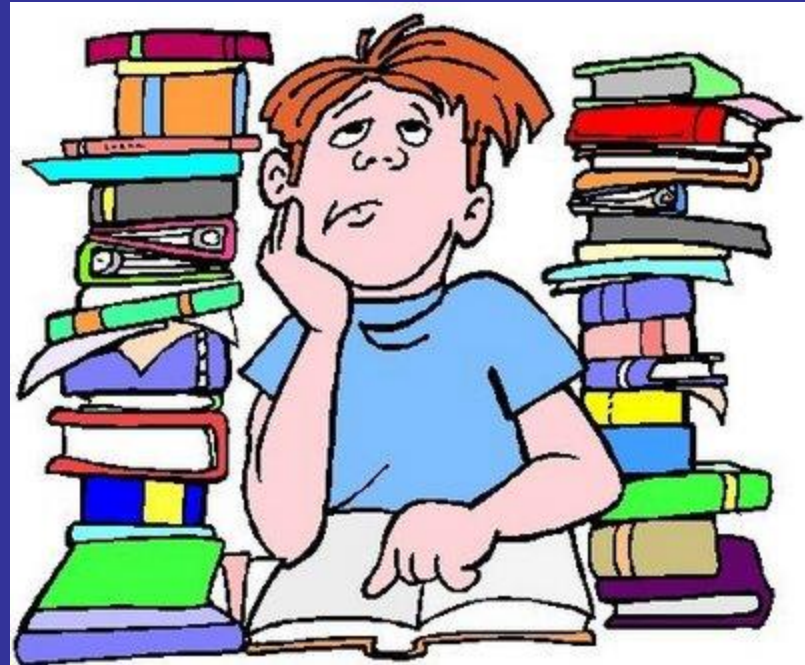
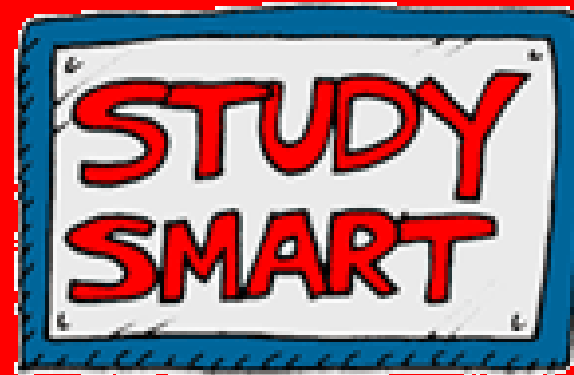


Exam I Review Slides





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, course overview, grading, expectations & success. 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

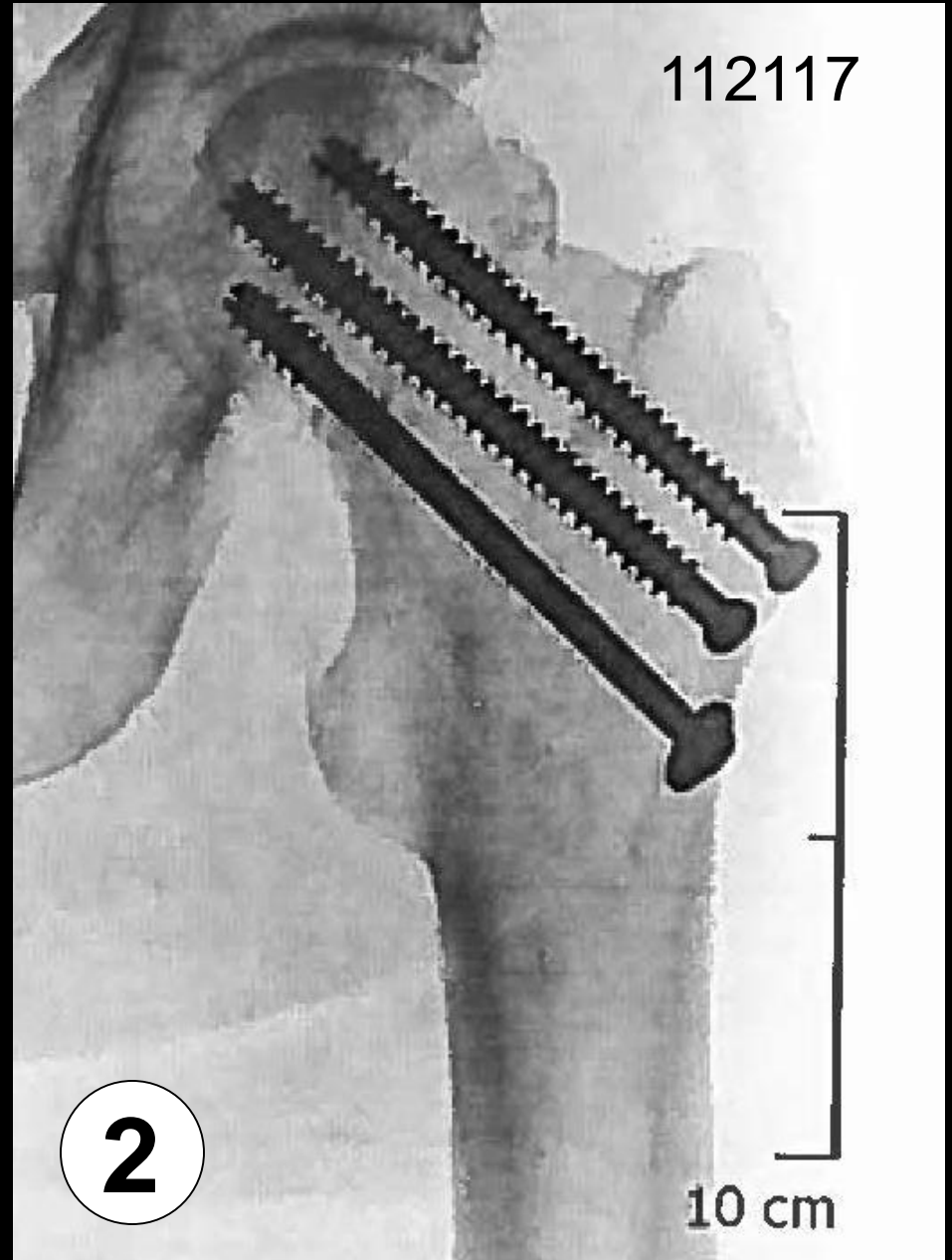
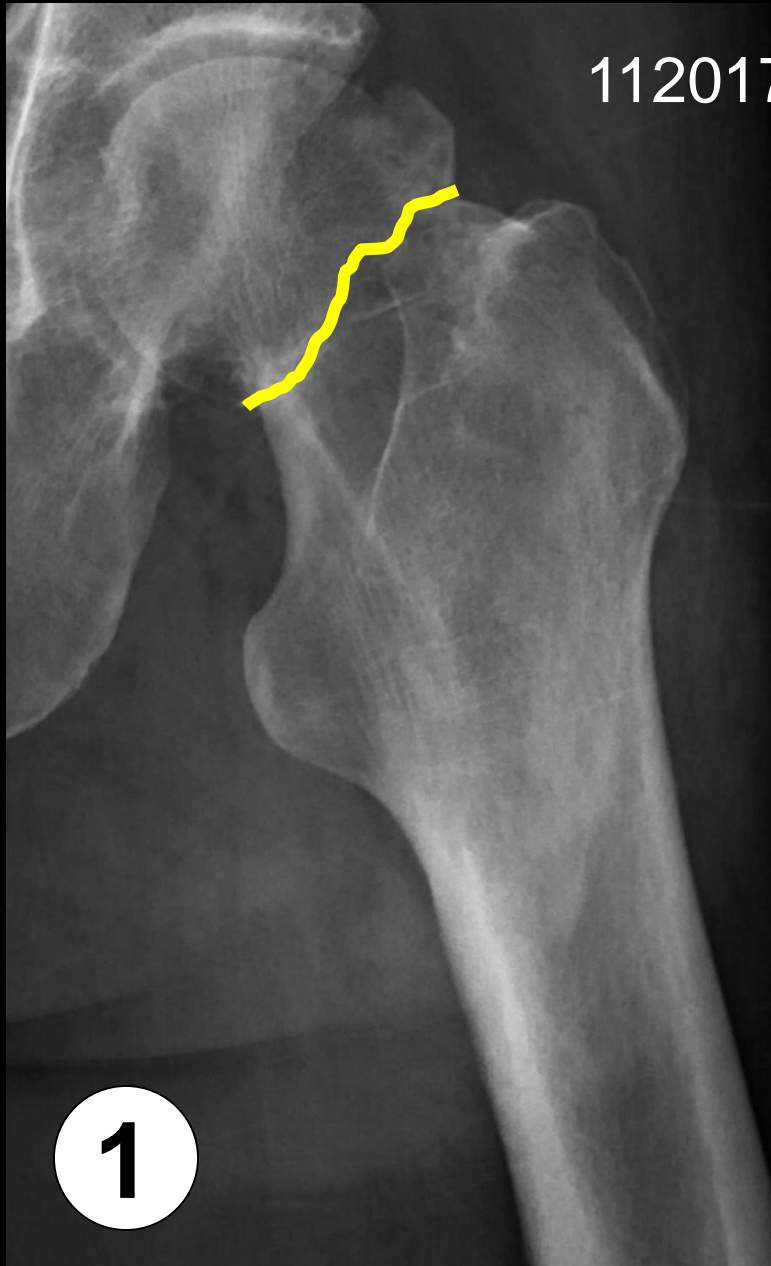
WHY?



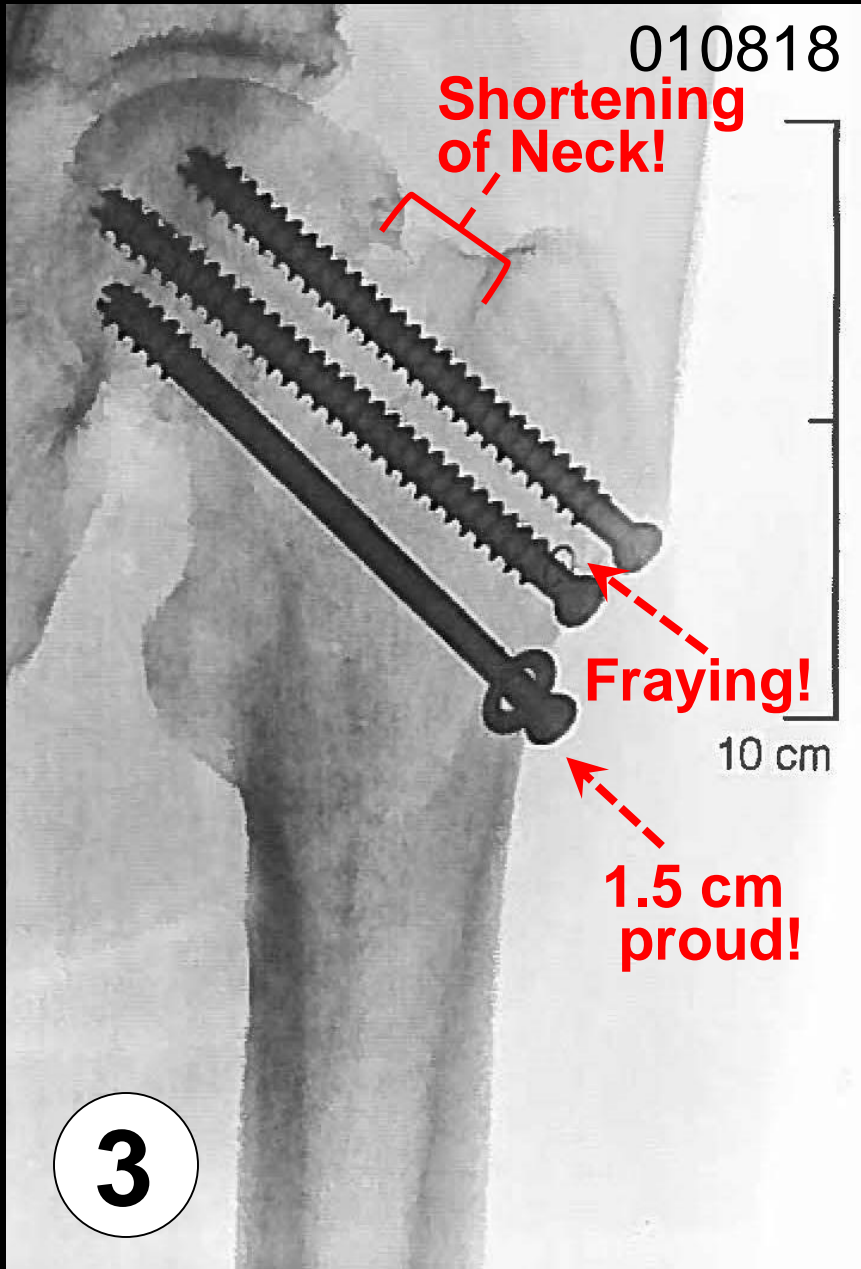
VS



Structure-Function: L Hip Fracture & Fixation w/Screws



L Hip Osteonecrosis & L Hip Replacement



Body Levels of Organization

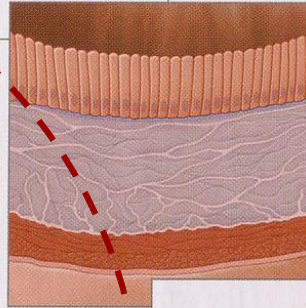
1. Molecular



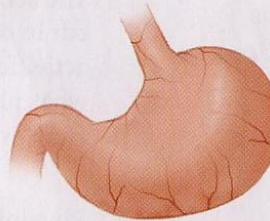
2. Cellular



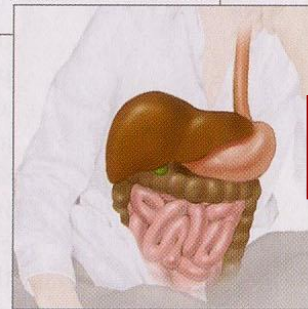
3. Tissue



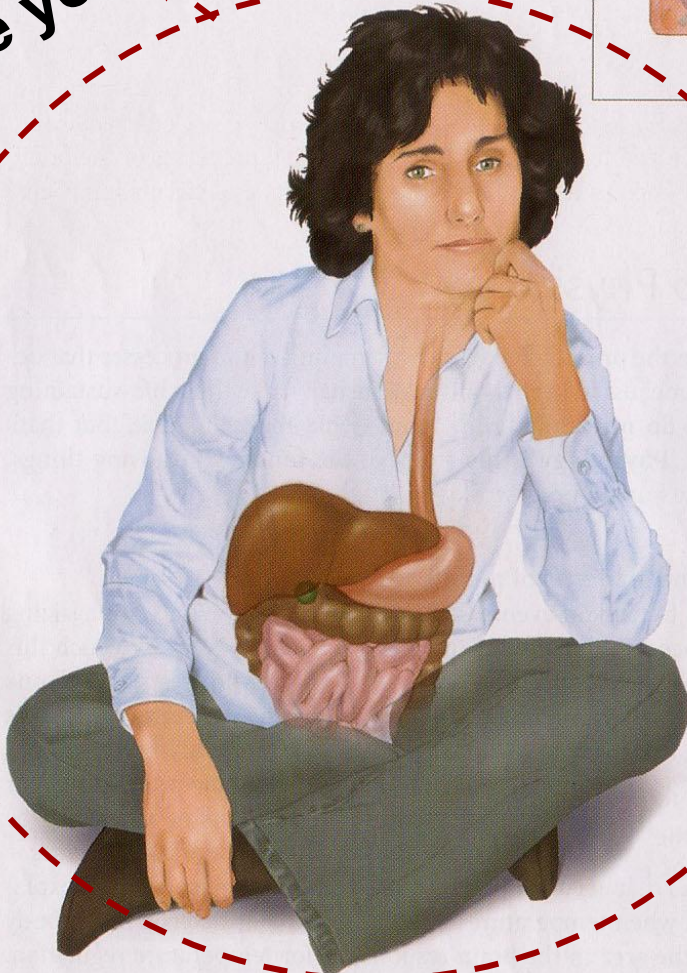
4. Organ

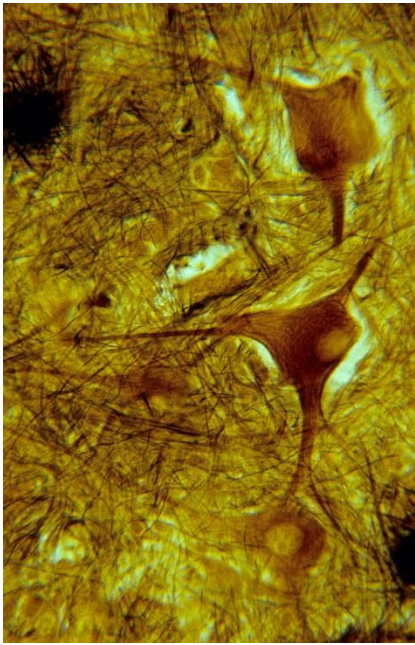


5. System

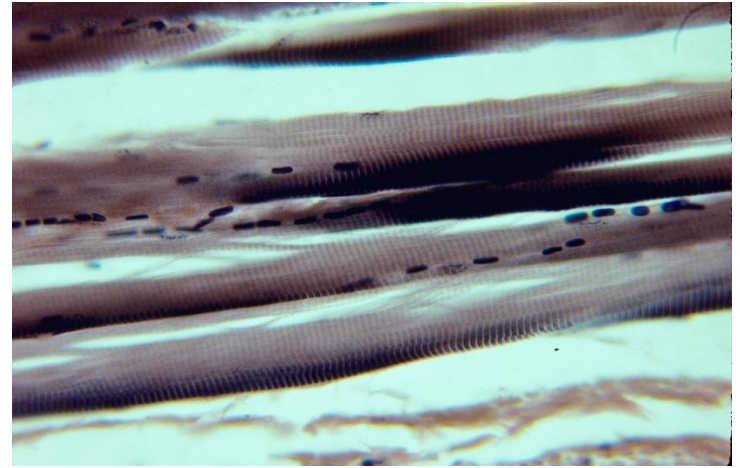


Entire Organism,
like you & me!

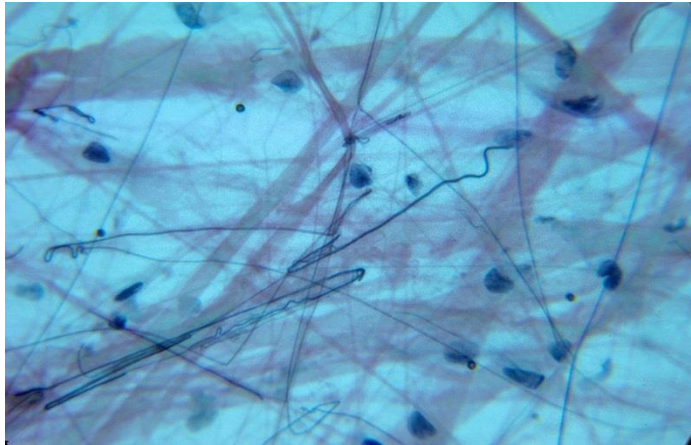




Nerve conducts



Muscle contracts

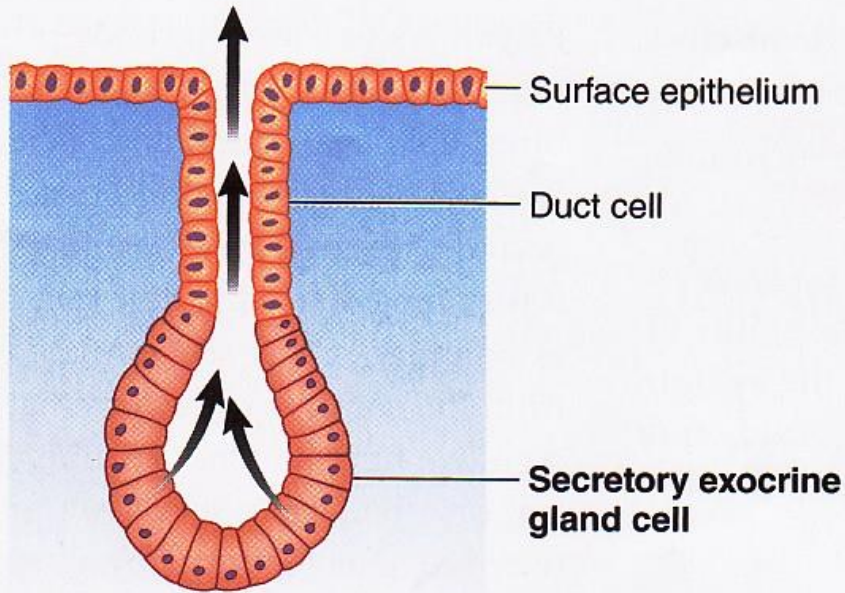


Connective connects!!

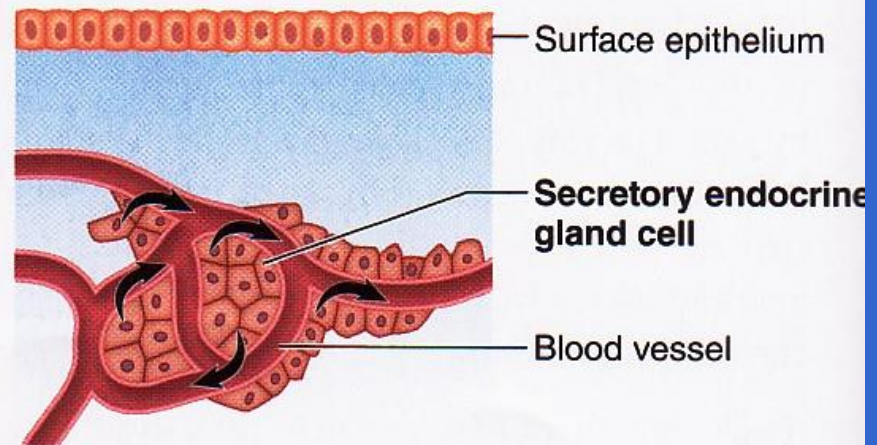


Epithelial covers

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

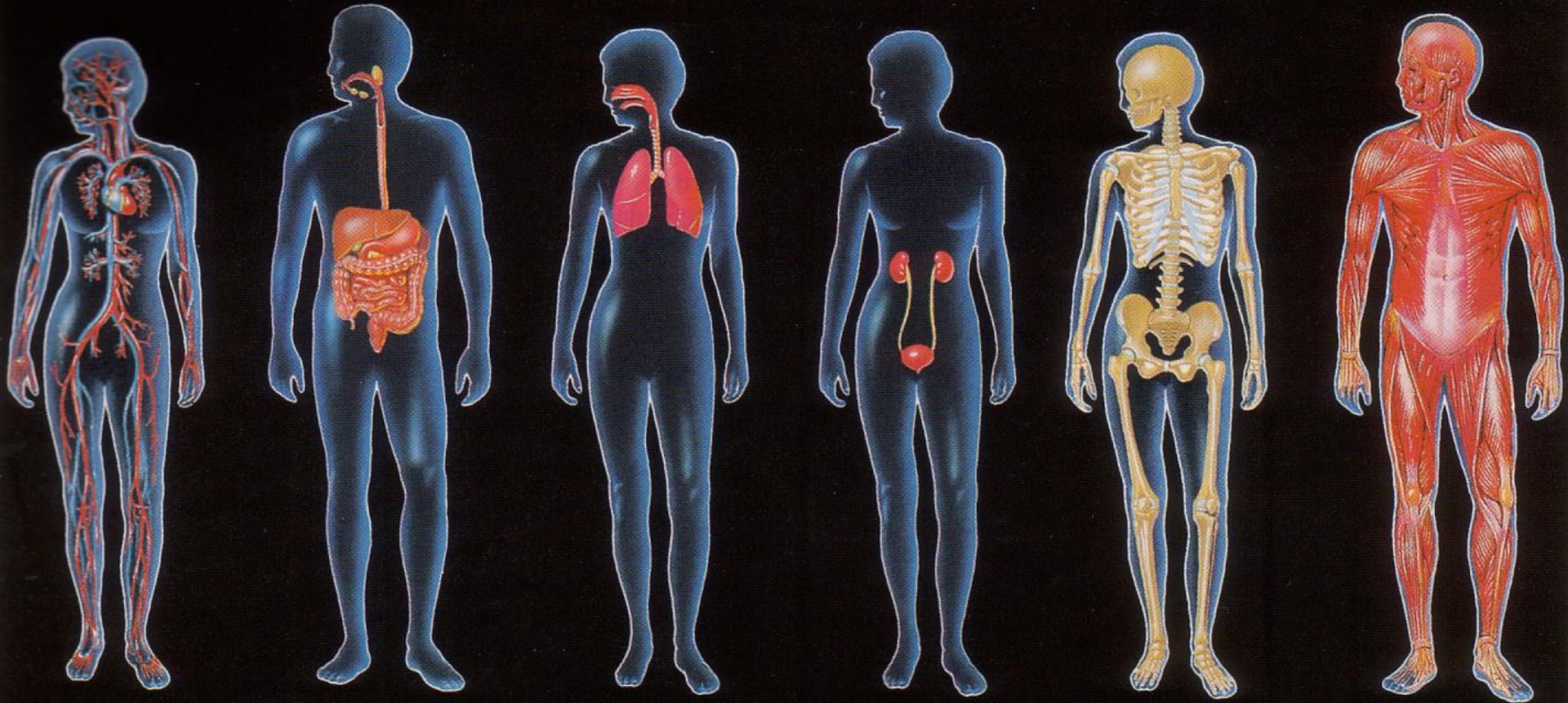


(a) Exocrine gland

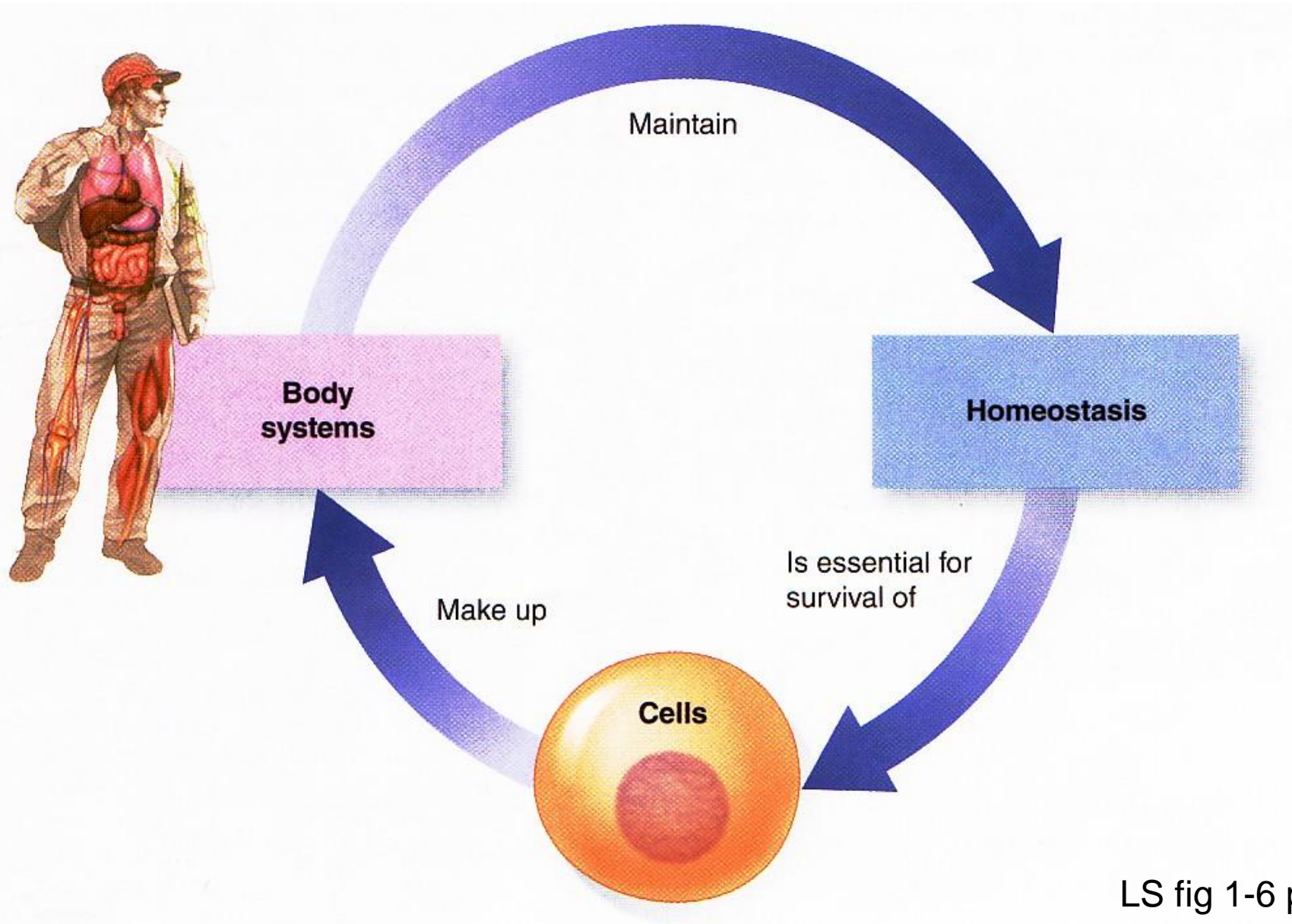


(b) Endocrine gland

Which body systems?



Homeostasis is essential for cell survival!

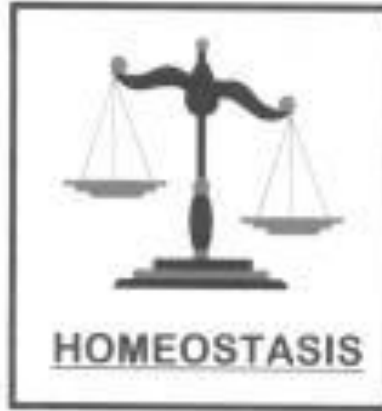


Maintenance of a relative constancy in the Internal environment = ECF = fluid outside of cells

**milieu
interieur?**



Claude Bernard



**100 trillion
cells working
intimately**



Walter B. Cannon



*** 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-2018/>

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 H₂O? 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

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

**milieu
interieur?**



Claude Bernard

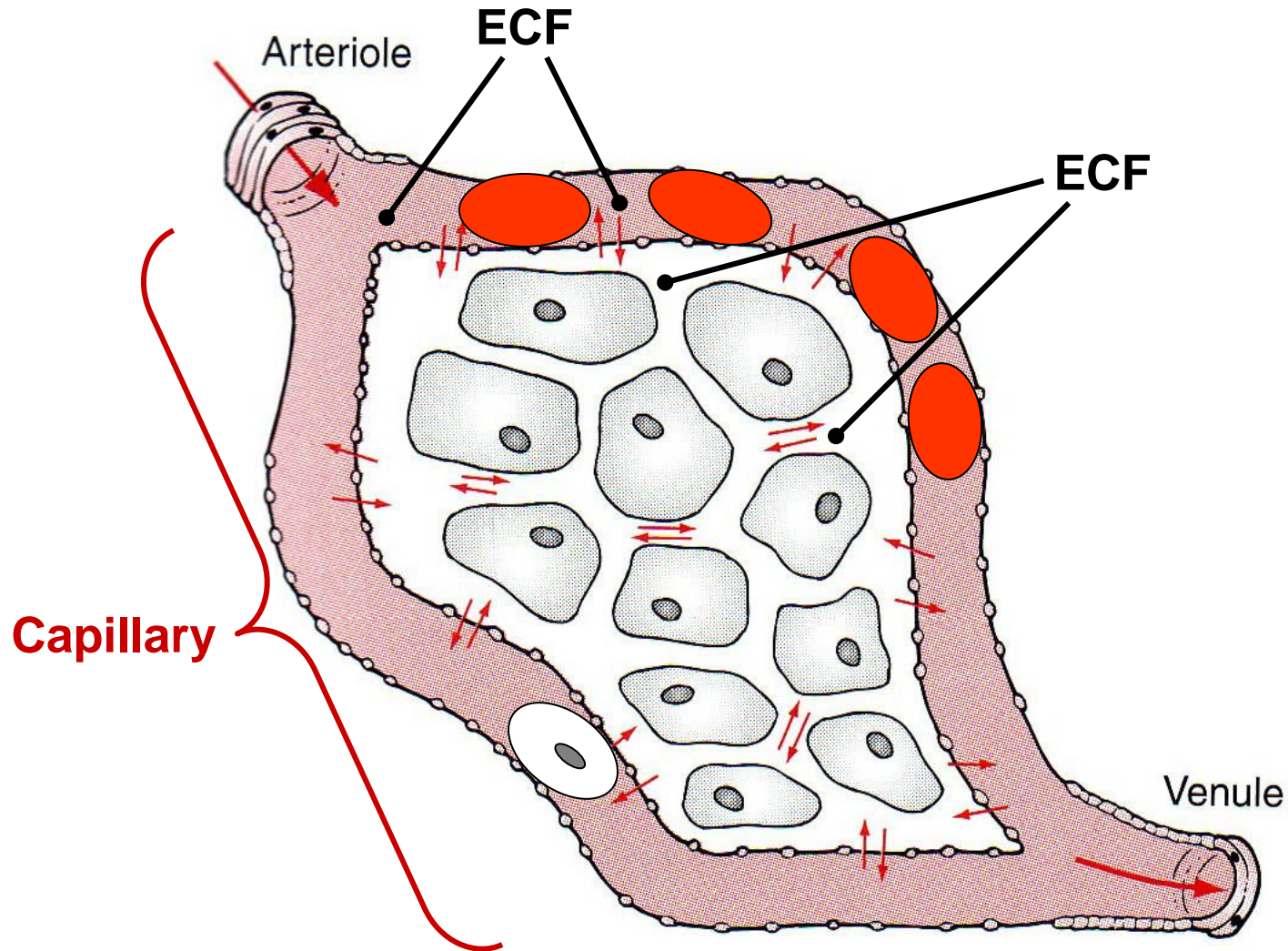


**100 trillion
cells working
intimately**



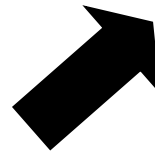
Walter B. Cannon

Where is extracellular fluid?

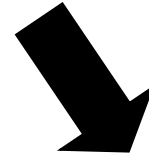


As long as between/outside cells, **ECF everywhere?**

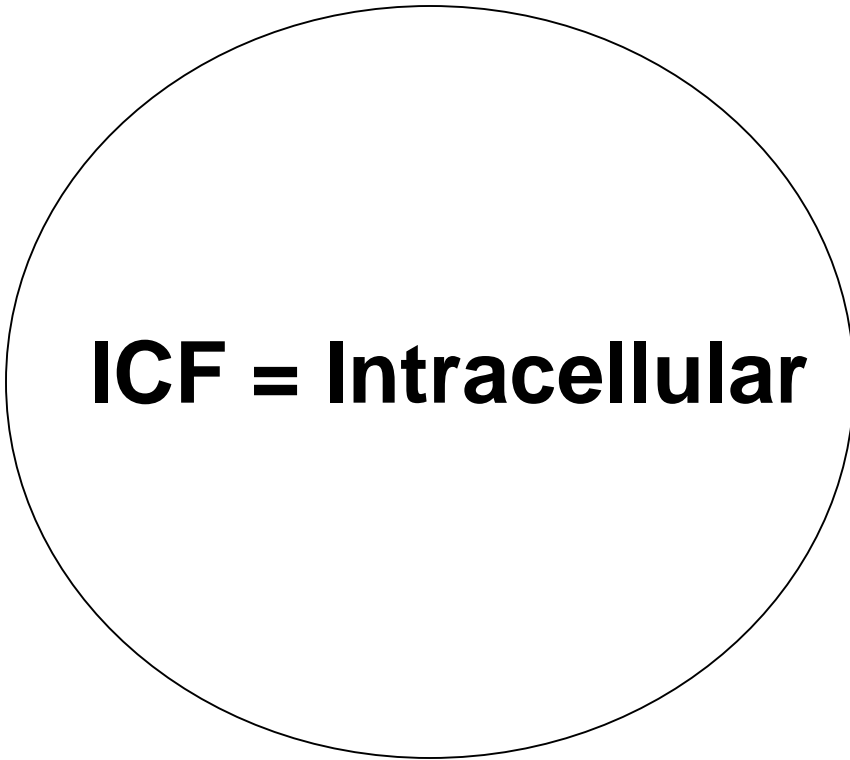
ECF = Extracellular



Plasma 
(within CV System)



Interstitium
(eg, between
muscle cells)

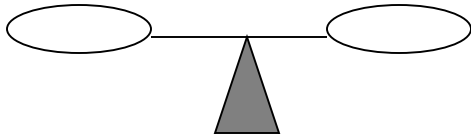


ICF = Intracellular

Metabolic

ANA-

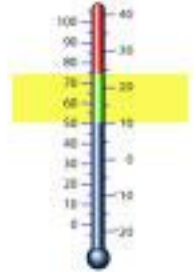
CATA-



H₂O



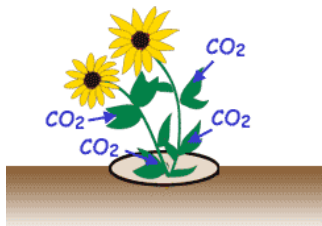
T^oC



Dr. Evonuk's 6 Balances

O₂/CO₂

Carbon Dioxide



Ion^{+/-}

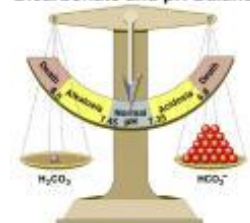


Captain Calcium



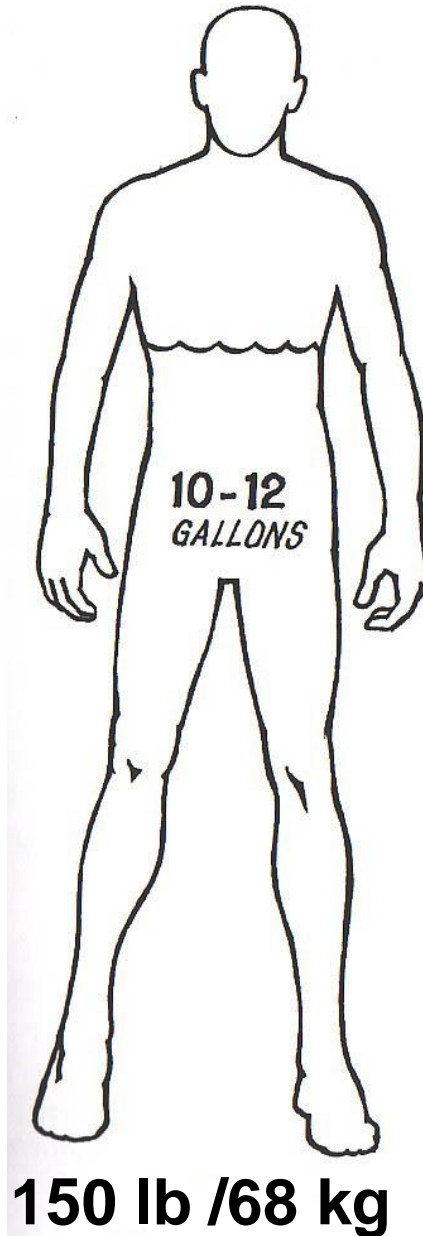
pH

Bicarbonate and pH Balance



Drink about 1 L per 1000 calories energy expenditure!!

Human ~ 2/3 H₂O
~ 60 – 70 %



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

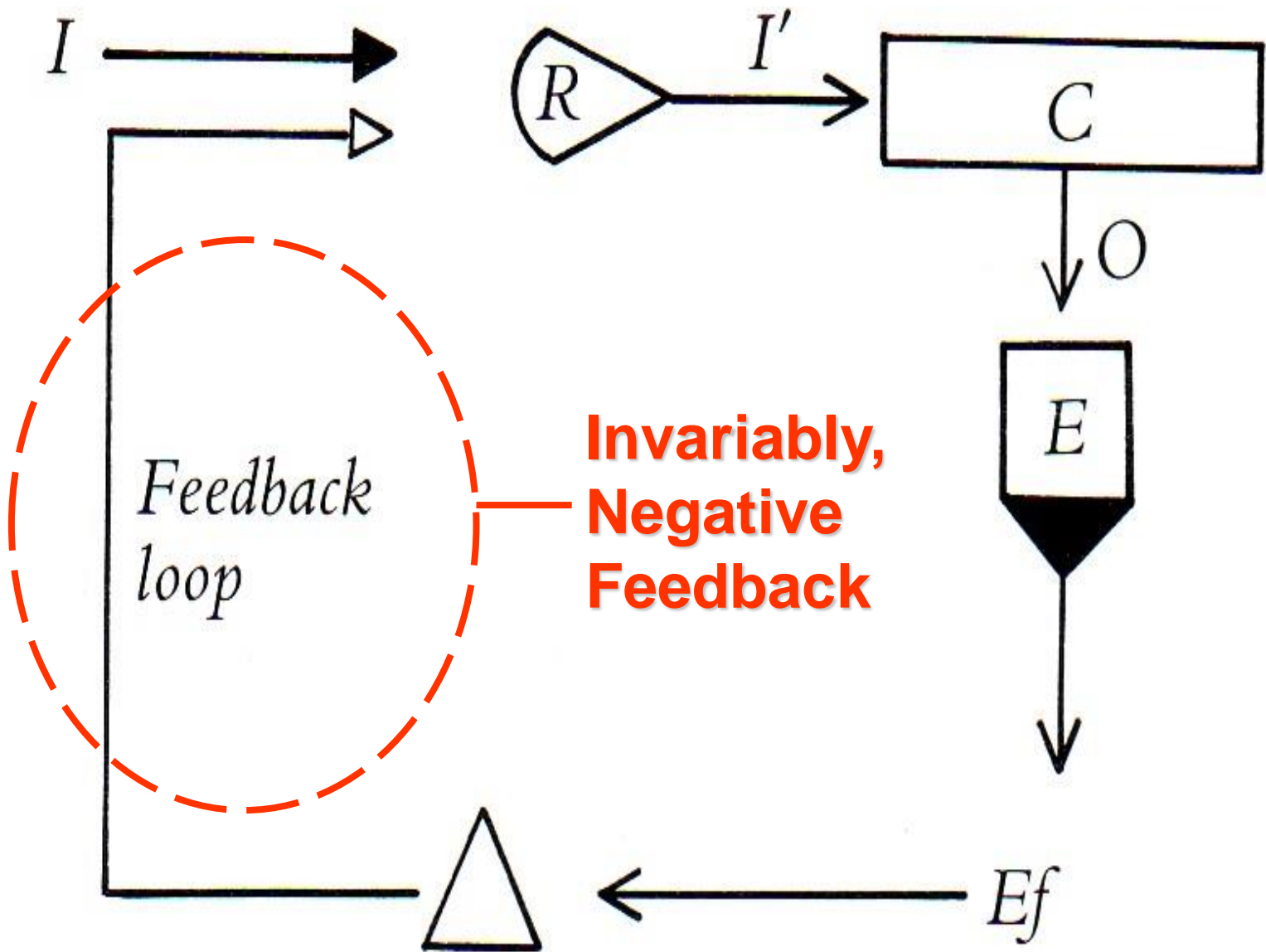
= ~40 – 48 kg H₂O

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.





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

II. Connections Homeostatic model: BP, H₂O + T °C 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 w/membranes

1. Endoplasmic Reticulum (ER) 2. Golgi 3. Lysosomes

4. Peroxisomes & 5. Mitochondria. LS 2012 pp 20-34

fig 2-1, 2-2, 2-3, 2-4, 2-5, 2-6, 2-7, 2-8 pp 20-7 tab 2-1 p 36

D. What about vaults? LS 2006, p 32

E. **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

V. Introduction to Genetics LS 2012 ch 2 p 20-1 + Appendix C

A. What's a gene? Where? p A-18, fig C-2, C-3

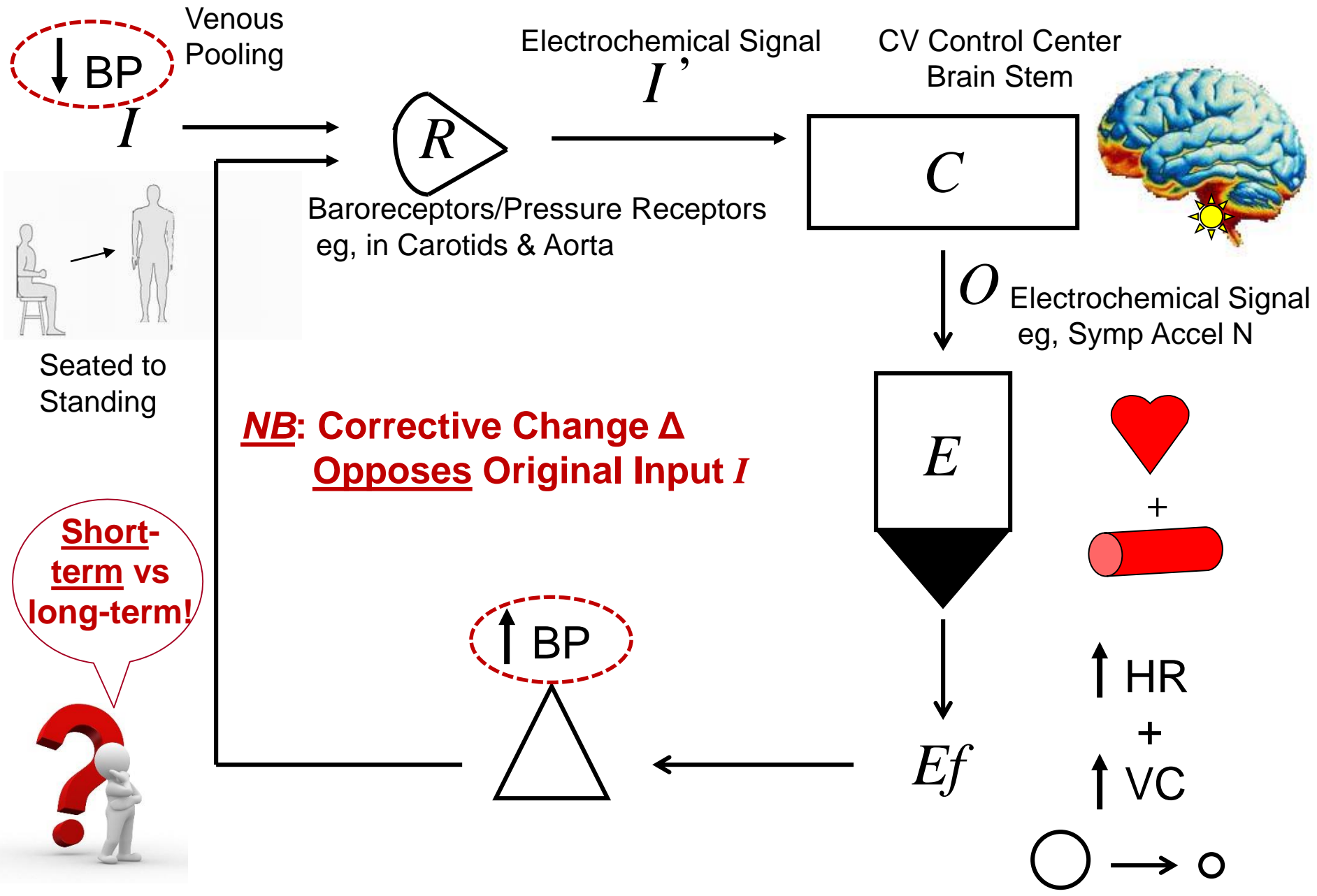
B. Why are genes important? p A-18

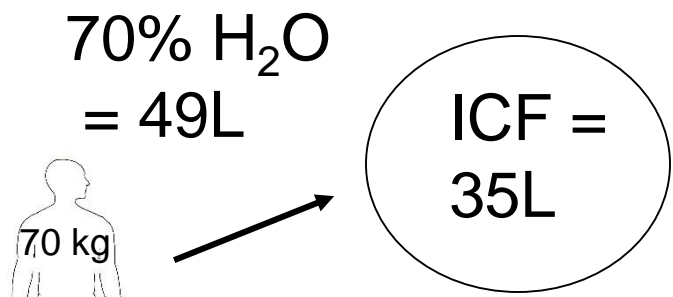
C. What's DNA & what does it look like? pp A-18 thru A-20

D. How does information flow in the cell? fig C-6

E. How does DNA differ from RNA? pp A-20 thru A-22

Blood Pressure Homeostasis





+

ECF = 14L

[Interstitium = 11L
Plasma = 3L]

INPUT

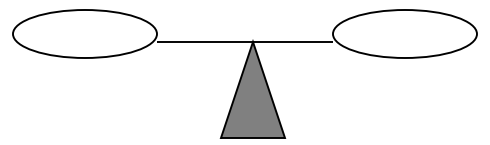
Dietary Drink	1200 mL
Dietary Eat	400 mL
Oxidation	400 mL
Total	= 2000 mL ✓



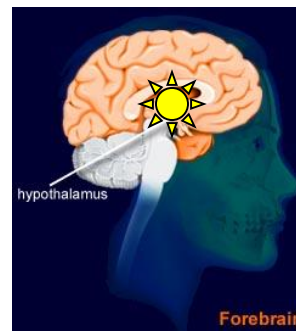
BALANCE!

OUTPUT

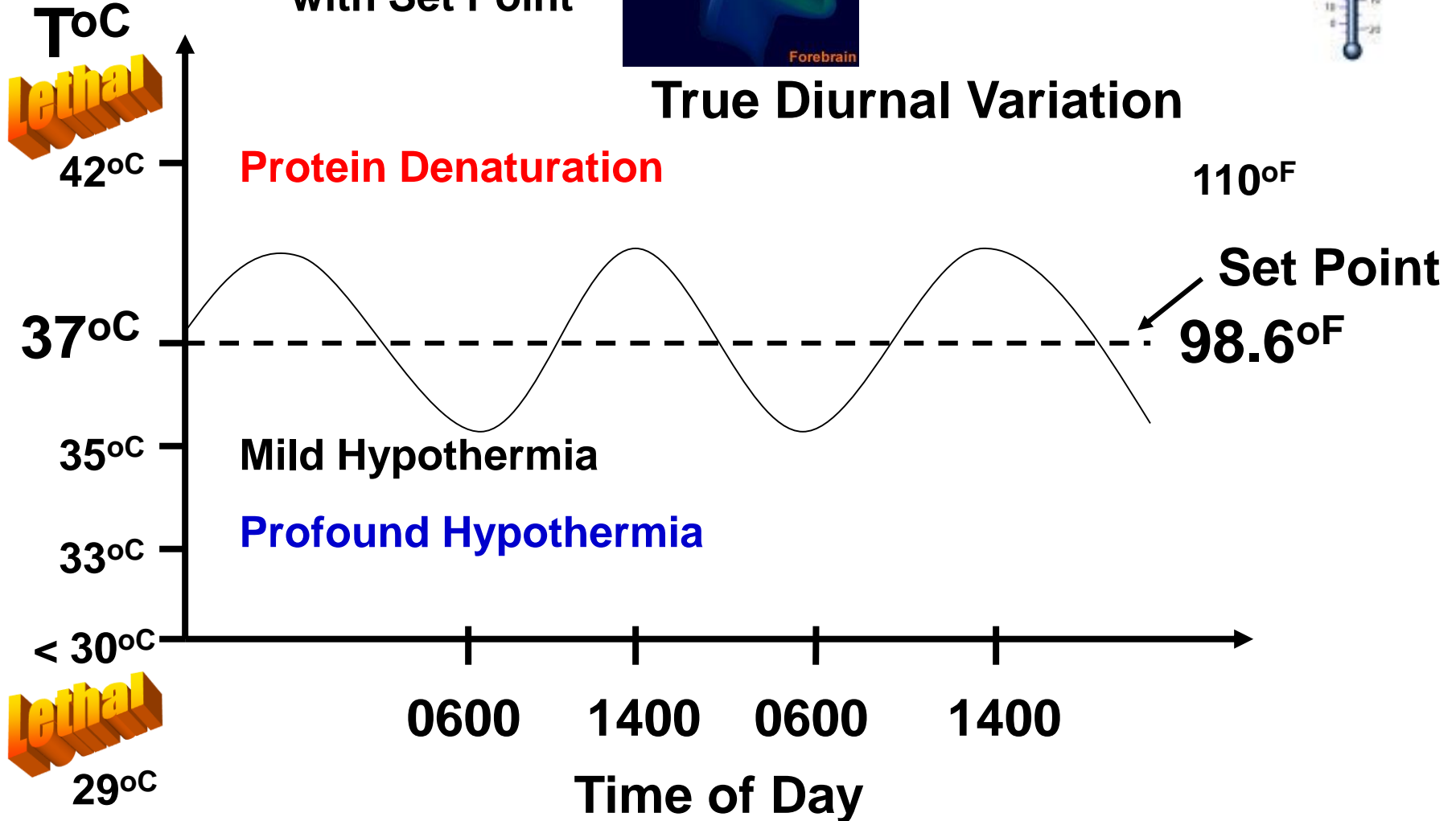
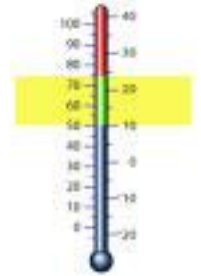
Urine	1000 mL
Sweat + Insensible	900 mL
Feces	100 mL
Total	= 2000 mL ✓



Controller =
Hypothalamus
with Set Point

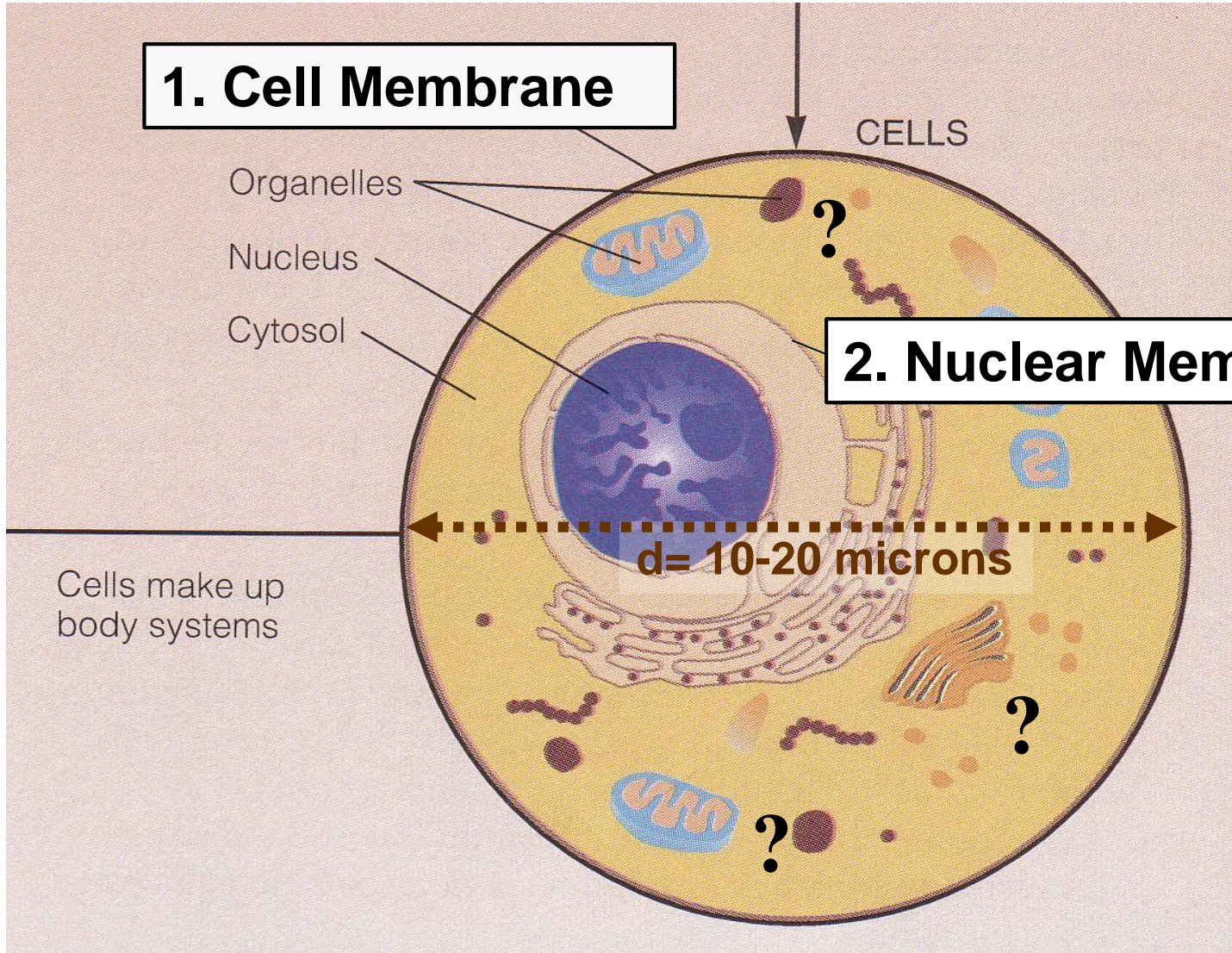


T_{bC}



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

How Big? 100 Cells Lengthwise = 1 mm!!

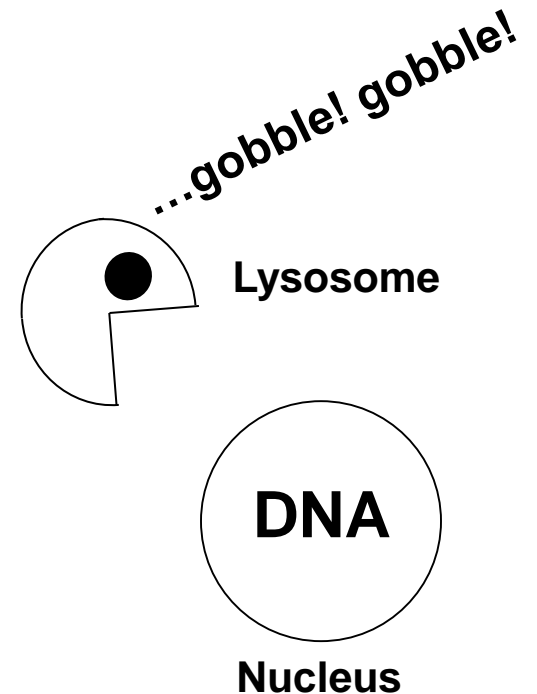


<http://opb.pbslearningmedia.org/resource/tdc02.sci.life.cell.nucleus/nucleus-cytoplasm-membrane/>

Why Compartments? Advantage?

**Incompatible reactions can
take place**

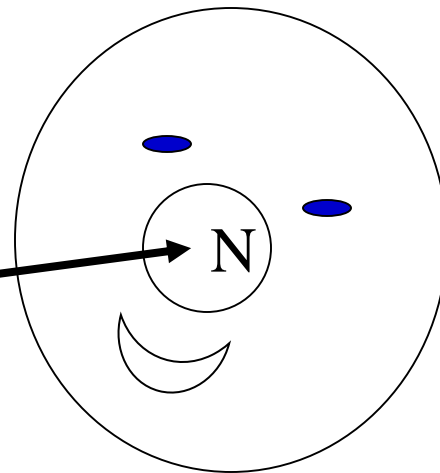
Simultaneously!!



Basic Cell Survival Skills?

- 1. Get food**
- 2. Use food**
- 3. Rid wastes**
- 4. Move**
- 5. Reproduce**

Nucleus or nose?



How to live?

1 Sample Cartoon of 100 Trillion (100×10^{12}) Cells!

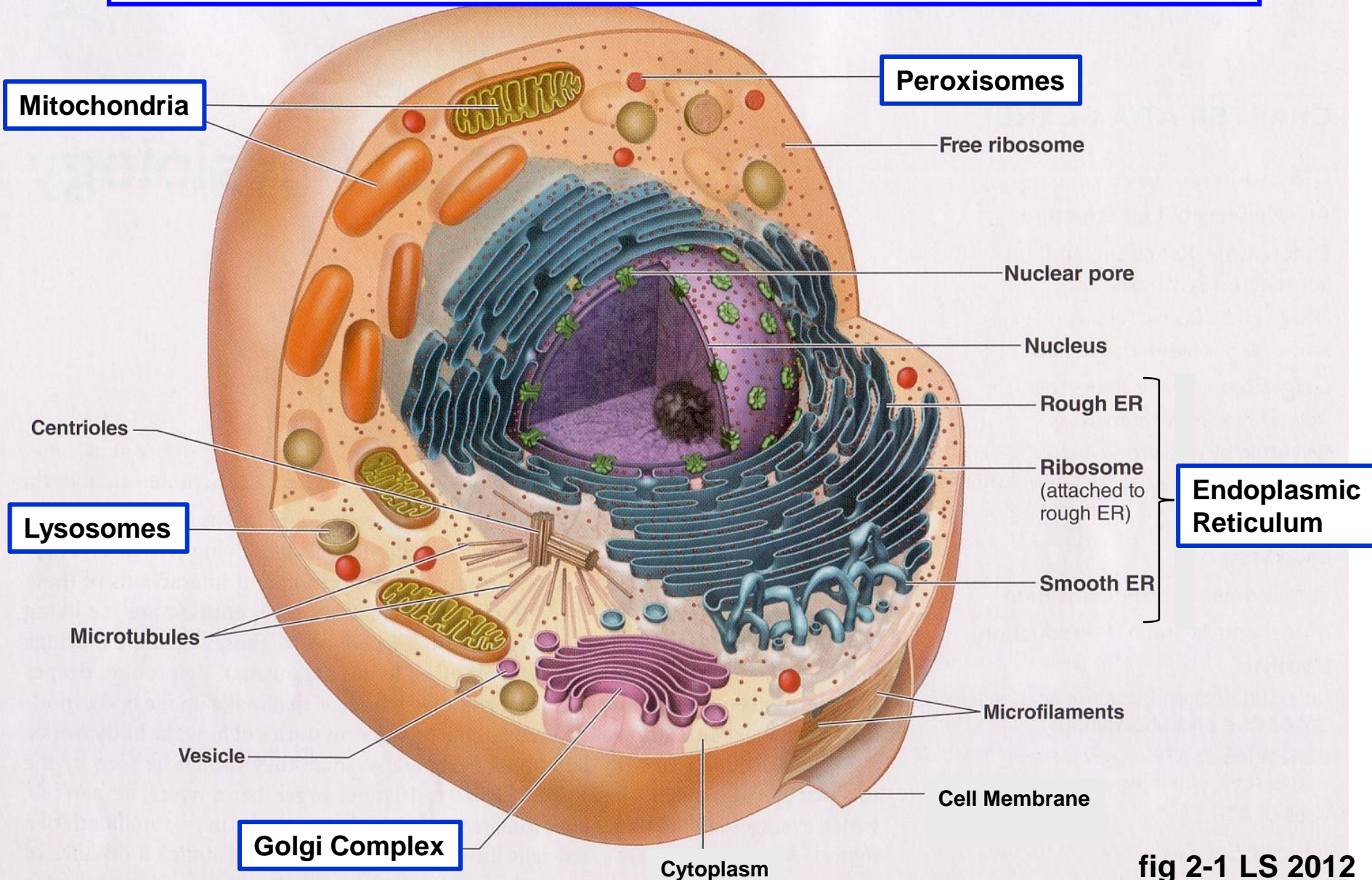


fig 2-1 LS 2012

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

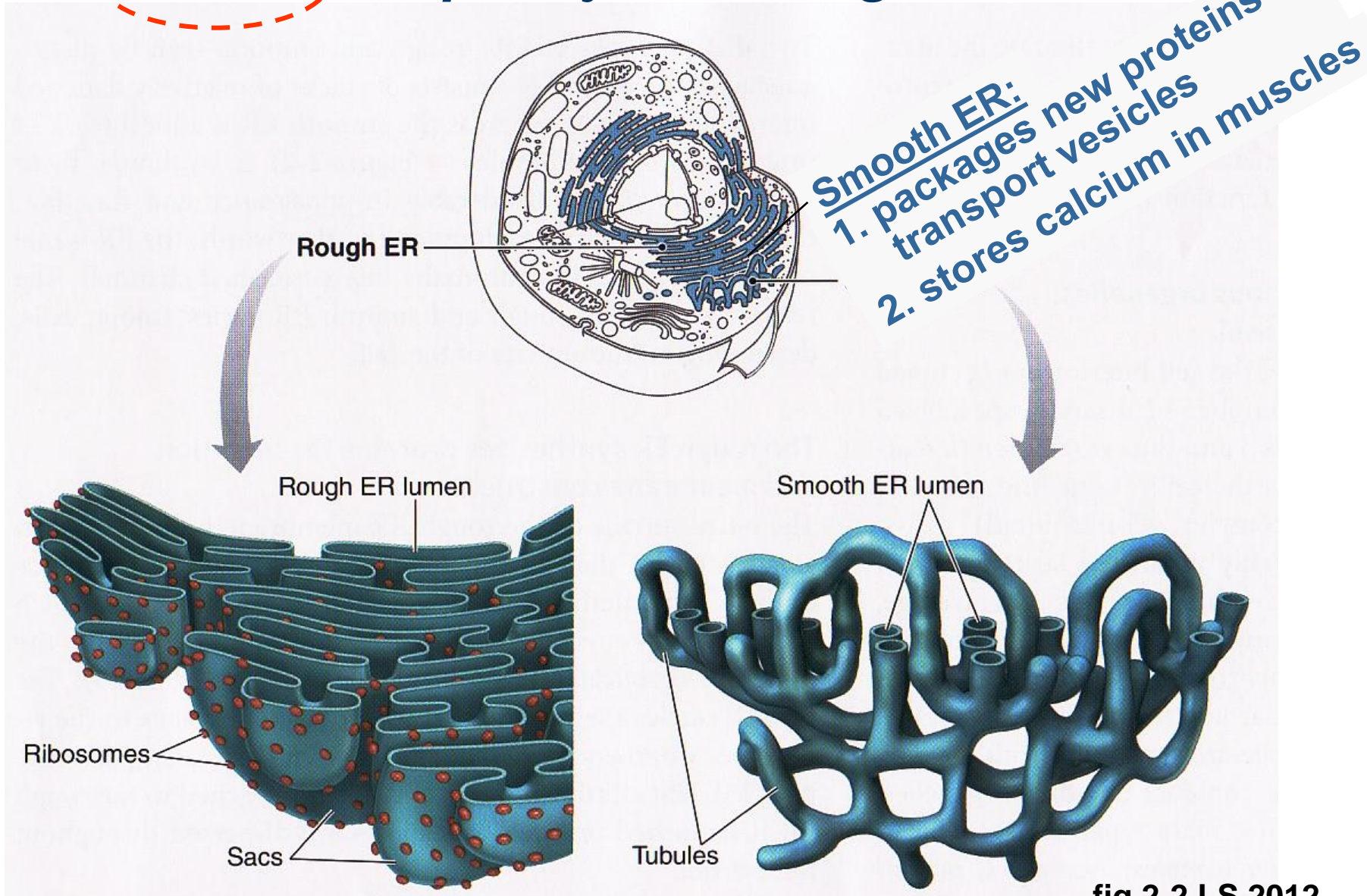
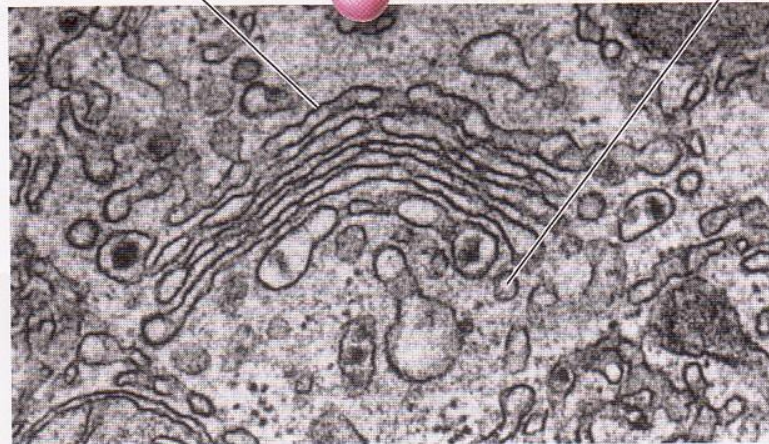
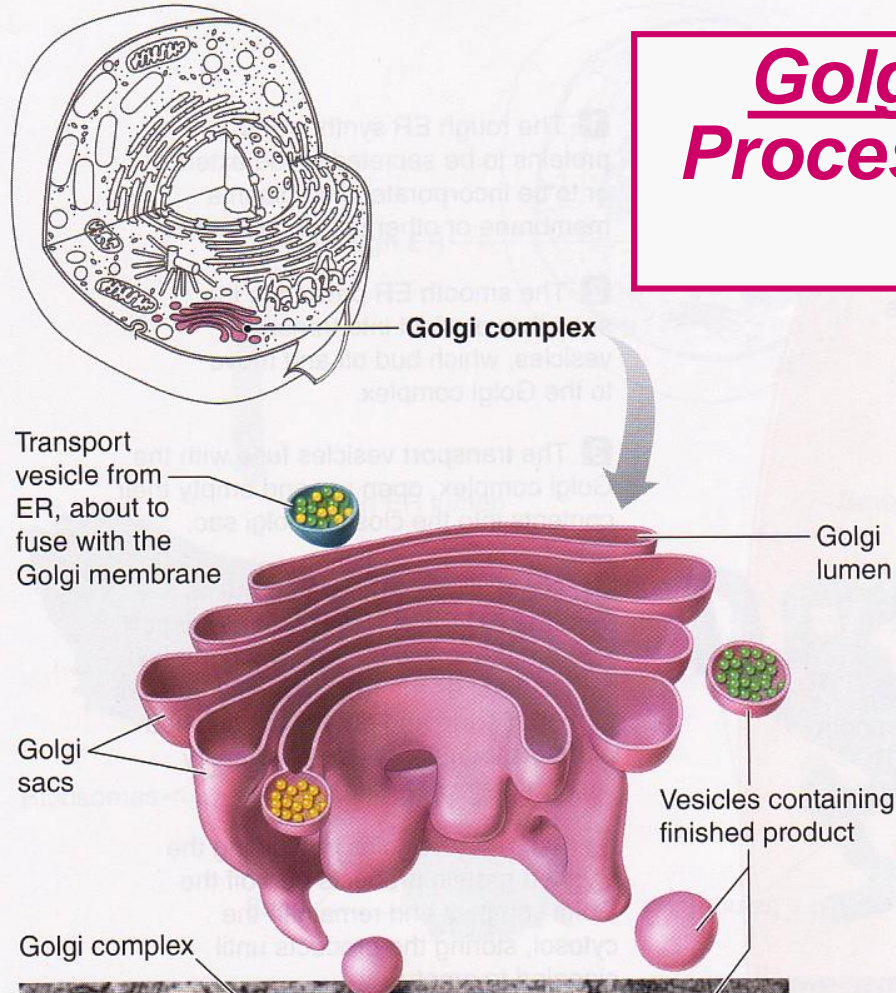


fig 2-2 LS 2012

Golgi Complex: Final Processing, Packaging & Distribution



Dr. Don Fawcett & R. Bollender/Visuals Unlimited

fig 2-4 LS 2012

Secretion of Proteins Produced by ER

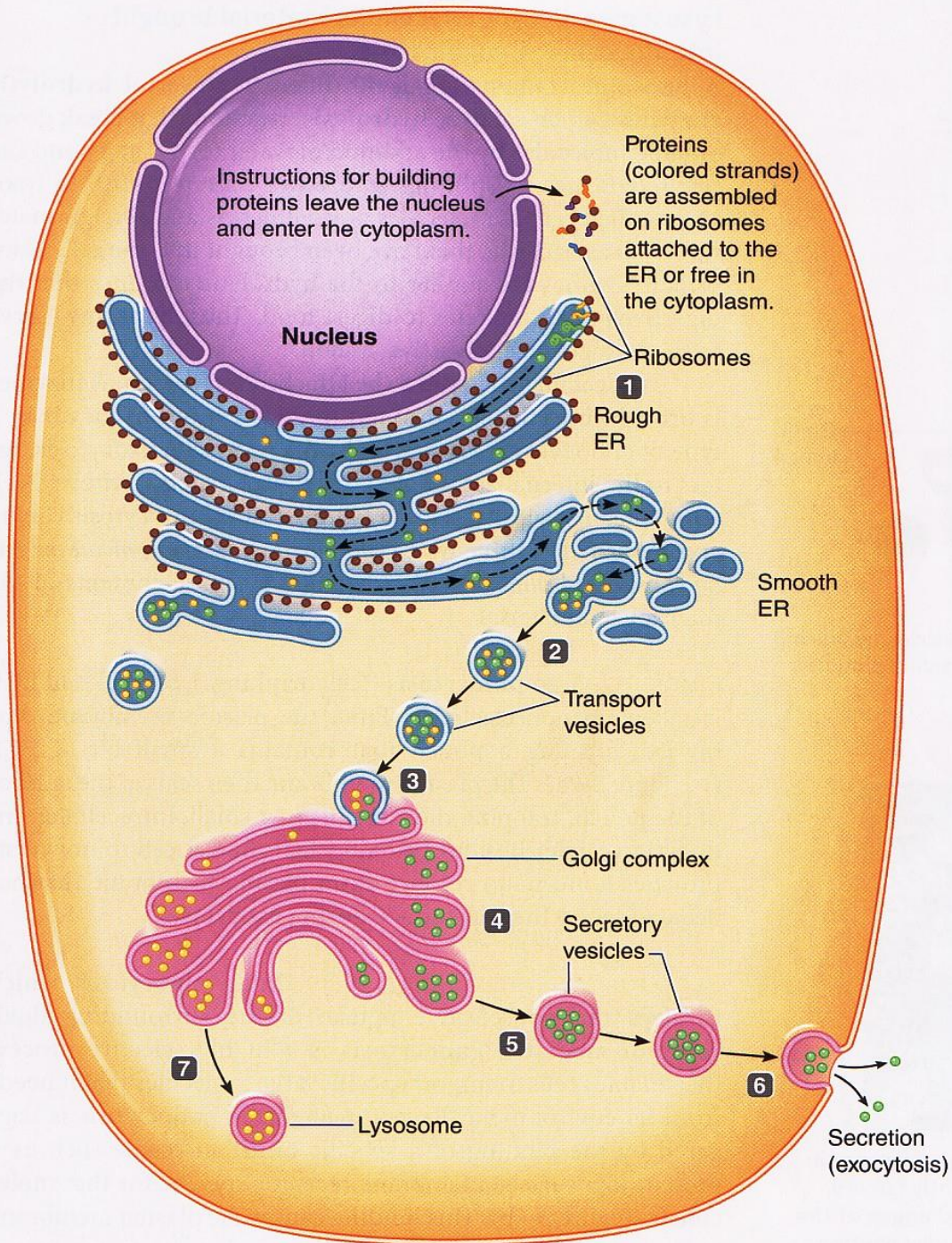
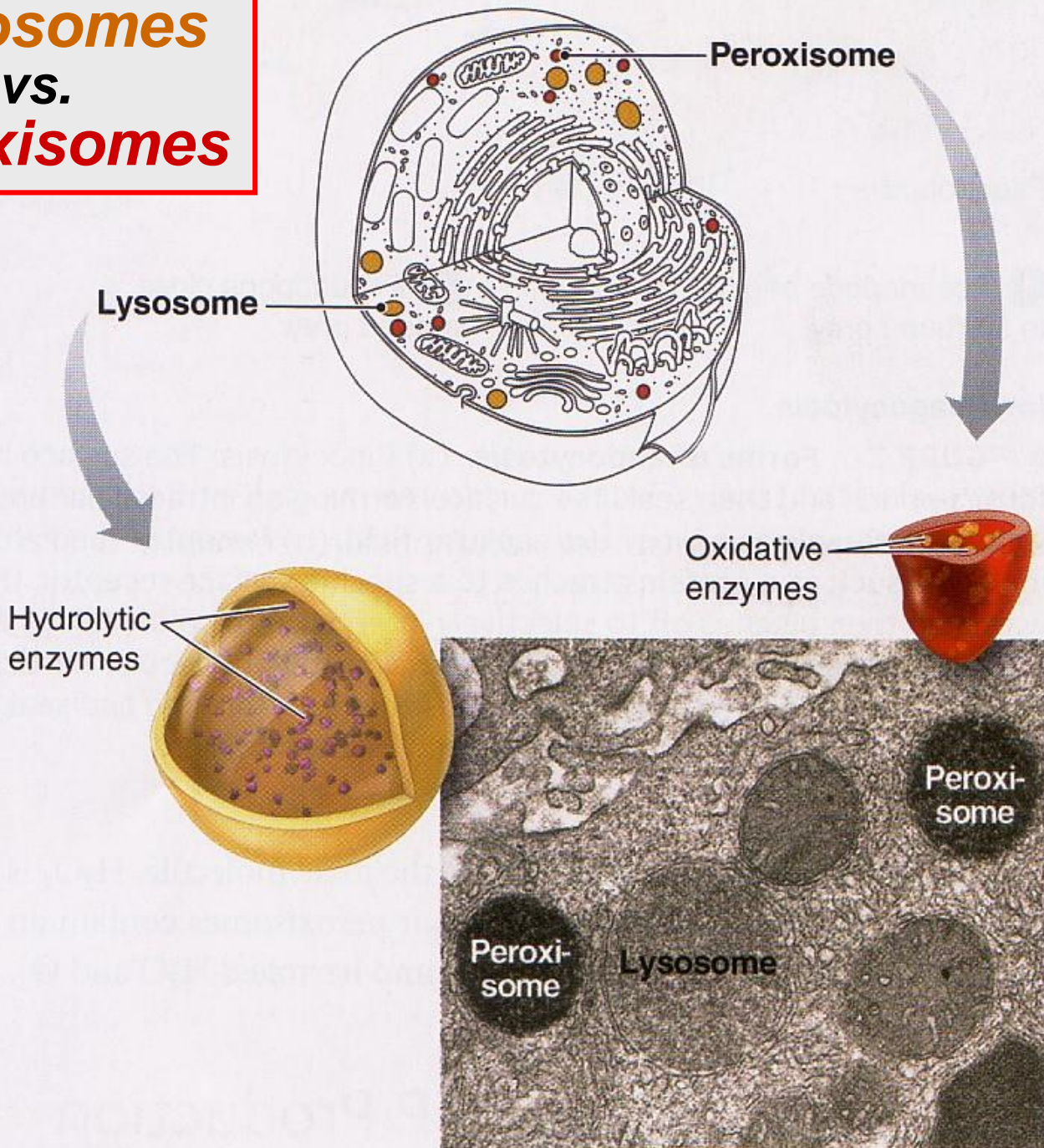


fig 2-3 LS 2012

Lysosomes vs. Peroxisomes



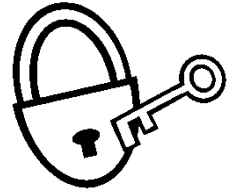
© Don W. Fawcett/Photo Researchers, Inc.

fig 2-6 LS 2012

BI 121 Lecture 4



Structure-function = fun!



I. Announcements Anatomy & Physiology Lab today!

Motivation to Study! Remember to complete p 3-7 dietary record in LM < Lab 3 next wk! Estimating serving sizes. Q?

II. Cell Physiology... Lysosomes, Peroxisomes, Mitochondria

III. Anaerobic vs Aerobic Metabolism Metabolism

LS ch 2 pp 26-33, fig 2-15, 2-9, 2-10, 2-11, 2-12 +...

A. Anaerobic: Cytosol ATP-PC immediate vs. Glycolysis

B. Aerobic: Mitochondria citric acid cycle, electron transport

IV. Introduction to Genetics LS pp 20-1 + Appendix C

A. What's a gene? Where? 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

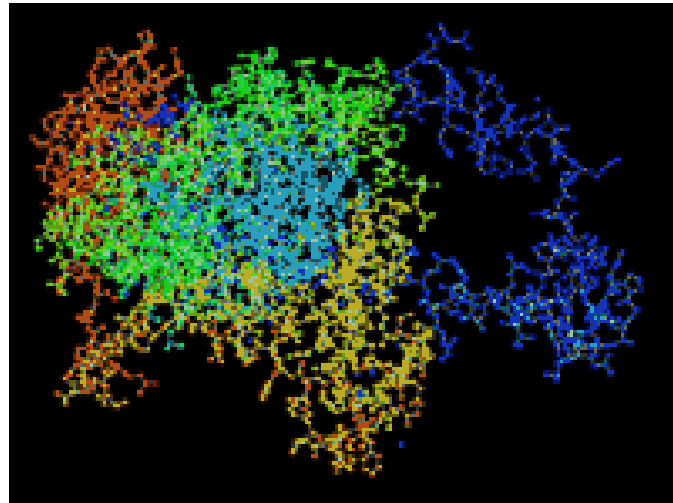
D. How does information flow in the cell? fig C-6

E. How does DNA differ from RNA? pp A-20 thru A-22

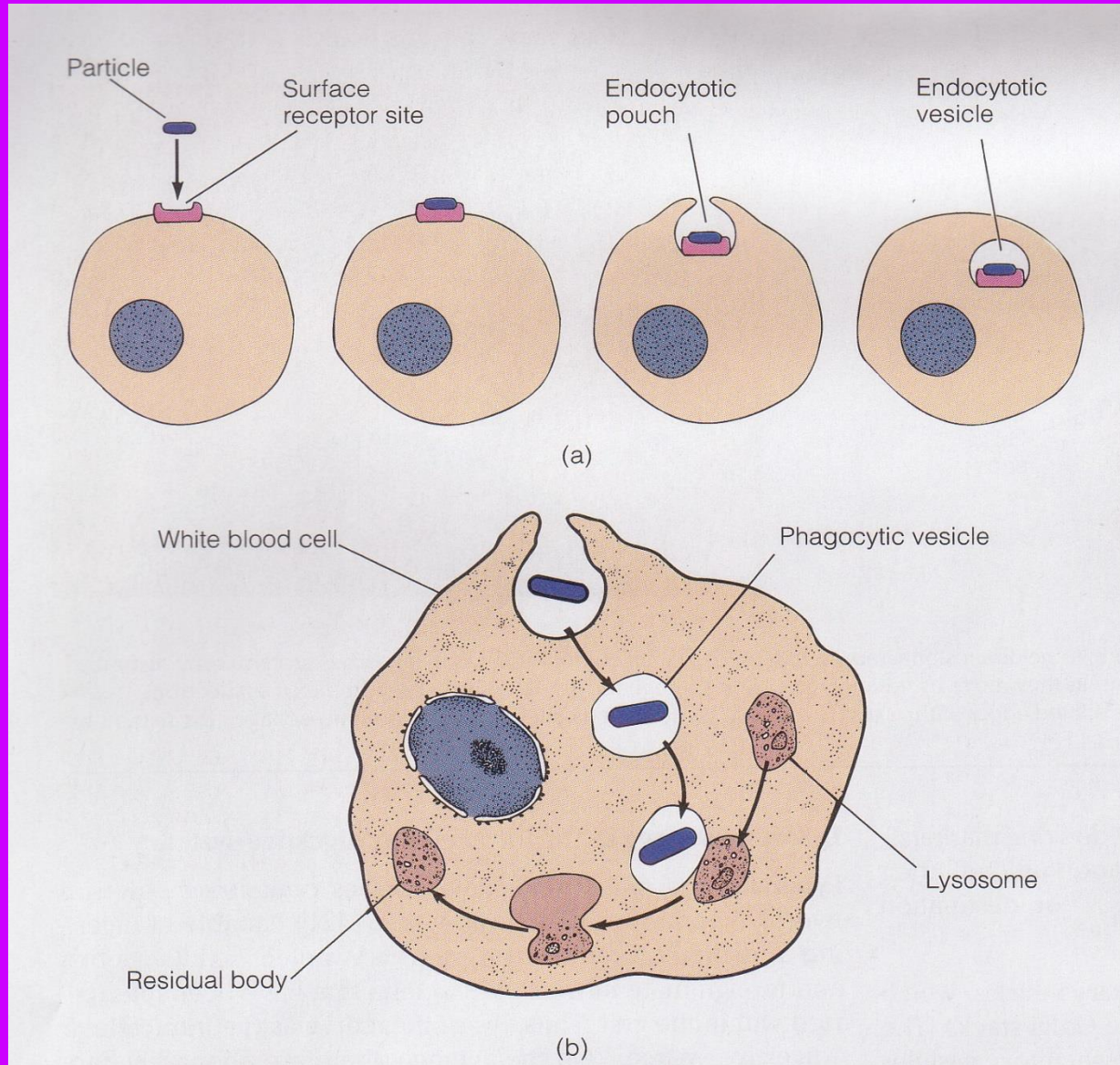
F. Genetic code? pp A-22, A-23

G. How are proteins made? Class skit! fig C-7, C-9

Catalase Enzyme Reaction in Peroxisomes Neutralize Toxin at Production Site!



Phagocytosis: Cell Eating!



Mitochondria: Energy Organelles

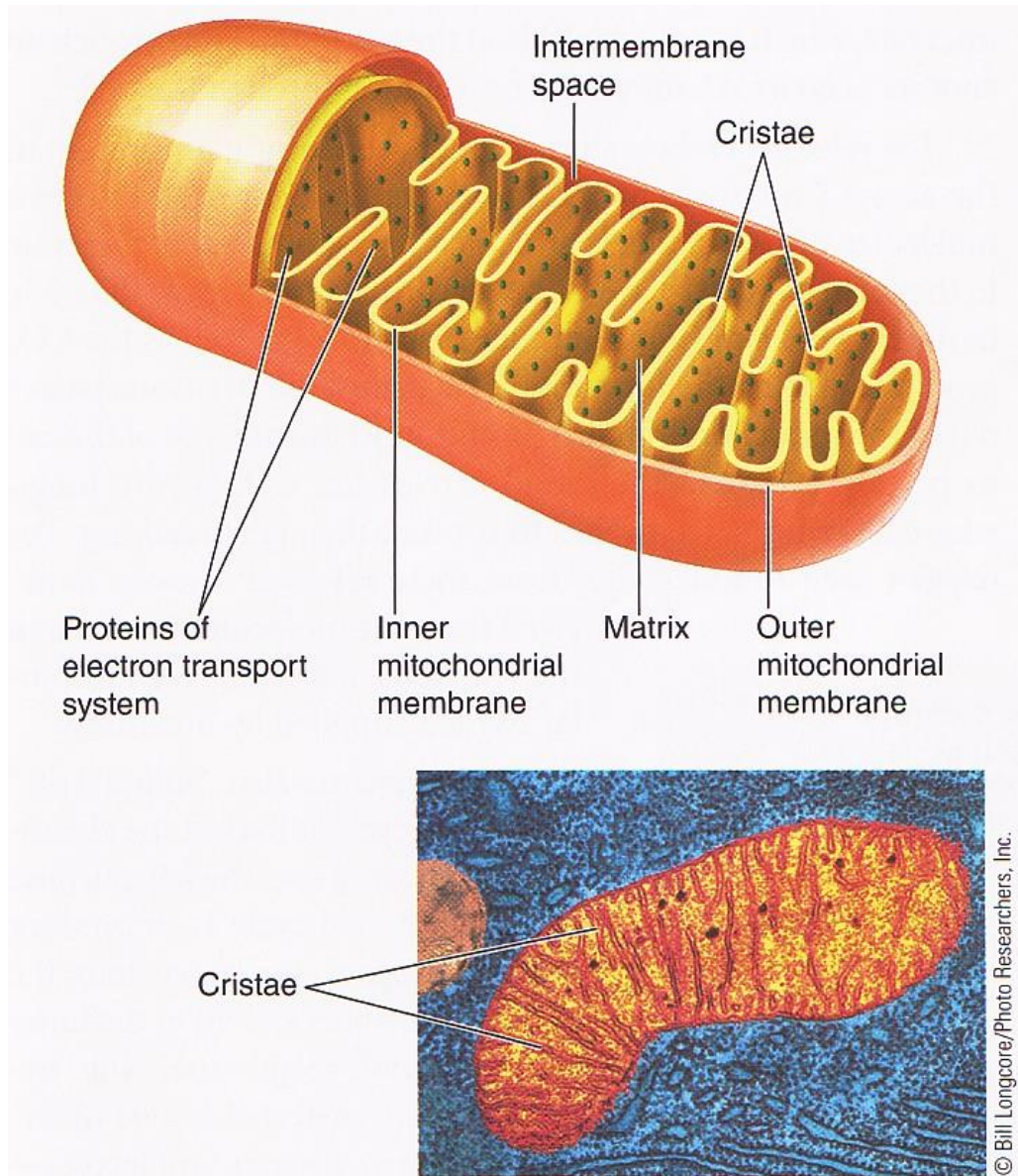


fig 2-8 LS 2012

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/O₂

=

MITOCHONDRION

ANAEROBIC

without O₂

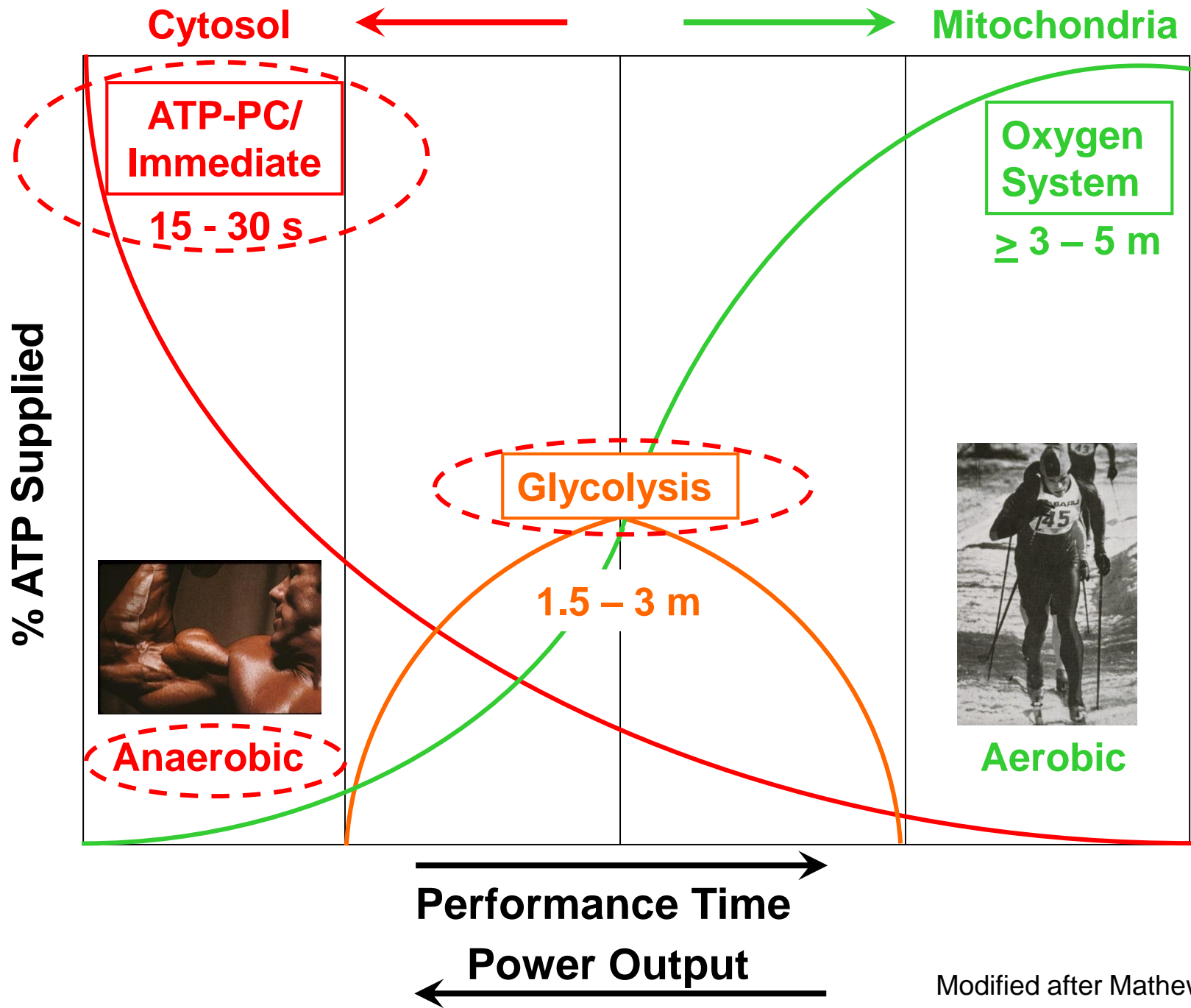
= CYTOSOL



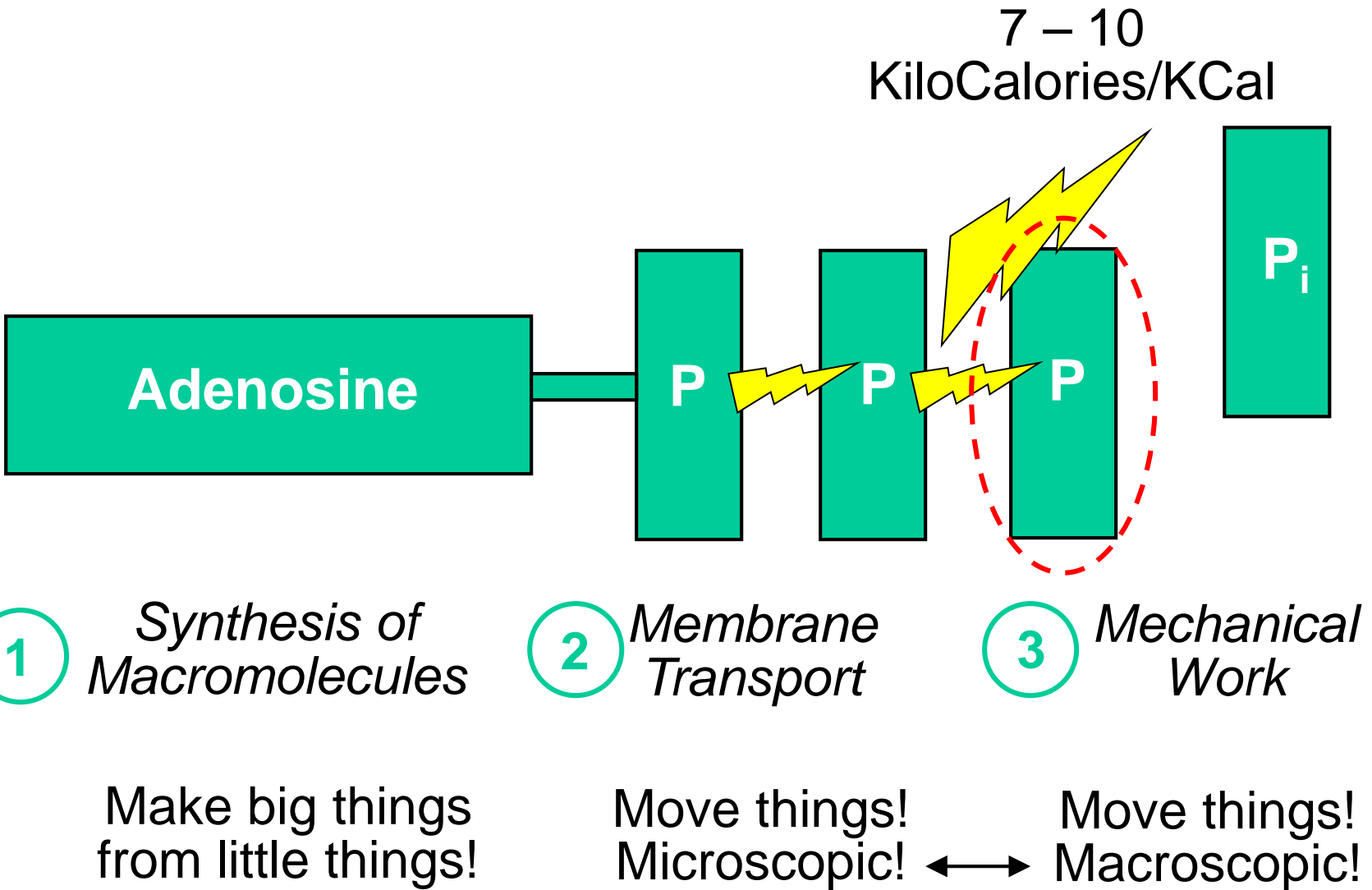
1. Immediate/ATP-PC
2. Glycolysis



<https://jissn.biomedcentral.com/articles/10.1186/s12970-017-0173-z>
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3407788/>

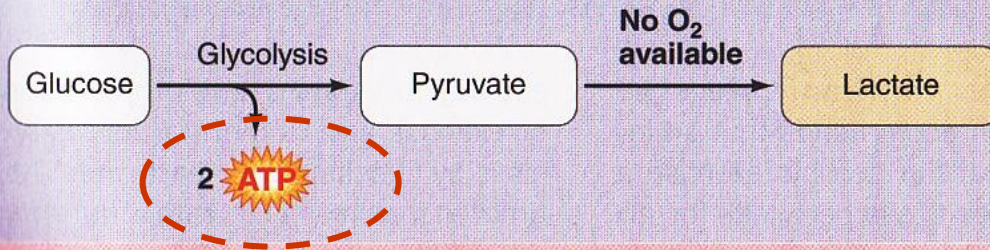


Cleave One High Energy Phosphate Bond To Do Work!!



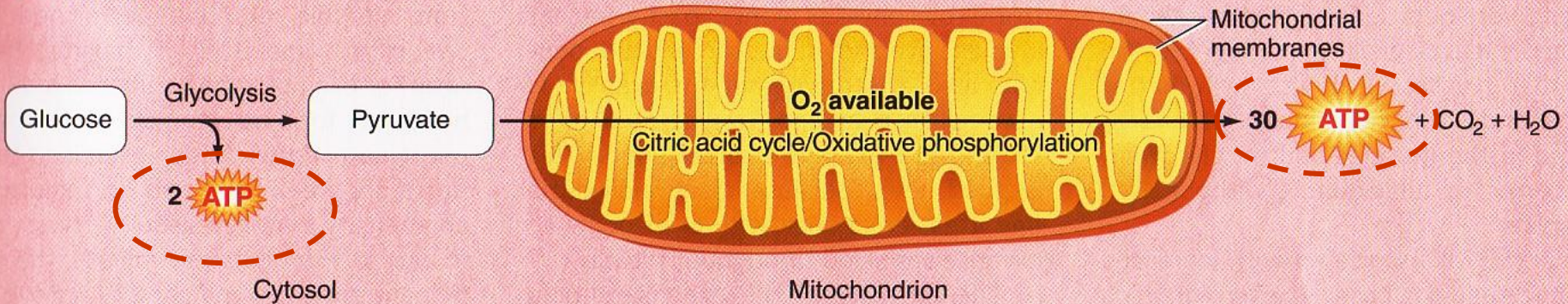
Anaerobic vs. Aerobic Metabolism

Anaerobic conditions



Anaerobic Glycolysis
"sugar dissolving"
without O₂. Net of 2 ATP
per molecule of glucose

Aerobic conditions

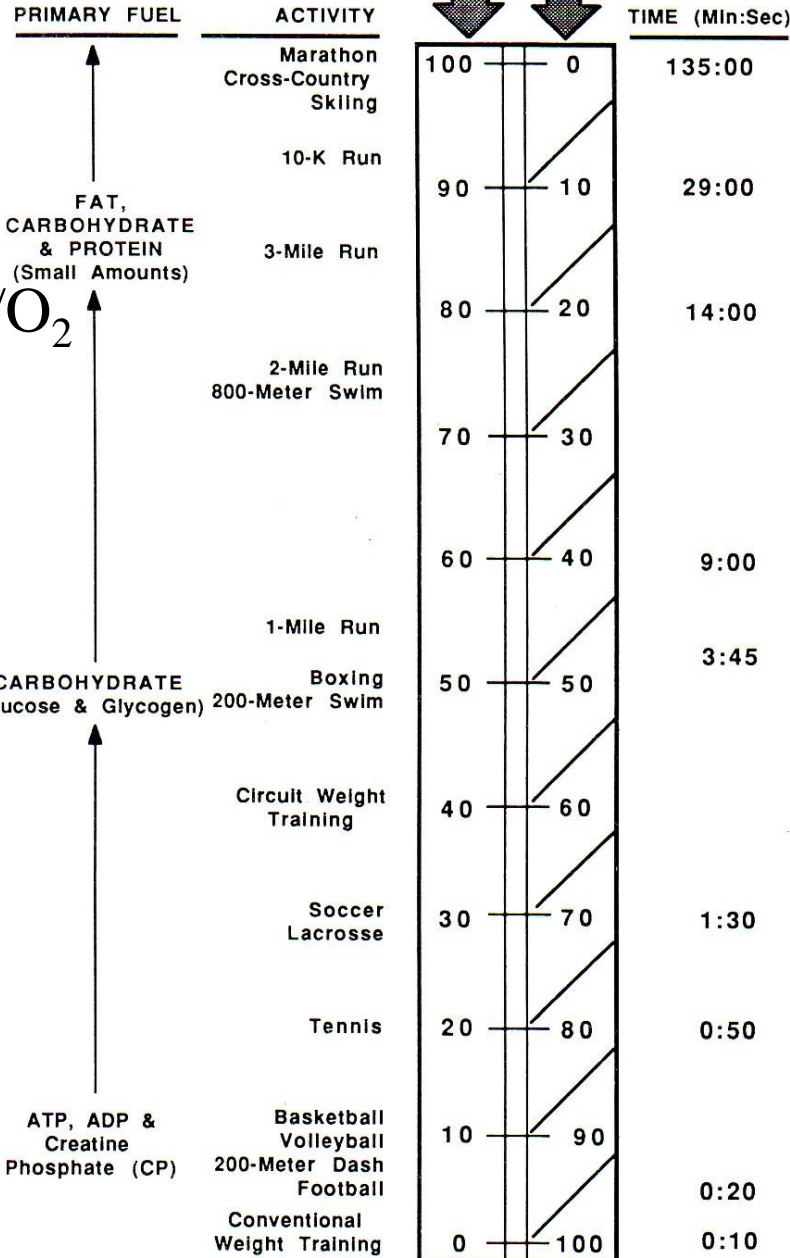


Aerobic Metabolism
+mitochondrial processing of
glucose with O₂. Net of 32 ATP
per molecule of glucose



AEROBIC

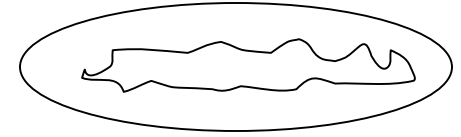
w/O₂



FAT,
CARBOHYDRATE
& PROTEIN
(Small Amounts)

CARBOHYDRATE
(Glucose & Glycogen)

ATP, ADP &
Creatine
Phosphate (CP)



MITOCHONDRIA

CYTOSOL

Glycolysis



Immediate/ATP-PC



ANAEROBIC

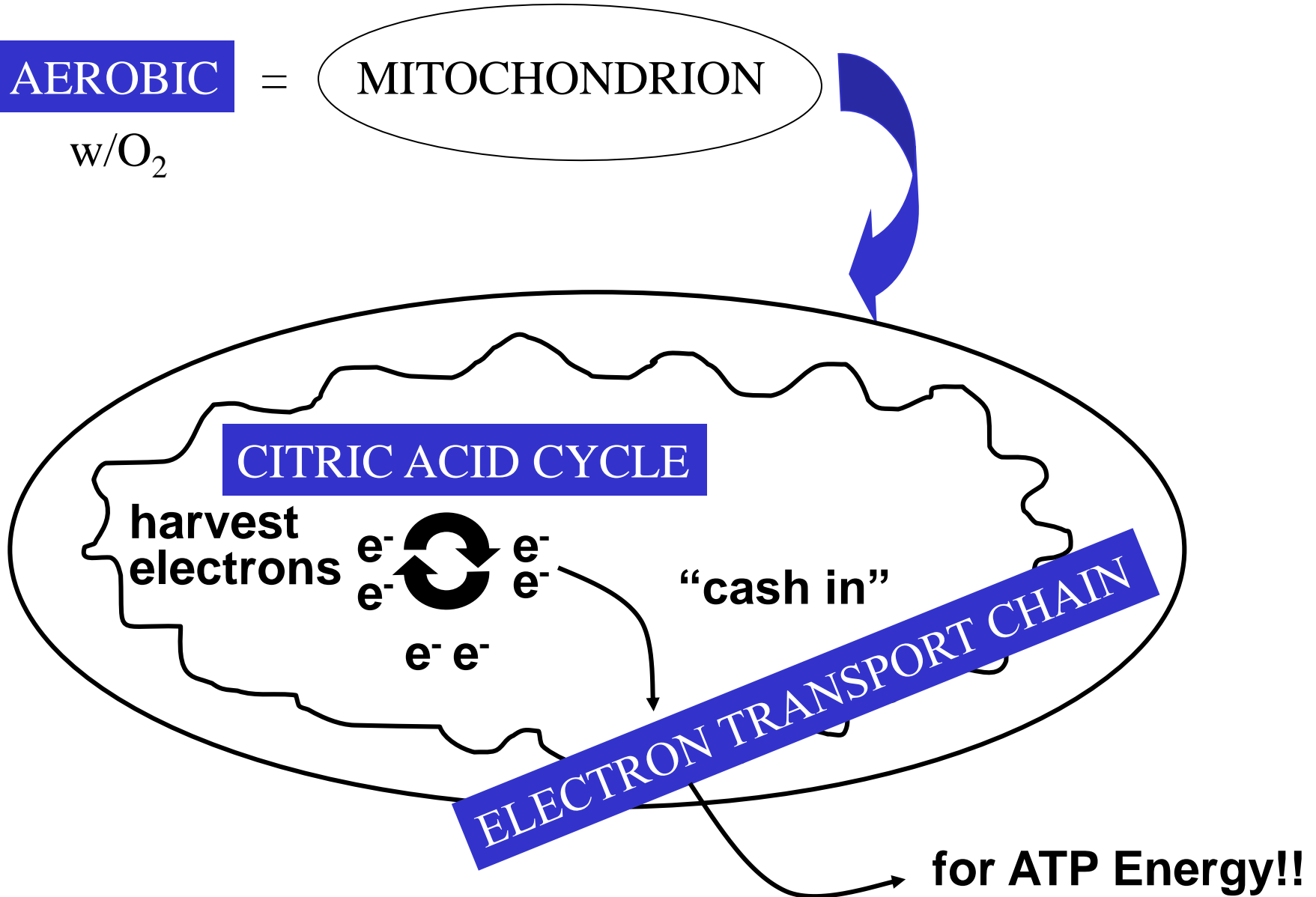
Goals of Aerobic Metabolism

AEROBIC

=

MITOCHONDRION

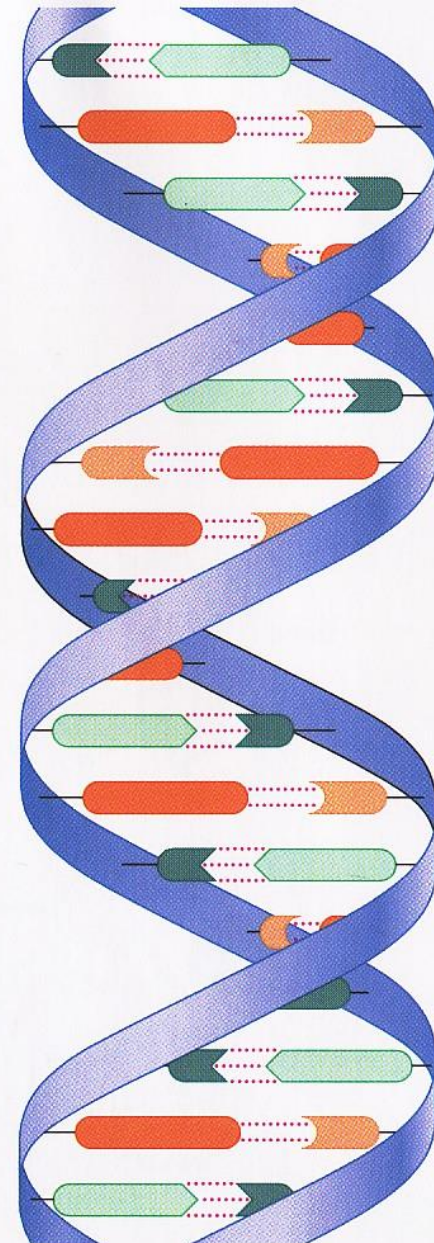
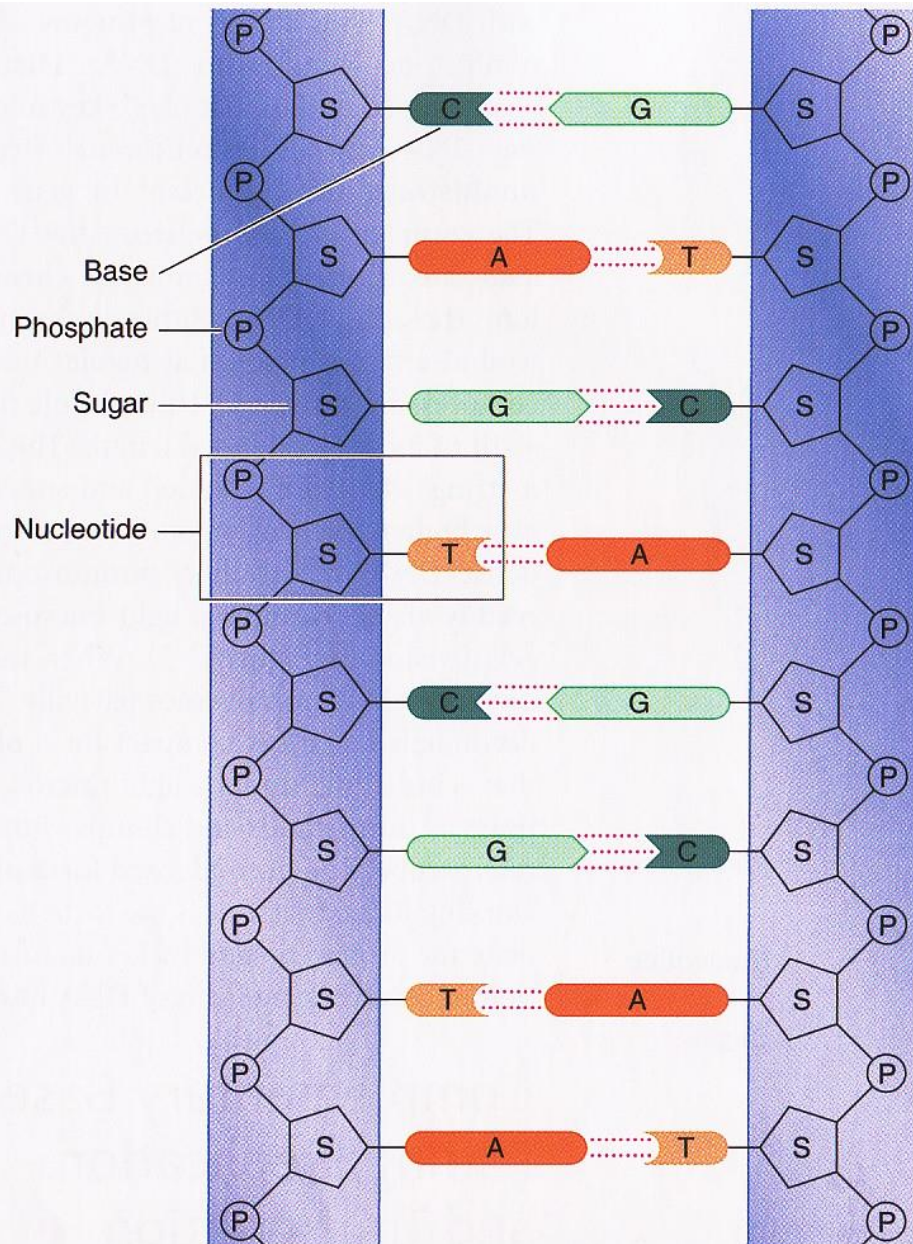
w/O₂



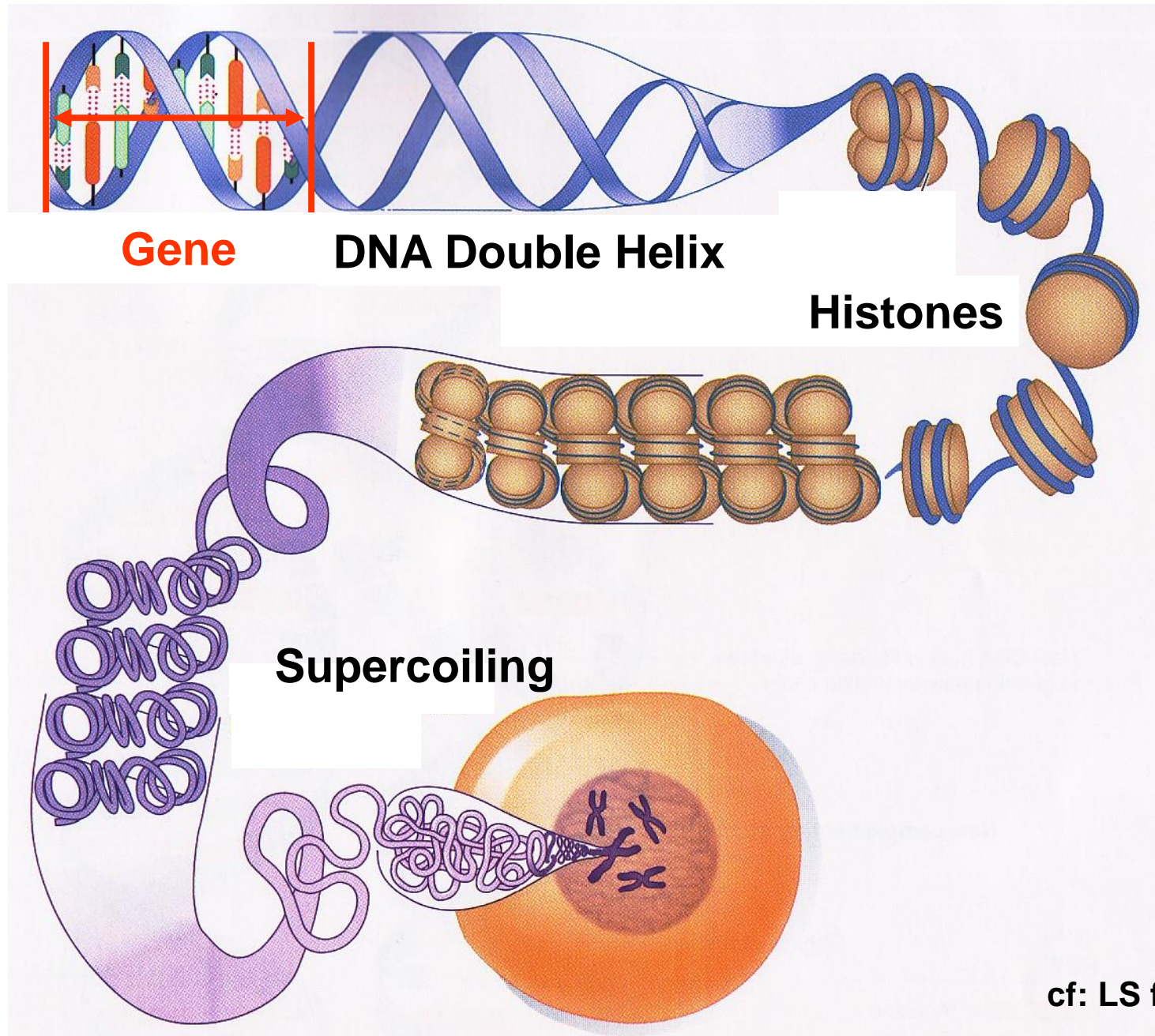
What are DNA's major functions? Heredity + Day-to-Day Cell Function



What does DNA look like? Double-helix!!



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



BI 121 Lecture 5



**...DietController!
More fun in Lab!!**



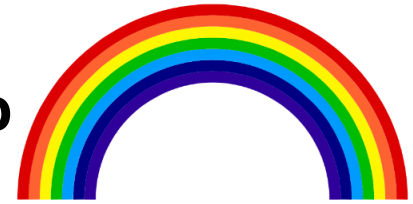
I. Announcements Nutrition Analyses this Thursday!
Please record diet on p 3-7 LM. Bring flash drive. Q?

II. Introduction to Genetics LS 2012 ch 2 p 20-1 + Appendix C

- A. How does DNA differ from RNA? pp A-20 thru A-22
- B. Genetic code? pp A-22, A-23
- C. How & where are proteins made? fig C-7, C-9
- D. Class skit: Making proteins @ ribosomes!

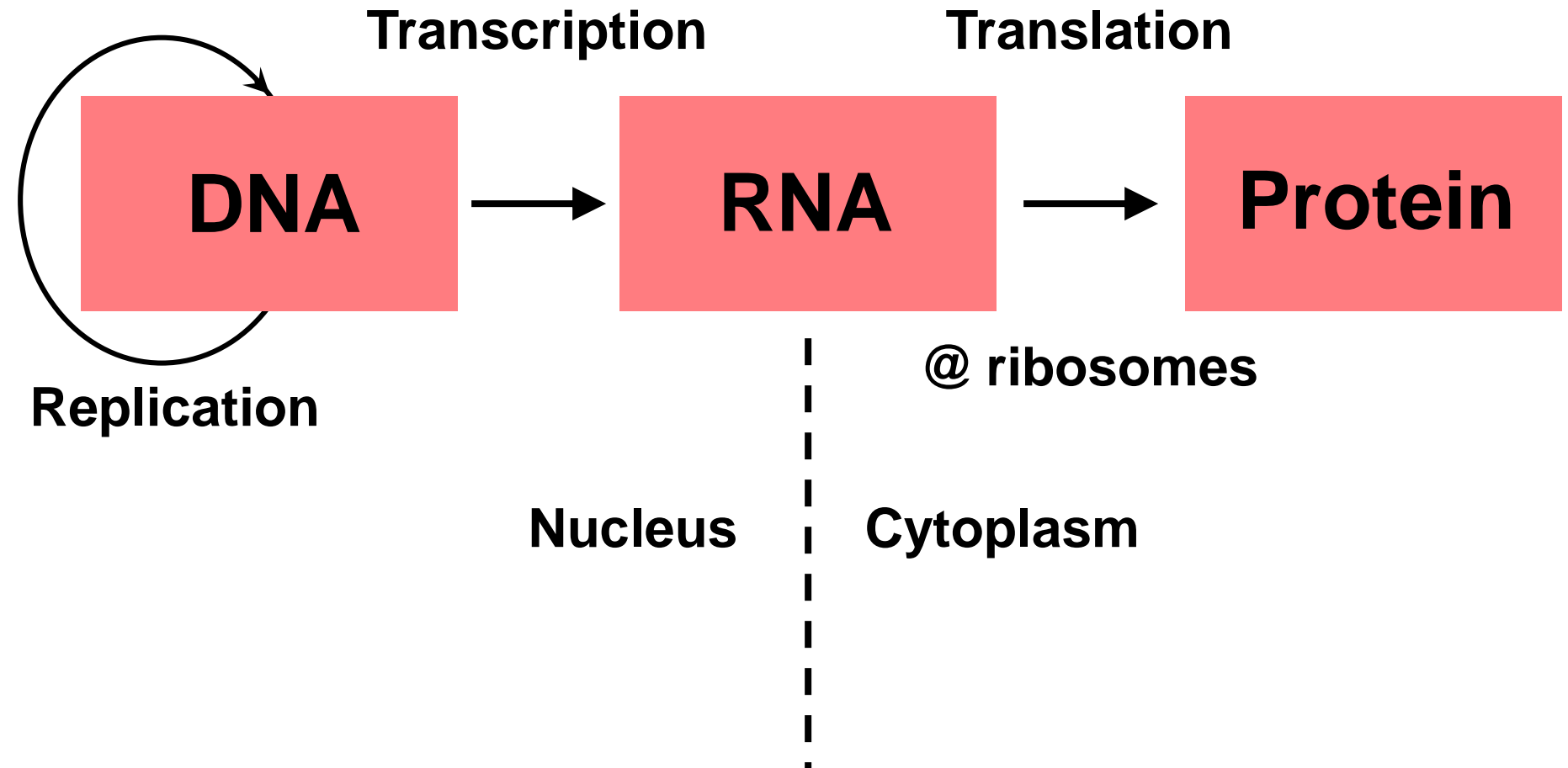
III. Nutrition PrimerSizer & Whitney (S&W) Sci Lib

- A. Essential Nutrients: H₂O, 1^o Carbohydrates, 2^o Fats, 3^o Proteins, Vitamins, Minerals; Macro- vs Micro-?
- B. Dietary Guidelines: USDA, AICR, Eat Like the **Rainbow!**
- C. **Blue Zones?** Pondering Paleo, Marlene Zuk, NAHL 2015...
- D. How much protein? Excess animal protein & disease?
- E. Carbohydrate confusion. Minimize what? Simple sugars
- F. Anti-aging diets, total vs intermittent fasting? NAHL 2018
- G. **Beware of Nutrition Quackery** S. Kleiner & Monaco
- H. Best diets? Exercise? Practical guidelines for wt loss!



IV. Introduction to Digestion Steps + hydrolysis

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^o 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

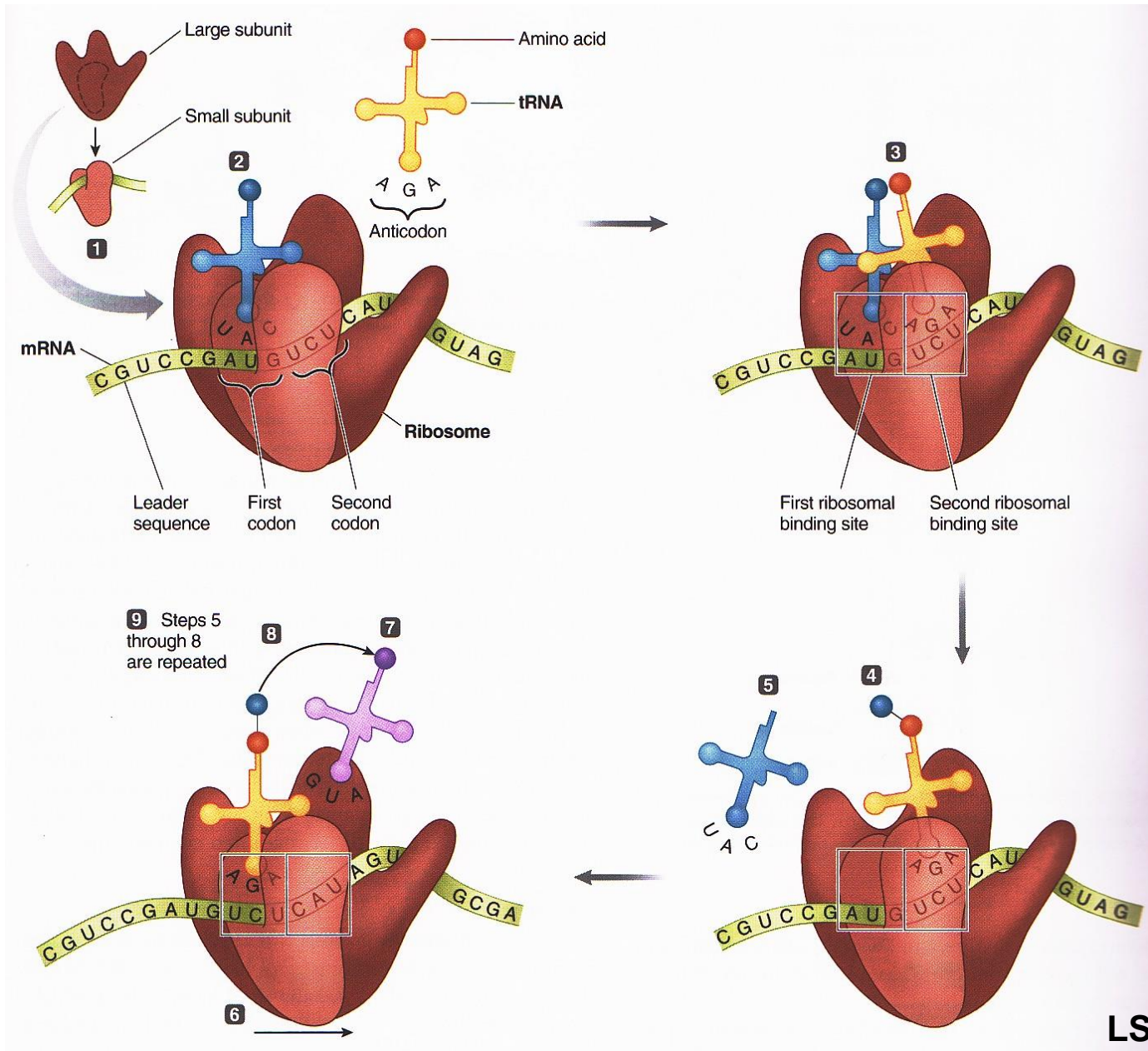
UUU

TAC

AUG

UAC

Translation? Ribosomes Make Proteins



Macronutrients & Micronutrients Essential for Life

Macronutrients

H₂O/Water

✓ 1^o Carbohydrates

✓ 2^o Fats/Triglycerides/Lipids

✓ 3^o Proteins

Micronutrients

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

Minerals (K⁺, Na⁺, Ca²⁺, Mg²⁺,
Fe²⁺, Zn²⁺,...)

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**



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)

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!



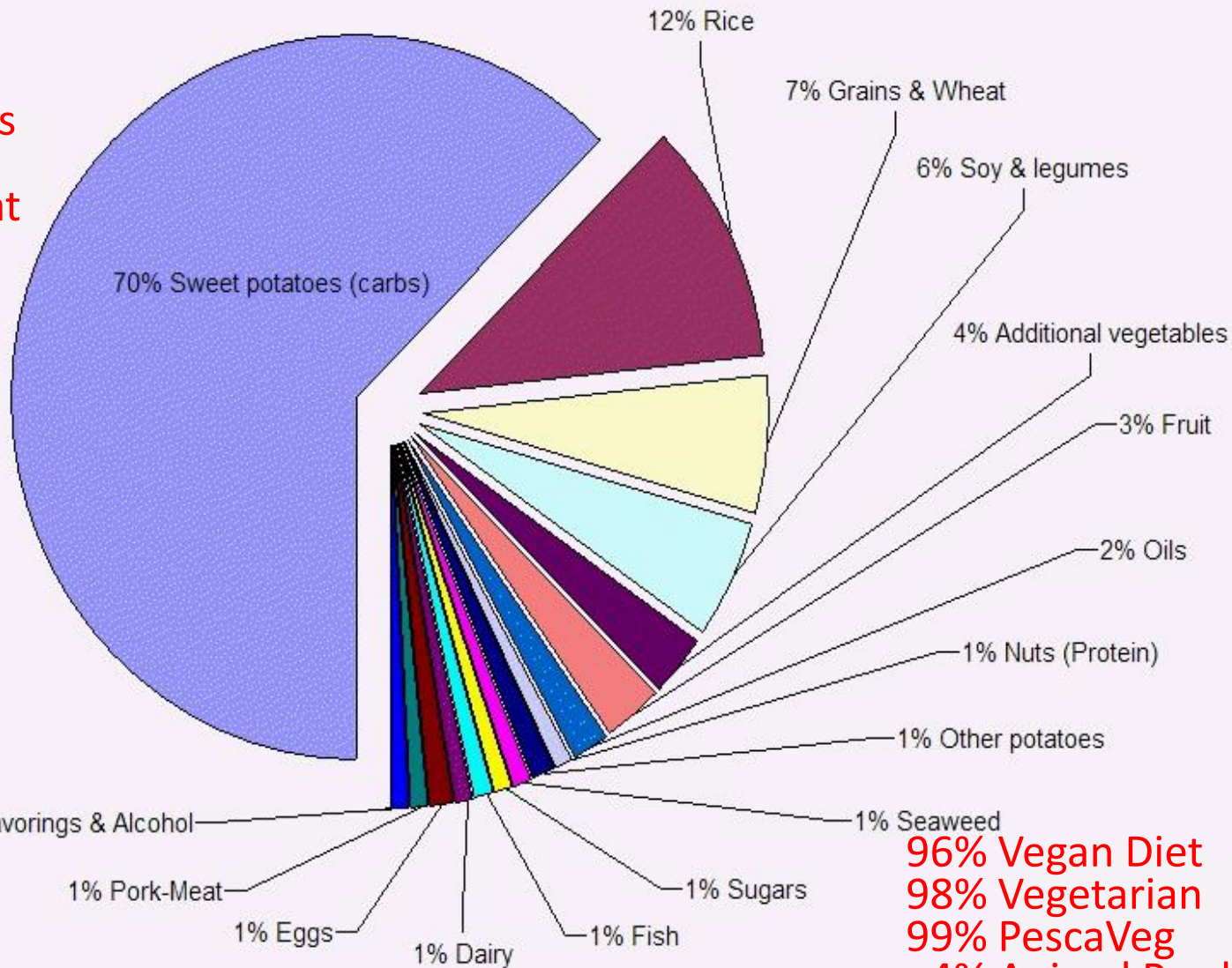
https://en.wikipedia.org/wiki/Blue_Zone

<https://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



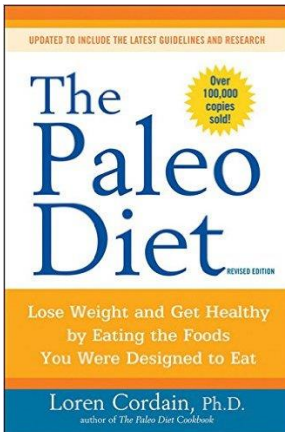
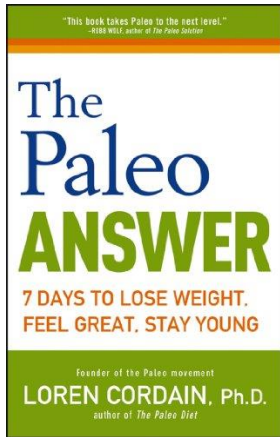
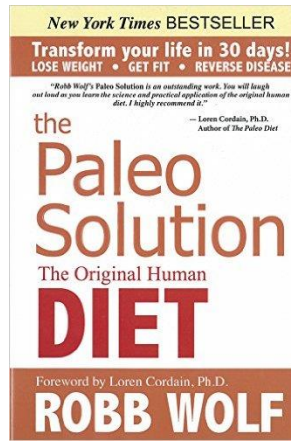
85% Carbohydrates
 9% Protein
 6% Fat
 85-10-5
 1785 Calories

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

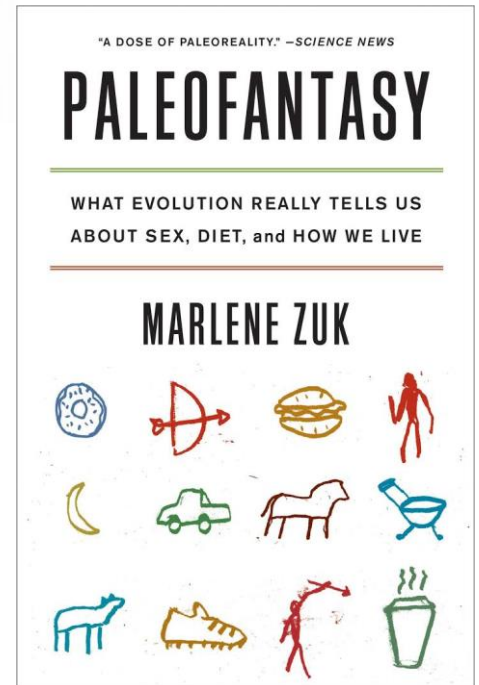
SCIENTIFIC STUDY: "The Diet of the World's Longest-Lived People and Its Potential Impact on Morbidity and Life Span"
 JOURNAL: Annals of the Academy of Sciences - Volume 1114: 434-455 (2007).

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

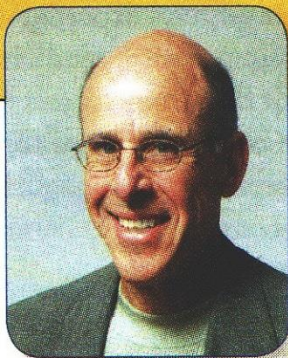
50 kg or 110 lb female ? ~ 40 g/d

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!**



John Swartzberg, M.D.
Chair, Editorial Board

WHO says to cut down on meat?

When I saw the headlines in October that meat was linked to cancer, I braced myself for the inevitable brouhaha. The news was that the International Agency for Research on Cancer (IARC), part of the World Health Organization (WHO), concluded that processed meats like hot dogs, bacon, and ham almost certainly increase the risk of colorectal cancer—by 18% per daily serving—and that red meat probably does as well.

But we've heard about this link many times before. Over the past 20 years, many observational studies have found that people who regularly eat red or processed meats have higher rates of several cancers, notably of the colon and rectum. And lab studies have shown that compounds formed when meat is processed (that is, smoked, salted, or cured) or cooked at high temperatures can cause cancer in animals or cells. All that research served as the basis of the IARC conclusions. But even in 2007 the World Cancer Research Fund, another key group of experts, concluded that there was "convincing" evidence that these meats increase the risk of colorectal cancer. And since 2002, WHO has advised people to moderate their consumption of processed meat, as do the still-pending 2015 Dietary Guidelines for Americans.

What elicited the most heated reaction in the press and blogosphere and especially from the meat industry was the fact that the IARC put processed meats in its Group 1—"carcinogenic to humans"—which includes tobacco smoking and asbestos. (It put red meats in Group 2A—"probably carcinogenic.") The IARC clearly explained that this classification merely indicates the strength of the evidence that something causes cancer, not the *degree* of risk. In fact, it said that the increased risk

from red or processed meat is "small" for individuals, though potentially important for public health since so many people eat meat.

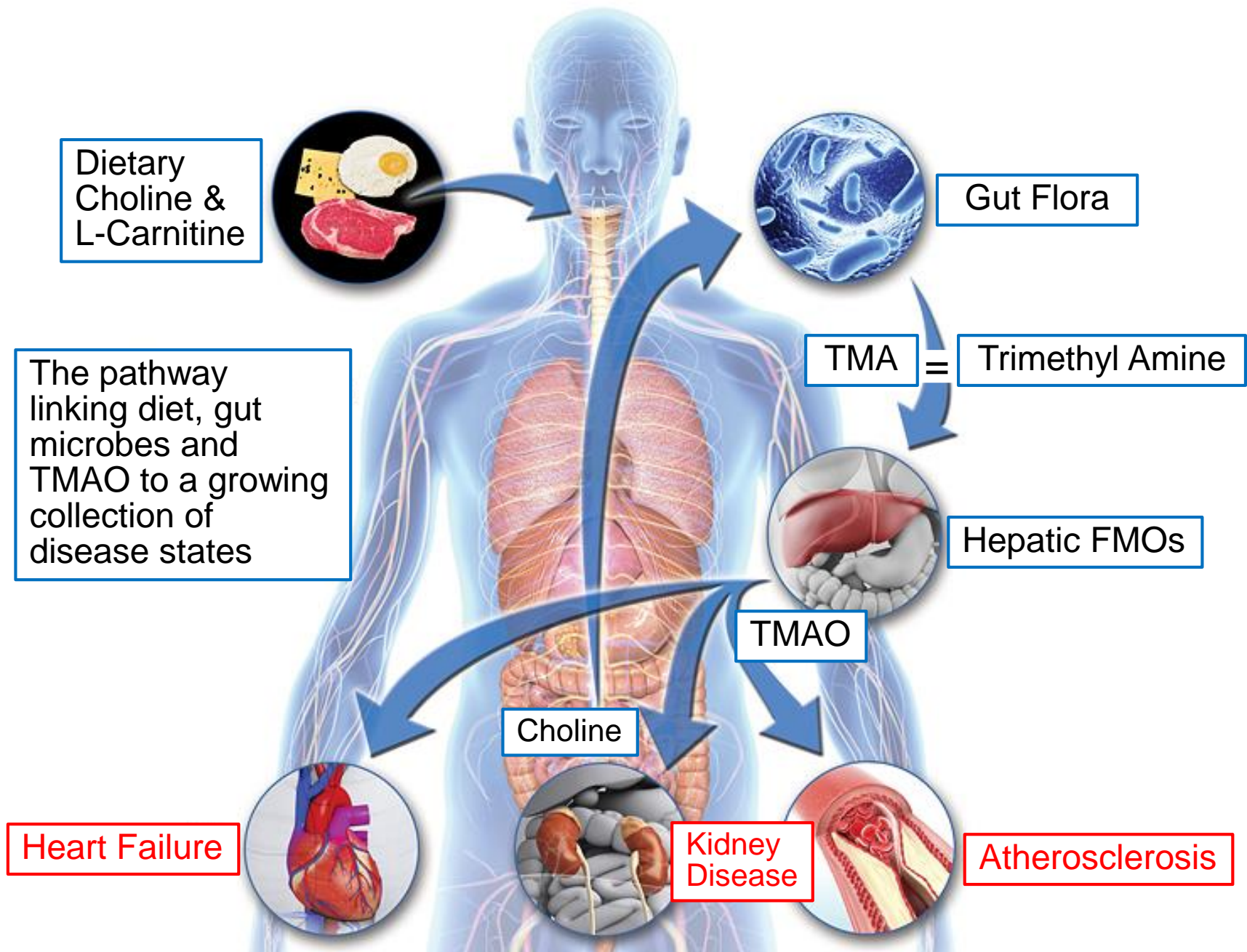
What about that 18% increase in risk? The IARC estimated that for every serving of processed meat (just under 2 ounces) or red meat (3½ ounces) eaten daily for years, the lifetime risk of colorectal cancer goes up by about 18%. But this is what's known as relative risk, which can be misleading. For instance, the lifetime risk of developing colorectal cancer in the U.S. is about 5%. An 18% increase does not mean $5\% + 18\% = 23\%$, but rather $5\% + (18\% \text{ of } 5\%) = 6\%$. That means one extra case of colorectal cancer per 100 meat eaters. In contrast, smoking increases the lifetime risk of lung cancer by roughly 2,000%—from about 1 per 100 people to about 20 per 100. So while IARC may classify both processed meat and smoking as Group 1 carcinogens, there's no comparison in their risks.

In fact, IARC cited estimates that 34,000 cancer deaths per year worldwide can be attributed to diets high in processed meat. In contrast, tobacco causes nearly 2 million cancer deaths per year.

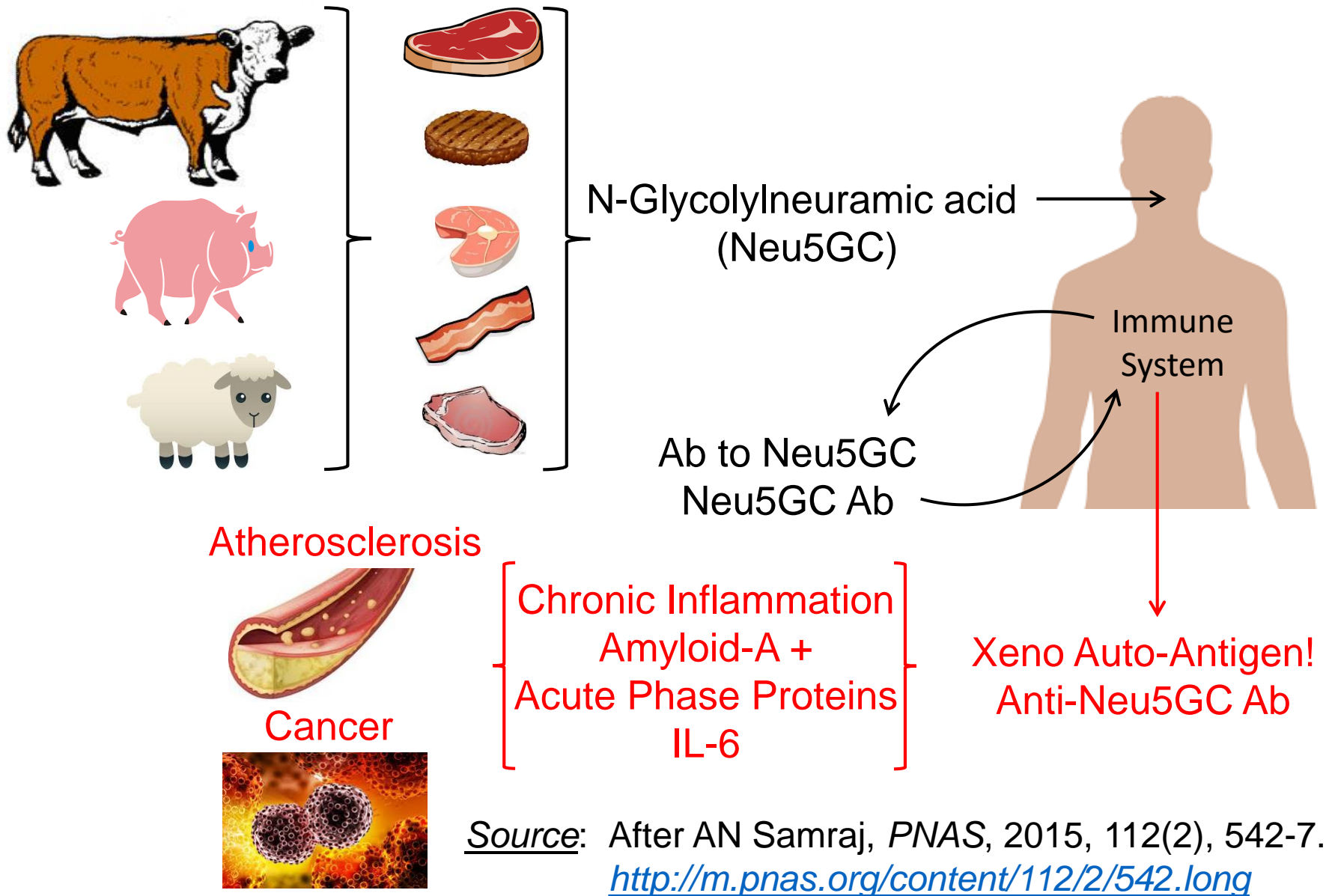
I should add that I don't think it has been clearly established that meat causes cancer. Proving that foods cause or help prevent cancer is difficult for many reasons. Notably, the observational studies upon which the IARC classifications were largely based can only find associations—they cannot prove cause and effect.

That said, there are plenty of other reasons to moderate your intake of red meats and limit processed ones. There's strong evidence linking them to cardiovascular disease and a variety of other disorders, though it's not clear which compounds in them are the possible culprits. What's more, eating more plant-based foods and less meat is better for the planet, resulting in less greenhouse gas production.

And there's a far surer way to reduce the risk of colorectal cancer than tinkering with your diet: Get screened.



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>

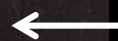
Nutrition *Action*

OCTOBER 2016 \$2.50

HEALTH LETTER®
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 "swears by the ketogenic diet,"
according to *Women's Health* magazine.

Photo: Danny Medlock/Getty



BI 121 Lecture 6

- I. [Announcements](#)** Data + flash drive/e-mail for today's lab!
If you want to be sure to have your notebook to study for Exam I on Tuesday Oct 23rd, best to turn in prior to lecture next Tuesday Oct 16th. Review Session Sunday Oct 21st, 6-7 pm. Q? Sample Exam Q? Be sure to see *Active Learning Questions!*
- II. [Nutrition Connections](#)** Why whole grains? Carbohydrates? Fasting, Intermittent dieting, Best diets? Practical weight loss?
- III. [Gastrointestinal Physiology](#)** DC Module 3 pp 17-23, LS ch 15+
 - A. Steps of digestion Dr. Evonuk + LS pp 437- 9; DC p 23
 - B. Hydrolysis + monomer to polymer: central linking themes!
 - C. What's missing? LS fig 15-1 p 438
 - D. GI-Doughnut analogy Dr. Brilla @ WWU
 - E. Common control mechanisms
 - F. Gut layers & secretions LS p 438, 440-1
 - G. Organ-by-organ review LS tab 15-1 pp 440-1 + DC fig 3-1
 - H. Accessory organs of digestion
 - I. Ulcers? Causes?

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

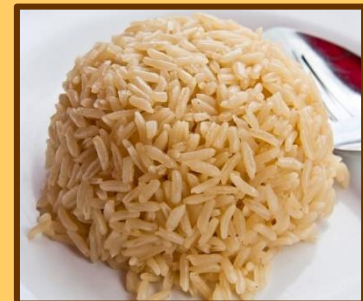
Iron ↑ O₂ carrying, ↓ iron-deficiency anemia in women

Magnesium ↑ bone building & muscle energy release

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



[https://www.choosemyplate.gov/
grains-nutrients-health](https://www.choosemyplate.gov/grains-nutrients-health)



Dietary Composition & Physical Endurance

eg, Atkins!

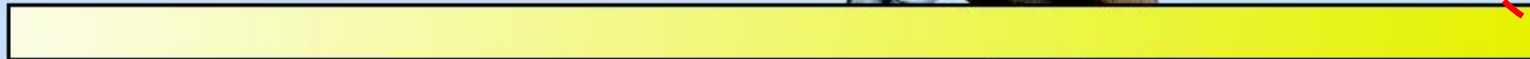
High-fat diet



Normal mixed diet



High-carbohydrate diet



~ 1/3 endurance!

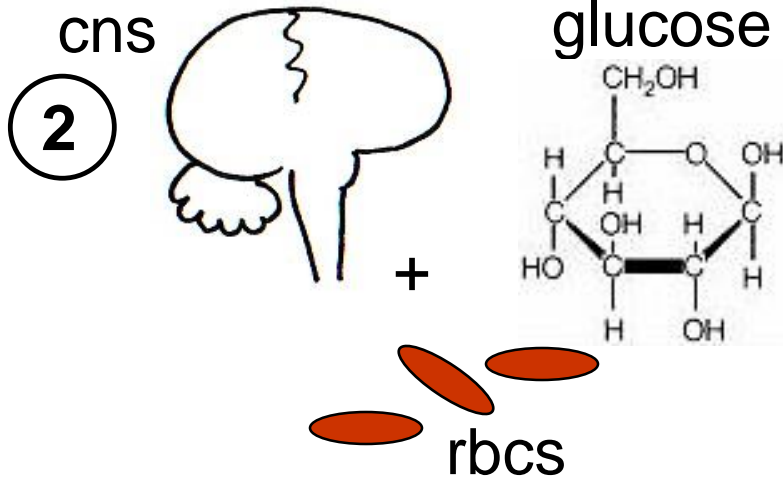
Maximum endurance time:

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

**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!

> $\frac{3}{4}$



CALERIE STUDY



Comprehensive Assessment of Long-term
Effects of Reducing Intake of Energy

- 2-yr kcal restriction, assess biomarkers longer, healthier life
- 218 people, 21 – 51 yr, ½ ~ overweight, ½ normal wt
- Usual diet or cut kcal by 25% (achieved ~ 12% so < ½ goal)
- If cut calories, lost 10% body wt ~ 17 lb & kept off for 2 yr
- Cardiometabolic Δ s: ↓ Cholesterol, ↓ Inflammatory markers,
↑ control blood sugar control w/o
adverse sexual or immune function Δ s

Some bone loss, but attributed to weight loss.



National Institute
on Aging



Das SK, Roberts SB, Bhapkar MV & coworkers.
Am J Clin Nutr 2017 Apr, 105(4):913-927.

<https://www.ncbi.nlm.nih.gov/pubmed/28228420>

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>

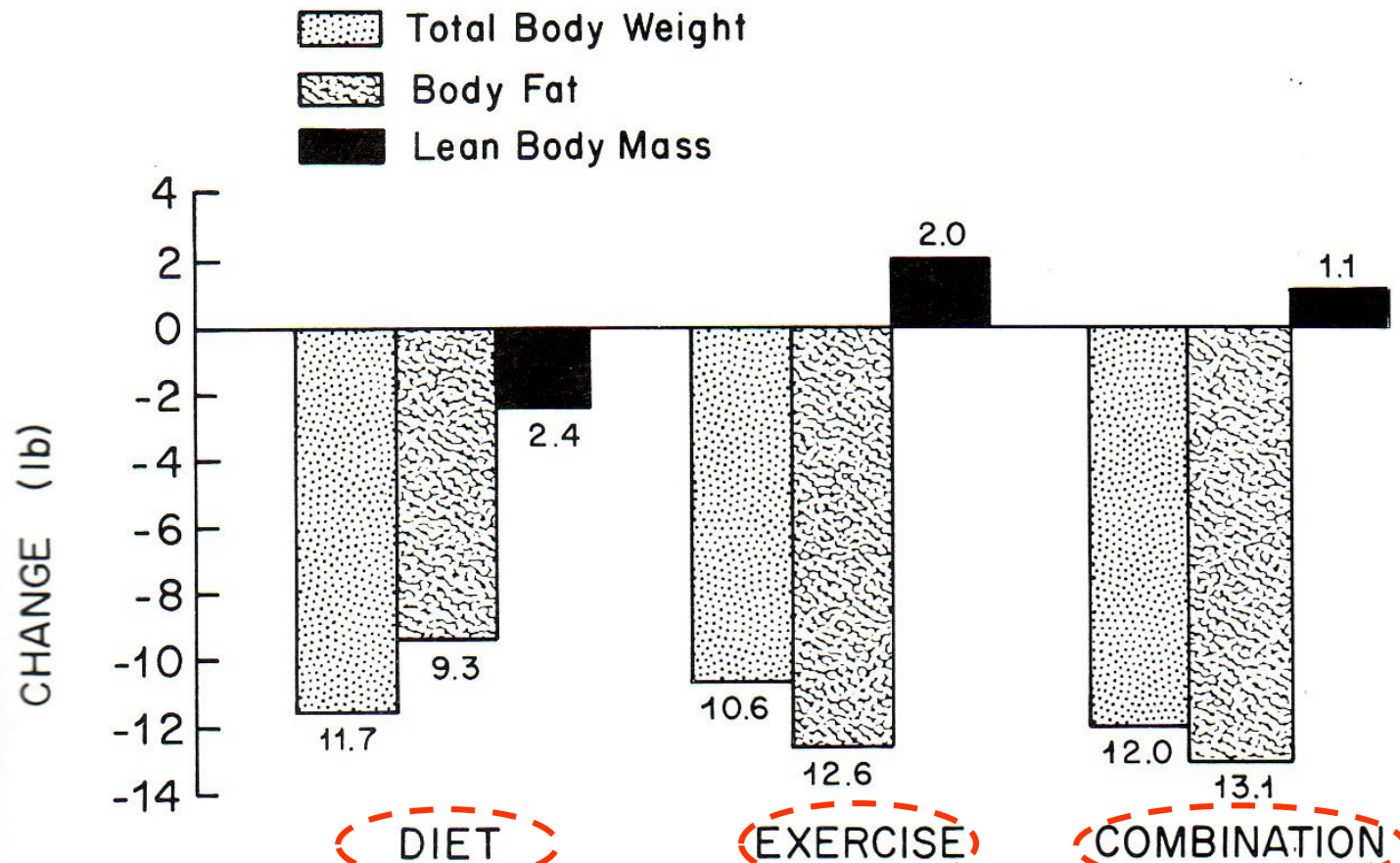
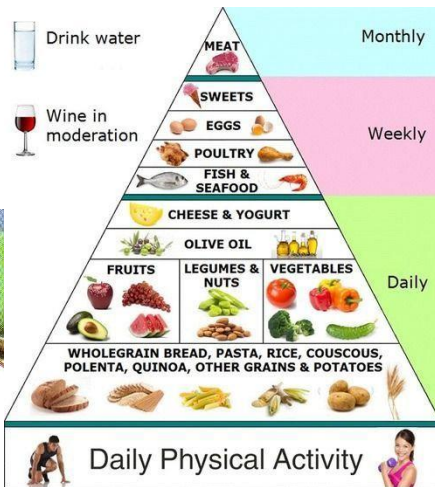
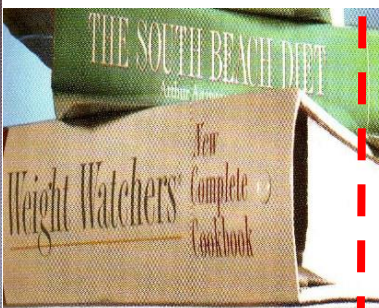
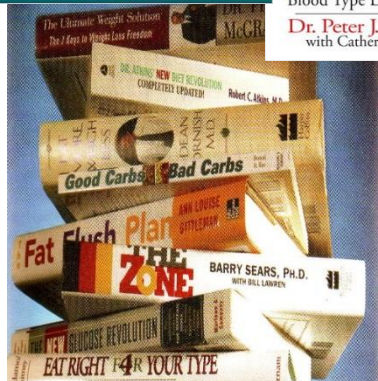
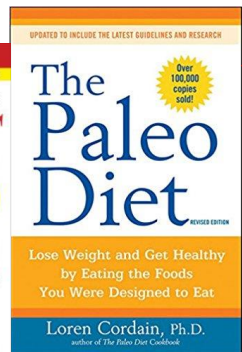
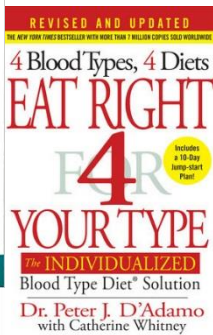
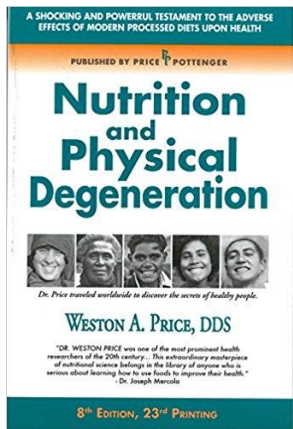


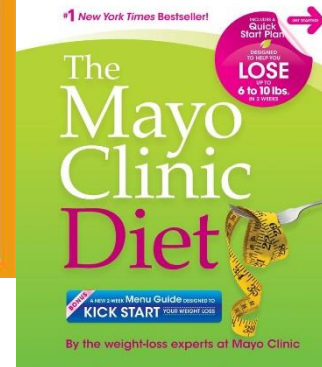
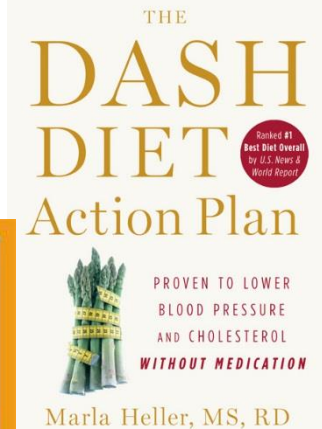
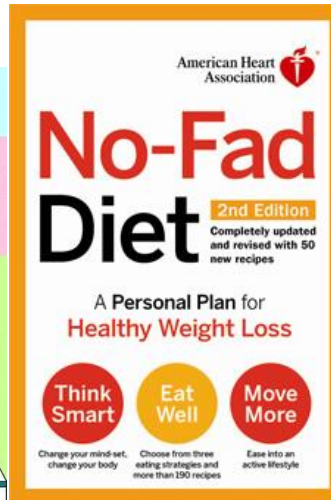
Figure 4-9. Changes in body weight, body fat, and lean body weight for diet, exercise, and combination groups. (From Zuti W. B., and Golding, L. A.: Comparing diet and exercise as weight reduction tools. *Phys. Sportsmed.* 4:49-53, 1976.)

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

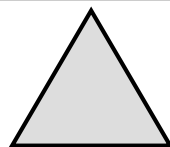
Which Diets are Best?



Mediterranean Diet



Not Plant-based
Lower Carbohydrate



Plant-based
Lower Fat



Not Peer-Reviewed = Trade Book
→ Opinion



Peer-Reviewed = Text Books
→ Research

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.)

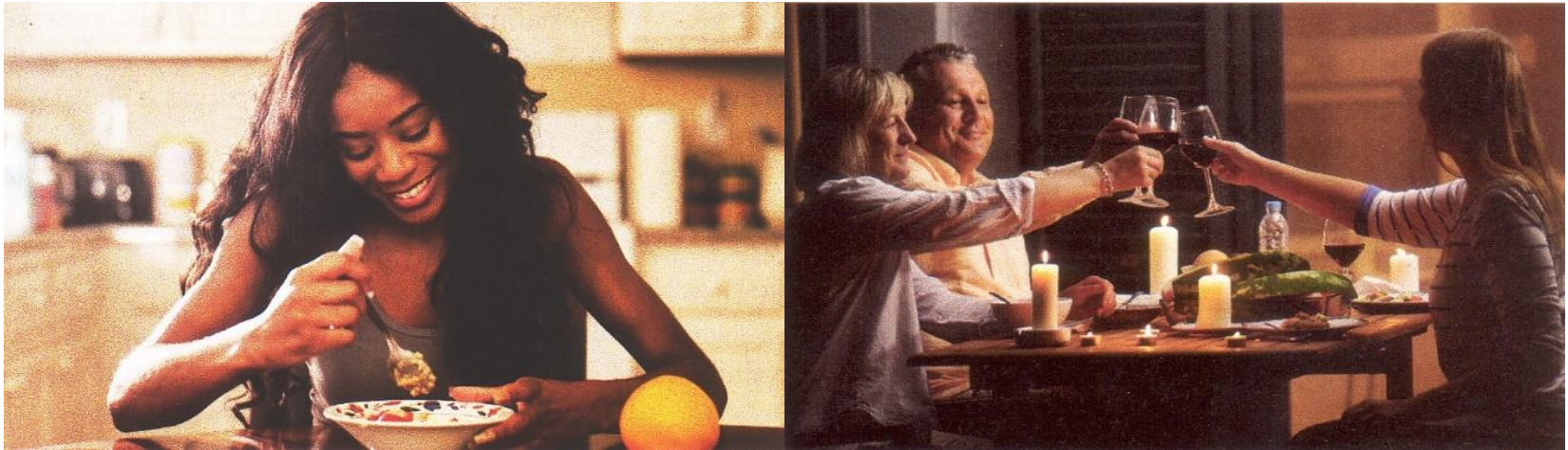
410 calories

Jogging | **50 min.**



**Better
choices!**

Eat Breakfast, Eat Early, Downsize, Go Low!



Eating early & less late (< ~ 6:30 pm) may help insulin work efficiently!

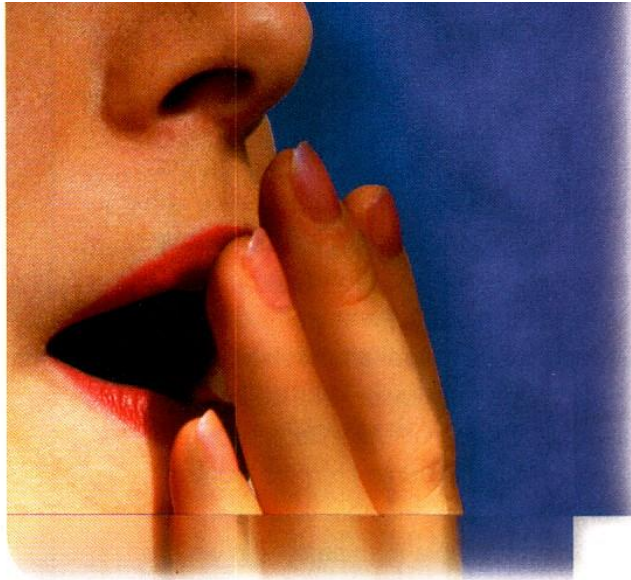


Smaller amount vs plate size!



**Fruits & vegetables for
low-calorie density!**

SOURCE: Dow C. How to eat less. What works. What doesn't.
Nutrition Action Health Letter, 2018 Jul-Aug, 6-8.



Sleep More, Eat Less

Wondering why you're so hungry? Maybe it's because you're not getting enough sleep.

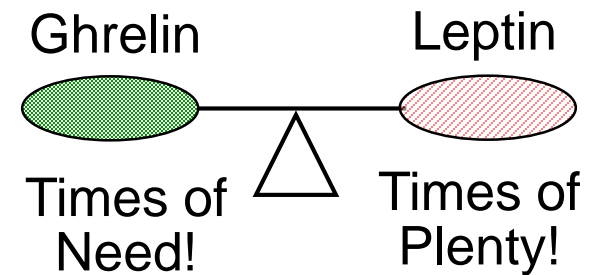
Researchers allowed 12 healthy young lean men to sleep for either four or eight hours in a laboratory. After one night of

four hours of sleep, the men ate 22 percent more calories the next day than they did after eight hours. They also reported being more hungry before breakfast and dinner.

In a separate study, scientists found that a single night with only four hours of sleep led to insulin resistance in nine healthy lean men and women in their 40s. After the night of restricted sleep, the participants were less able to move blood sugar into their cells, which suggests that their bodies were at least temporarily resistant to insulin. Insulin resistance can lead to heart disease, diabetes, and possibly breast cancer.

What to do: Get enough sleep. Most adults need 7 to 8 hours a night. (School-aged children need at least 9 hours.) Other studies that limit adults' sleep find higher levels of ghrelin (which makes people hungry) and lower levels of leptin (which makes people feel full) in their blood. Changes in ghrelin, leptin, and insulin resistance may explain why studies find a higher risk of obesity, heart disease, diabetes, and high blood pressure in people who get too little sleep.

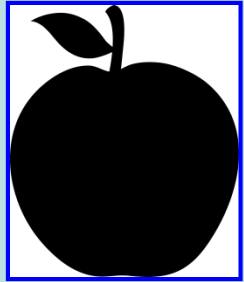
**promotes
Leptin
release!**



<http://www.vivo.colostate.edu/hbooks/pathphys/endocrine/gi/ghrelin.html>

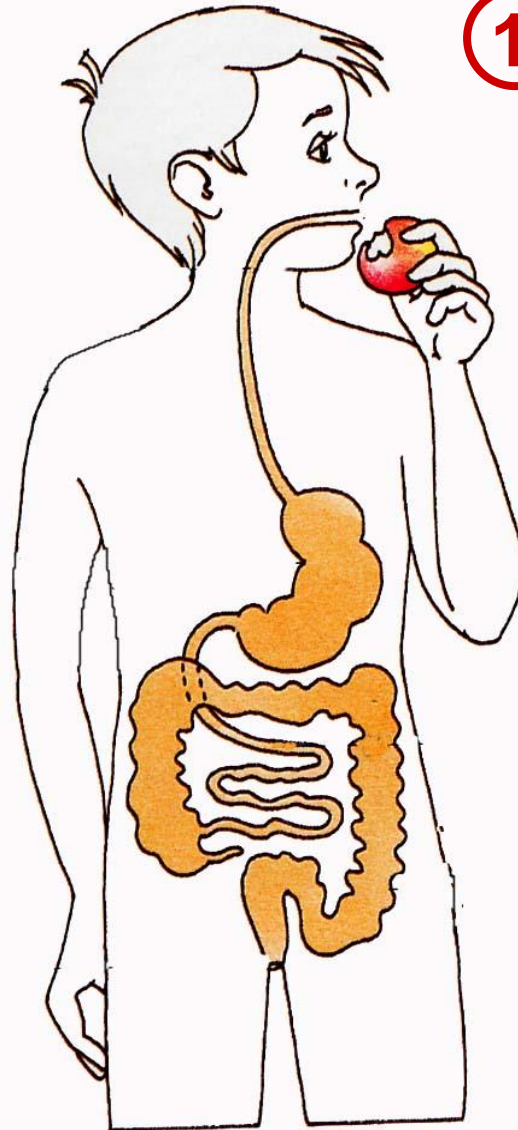
Successful Dieting – National Weight Control Registry

- 5000 people, ≥ 30 lb weight loss, ≥ 5 yr
- High-carbohydrate (55-60%), low-fat (24%) diet with the rest (~ 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 ≥ 1 x/wk & many still keep food dairies
- Much planned physical activity, 60-90 min/d, 1⁰ walking + looked for other ways to be active



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

Digestion Steps



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

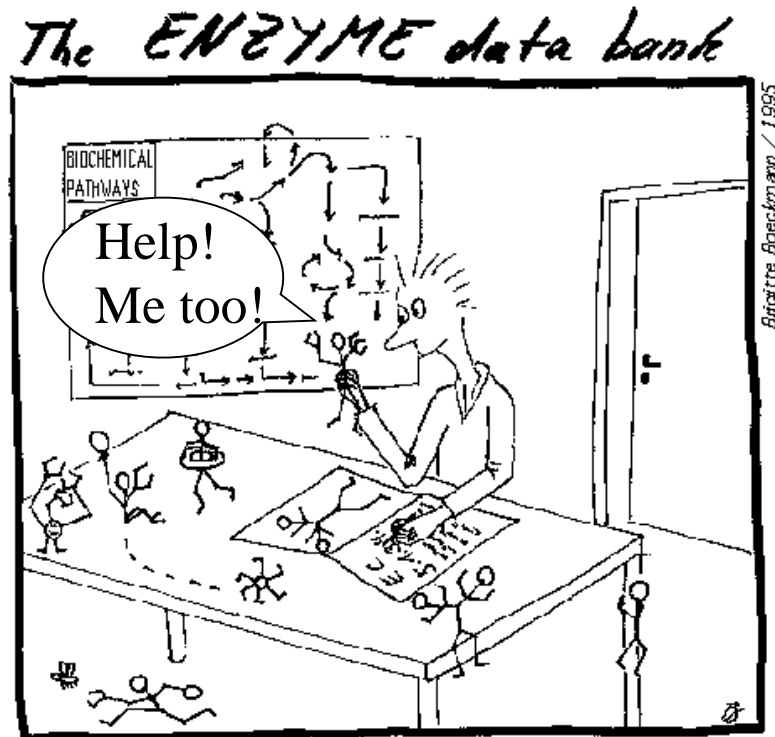
SOURCE: Dr. Eugene Evonuk, 1989. cf. L Sherwood, 2012 pp 437-8.

Hydrolysis of Energy Nutrients

Hi gang!!
You need me
for digestion!!



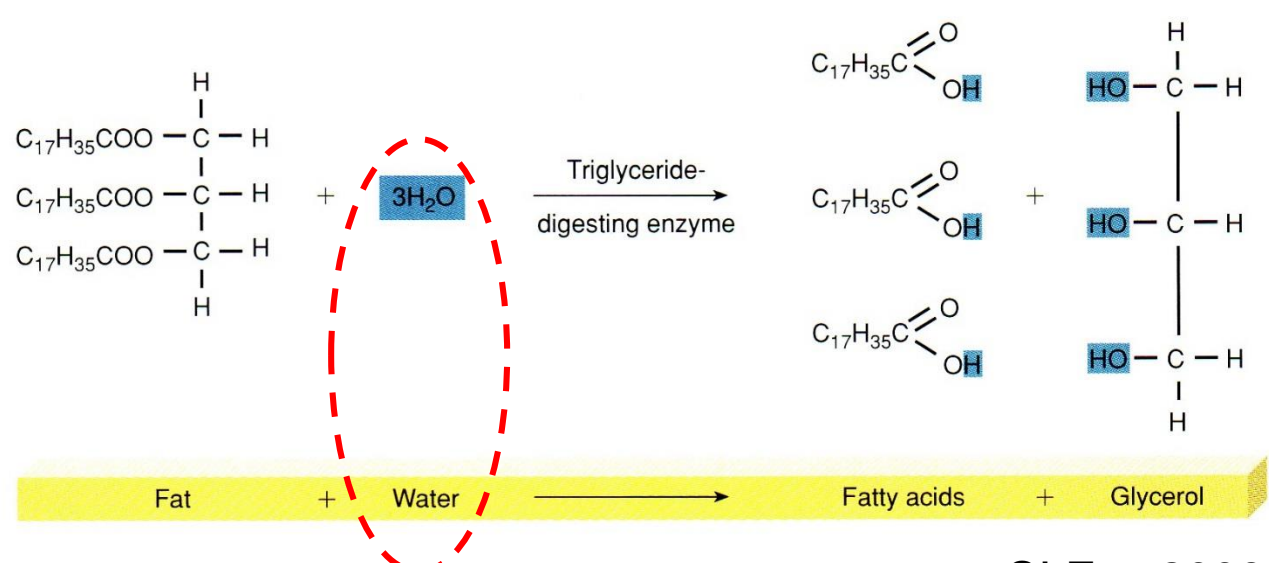
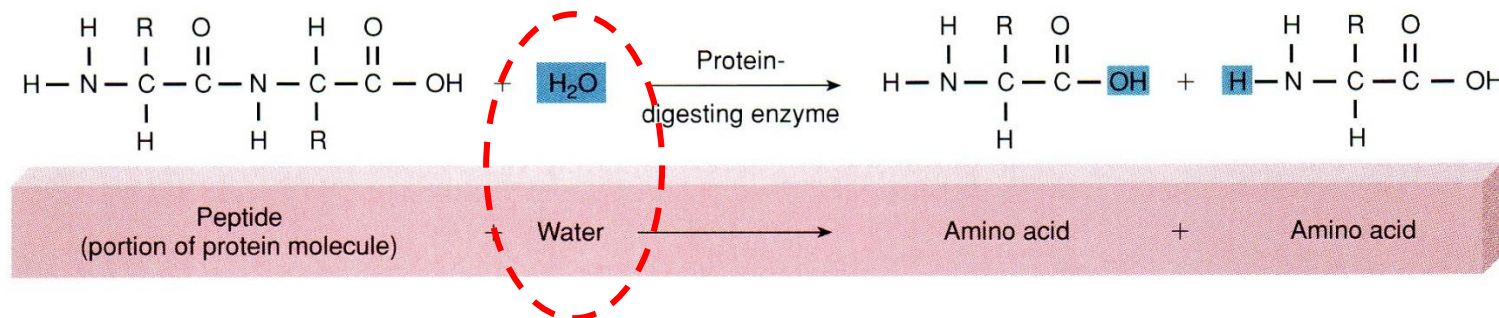
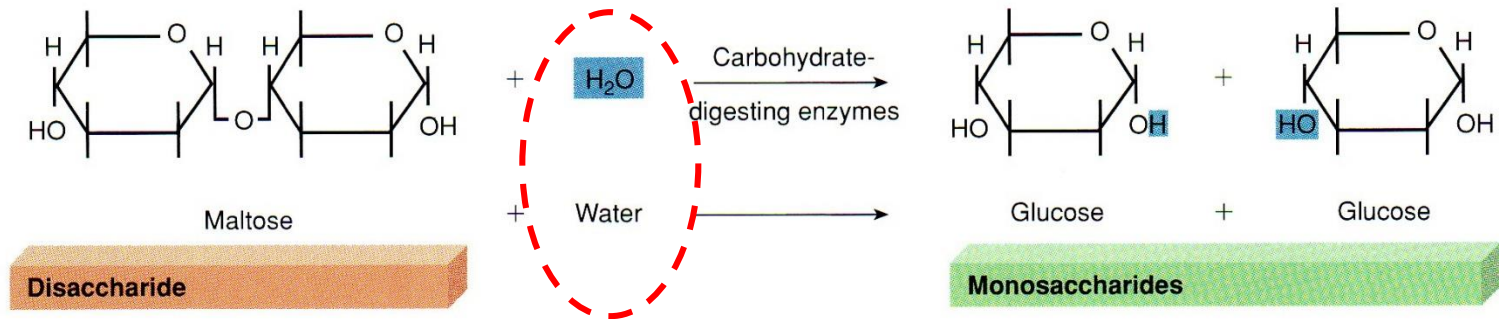
+



H₂O

+

Enzyme



BI 121 Lecture 7



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

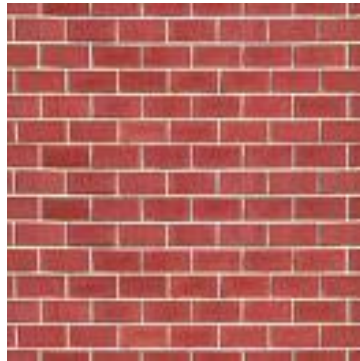


- I. Announcements** Exam I one week from today, Oct 23rd! Discussion+Review, Sunday Oct 21st, 6-7:30 pm, here! Q?
- II. Gastrointestinal Physiology** DC Mod 3 pp 17-23, LS ch 15+
 - A. Central-linking themes: hydrolysis, polymer to monomer
 - B. GI = Doughnut? Secretions: What? Where? Why? LS p 438
 - C. Control + Organ-by-organ review LS tab 15-1 pp 440-1 +...
 - D. Zymogen? = Inactive precursor LS fig 15-9 p 452...
 - E. Accessory organs? Pancreas, Liver, Recycling! pp 457-63
 - F. Small intestine? Ulcers? LS fig 15-20,15-22 pp 467-8
<http://www.cdc.gov/ulcer> *Beyond the Basics* LS p 456
 - G. 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+...

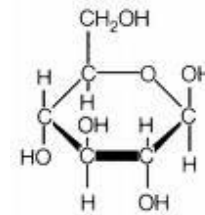
Polymer to Monomer (Many to One)



...Central-linking theme!!

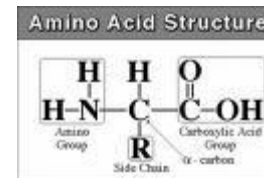


Carbohydrate

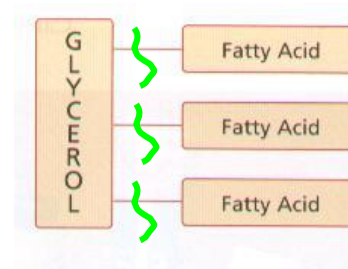
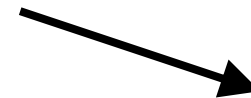


Glucose

Protein
+
Fat



Amino Acids



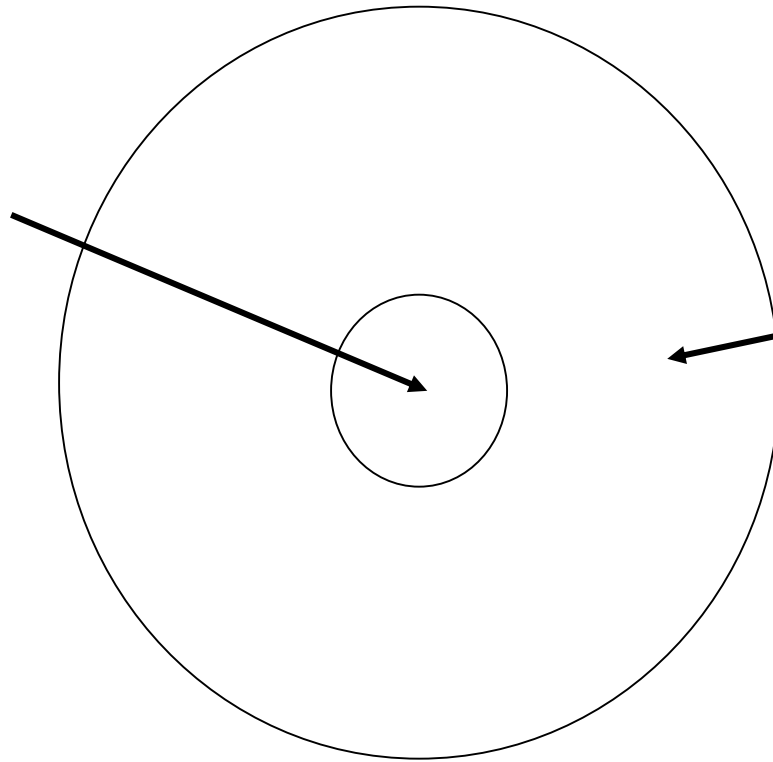
Fatty Acids
+
Glycerol



GI-Doughnut Analogy



GI Lumen



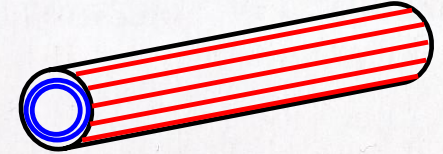
Body



Me?



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

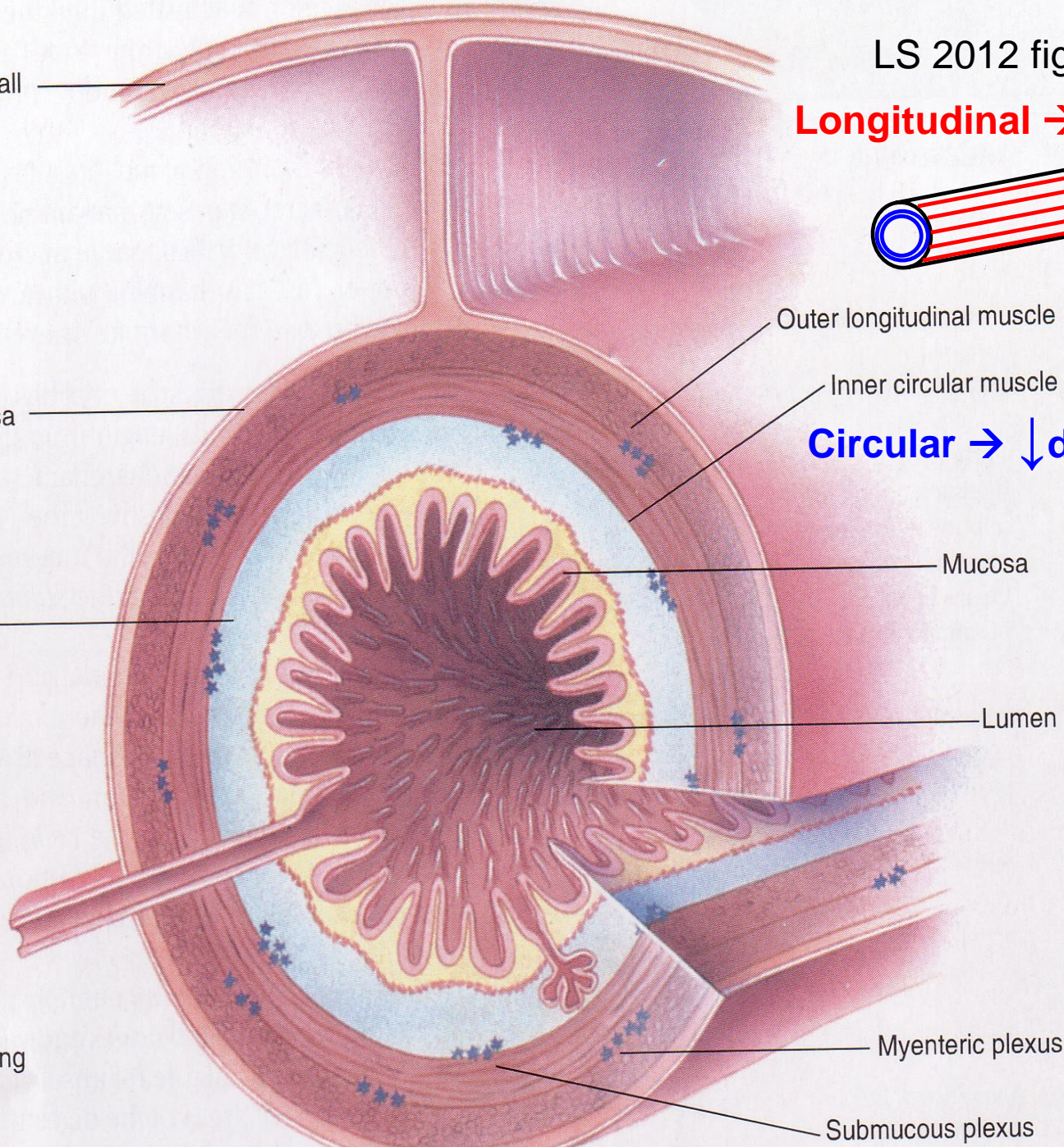
Muscularis externa

Mucosa

Lumen

Myenteric plexus

Submucous plexus



Gut Secretions

Secretion

Release Site

1. Mucus

into GI Lumen

2. Enzymes

into GI Lumen

3. H₂O, acids, bases+

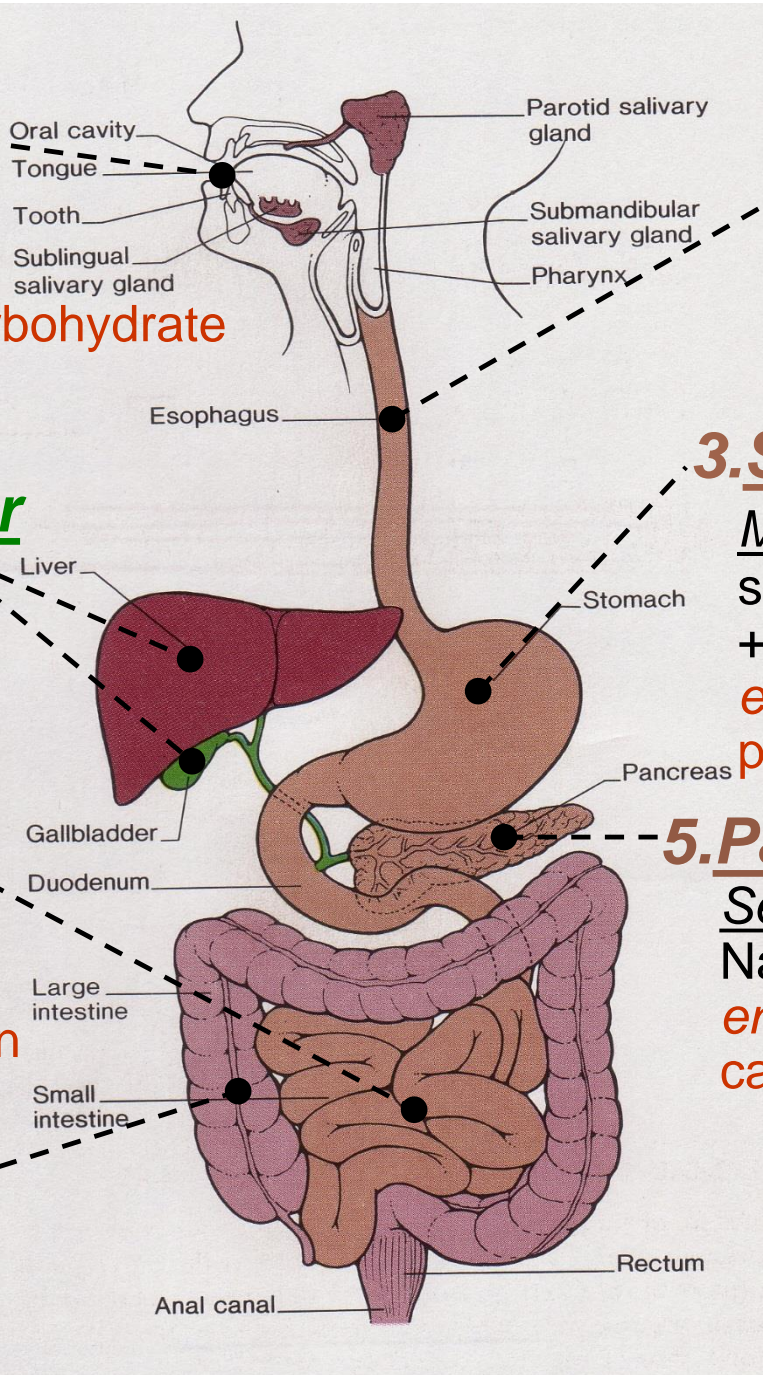
into GI Lumen

4. Hormones

into Blood

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 +
 NaHCO_3 + enzymes
enzymatic digestion:
carbohydrate, fat, protein

4. Liver-Gall Bladder

Emulsification =
detergent action of bile
+ secretion

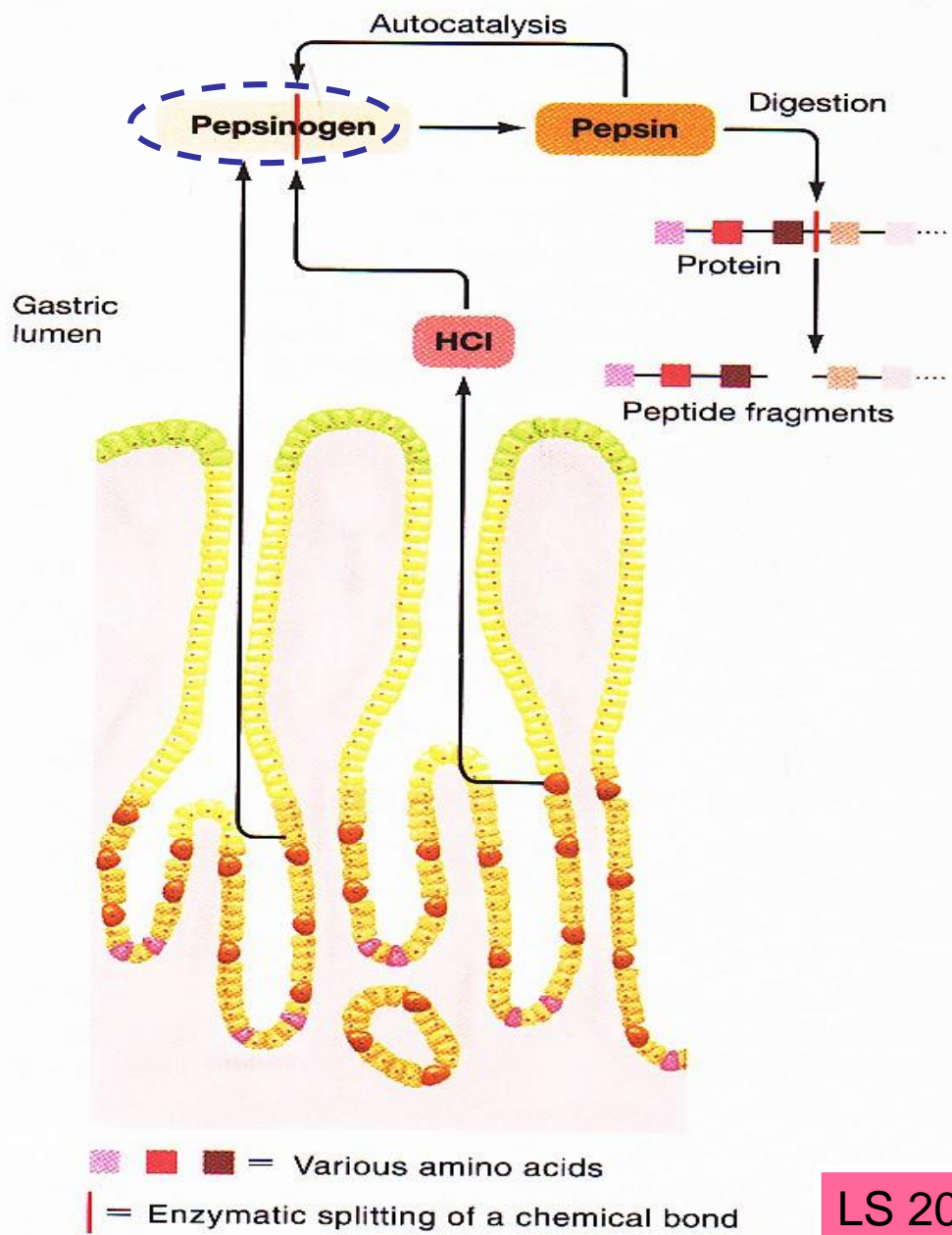
6. Small Intestine

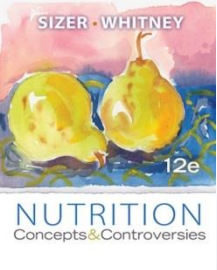
Absorption
Secretion mucus
+ enzymes
enzymatic digestion:
carbohydrate, fat, protein
Peristalsis

7. Large Intestine

Dehydration
secretion + absorption
storage + peristalsis

Zymogen=
an inactive
precursor





Why Do Some People Have Trouble Digesting Milk?

- Ability to digest milk carbohydrates varies
 - Lactase
 - Made by small intestine
- Symptoms of intolerance
 - Gas, diarrhea, pain, nausea?
- Milk allergy?
- Nutritional consequences
- Milk tolerance and strategies



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.

BI 121 Lecture 8

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



- I. Announcements** **Exam I next session; 1 & 2 pm lab sections go directly to 13 KLA & 21 KLA. All others (except AEC) here (100 WIL)! Review: Sunday, 6 pm 123 PAC! Lab Manuals. Q?**
- II. Cardiovascular Connections** LS 2012 ch 9, Torstar Books+...
- 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

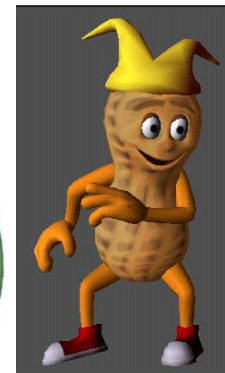
C. How to minimize risk of CVDs? Treatment triad:

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

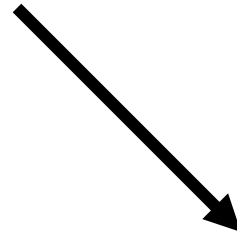
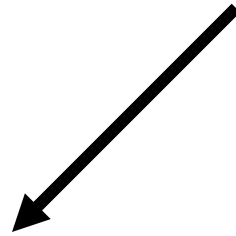
D. Food choices
make a difference?

Plant-based diet!

What's HAPOC?



Cardiac Cycle

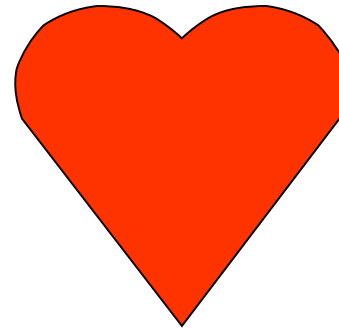
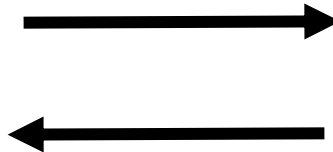
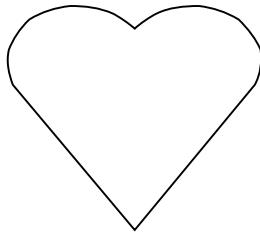


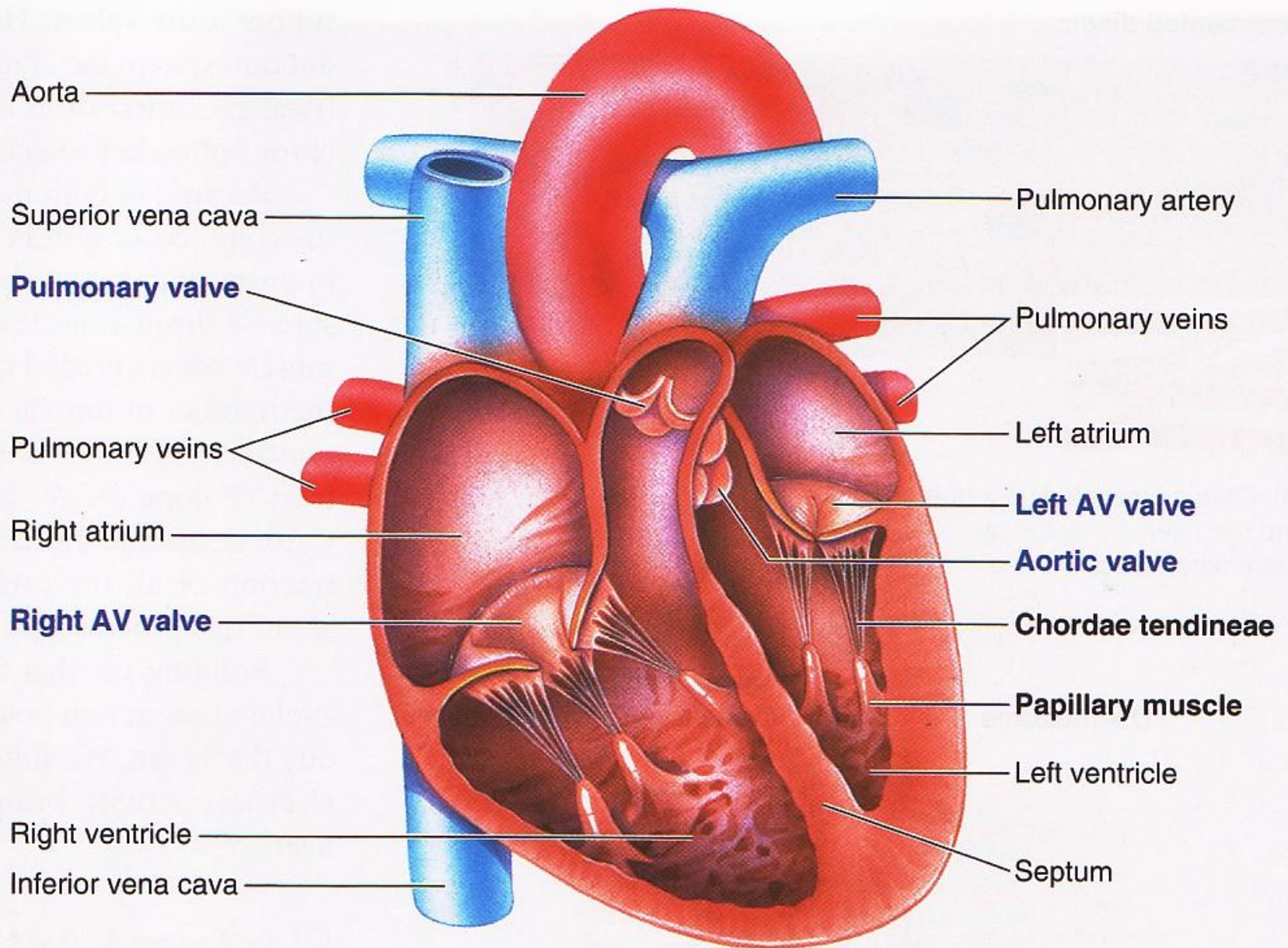
Systole

Contract
& Empty

Diastole

Relax
& Fill





(a) Location of the heart valves in a longitudinal section of the heart

Heart Valves Ensure Unidirectional Blood Flow!



Right AV valve



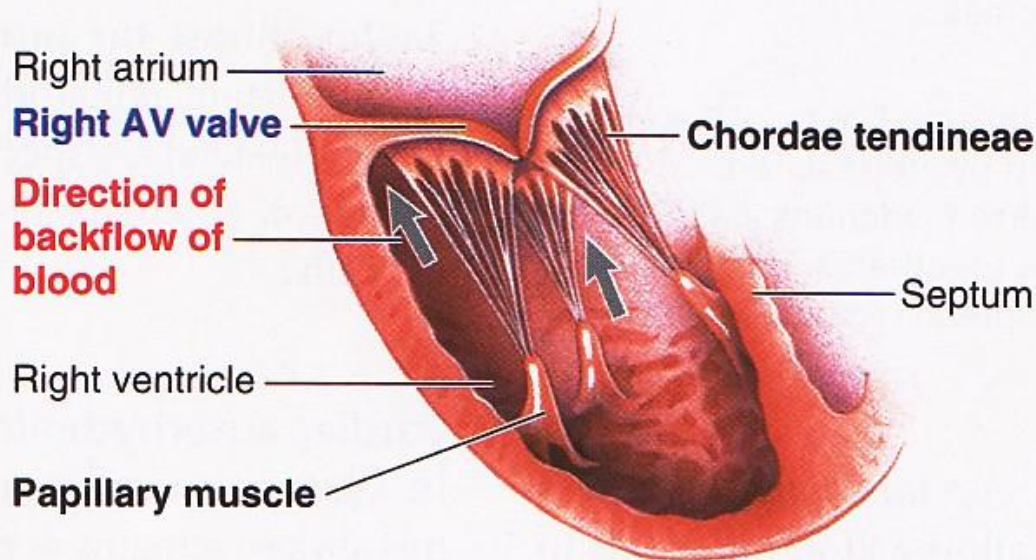
Left AV valve

Mom's valve!



Aortic or pulmonary valve

(b) Heart valves in closed position, viewed from above



(c) Prevention of eversion of AV valves

● **FIGURE 9-4** Heart valves.

Valves must be normal & healthy to work well!



Human ♥ = 4 unique valves?
2 valve sets?

Semilunar = Half-moon shaped

More
rigid

1. Pulmonic/Pulmonary
2. Aortic

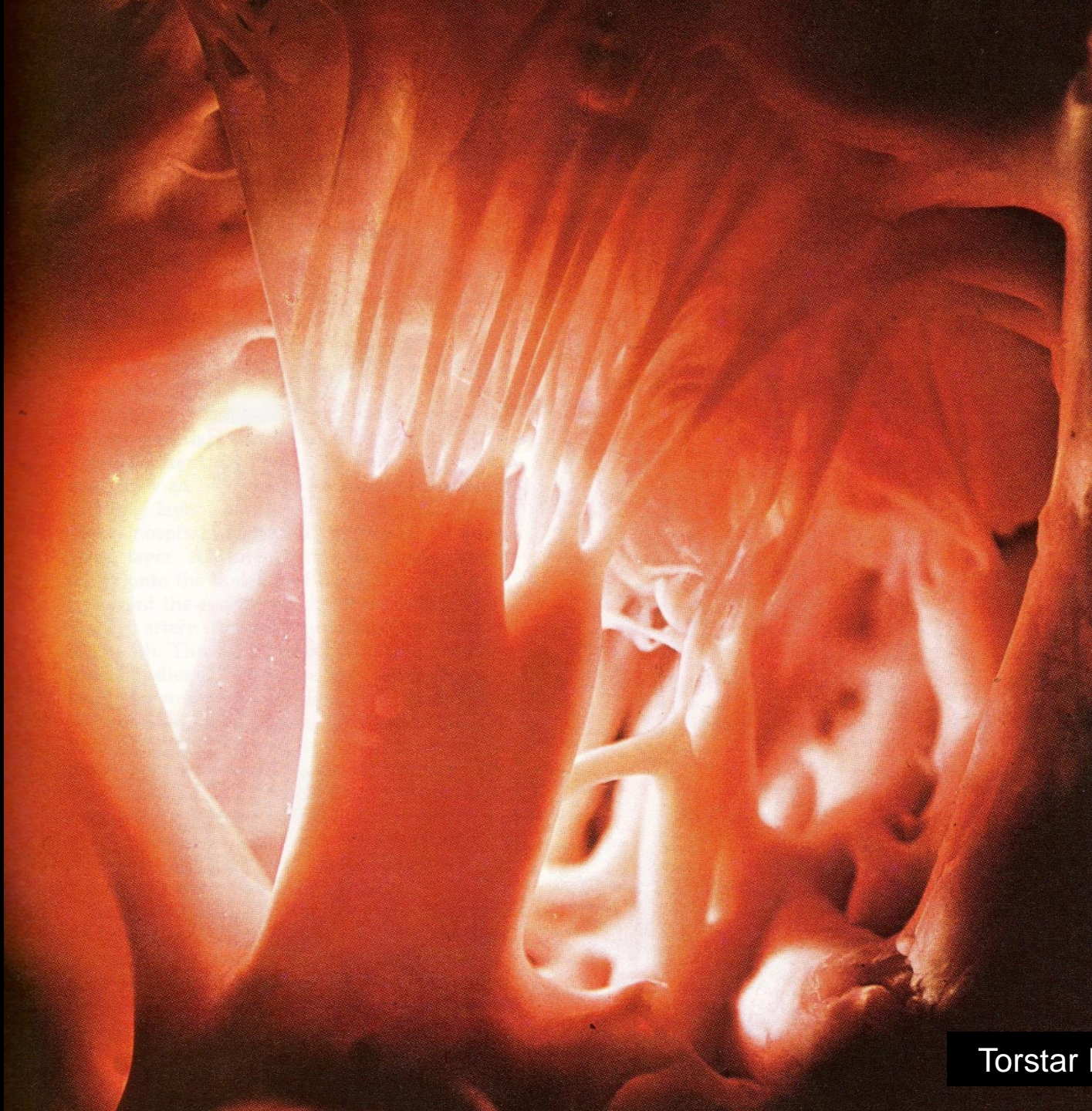


AV = Atrioventricular

More
flimsy

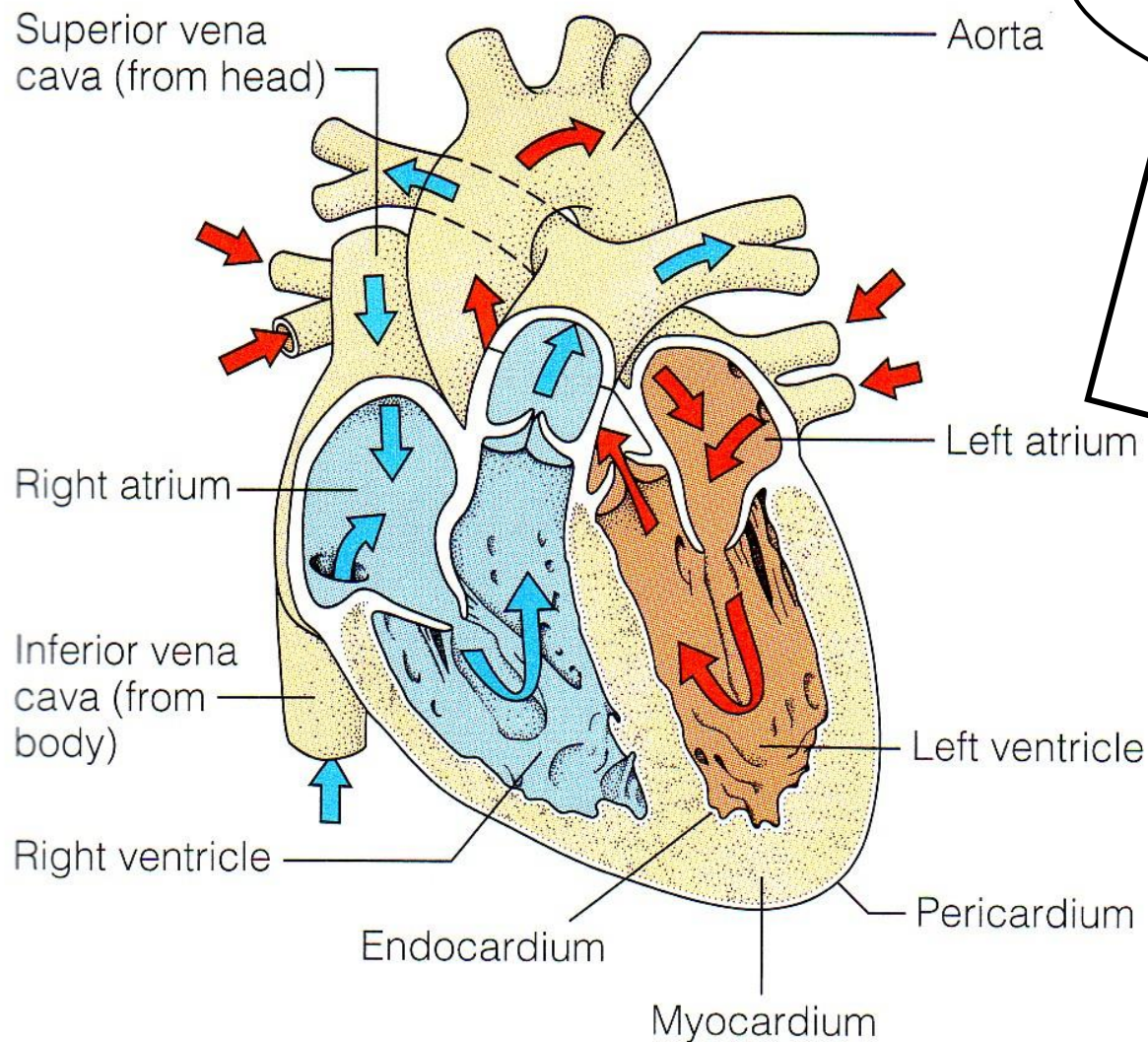
3. (R) AV = Tricuspid
4. (L) AV = Mitral/Bicuspid



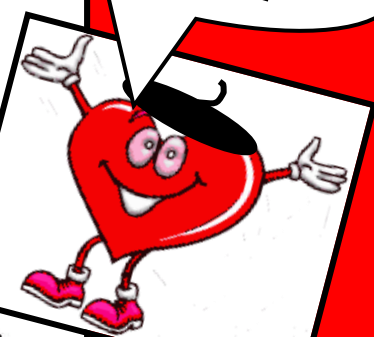


Torstar Books 1984

Veins → Atria → Ventricles → Arteries



VAVA!



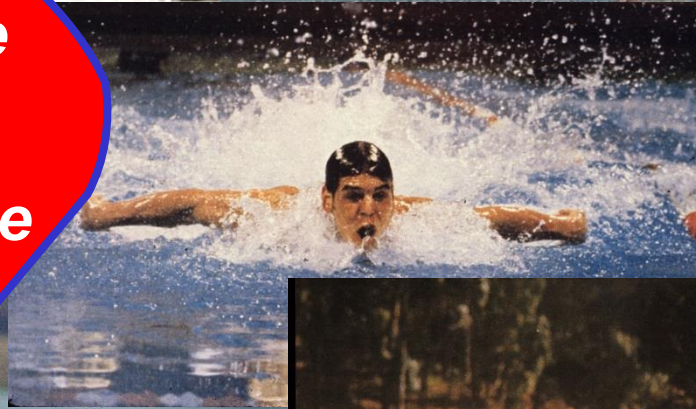
LS2007

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

How much aerobic?



Continuous exercise
≥ 50% muscle mass
≥ Conversational pace
20-60 min/session
3-5 days/wk



<https://www.acsm.org/acsm-positions-policy/official-positions/ACSM-position-stands>
<https://www.ncbi.nlm.nih.gov/pubmed/21694556>

How much strength?

- ✓ 2-3 days/wk
- ✓ 8-10 exercises for major muscle groups
- ✓ ≥ 1 set/exercise
- ✓ 8-12 (most) or 10-15 (frail/ $> 50-60$ yr) repetitions/set



CVDs

AMI

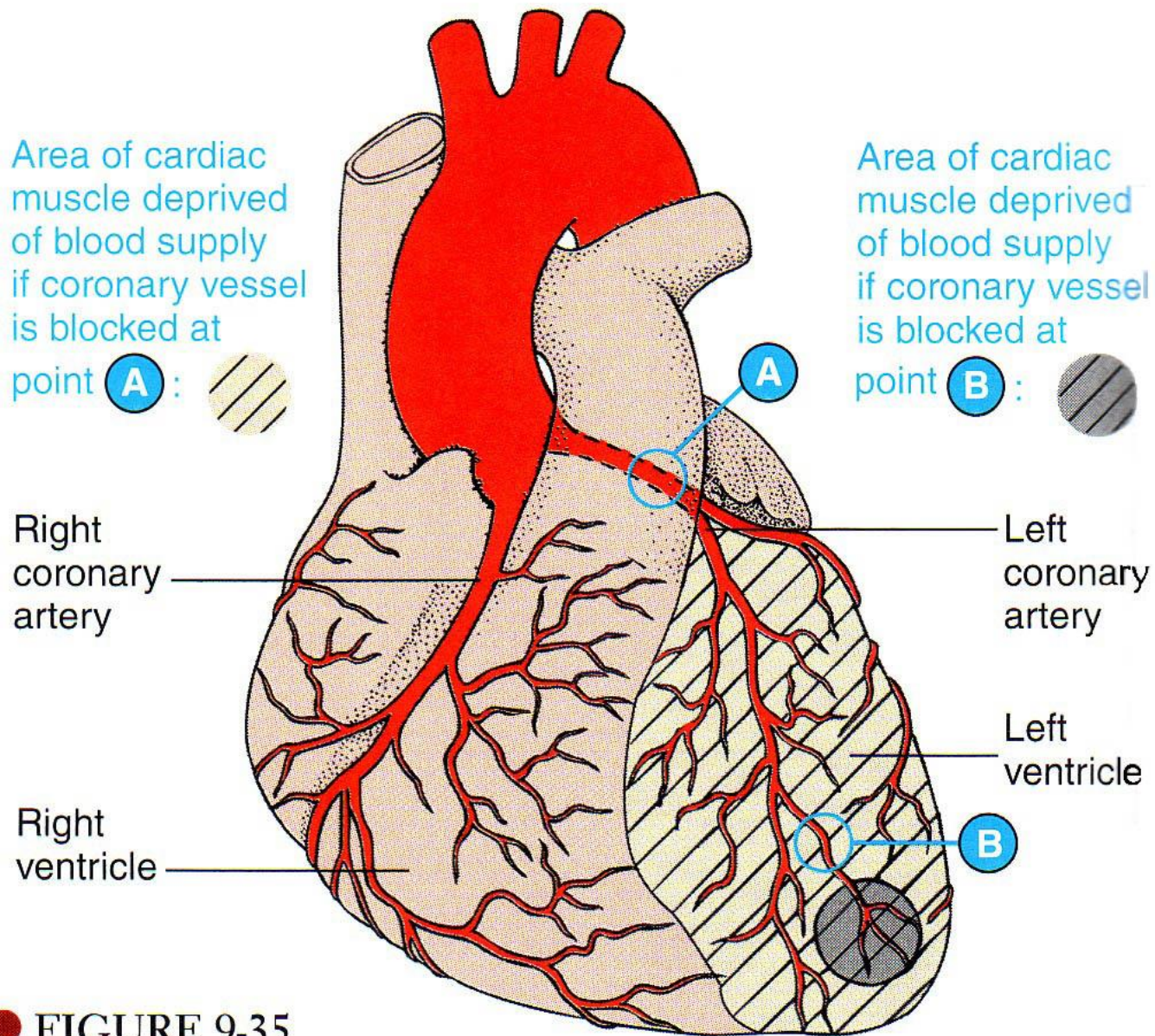
CVA



TIA

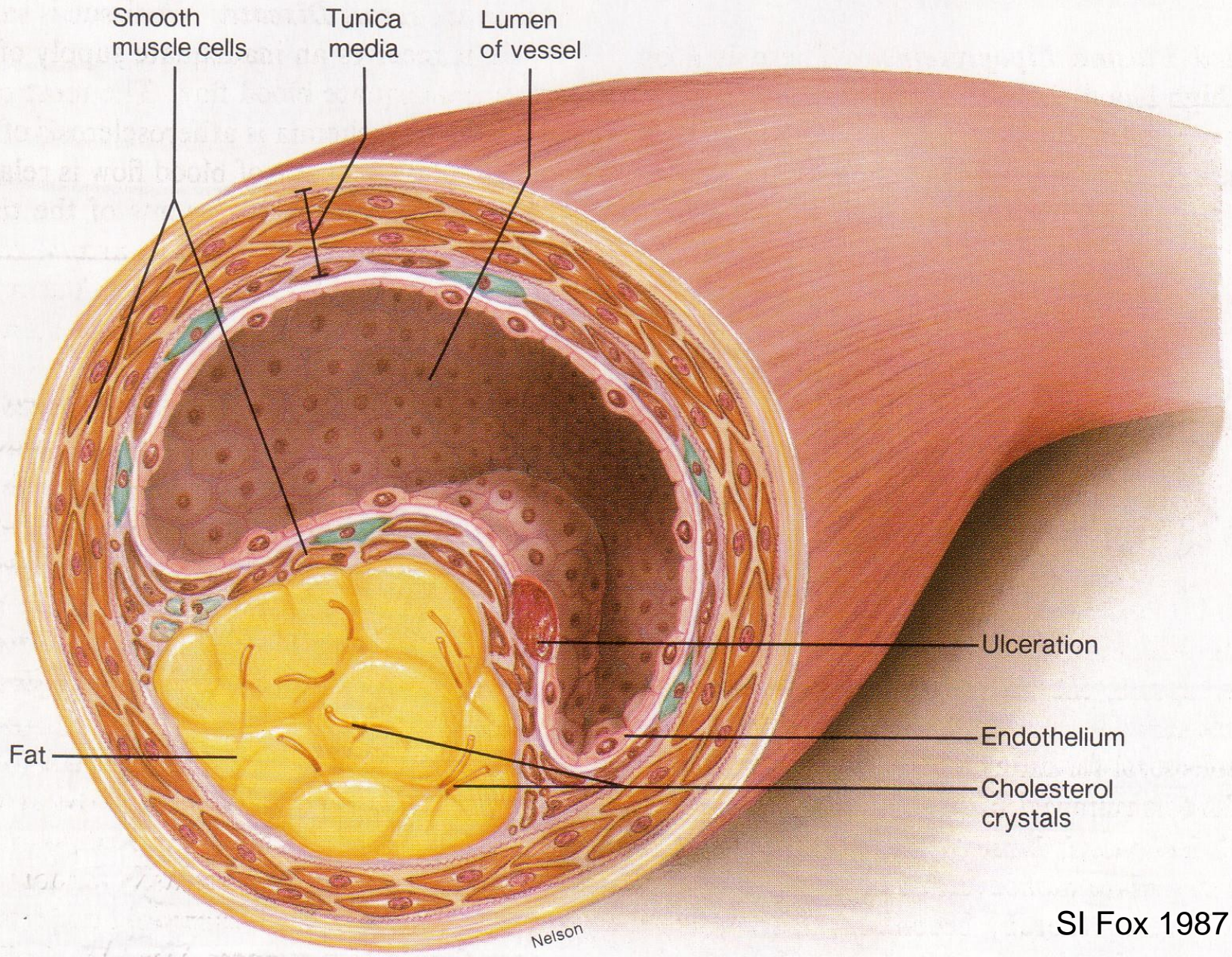
HTN

PVD



● FIGURE 9-35

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



Smooth muscle cells

Tunica media

Lumen of vessel

Fat

Ulceration

Endothelium

Cholesterol crystals

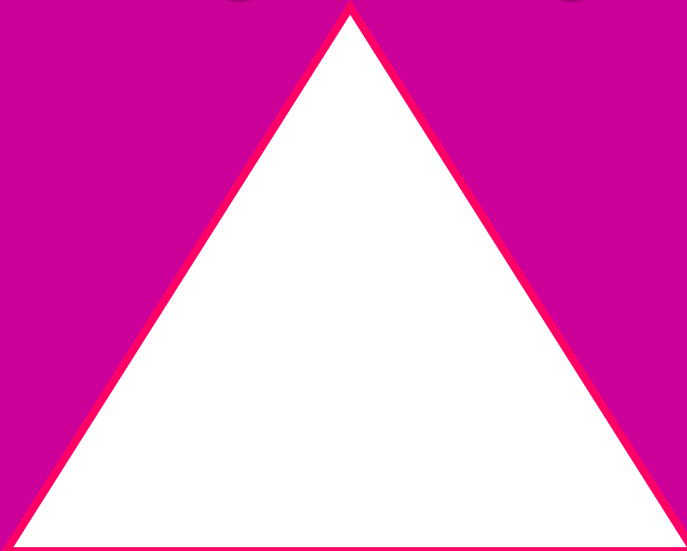
Nelson

Treatment Triad

NB: Last blasted resort!!

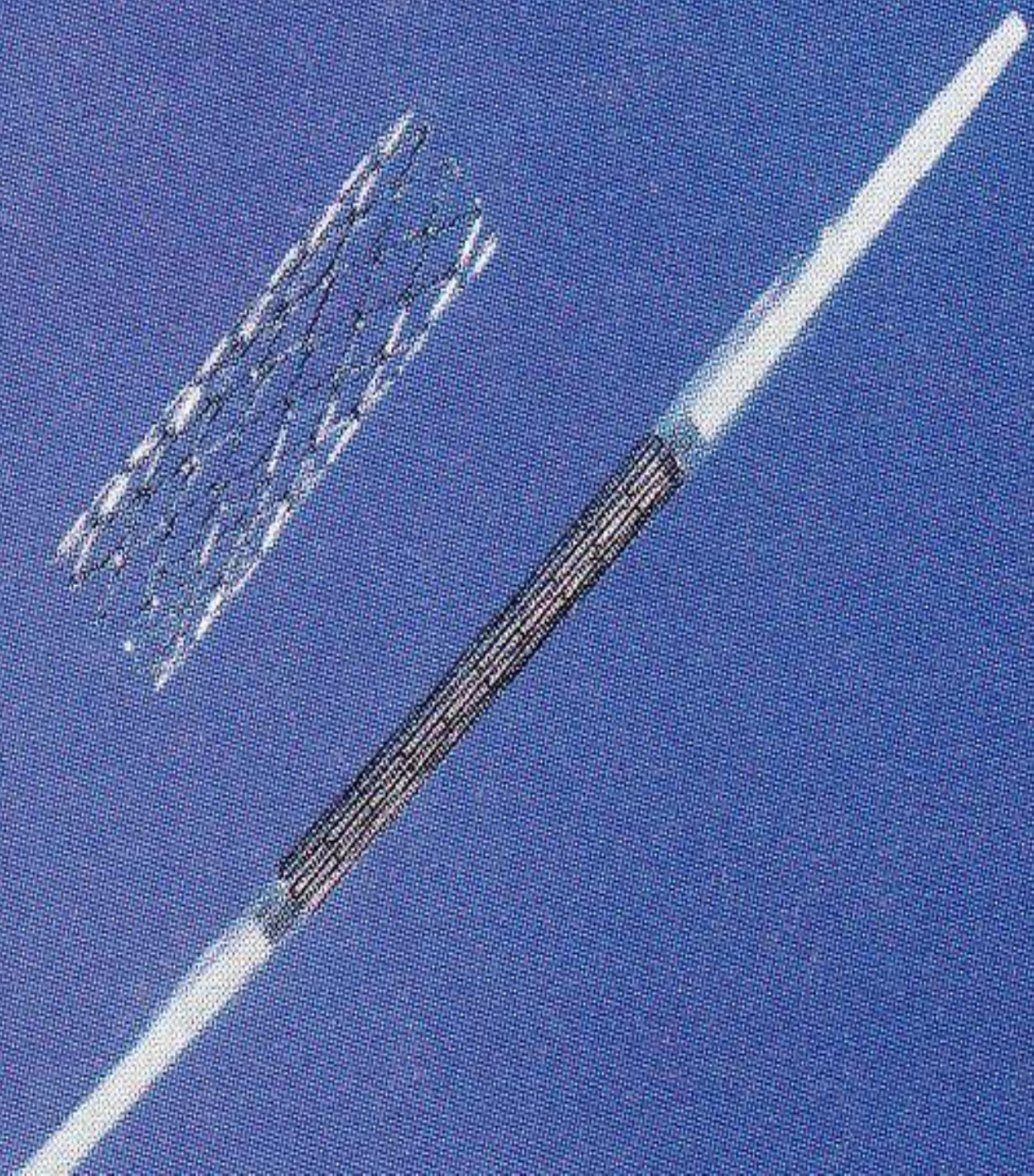


Drugs/Surgery



Exercise

*Dietary
Modification*



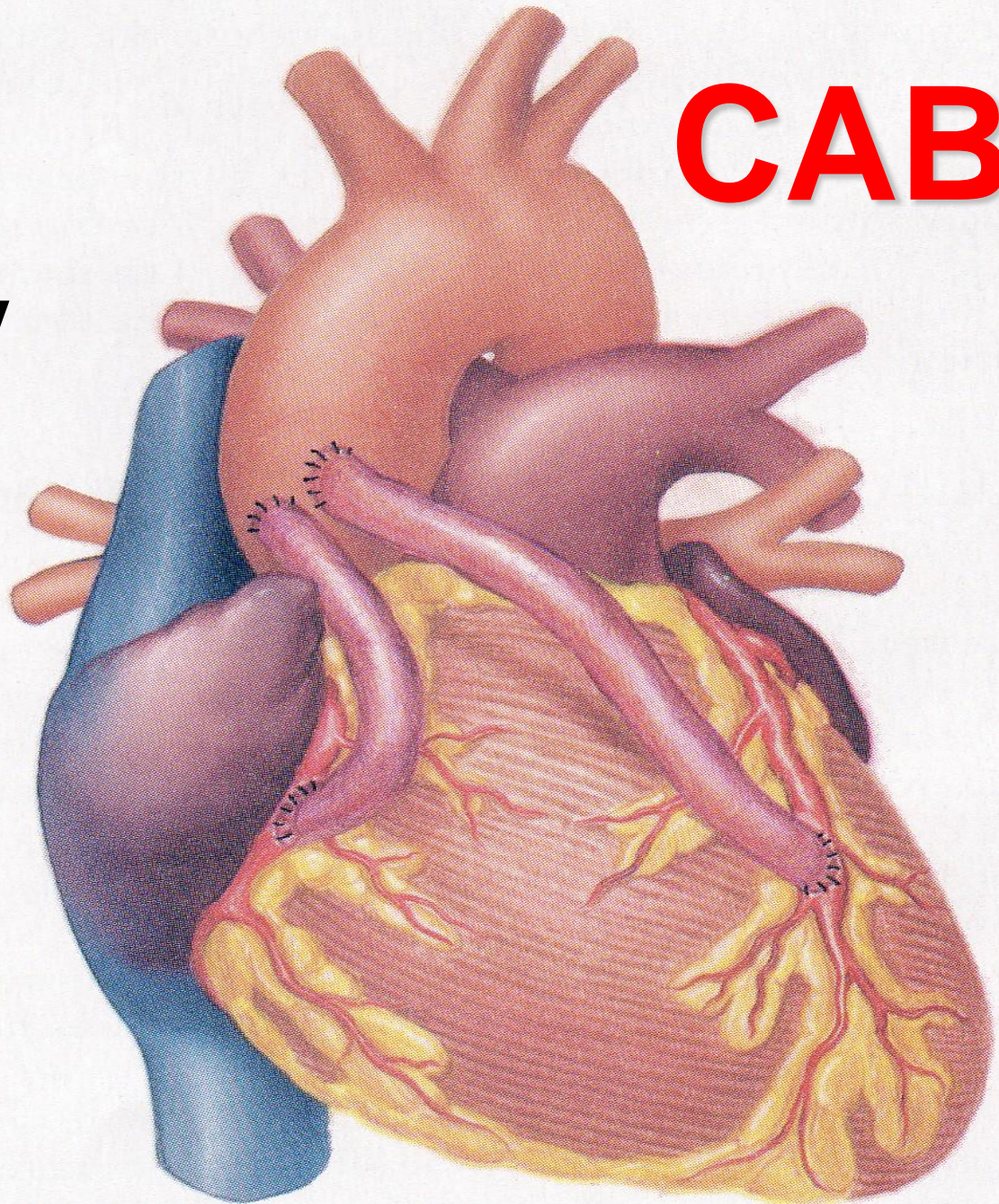
CABG

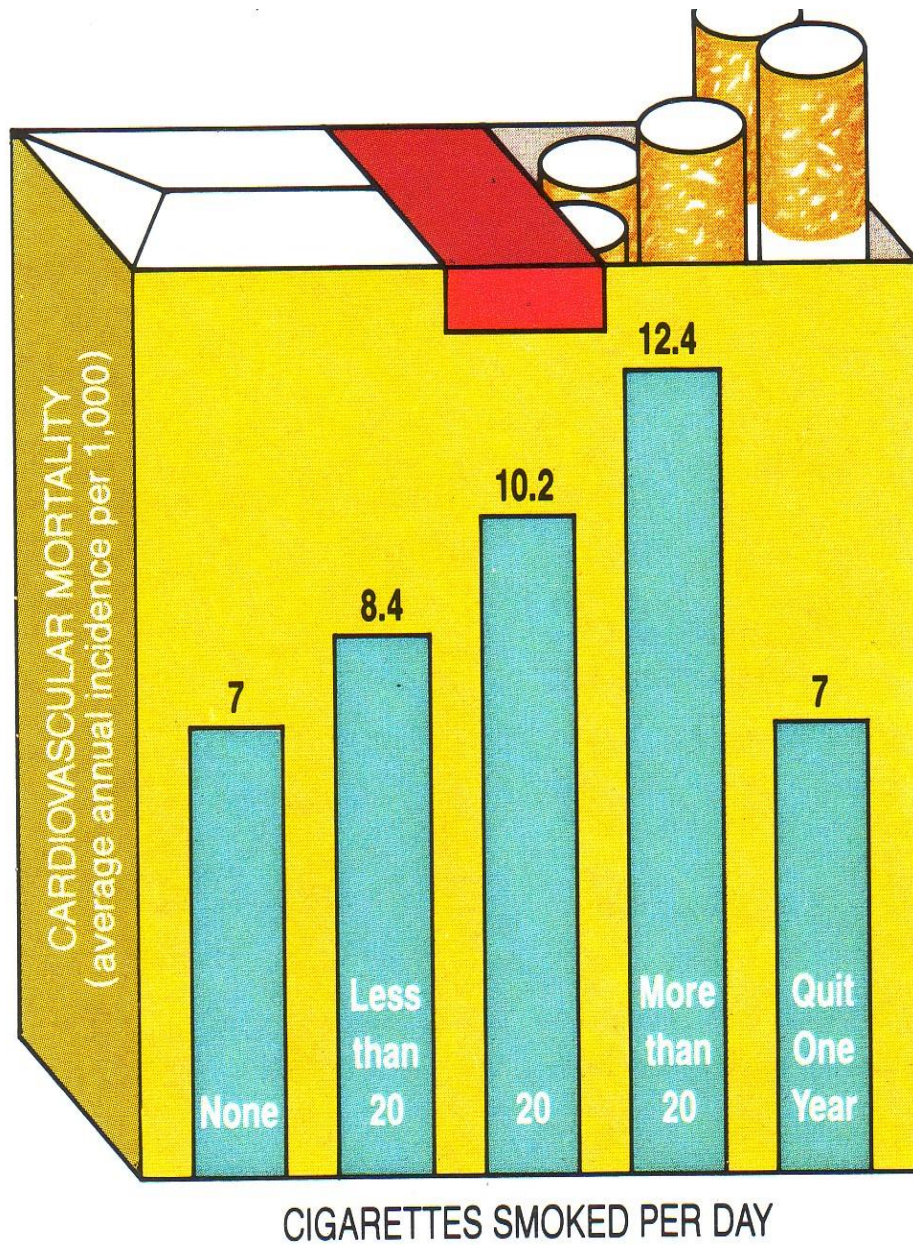
Coronary

Artery

By-pass

Graft



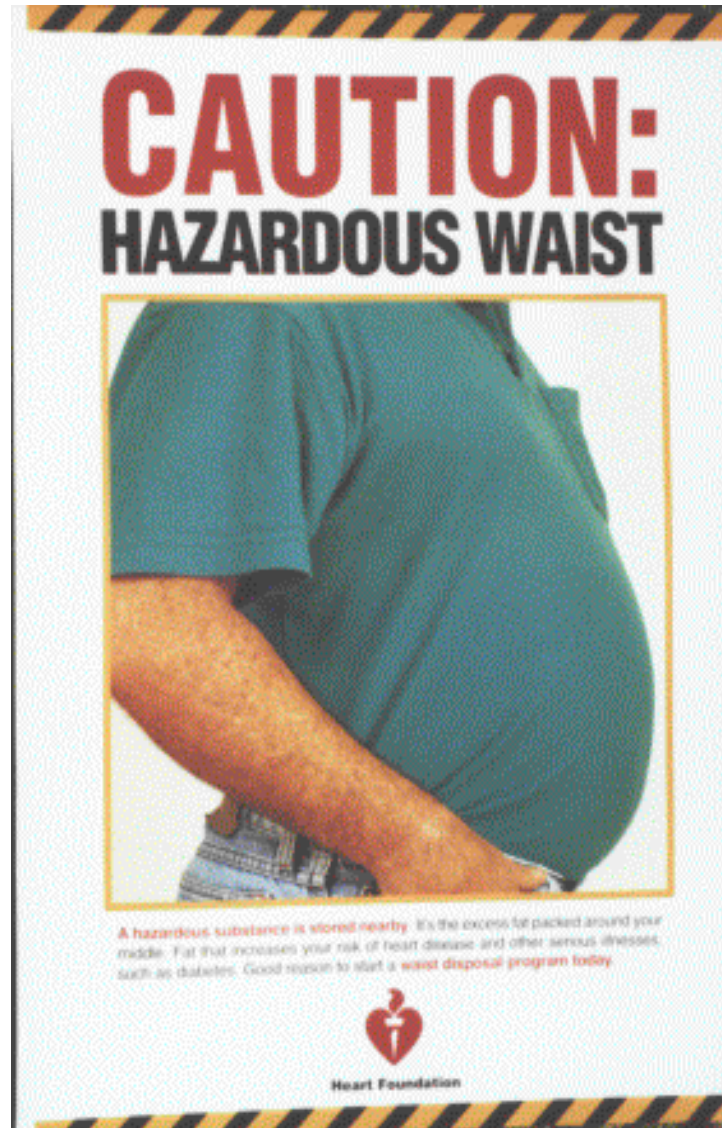


Apple type of obesity predisposed to CVD!

Pear type of fat pattern...



implies lower disease risk!

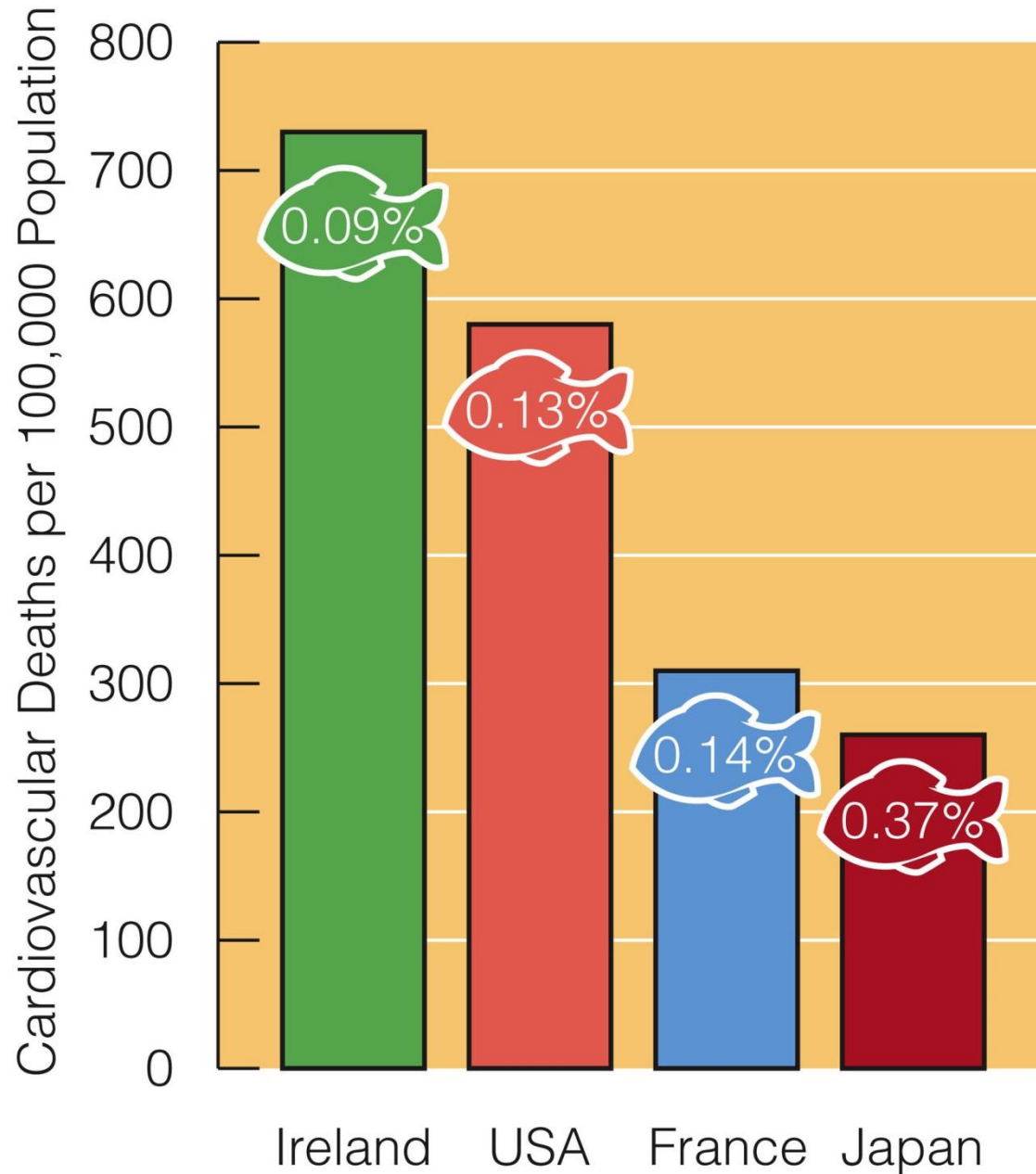


Eat more apples...



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

