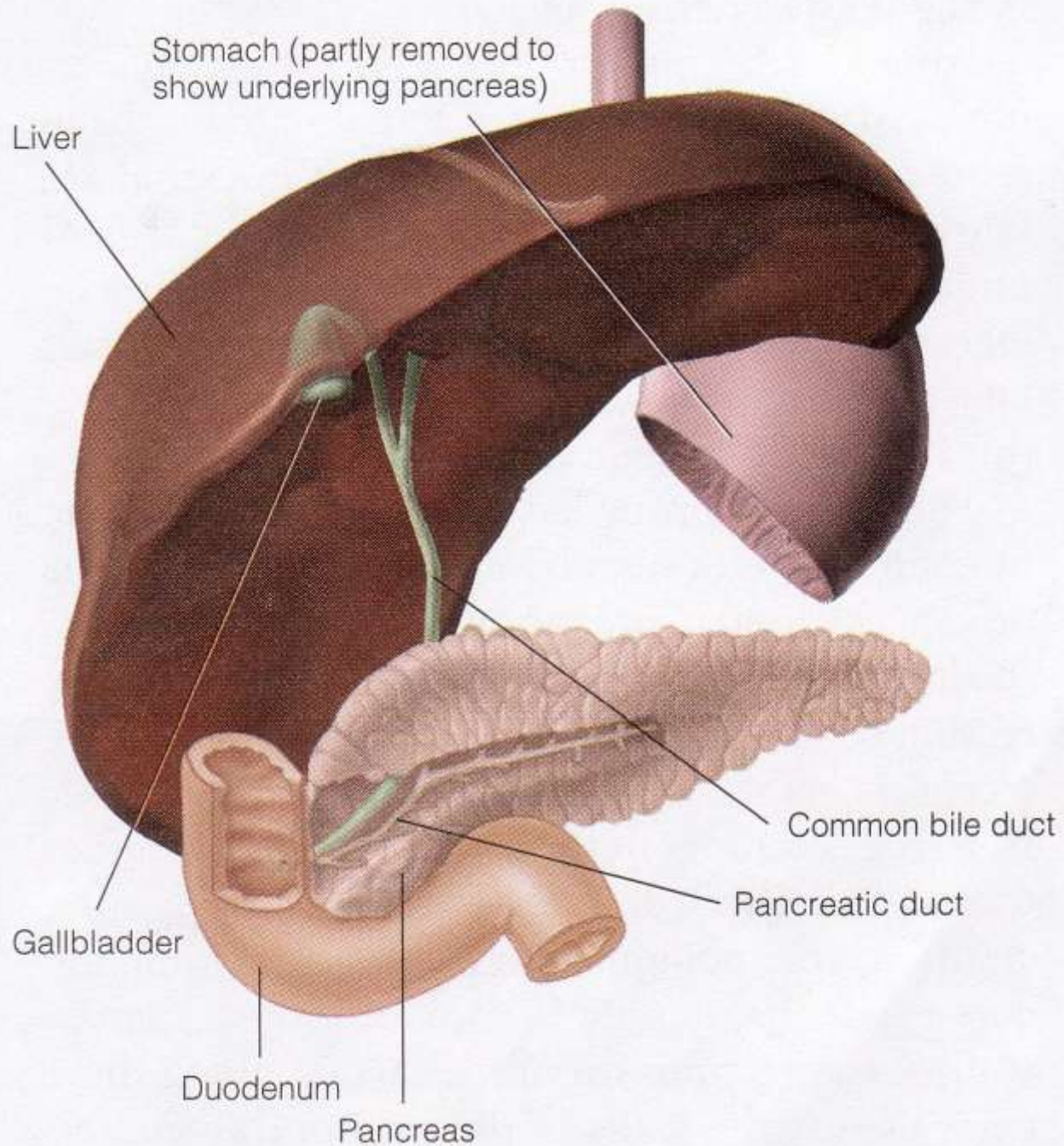
Duct cells secrete aqueous  $\text{NaHCO}_3$  solution

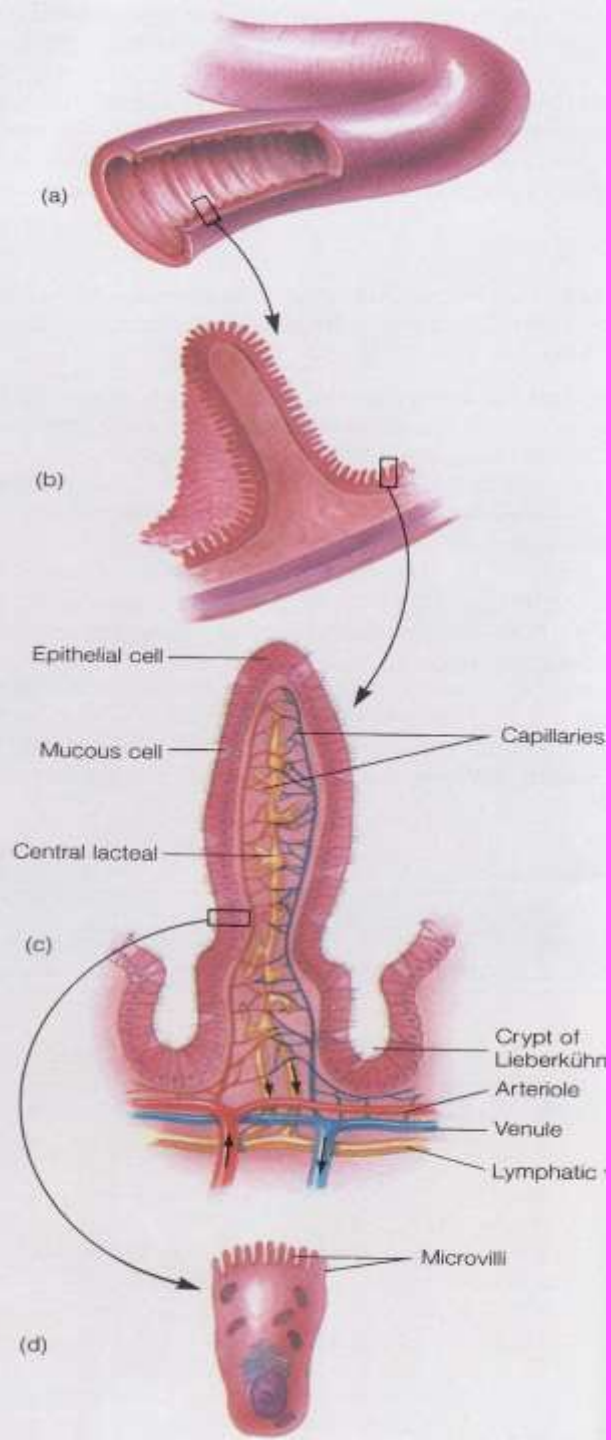
Acinar cells secrete digestive enzymes

Endocrine portion of pancreas (Islets of Langerhans)

The glandular portions of the pancreas are grossly exaggerated.

LS 2012 fig 15-11 p 457 Exocrine portion of pancreas (Acinar and duct cells)





## Ulcer Facts

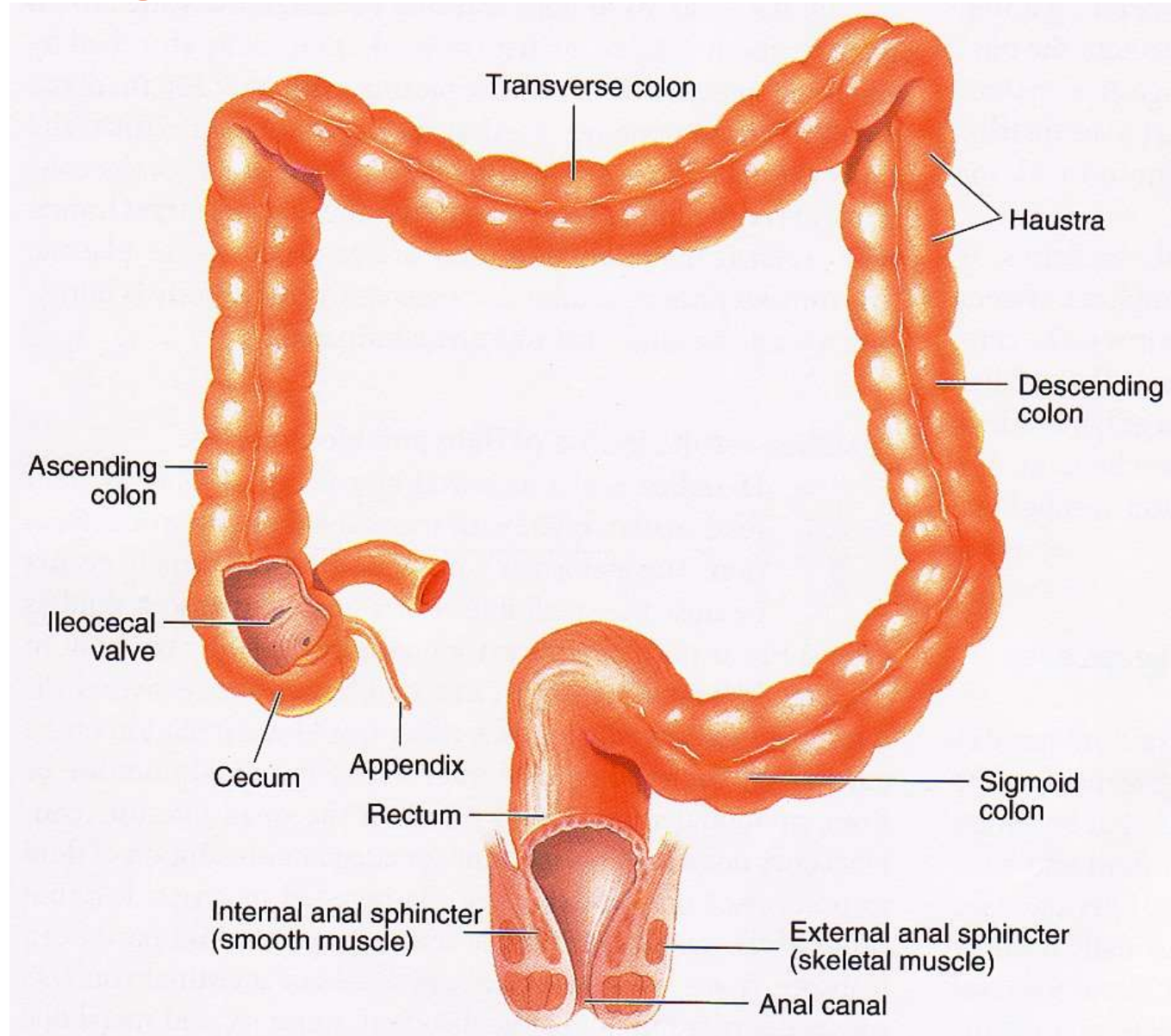
- Most ulcers are caused by an infection, not spicy food, acid or stress.
- The most common ulcer symptom is burning pain in the stomach.
- Your doctor can test you for *H. pylori* infection.
- Antibiotics are the new cure for ulcers.
- Eliminating *H. pylori* infections with antibiotics means that your ulcer can be cured for good.



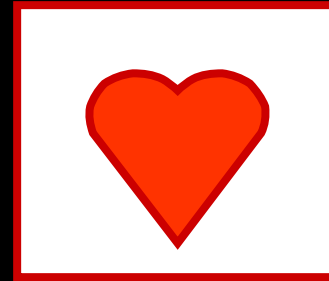
▲ **Table 15-5 Digestive Processes for the Three Major Categories of Nutrients**

Nutrients	Enzymes for Digesting the Nutrients	Source of Enzymes	Site of Action of Enzymes	Action of Enzymes	Absorbable Units of the Nutrients
<b>Carbohydrates</b>	Amylase	Salivary glands	Mouth and (mostly) body of stomach	Hydrolyzes polysaccharides to disaccharides (maltose)	
		Exocrine pancreas	Small-intestine lumen		
	Disaccharidases (maltase, sucrase, lactase)	Small-intestine epithelial cells	Small-intestine brush border	Hydrolyze disaccharides to monosaccharides	Monosaccharides, especially glucose
<b>Proteins</b>	Pepsin	Stomach chief cells	Stomach antrum	Hydrolyzes protein to peptide fragments	
	Trypsin, chymotrypsin, carboxypeptidase	Exocrine pancreas	Small-intestine lumen	Attack different peptide fragments	
	Aminopeptidases	Small-intestine epithelial cells	Small-intestine brush border	Hydrolyze peptide fragments to amino acids	Amino acids
<b>Fats</b>	Lipase	Exocrine pancreas	Small-intestine lumen	Hydrolyzes triglycerides to fatty acids and monoglycerides	Fatty acids and monoglycerides
	Bile salts (not an enzyme)	Liver	Small-intestine lumen	Emulsify large fat globules for attack by pancreatic lipase	

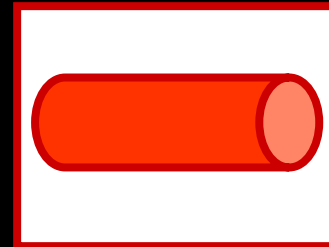
# Large Intestine Structure & Function



***Cardiovascular (CV) = Heart + Vessels + Blood!***



+

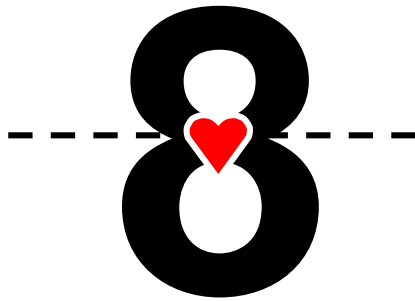


+

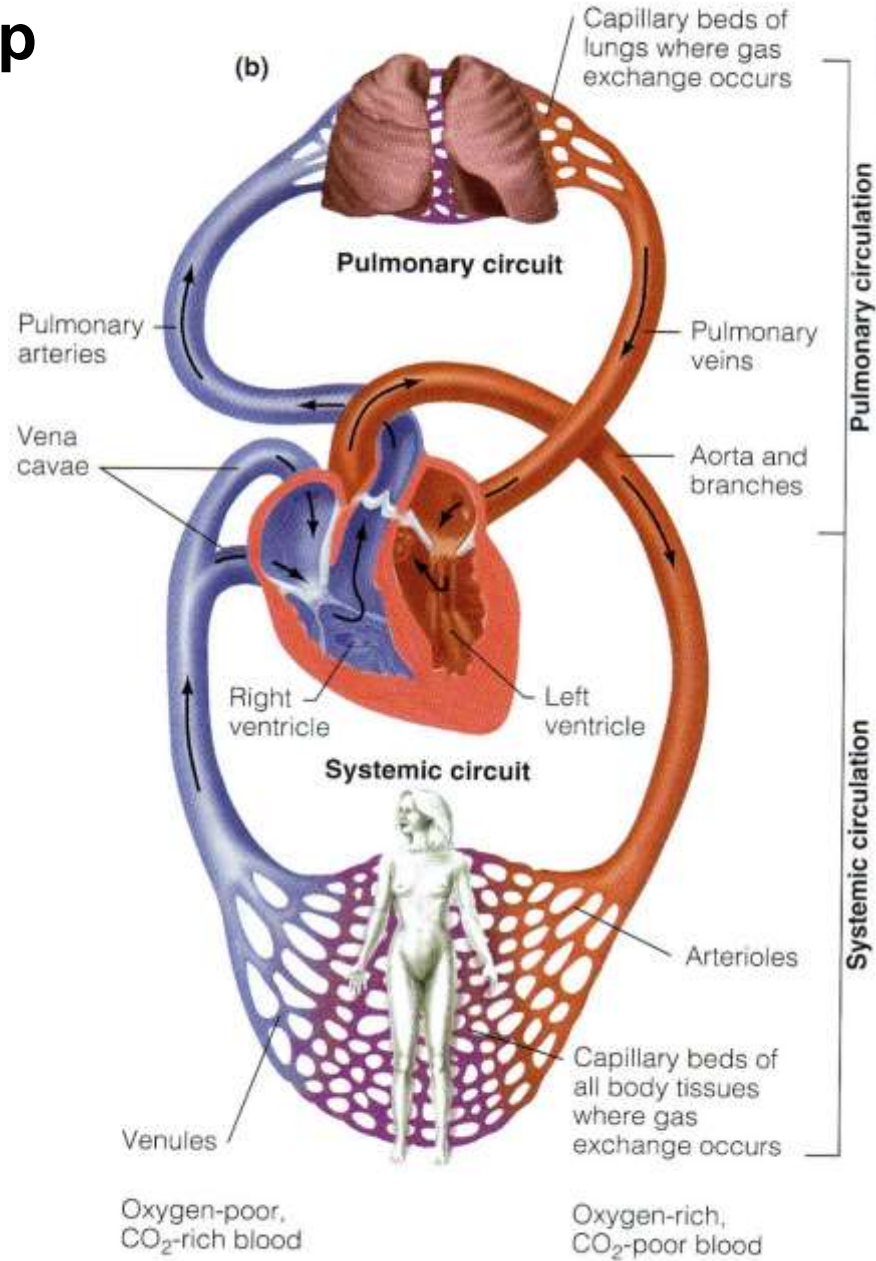


**NB: Figure-8 loop**

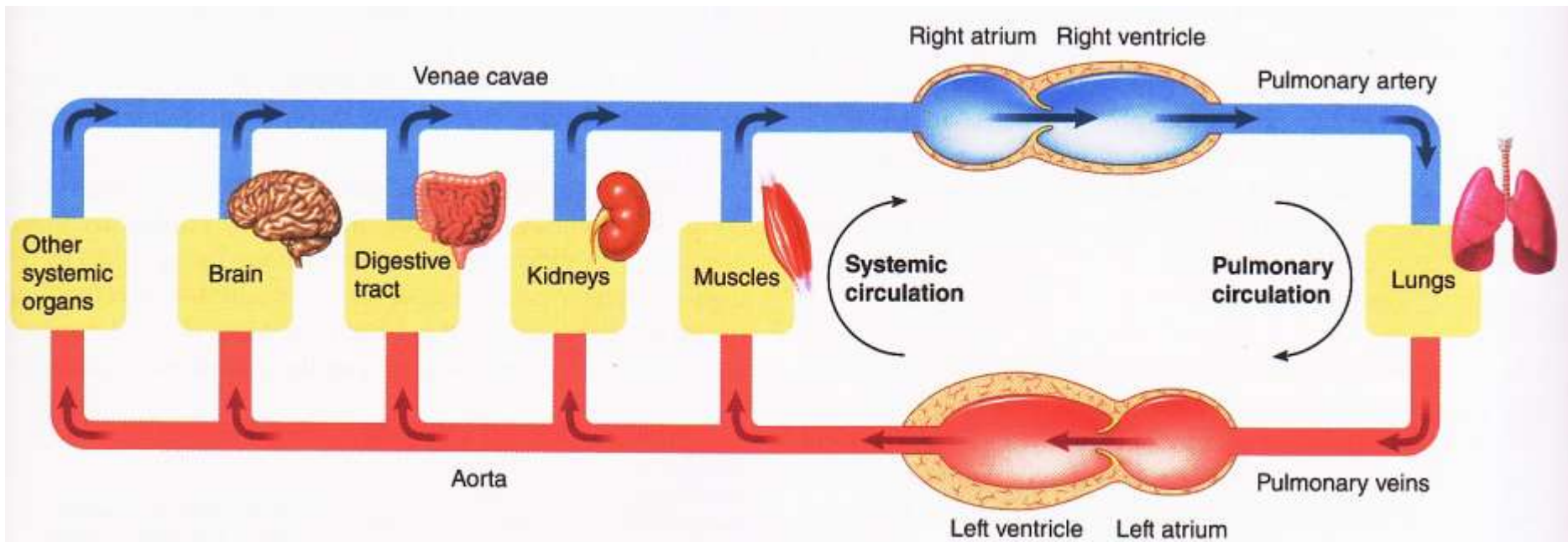
**Pulmonary**

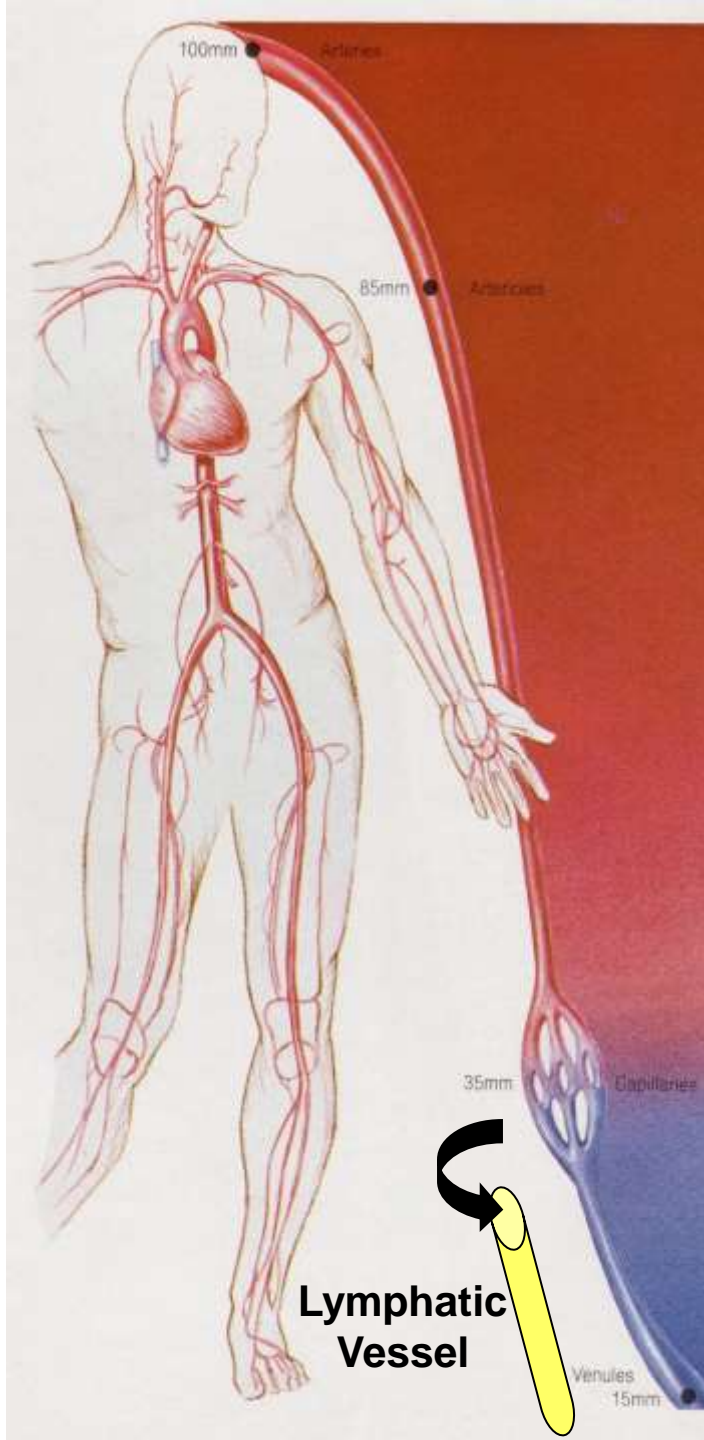


**Systemic**



# Dual Pump Action & Parallel Circulation



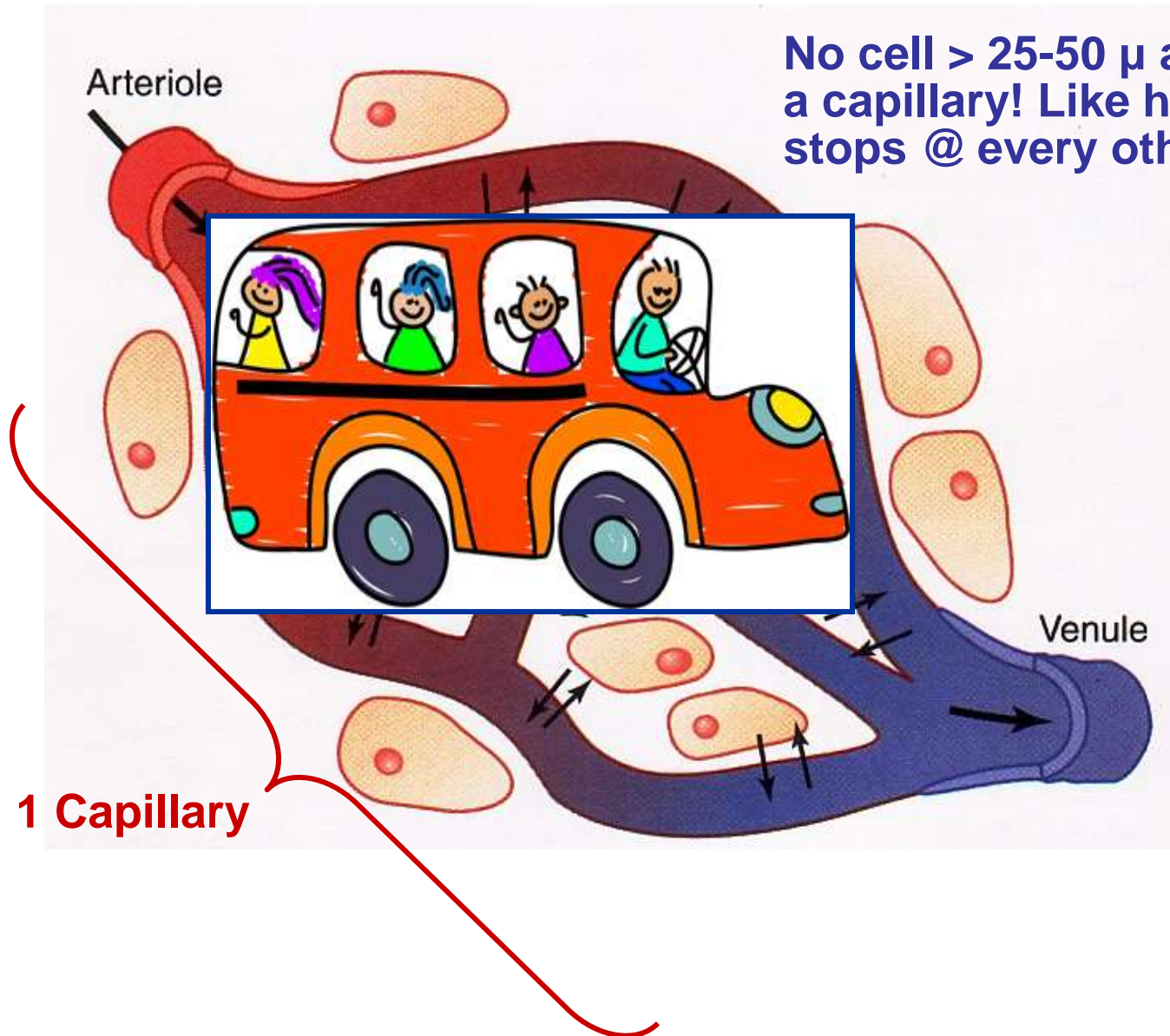


**Lymphatics collect run-off & are parallel to venules/small veins!**

# ***Lymphatic System Blockage in Elephantiasis from Mosquito-borne Parasitic Filaria Worm***



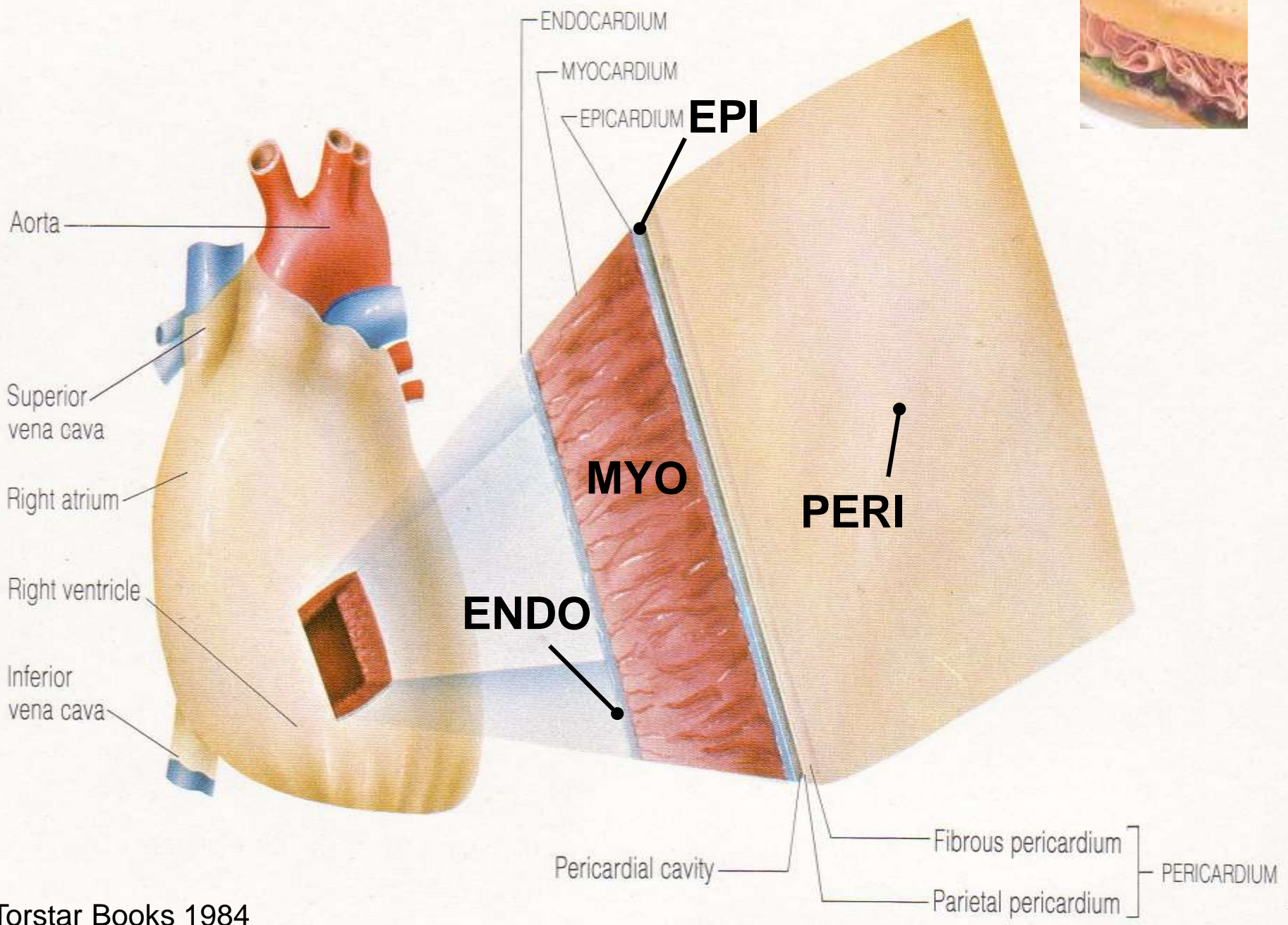
# Microcirculation Exchange: 10 Billion Capillaries!



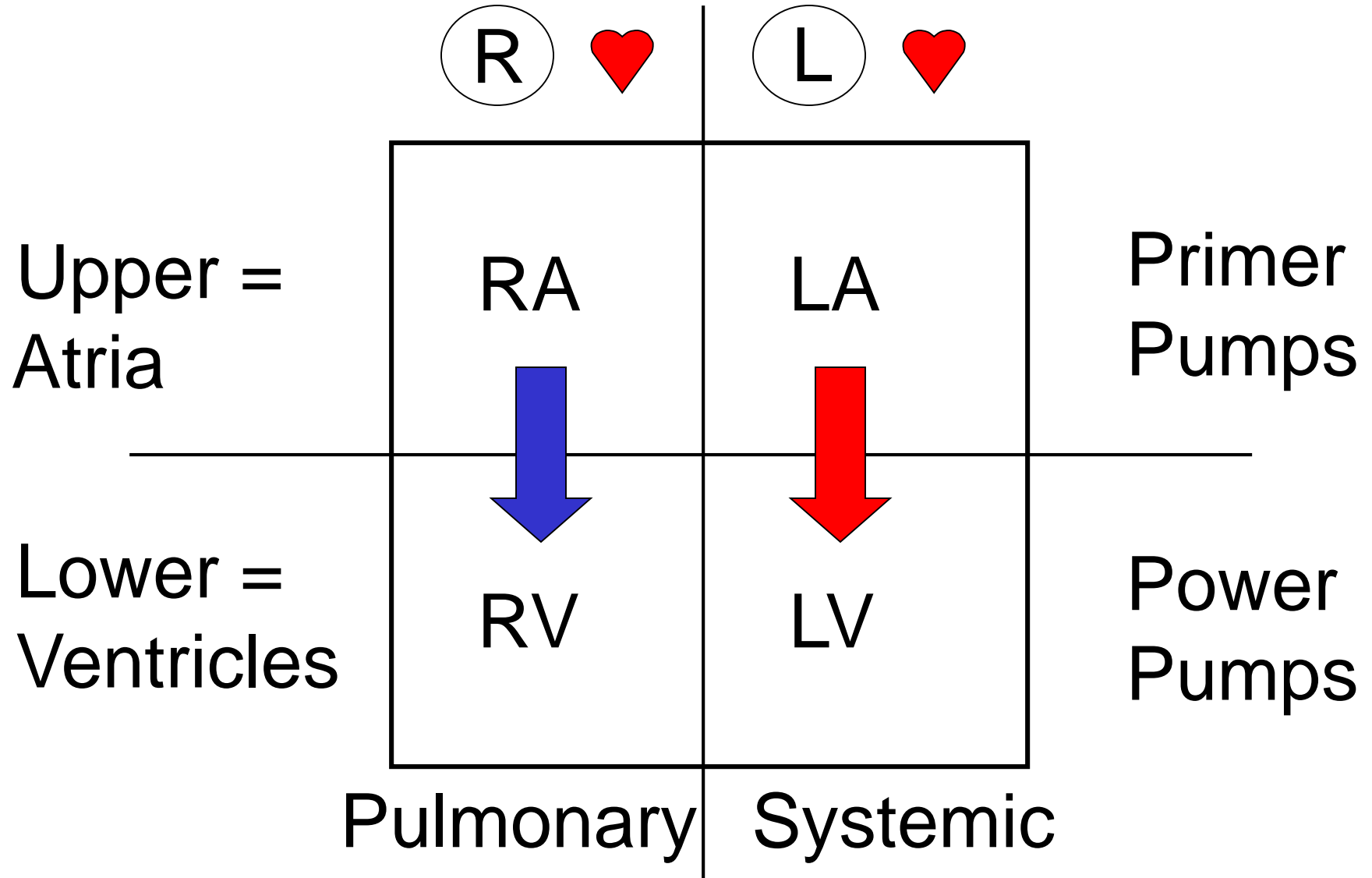
No cell > 25-50  $\mu$  away from a capillary! Like having bus stops @ every other block!

1 Capillary





Human  = 4-chambered box?  
2 separate pumps?



Human ♥ = 4 unique valves?  
2 valve sets?

Semilunar = Half-moon shaped

More  
rigid

1. Pulmonic/Pulmonary
2. Aortic



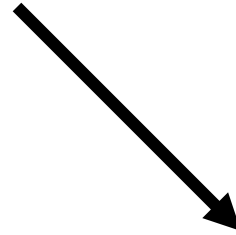
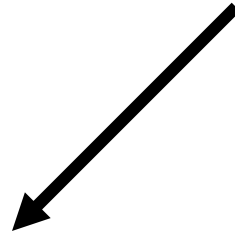
AV = Atrioventricular

More  
flimsy

3. (R) AV = Tricuspid
4. (L) AV = Mitral/Bicuspid



# Cardiac Cycle

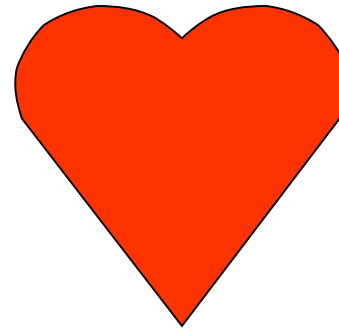
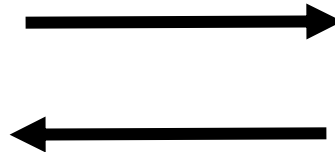
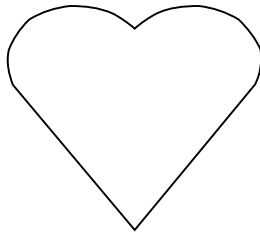


***Systole***

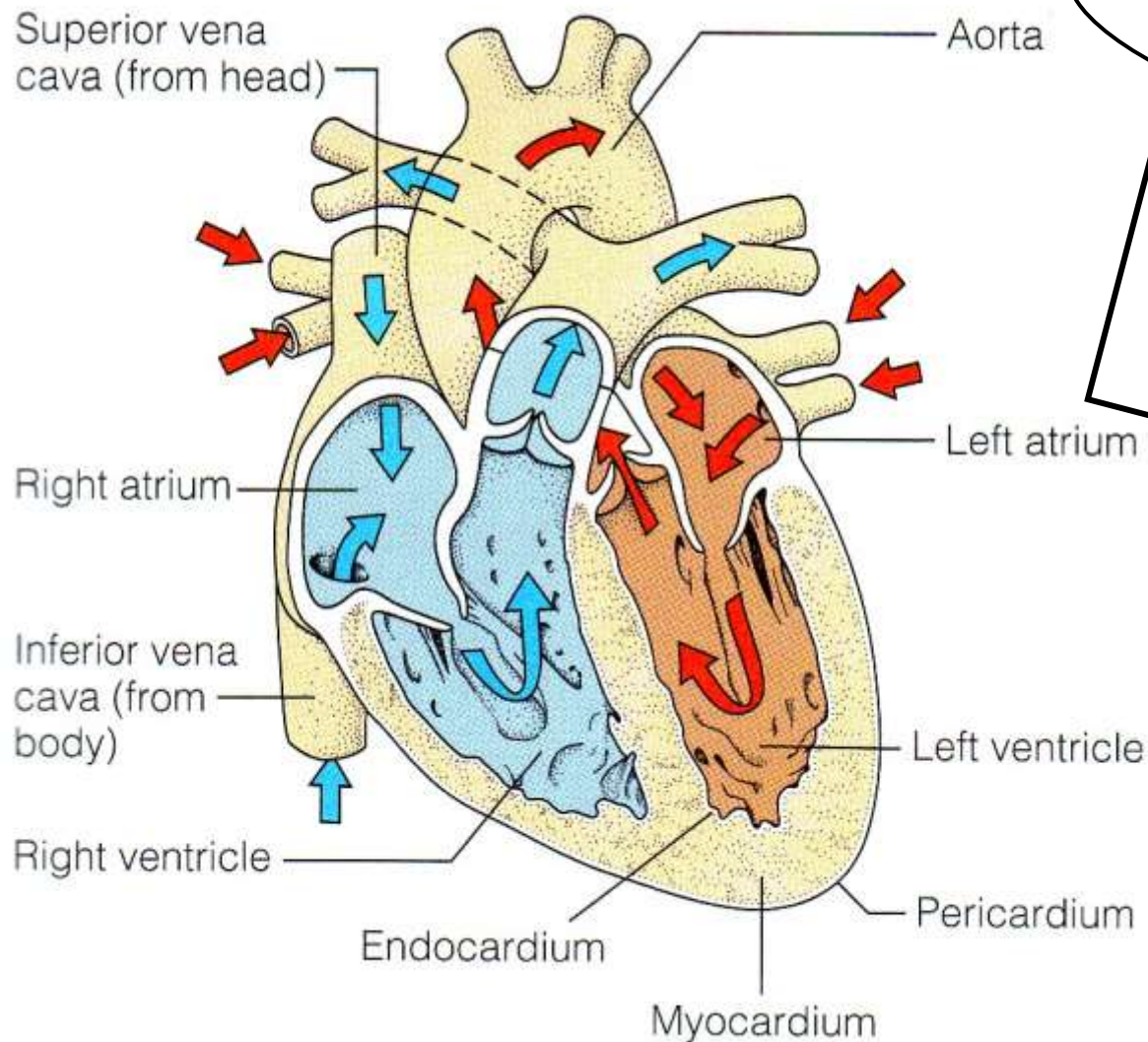
Contract  
& Empty

***Diastole***

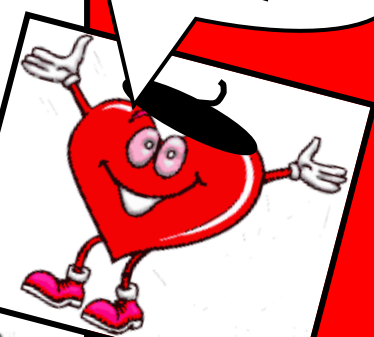
Relax  
& Fill



# Veins → Atria → Ventricles → Arteries



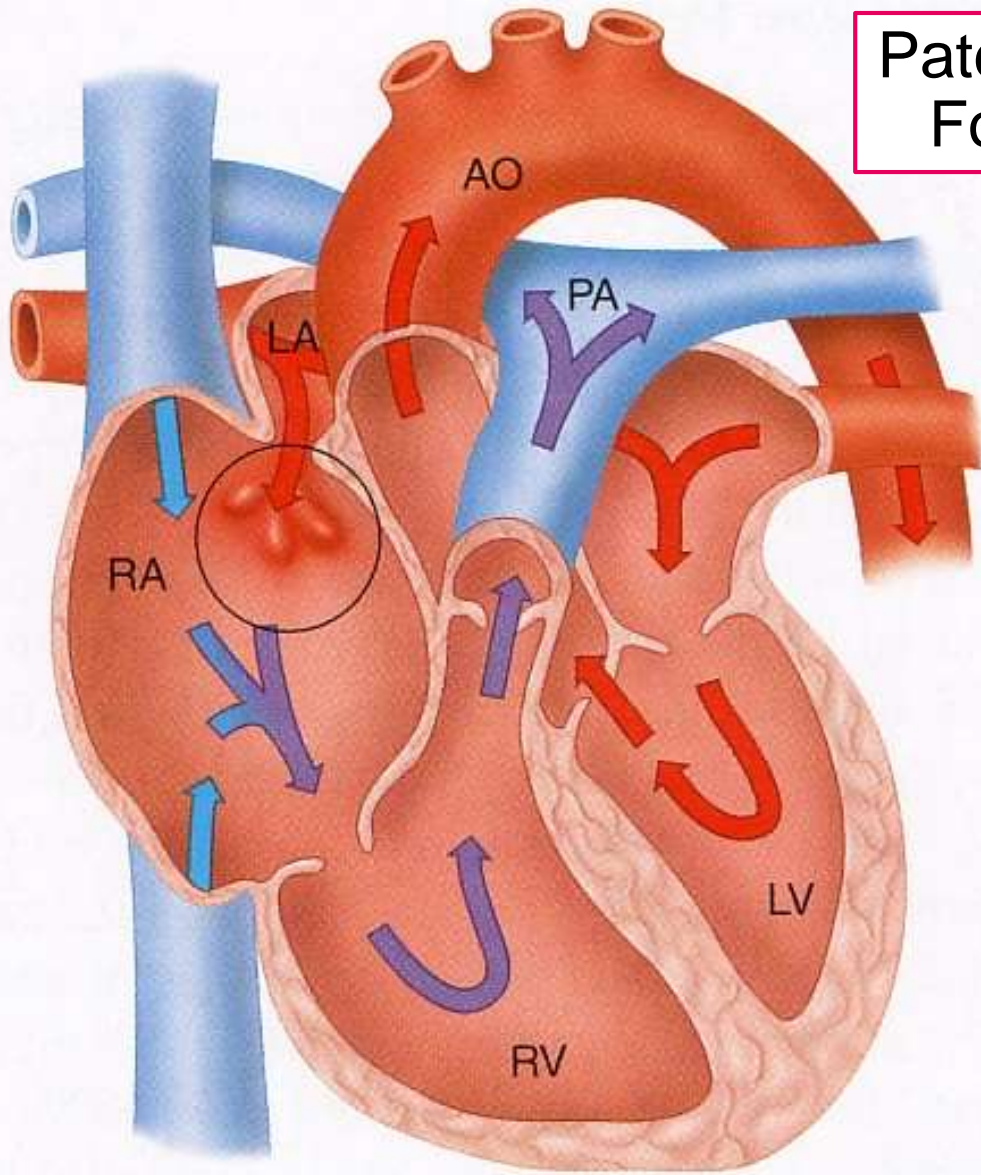
VAVA!



LS2007

<https://www.nhlbi.nih.gov/health-topics/how-heart-works>  
<https://www.youtube.com/watch?v=zJXAIh9VDDU>

Patent or still open!  
Foramen ovale!

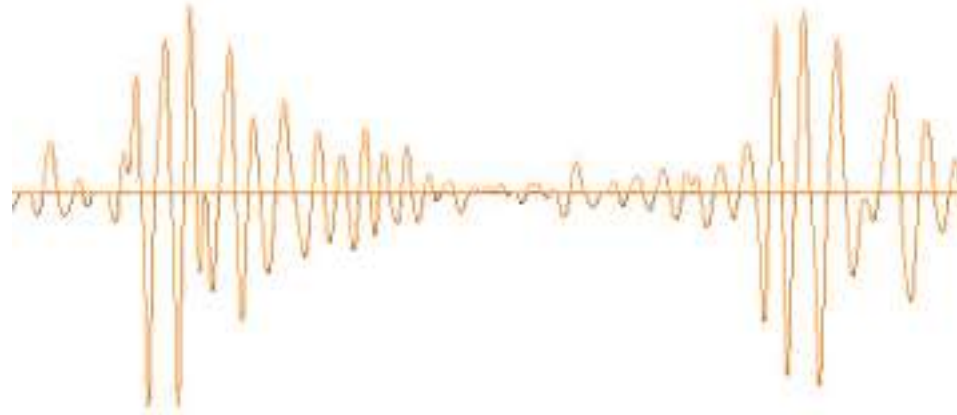


Septal defect  
in atria

***Heart Murmurs? An unusual or extra heart sound  
lub-dup, lub-dup vs lub-gurgle-dup, lub-swish-dup...***

**S1 = lub**

**S2 = dup**



**<https://www.thinklabs.com/heart-sounds>**

Fun heart rate & BP lab today! Hooray!!...



## BI 121 Lecture 8

**I. Announcements** **Exam I next time: 10 & 11 am lab sections go directly to 5 KLA & 129 HUE. All others (except AEC) here, 100 WIL!** **Review: Sun, 6 pm 100 WIL!** Lab Manuals. Q?

**II. Cardiovascular Connections** DC Module 4, LS ch 9, Torstar+...

**III. CV Physiology in News** AHA + ACSM exercise guidelines!

**IV. CV Pathophysiology & Risk Reduction** LS ch 9, 10 +...

A. AMI, CVA, CVD, PVD, TIA, HTN? + surgical treatments

B. Atherosclerosis? LS fig 9-27, 9-25, 9-26 pp 266-8

C. How to minimize risk of CVDs? Treatment triad:

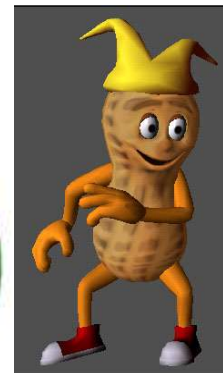
1. Exercise, 2. Diet, 3. Drugs+Surgery

D. Food choices

make a difference?

Plant-based diet!

What's HAPOC?







**AMERICAN COLLEGE**  
of **SPORTS MEDICINE**



## **Guidelines: Healthy Adults < 65 yr**

**Do moderately intense aerobic exercise  
30 min/d, 5 d/wk**

**OR**

**Do vigorously intense aerobic exercise  
20 min/d, 3 d/wk**

**AND**

**Do 8-10 strength-training exercises  
8-12 repetitions/each exercise, 2 d/wk**

# CVDs

AMI

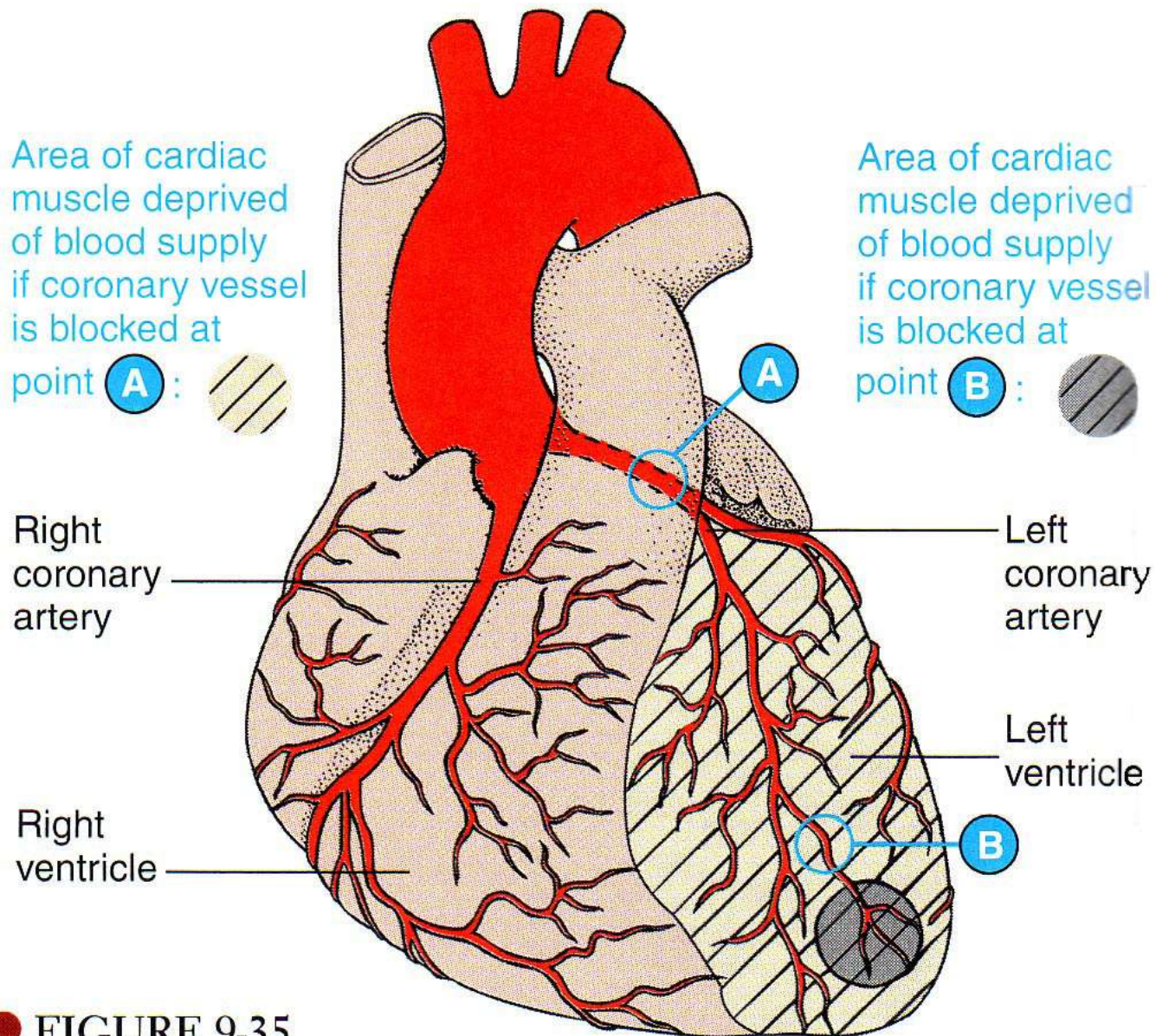
CVA



TIA

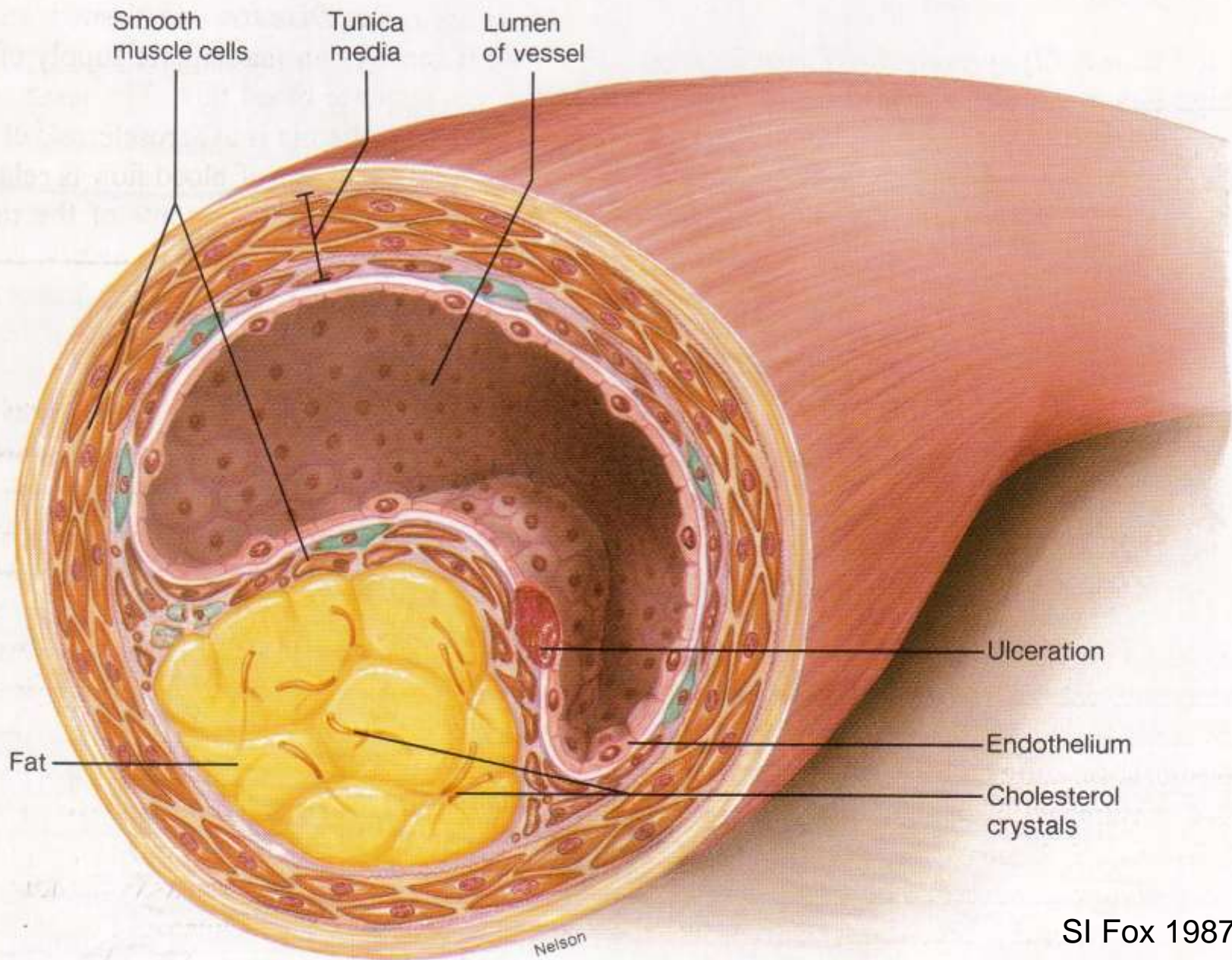
HTN

PVD



**●** FIGURE 9-35

Extent of myocardial damage as a function of the size of the occluded vessel

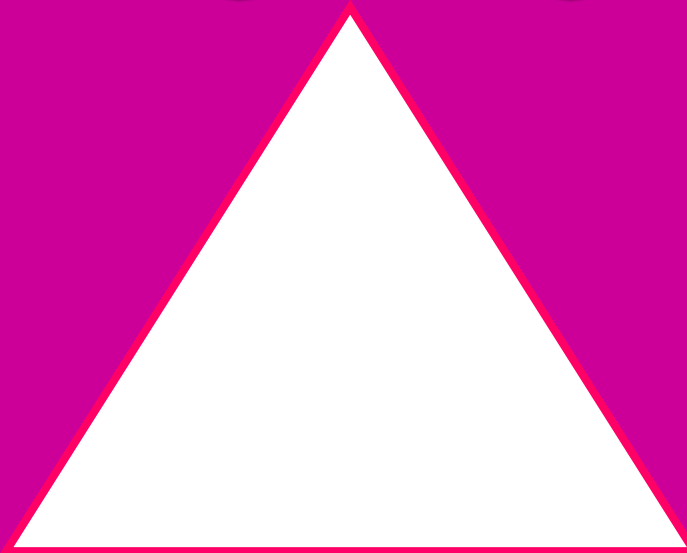


# *Treatment Triad*

NB: Last blasted resort!!

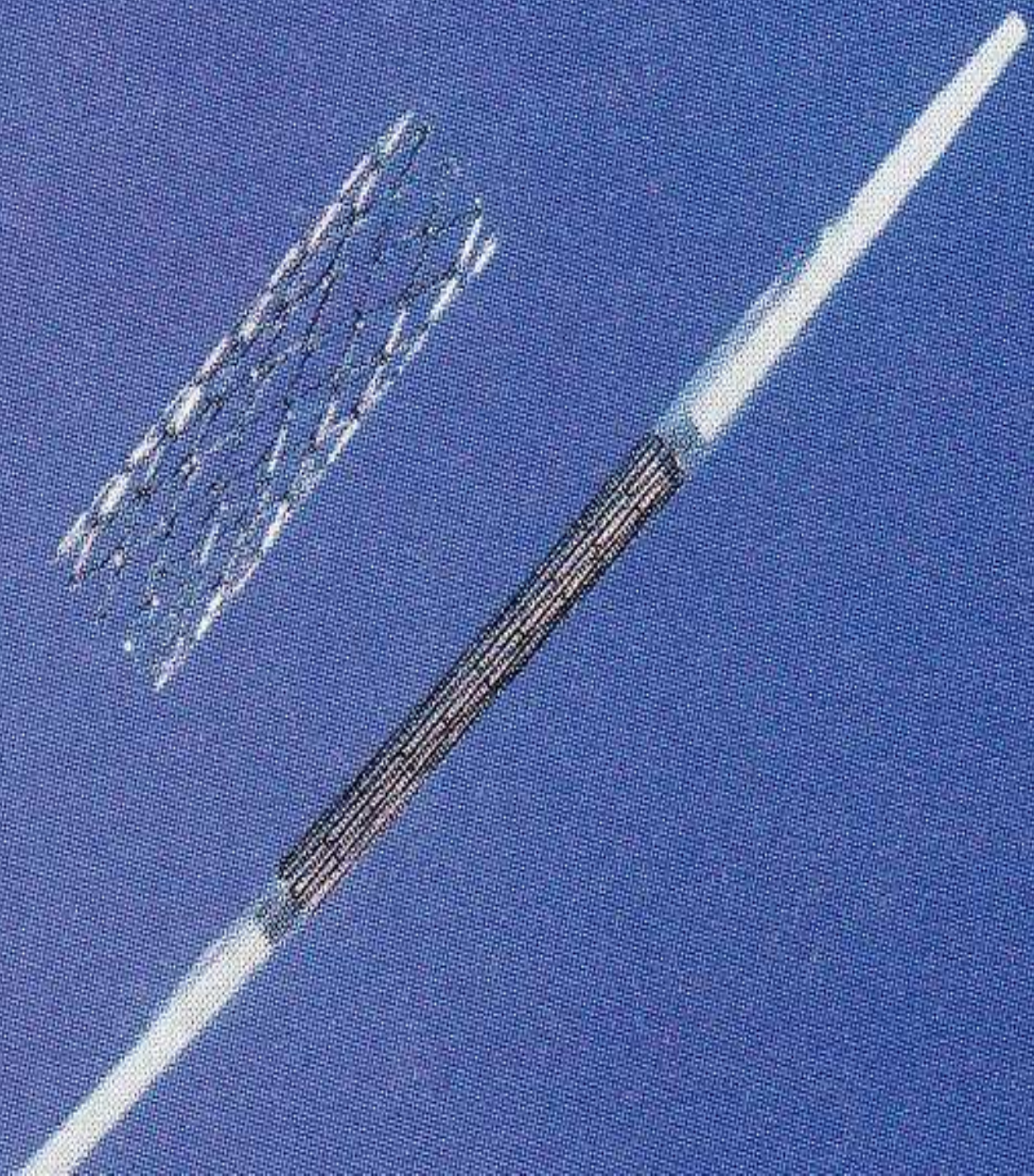


*Drugs/Surgery*



*Exercise*

*Dietary  
Modification*



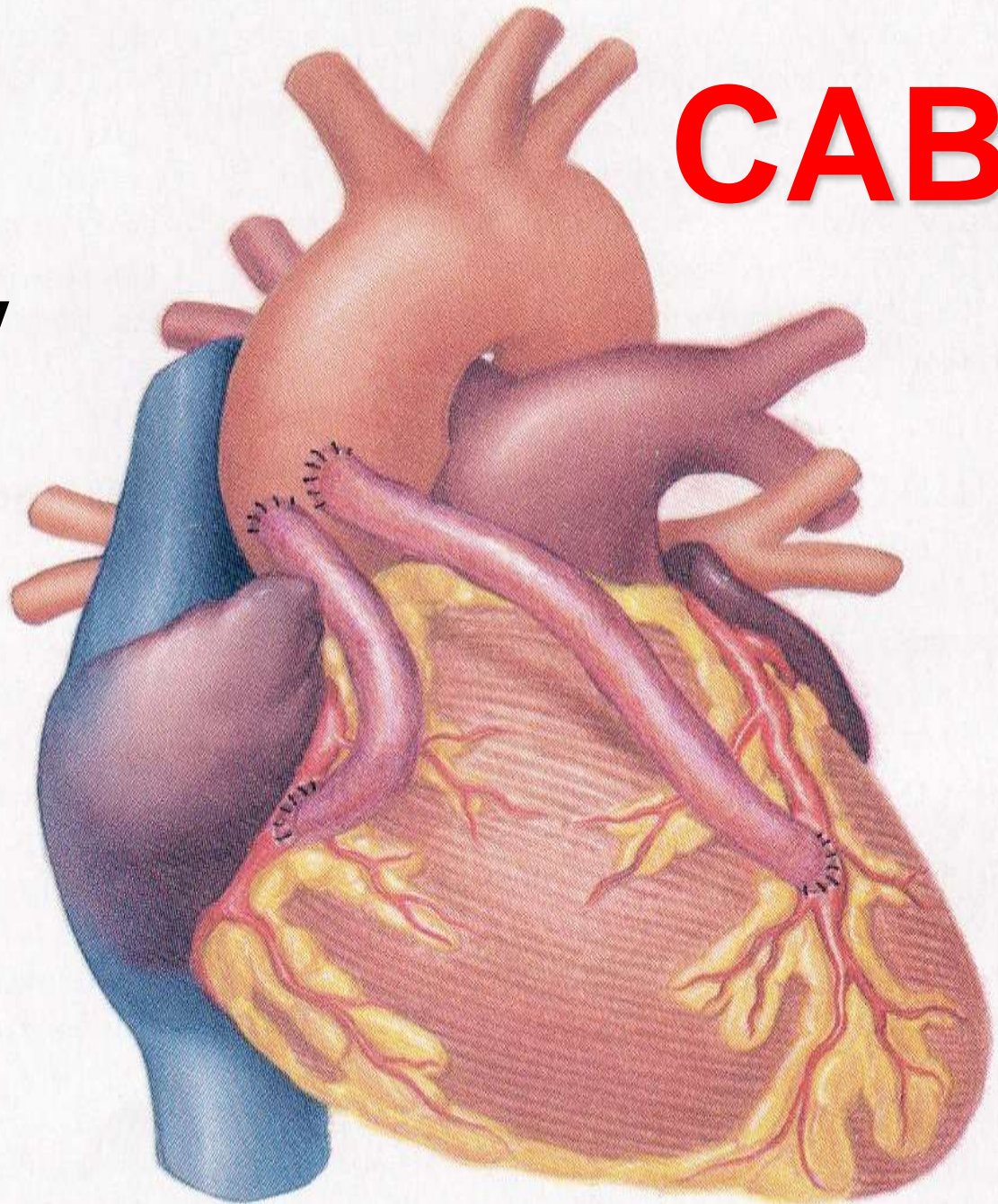
# CABG

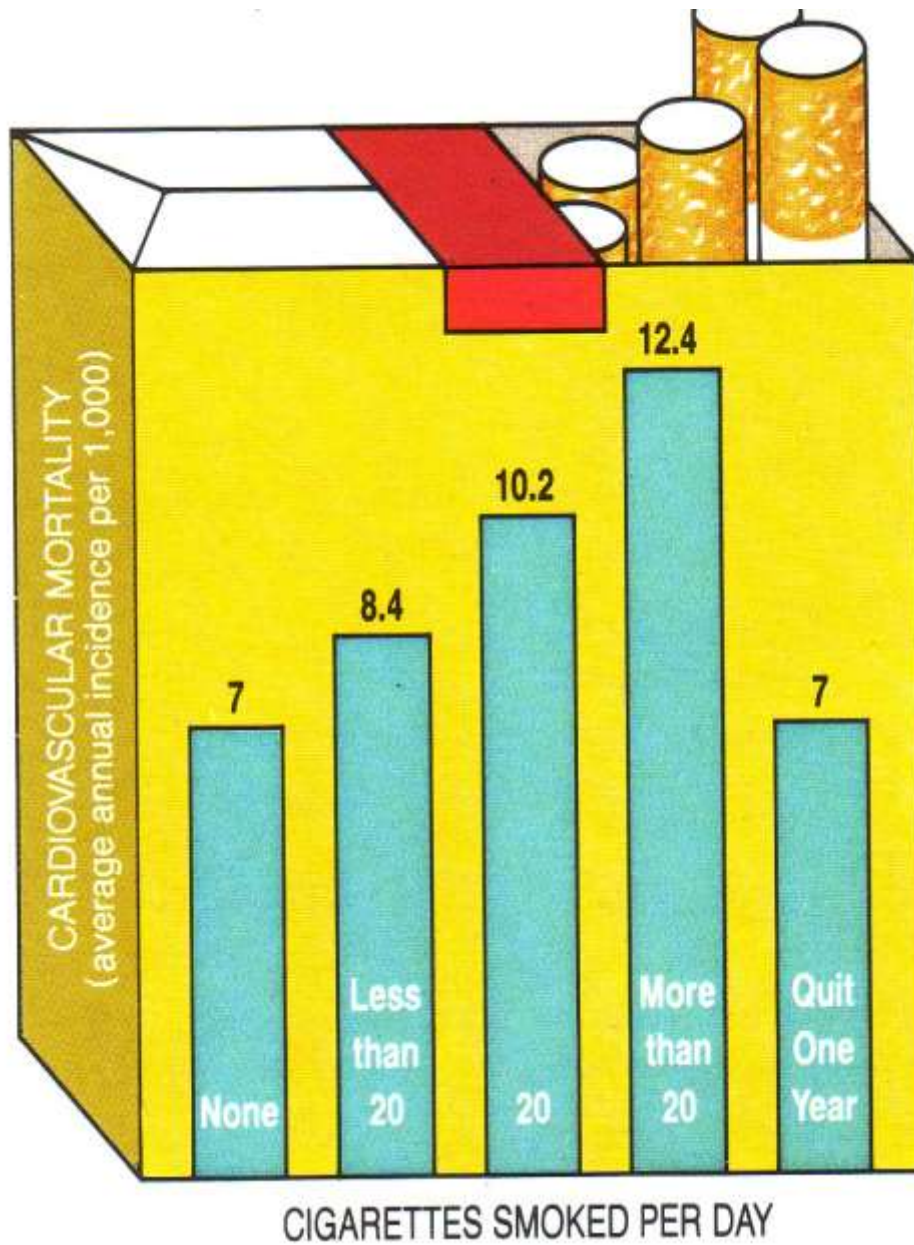
**C**oronary

**A**rtery

**B**y-pass

**G**raft





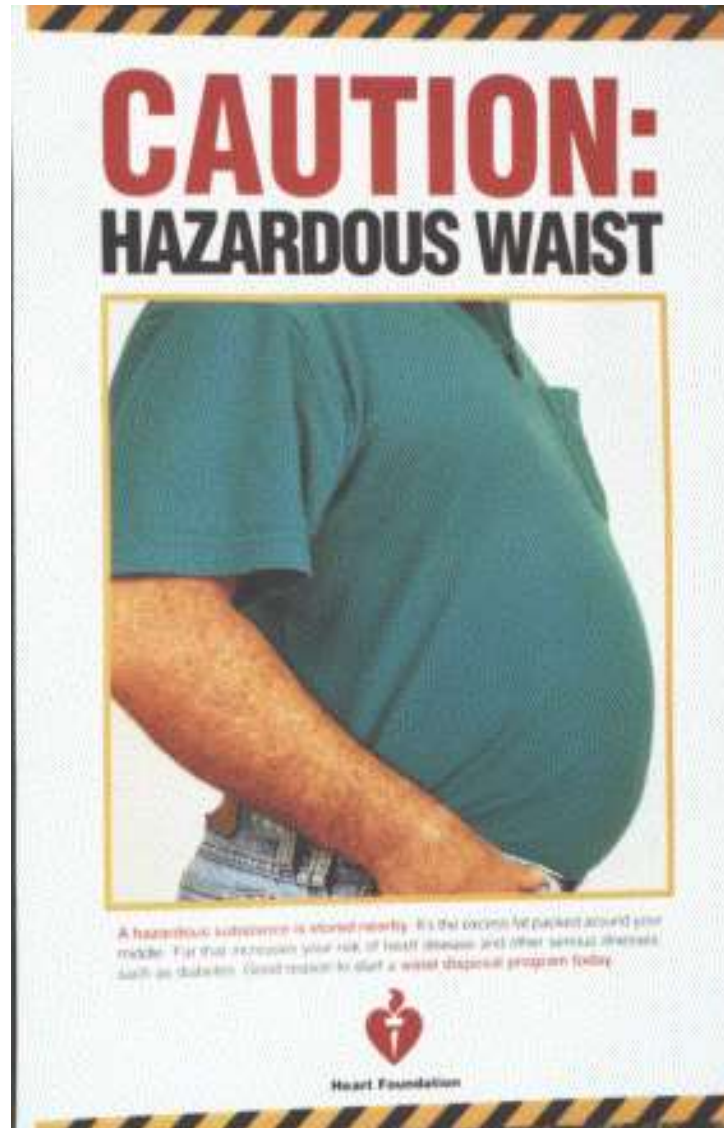


# Apple type of obesity predisposed to CVD!

Pear type of fat pattern...



implies lower disease risk!

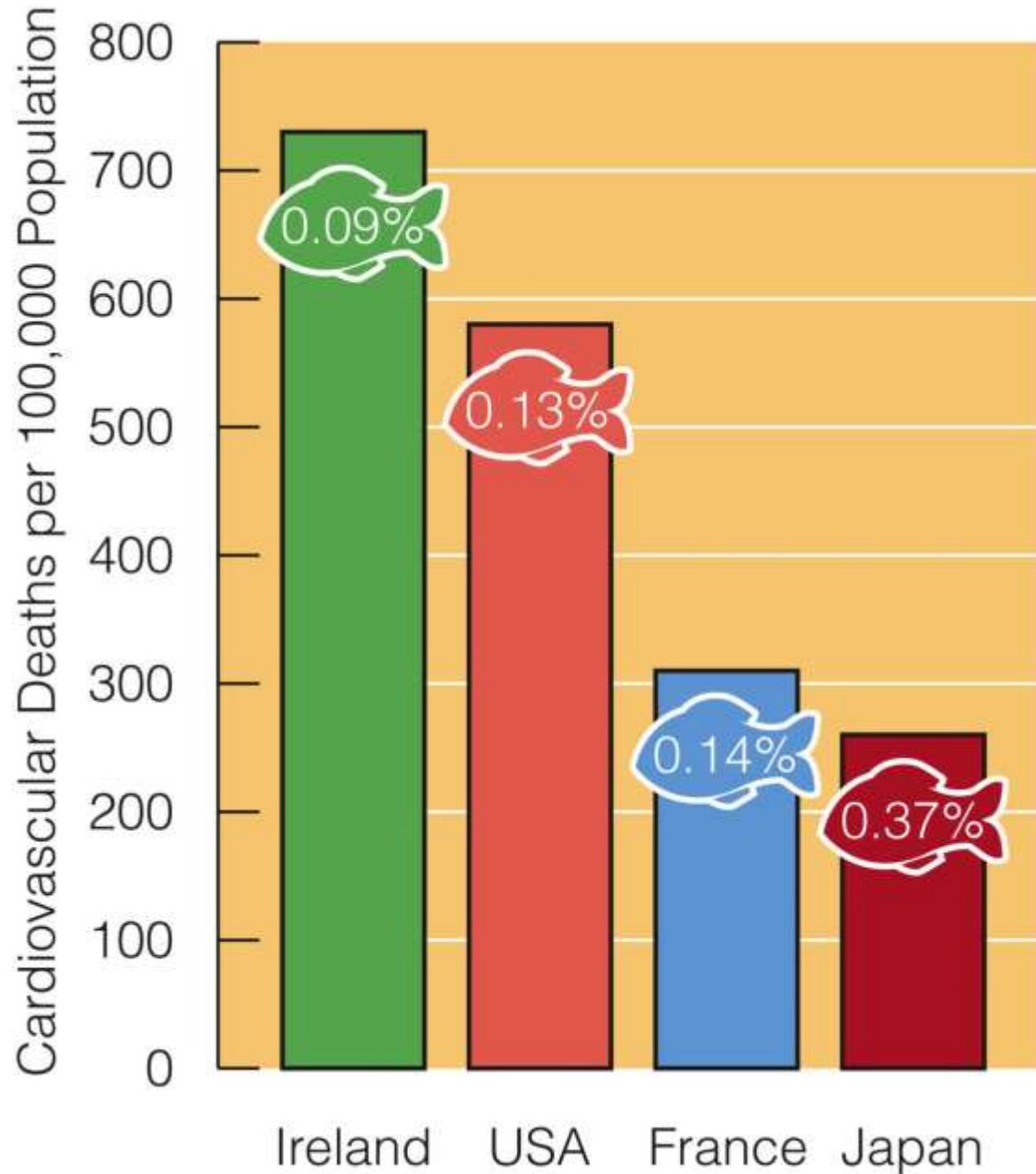


Eat more apples...



to help prevent the apple type of obesity!

# *Fish Oil Intakes & Cardiovascular Death Rates*





# Healthy Oils to Minimize Atherosclerosis HAPOC?

# H

# A

# P

# O

# C

