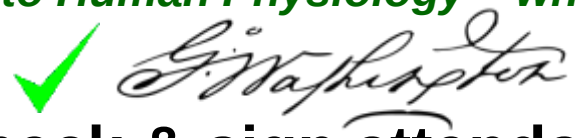
...Welcome to Human Physiology – what makes us tick!



BI 121 Lecture 1

I. *Announcements*: Please check & sign attendance roster. Not on list? See Pat during break/>class. *Lab 1 Histology* Thursday, 10 am – 5 pm sections in 130 HUE. 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 *vs* **PHYSIOLOGY**

STRUCTURE *vs* **FUNCTION**

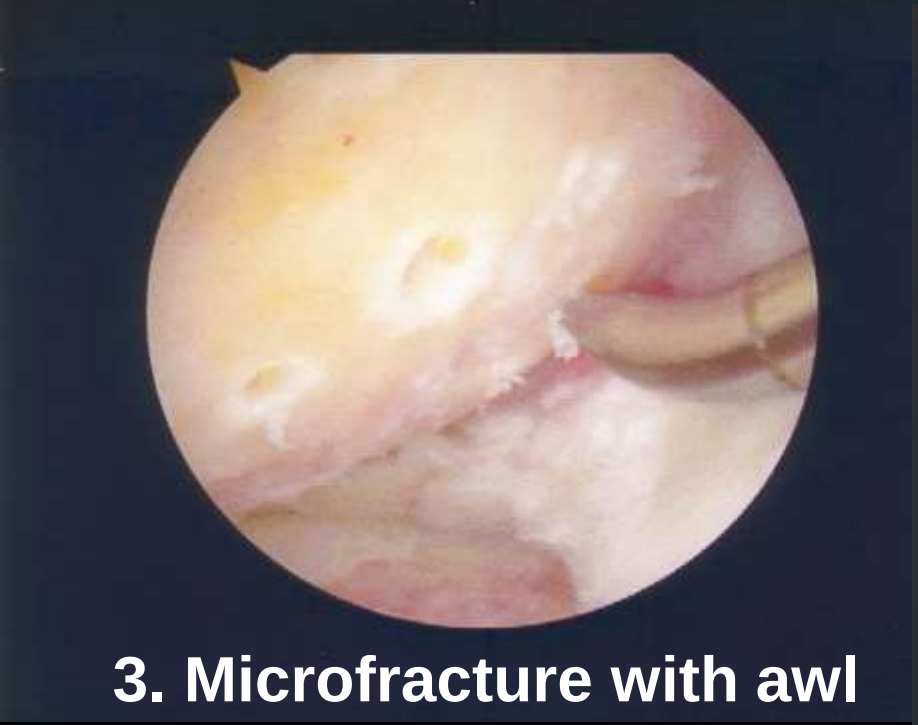
WHAT? *vs* **HOW?**

WHERE? *vs* **WHY?**

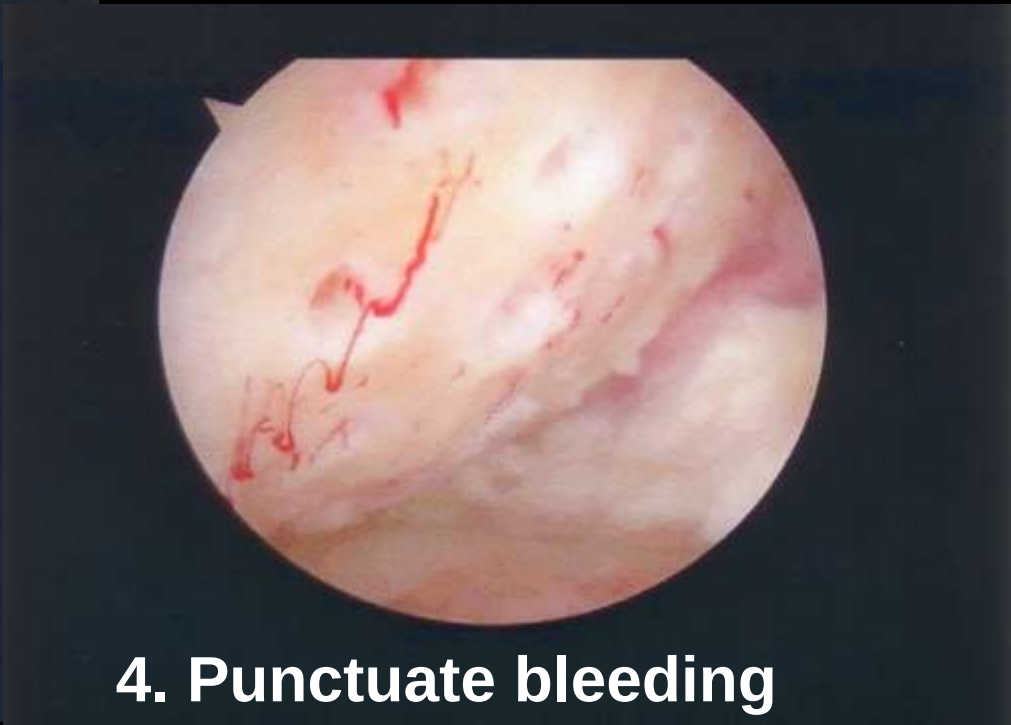
vs

1. Arthroscopy clean-up

2. Debridement complete



3. Microfracture with awl



4. Punctuate bleeding

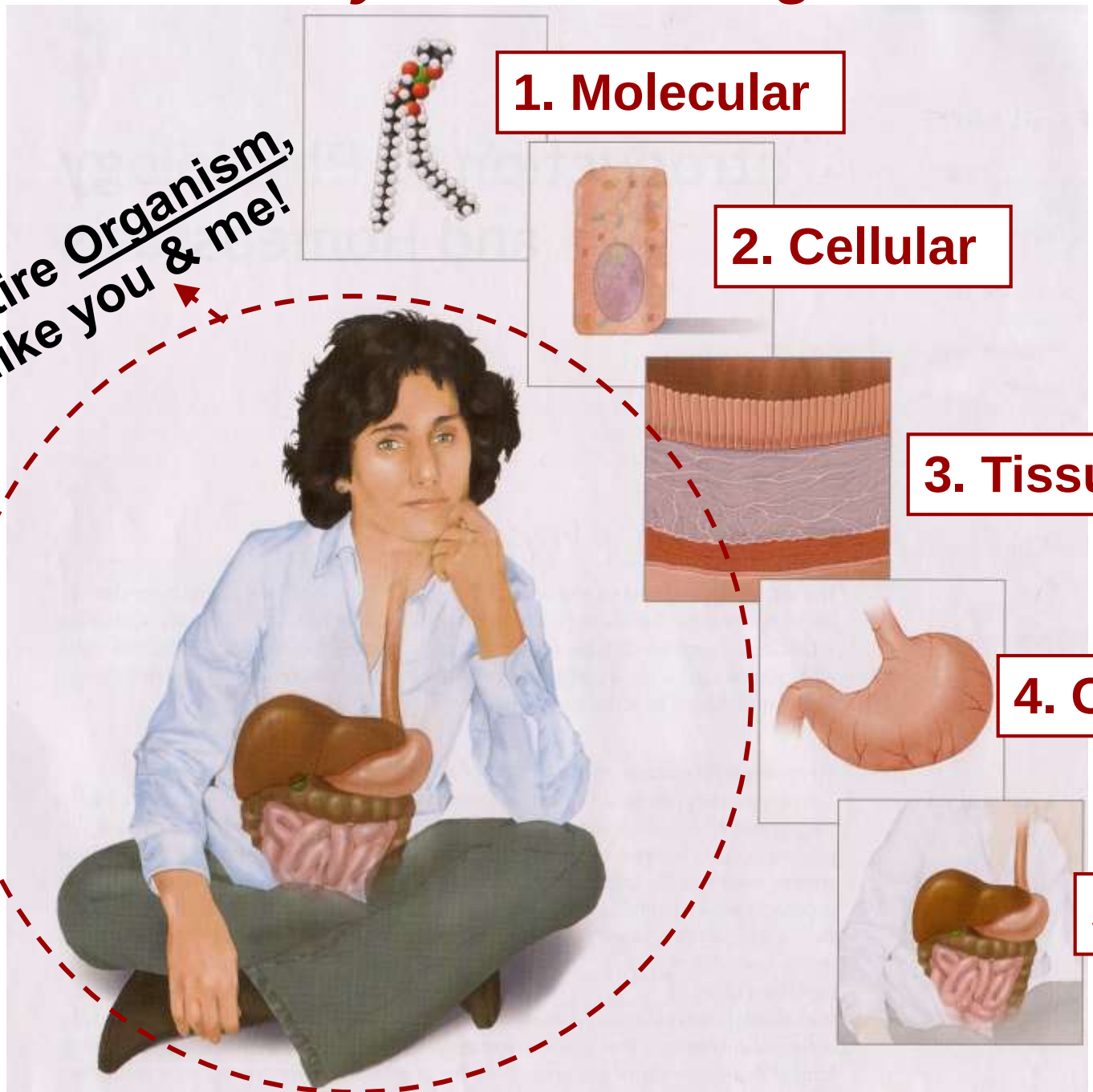
High-Tibial Osteotomy (HTO) to Realign the Joint

1. Oscillating saw cut

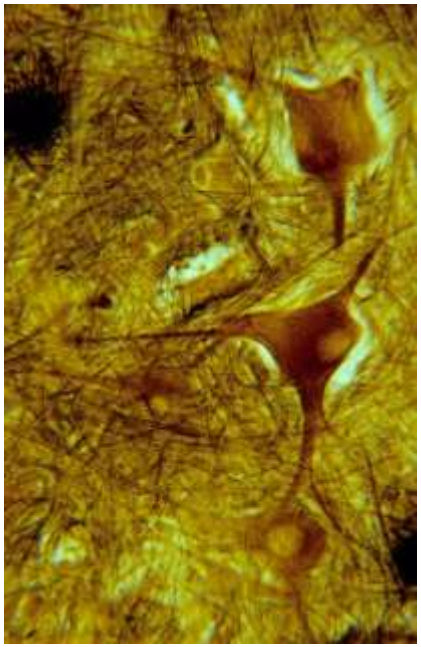
2. R plate/scaffolding insert

3. Align, stabilize w/screws & pack defect

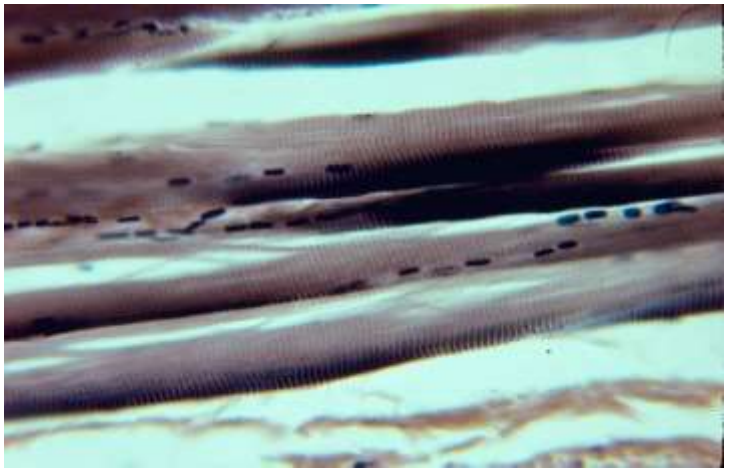
Body Levels of Organization



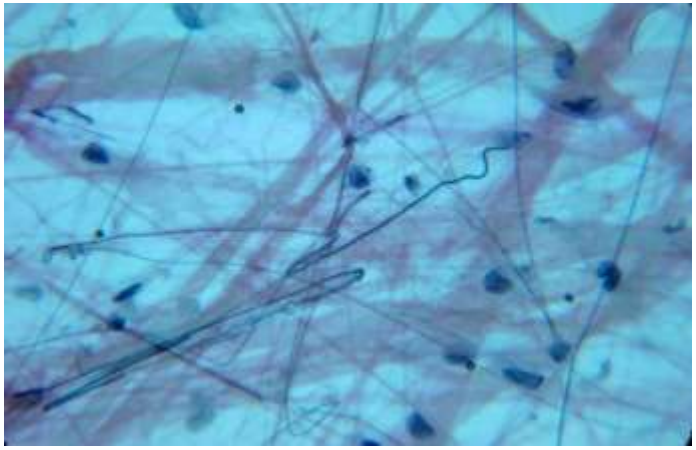
LS fig 1-1 p 2



Nerve conducts



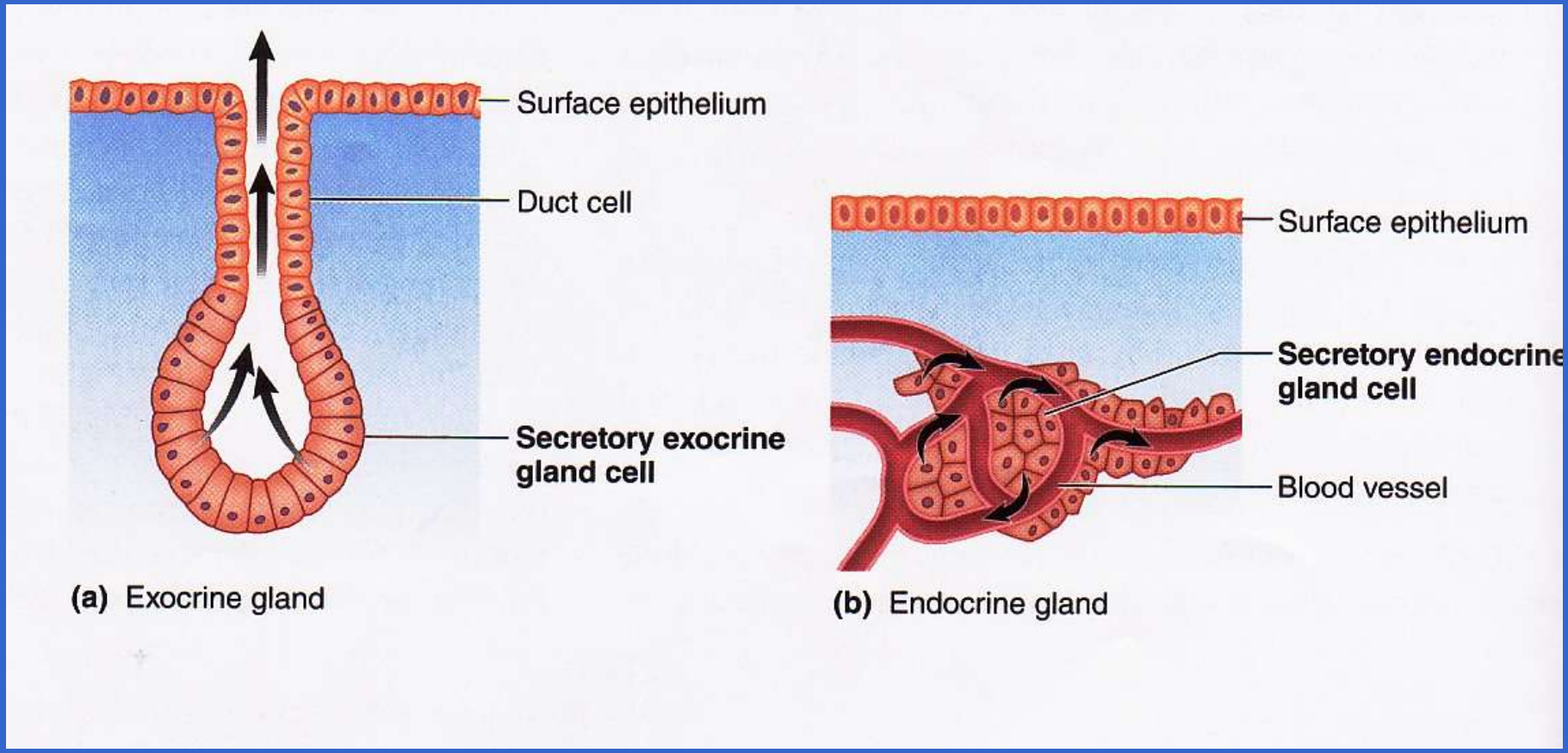
Muscle contracts



Connective connects!!

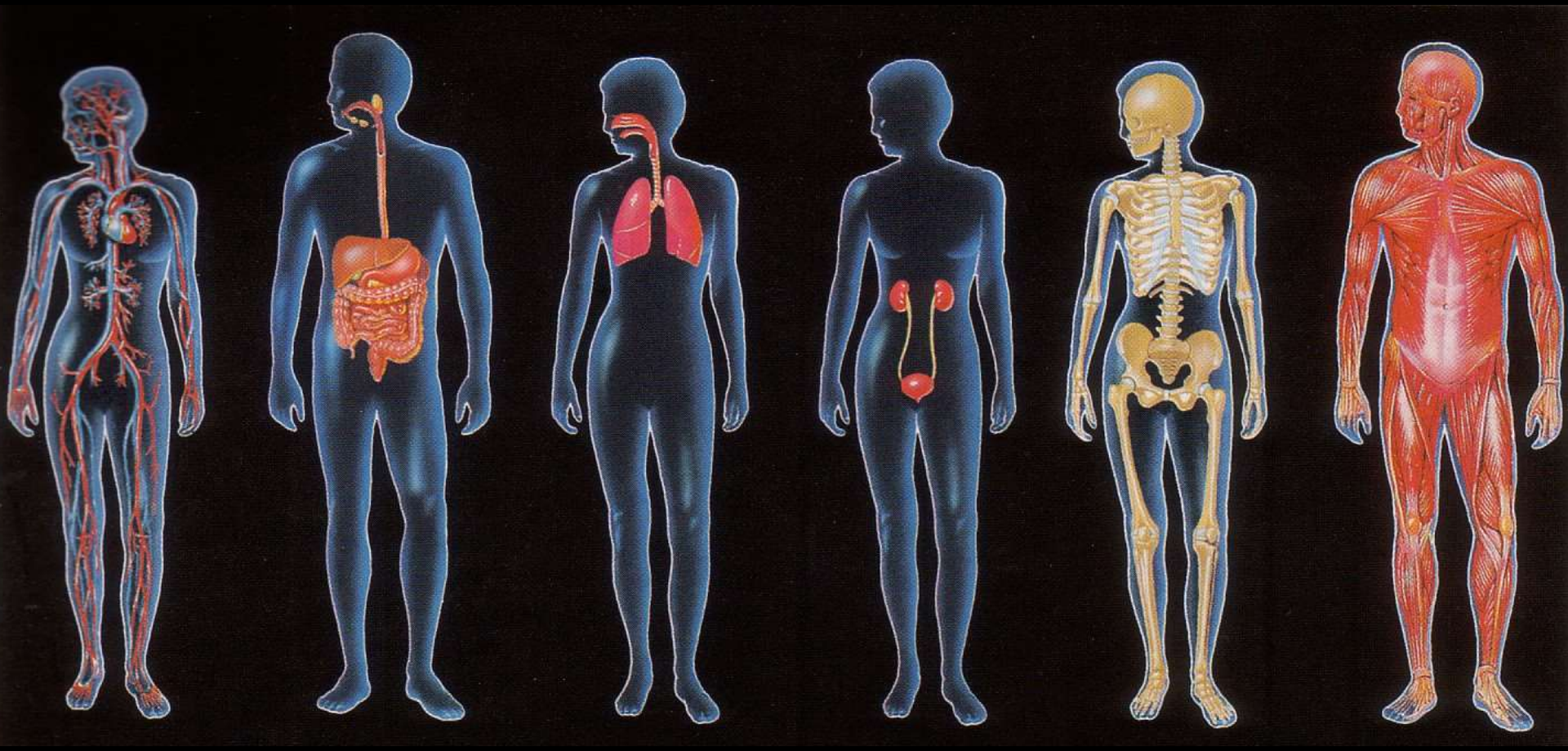
Epithelial covers

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



LS fig 1-3 p 4

Which body systems?



LS fig 1-4 p 6

Bl 121 Lecture 2

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

I. ***Announcements*** **Lab 1 Histology today! 130 HUE. Fun! Readings: DC, LS, LM? *NB*: UO Biology blog *vs.* Canvas *http://blogs.uoregon.edu/bi121/fall-2017/***

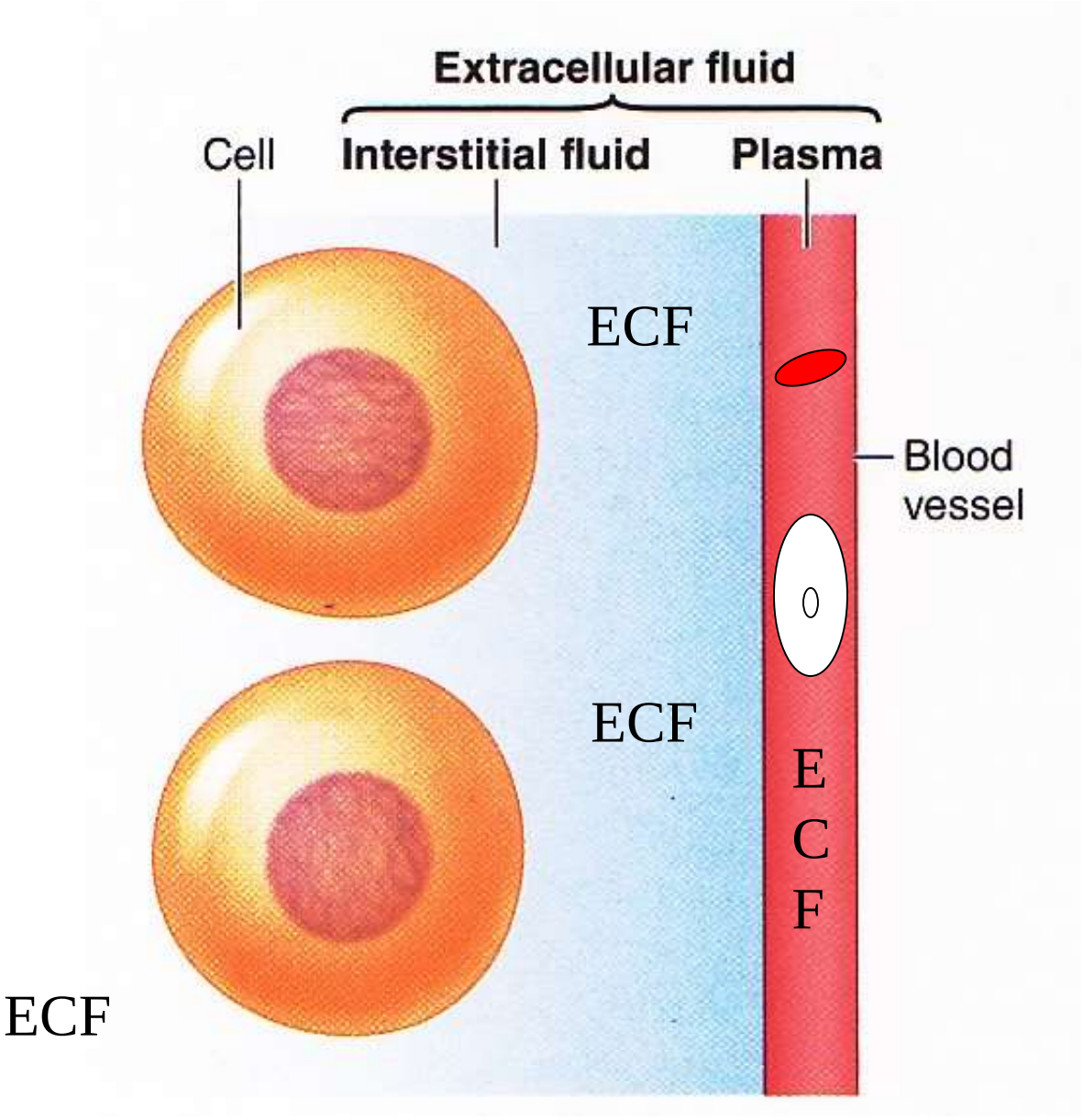
II. ***Homeostasis*** **LS ch 1, DC Module 1**

- 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_2O? Are we like watermelons?**
- F. ***How*** **are balances maintained? Simplified Homeostatic Model *cf:* LS fig 1-7 p 14; T^oC + 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**

Where is extracellular fluid?



LS fig 1-5 p 7

ECF = Extracellular

Plasma

(within CV System)

Interstitium

(eg, between muscle cells)

ICF = Intracellular

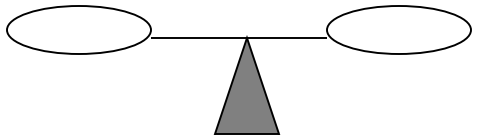
https://www.youtube.com/watch?v=B658Yn3INYc

Homeostasis
or
Homeokinesis?

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

Metabolic

ANA- CATA-

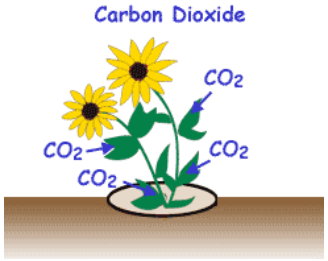


H_2O

T^oC

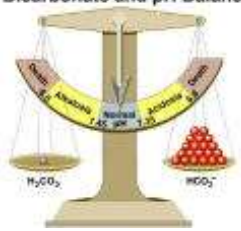
Dr. Evonuk's 6 Balances

O_2/CO_2



$Ion^{+/-}$

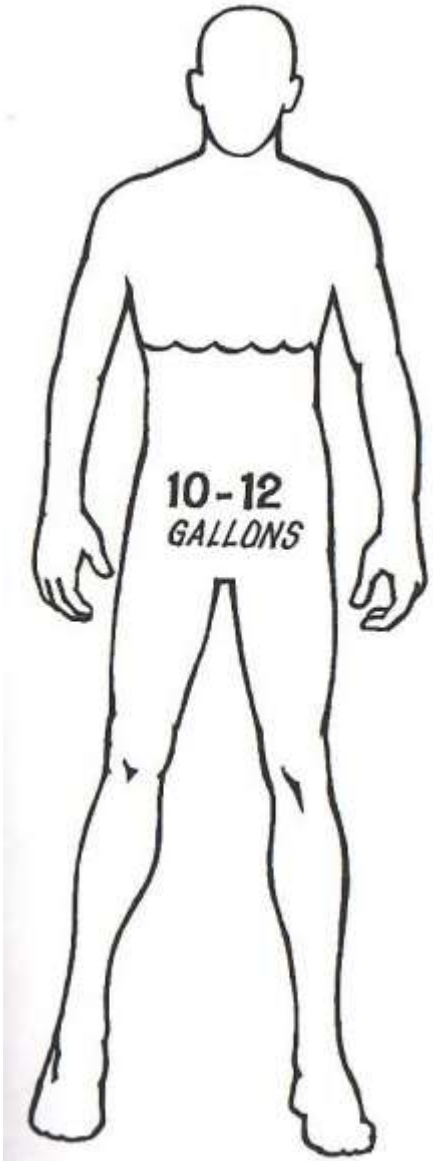
pH



Drink about 1 L per 1000 calories energy expenditure!!

Human ~ 2/3 H_2O

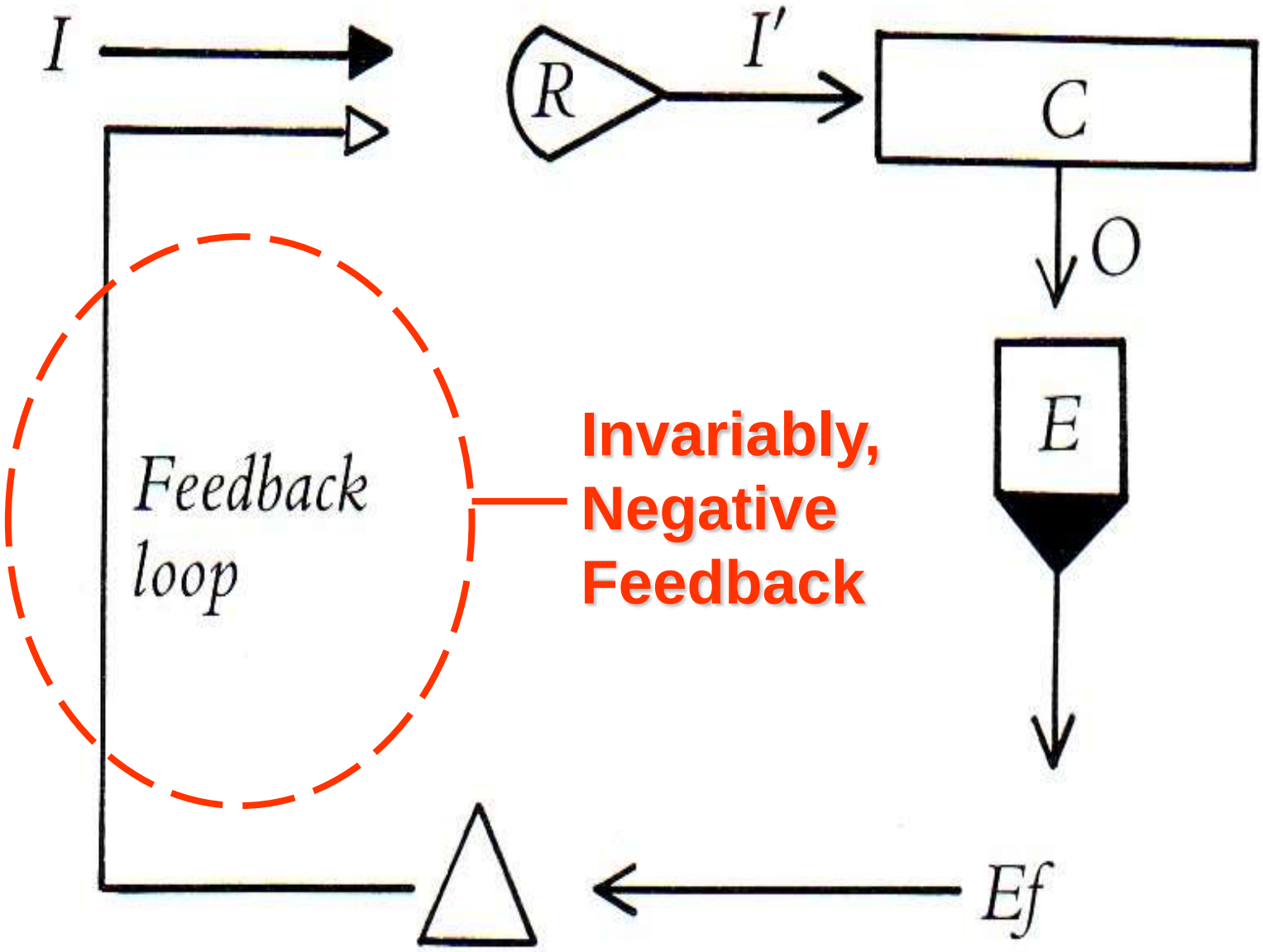
~ 60 – 70 %



150 lb /68 kg

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

= ~40 – 48 kg H_2O


I
R
I′
C
O
E
Feedback
loop
Invariably,
Negative
Feedback
Ef

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

Selected +FB eg:

LH Surge + Ovulation
Oxytocin + Uterine Contraction
Blood Clotting Cascade
cAMP Cascade
Na+ influx during AP

70% H_2O
= 49L

eg

ICF =
35L

+

ECF = 14L

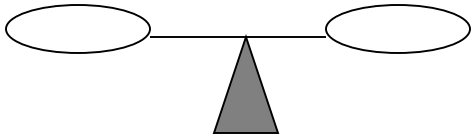
Interstitium = 11L
Plasma = 3L

H_2O

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

Blood Pressure Homeostasis

BP ↓

Venous Pooling

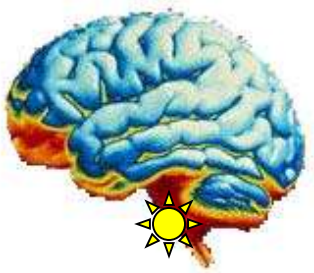
I

R

Baroreceptors/Pressure Receptors
eg, in Carotids & Aorta

Electrochemical Signal
I'

CV Control Center
Brain Stem

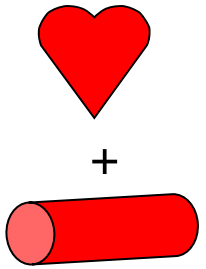


C

O

Electrochemical Signal
eg, Symp Accel N

E

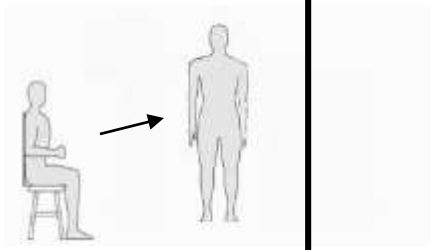


+

↑ HR
+
↑ VC

Ef

↑ BP



Seated to Standing

***NB*: Corrective Change Δ**
Opposes Original Input *I*

Short-term vs long-term!

Bl 121 Lecture 3 …Anatomy & Physiology Lab Thurs! Fun again!

I. *Announcements* Registered? AEC Notes? Come to office hr!

II. *Connections* Videos + Q about Homeostatic Model for BP

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

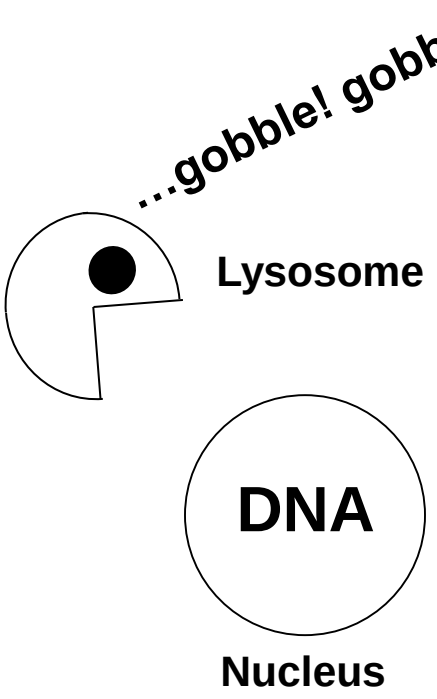
F. Genetic code? pp A-22, A-23

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

Why Compartments? Advantage?

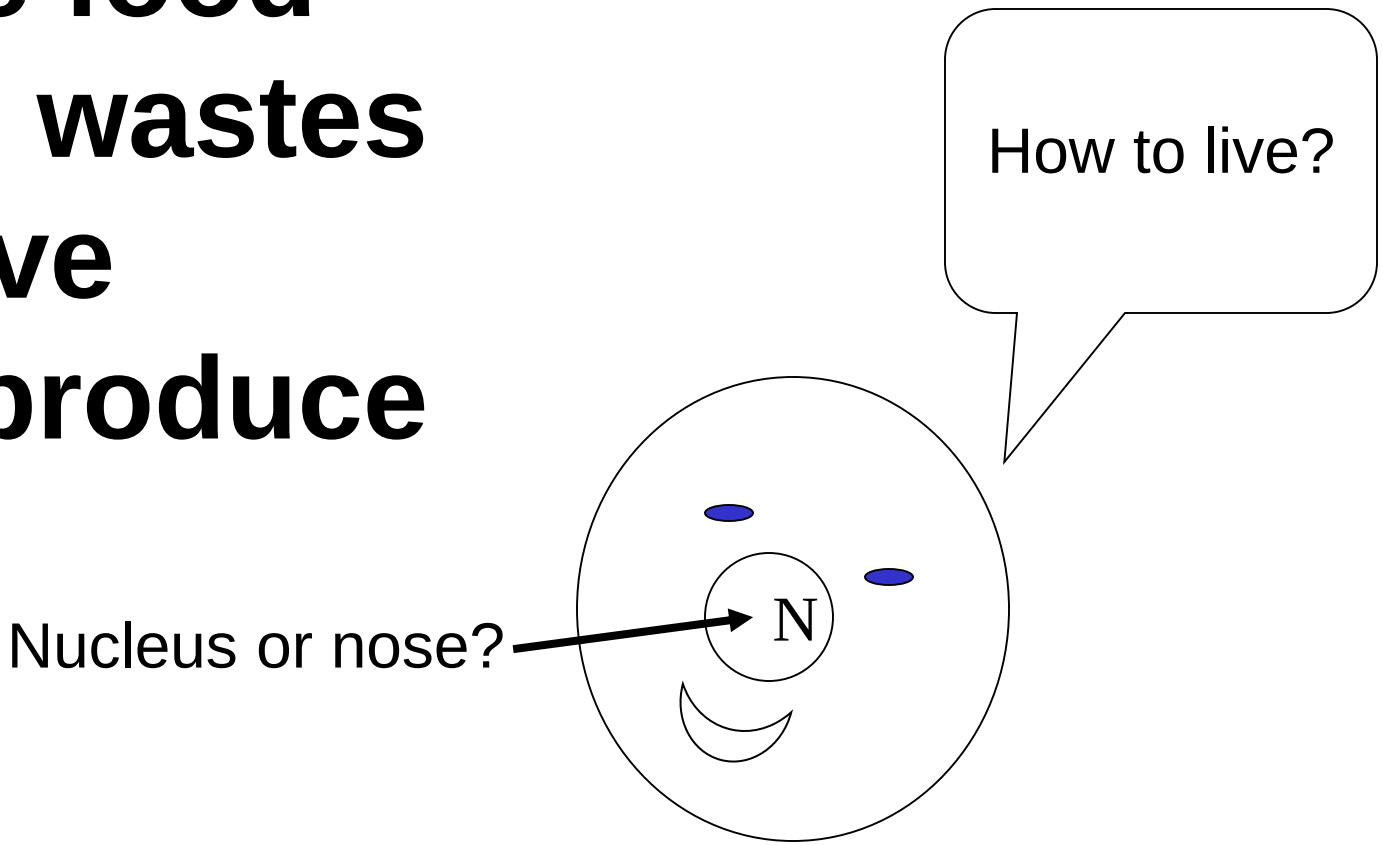
<u>*Incompatible*</u> reactions can take place

<u>*Simultaneously*</u>!!



Basic Cell Survival Skills?

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



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

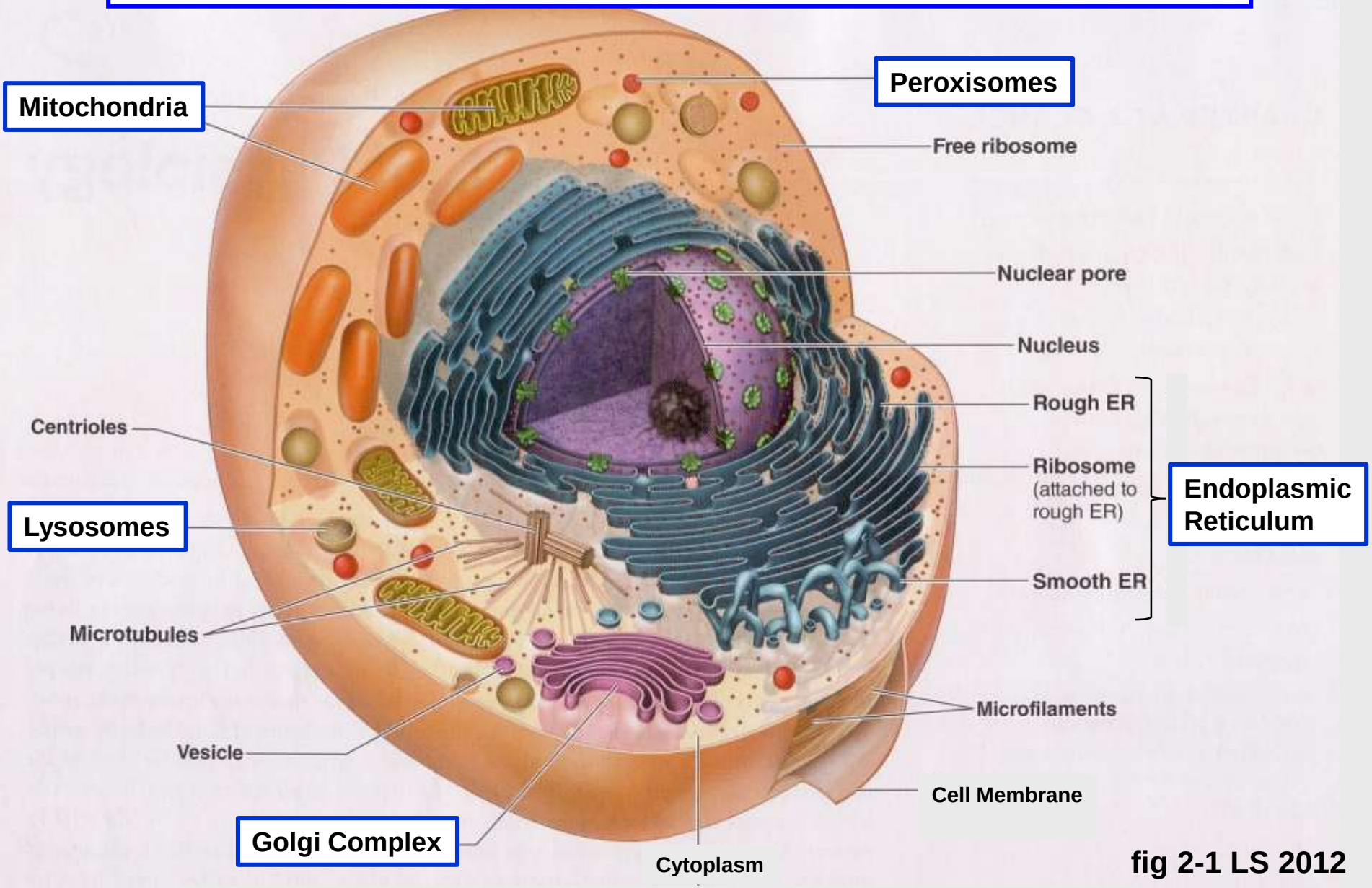


fig 2-1 LS 2012

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

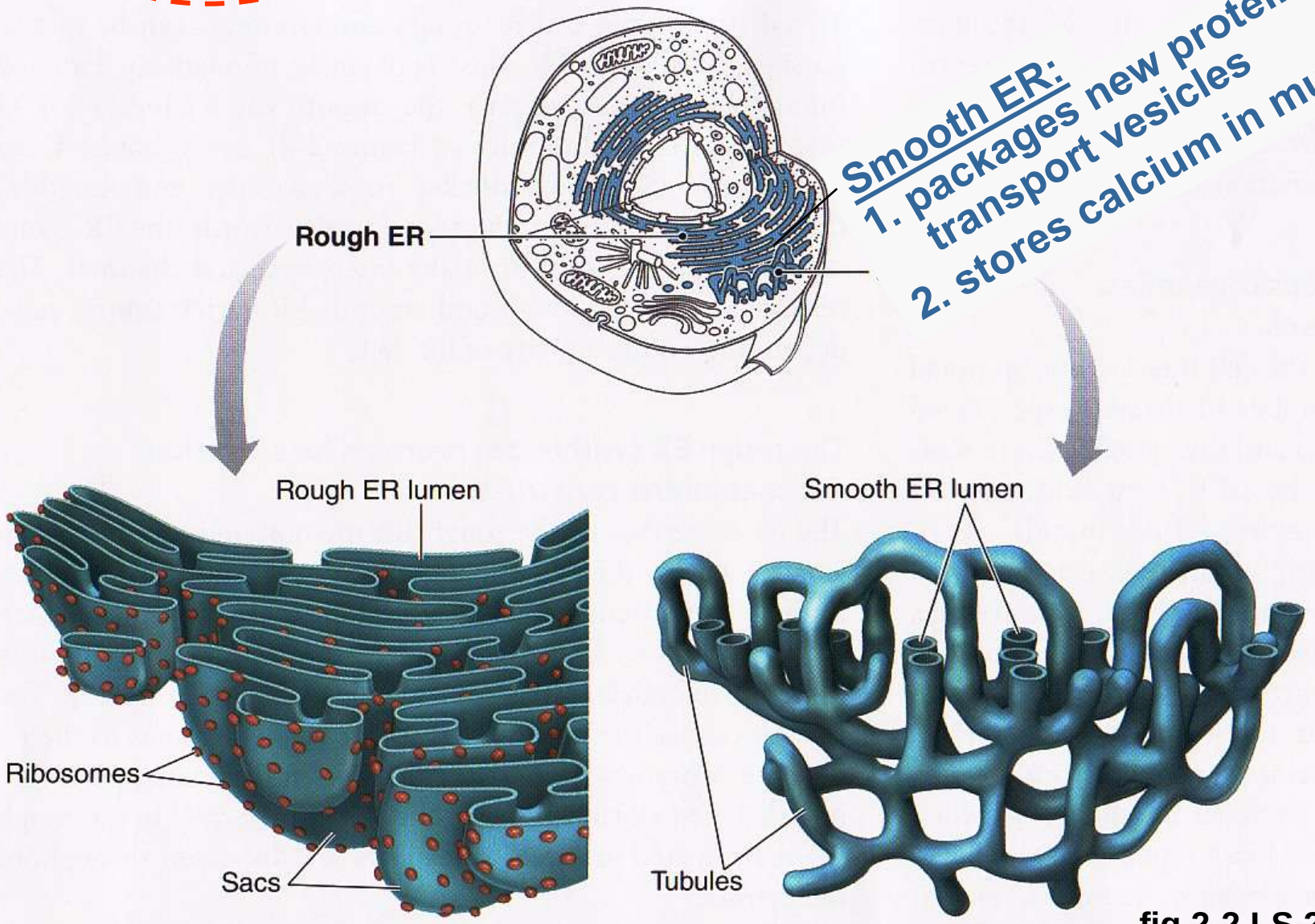


fig 2-2 LS 2012

Secretion of Proteins Produced by ER

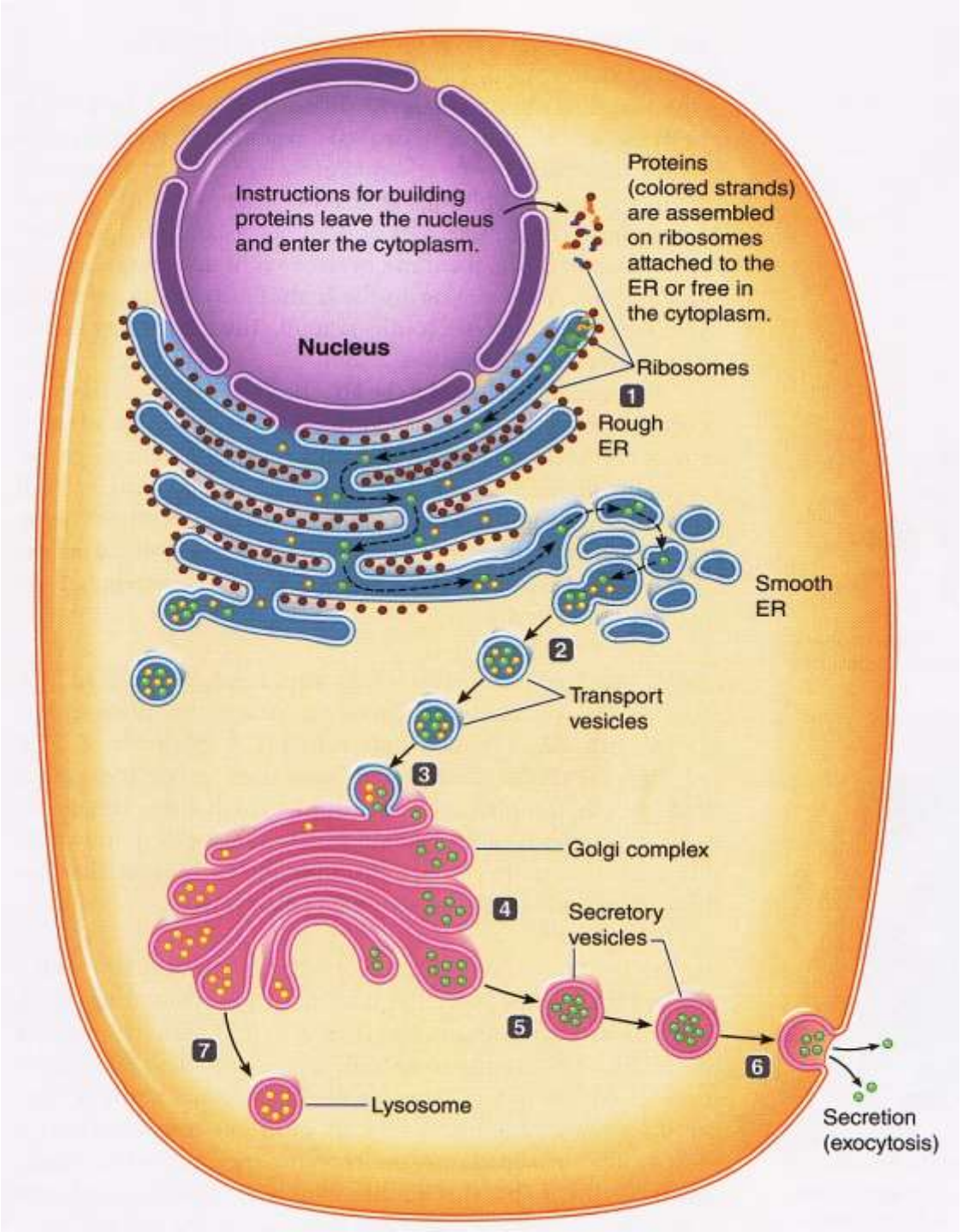


fig 2-3 LS 2012

Lysosomes vs. *Peroxisomes*

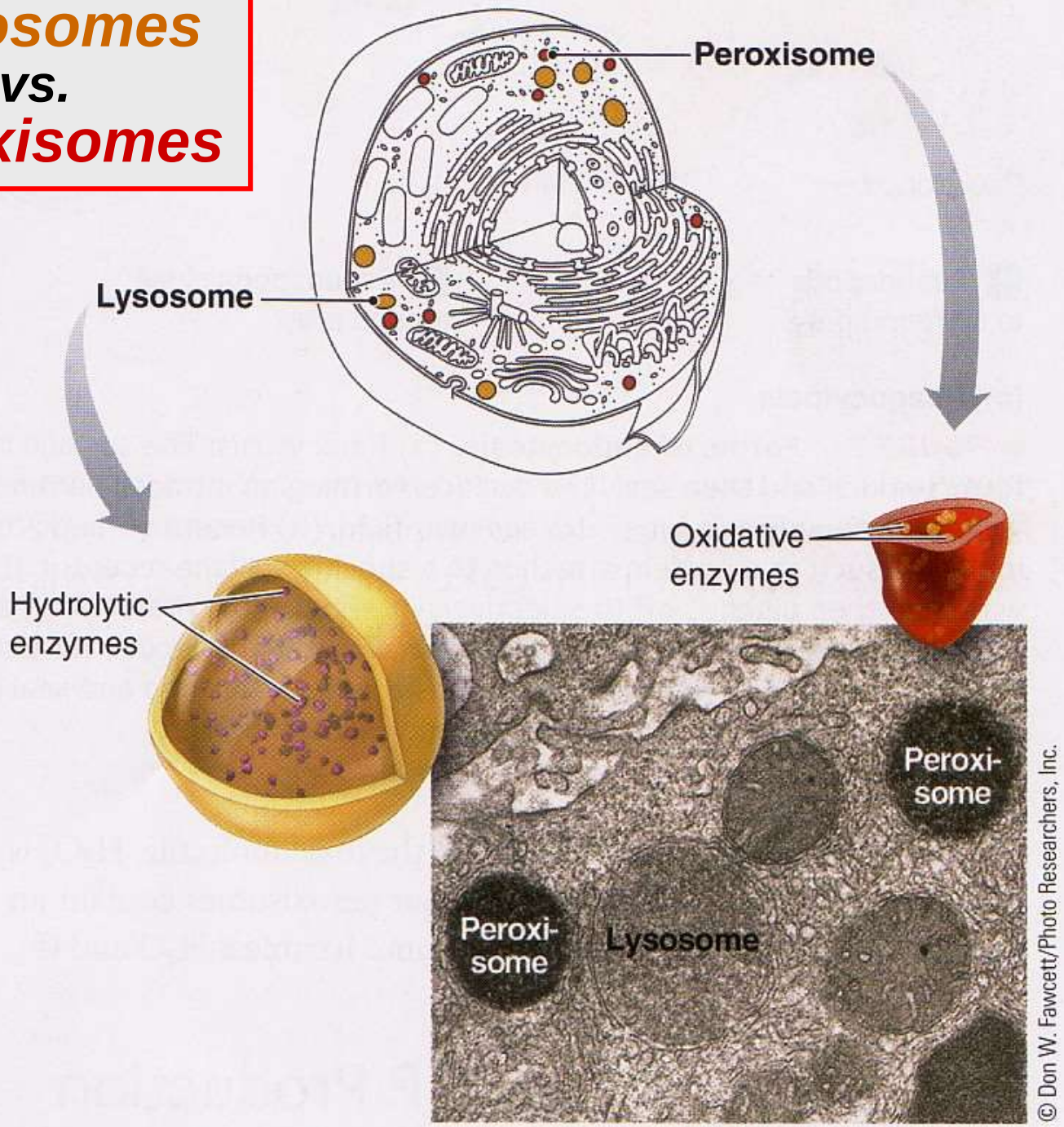
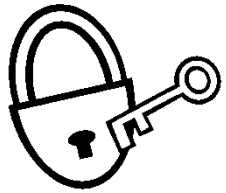


fig 2-6 LS 2012

BI 121 Lecture 4

Structure-function = fun!



I. ***Announcements*** **Anatomy & Physiology Lab today!**
Be sure to complete p 3-7 dietary record in LM < lab next wk!
Help with estimating serving sizes for Nutrition Lab 3. Q?

II. ***Cell Organelle Connections*** **Little organs or specialty shops!**

III. ***Physiology News*** ♀ ***vs*** ♂ **Mitochondria; Vaults?** ***Sci News***

IV. ***Anaerobic vs Aerobic Metabolism Connections***

LS ch 2 pp 26-33

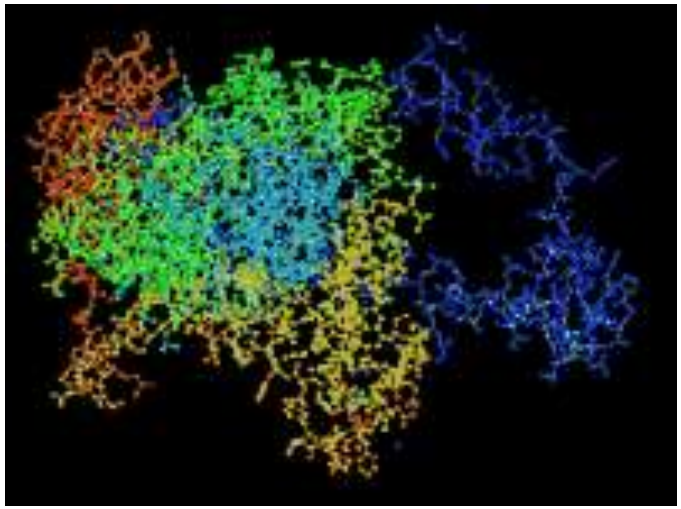
A. **Take-home points + key differences fig 2-15 + vpl**
B. **Few details: Glycolysis, CAC, ETC fig 2-9, 2-10, 2-11, 2-12**

V. ***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**


Film: Neutrophil engulfing bacterium
http://devreotes.johnshopkins.edu/videos
L. Nilsson, Nat Geog 1986
10,000 x

Catalase Enzyme Reaction in Peroxisomes Neutralize Toxin at Production Site!



Mitochondria: Energy Organelles

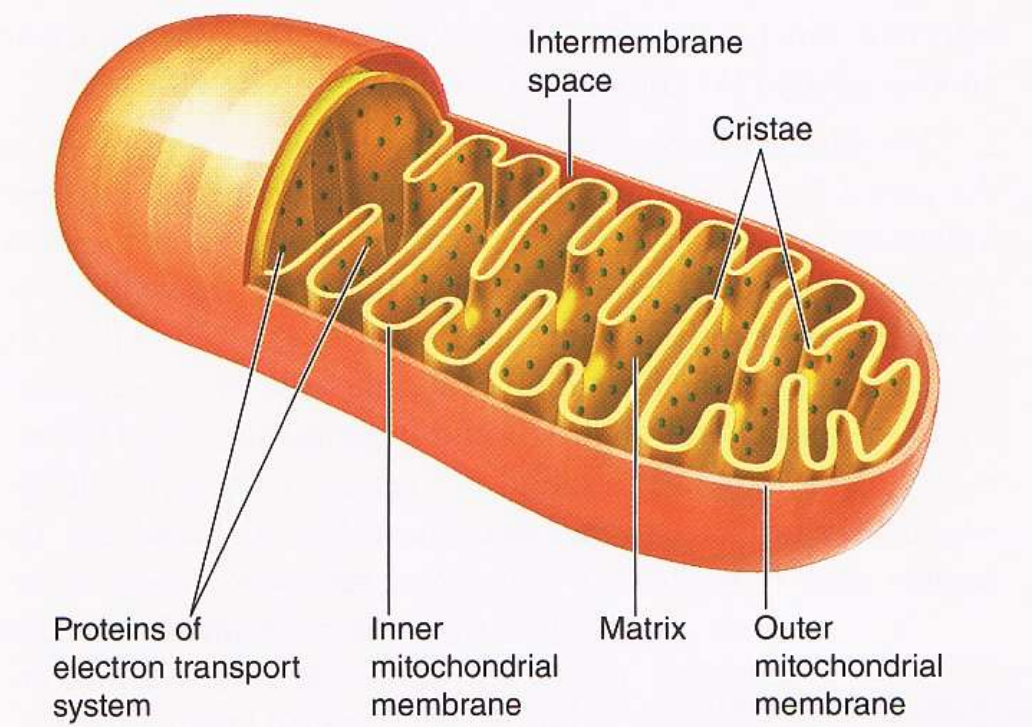
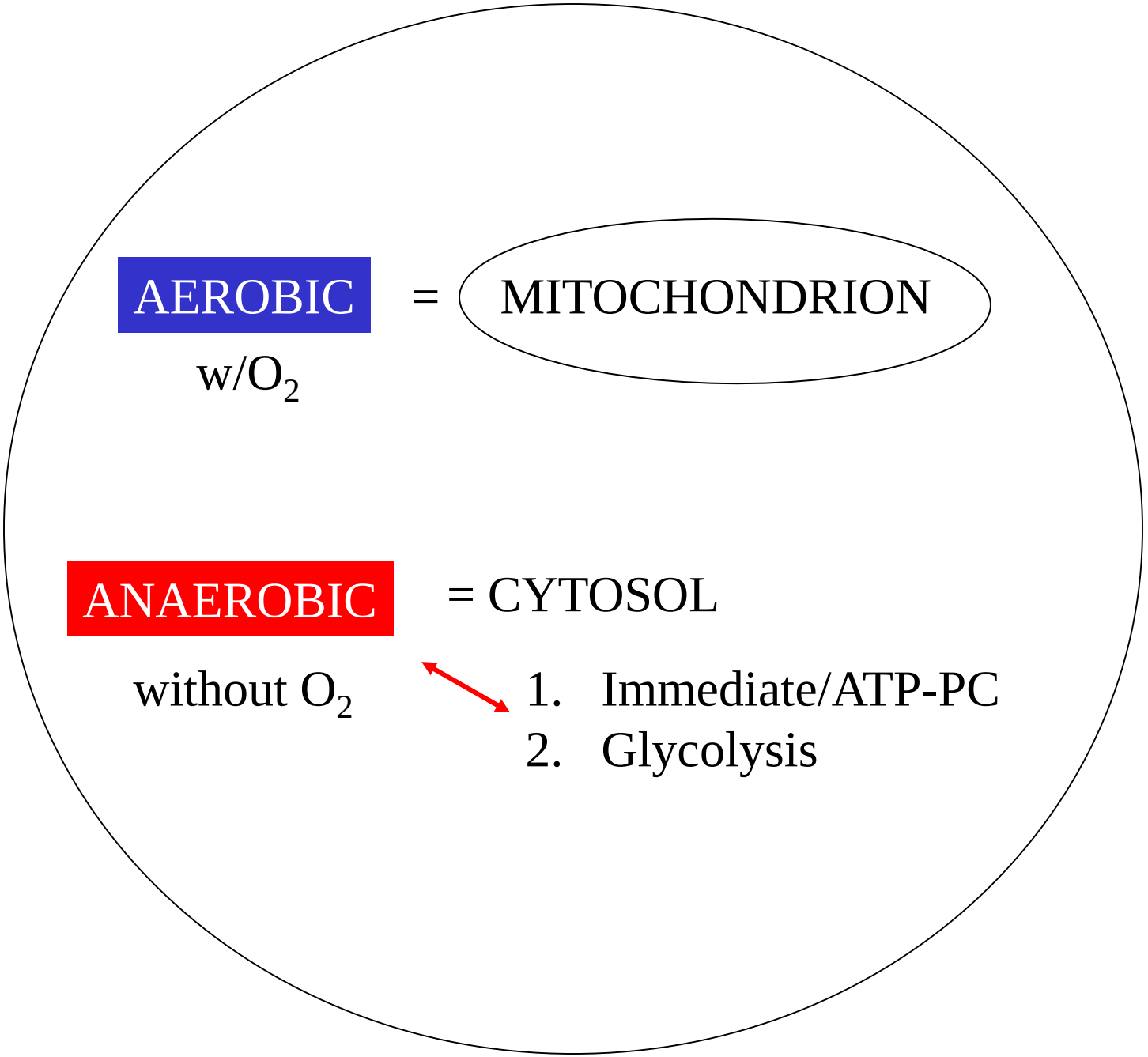
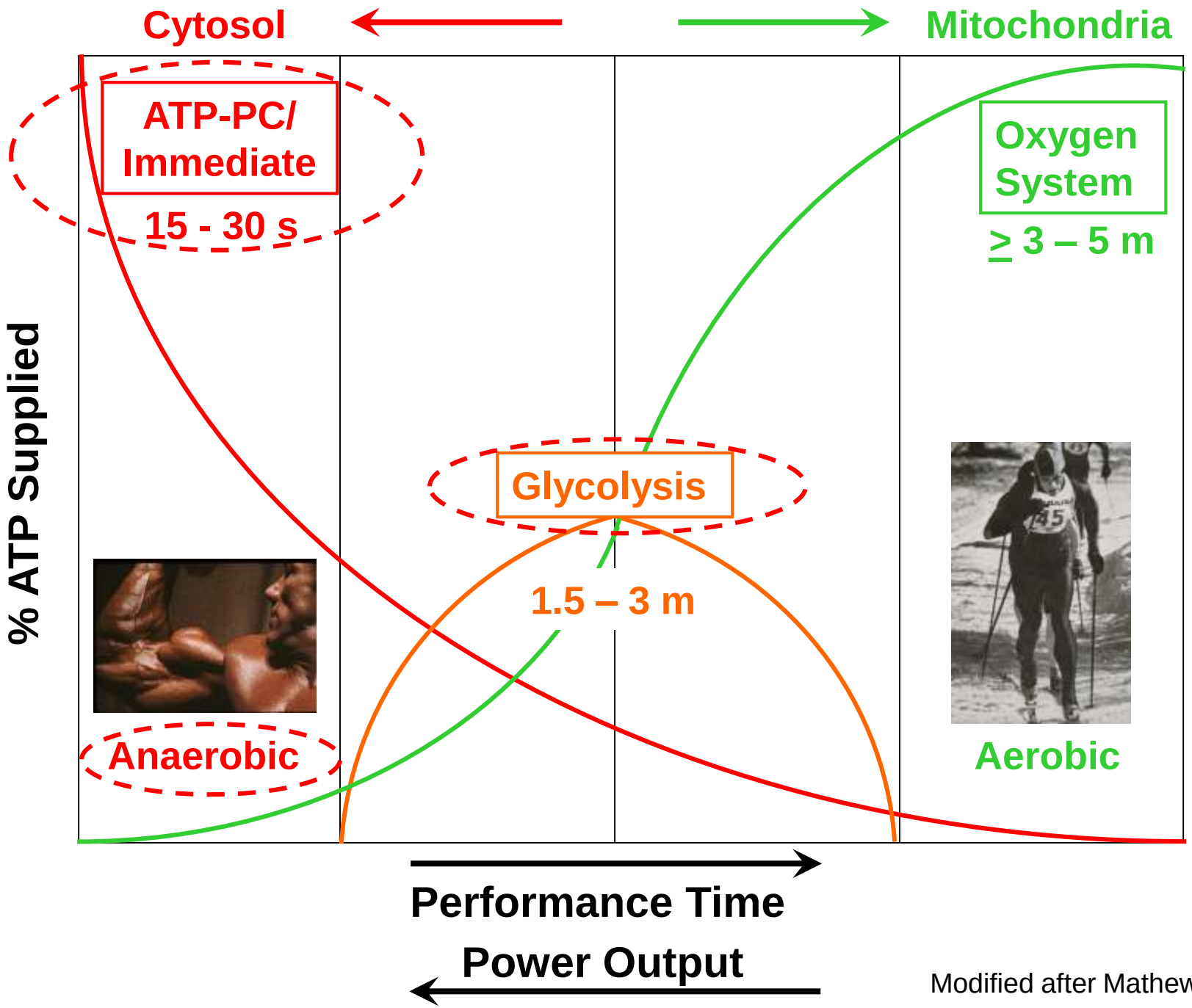


fig 2-8 LS 2012

Inside a fertilized egg, with its two sets of chromosomes (blue), the protein ubiquitin (red) tags sperm mitochondria (yellow).

***SOURCE*: Sutovsky P, Moreno RD, Ramalho-Santos J, Dominko T, Simerly C, Schatten G. *Nature* 1999;402(6760), 371-2.**

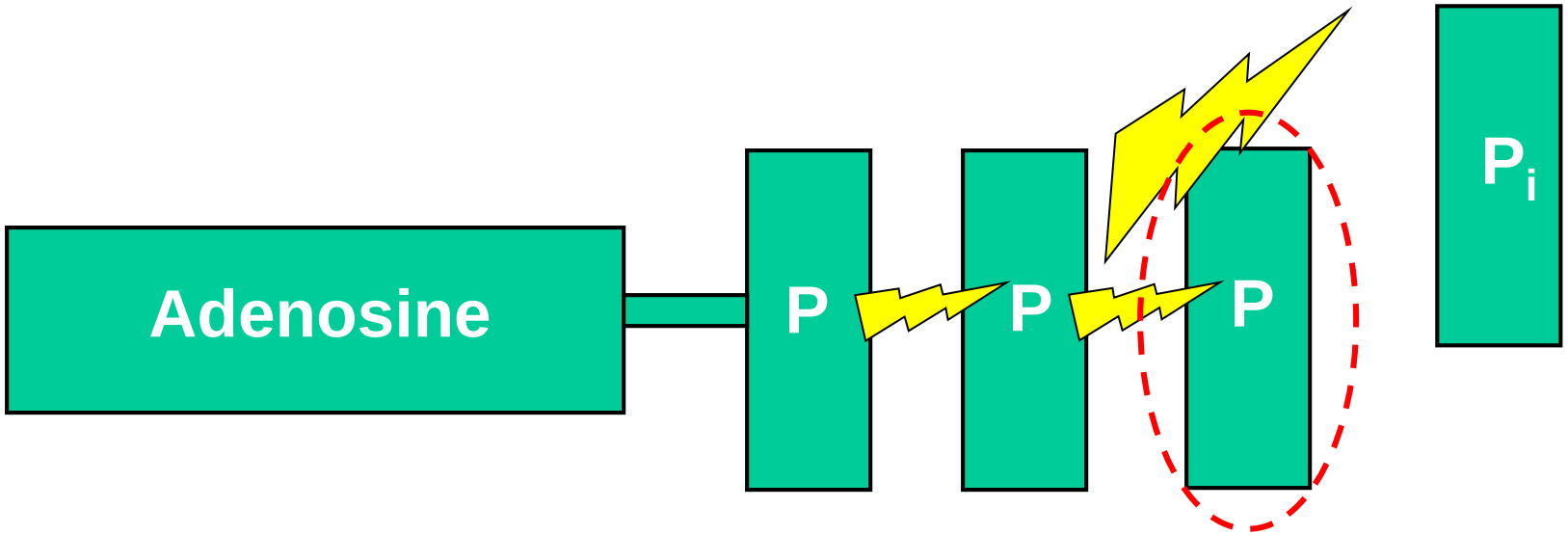

AEROBIC
=
MITOCHONDRION
w/O_2
ANAEROBIC
= CYTOSOL
without O_2
1. Immediate/ATP-PC
2. Glycolysis



Modified after Mathews & Fox

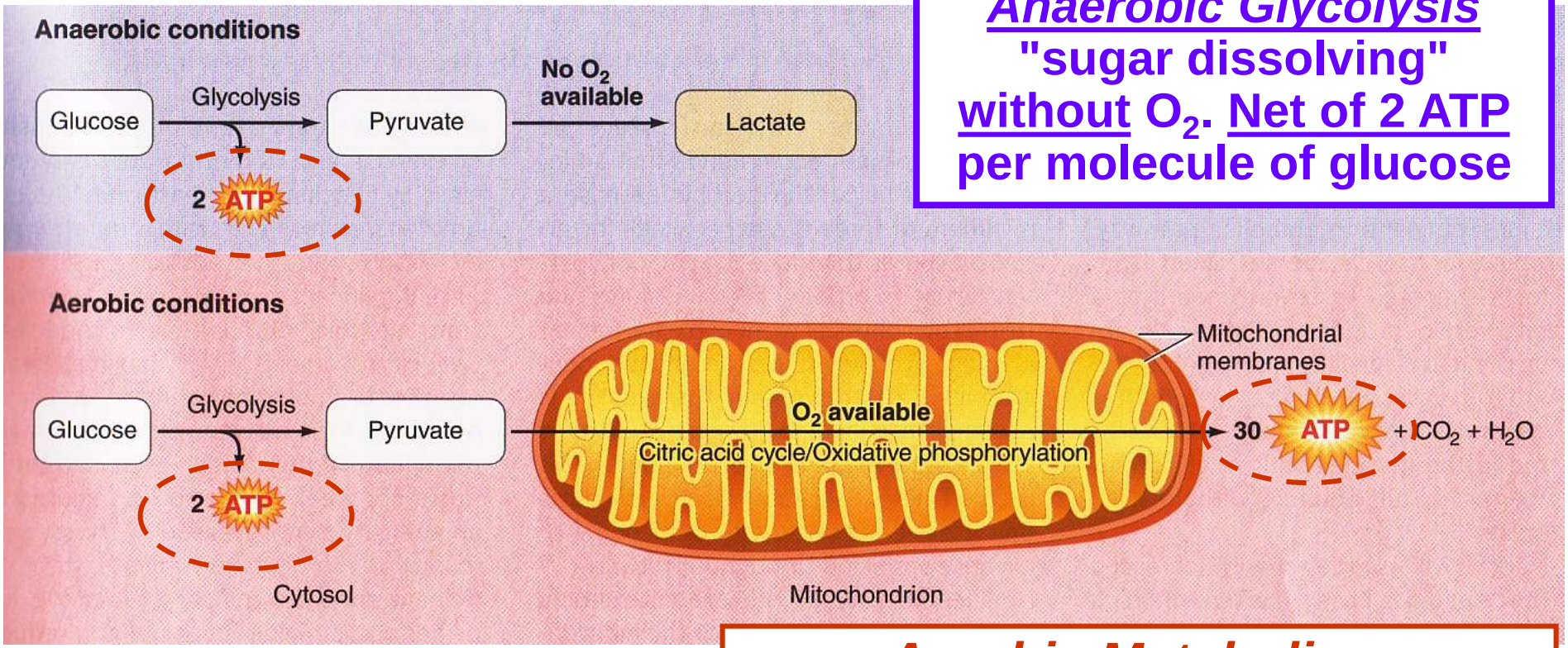
Cleave One High Energy Phosphate Bond To Do Work!!

7 – 10
KiloCalories/KCal



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

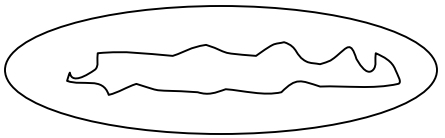


Anaerobic Glycolysis
"sugar dissolving" without O_2. Net of 2 ATP per molecule of glucose

Aerobic Metabolism
+mitochondrial processing of glucose with O_2. Net of 32 ATP per molecule of glucose

fig 2-15 LS 2012

AEROBIC w/O_2



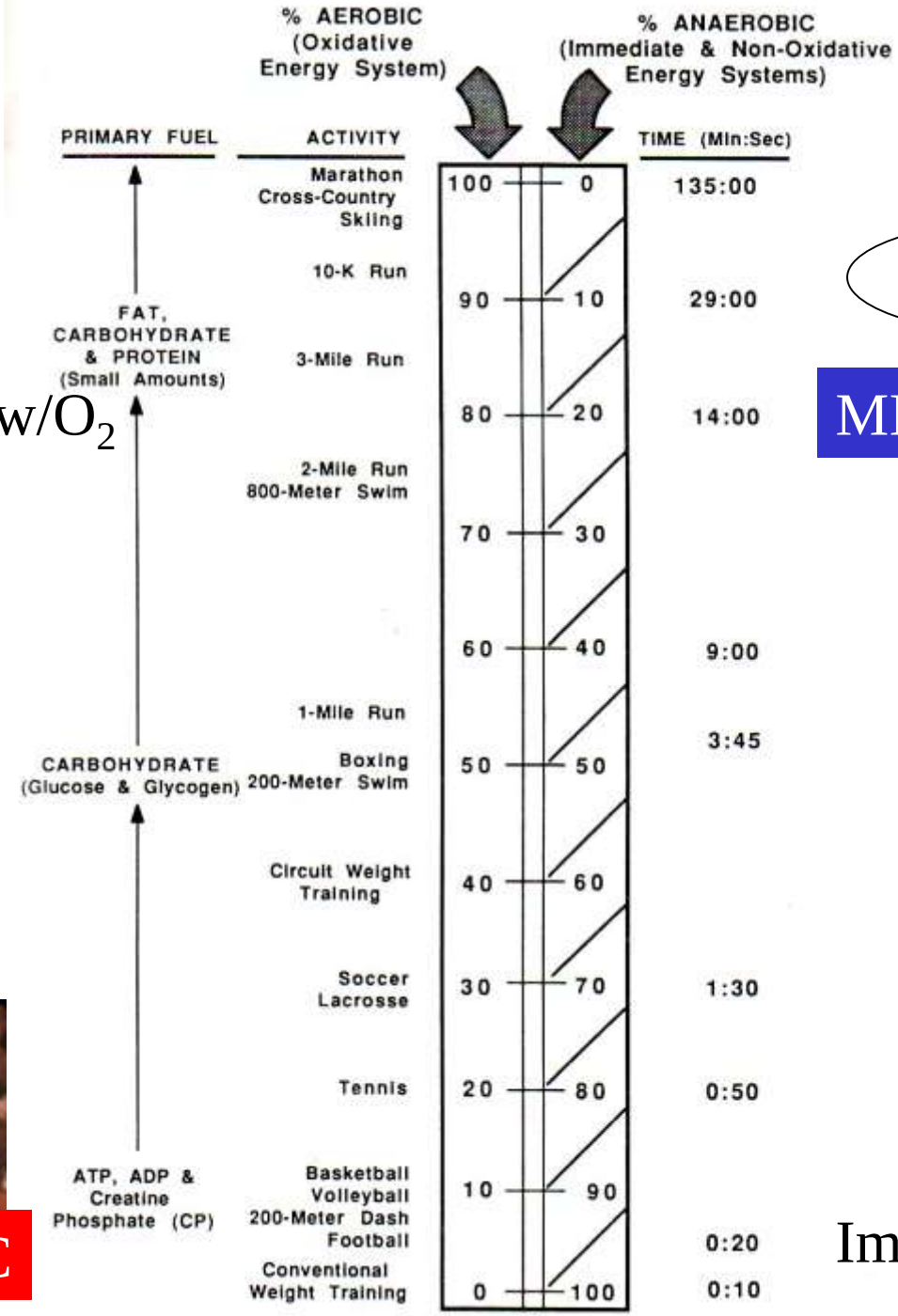
MITOCHONDRIA

ANAEROBIC

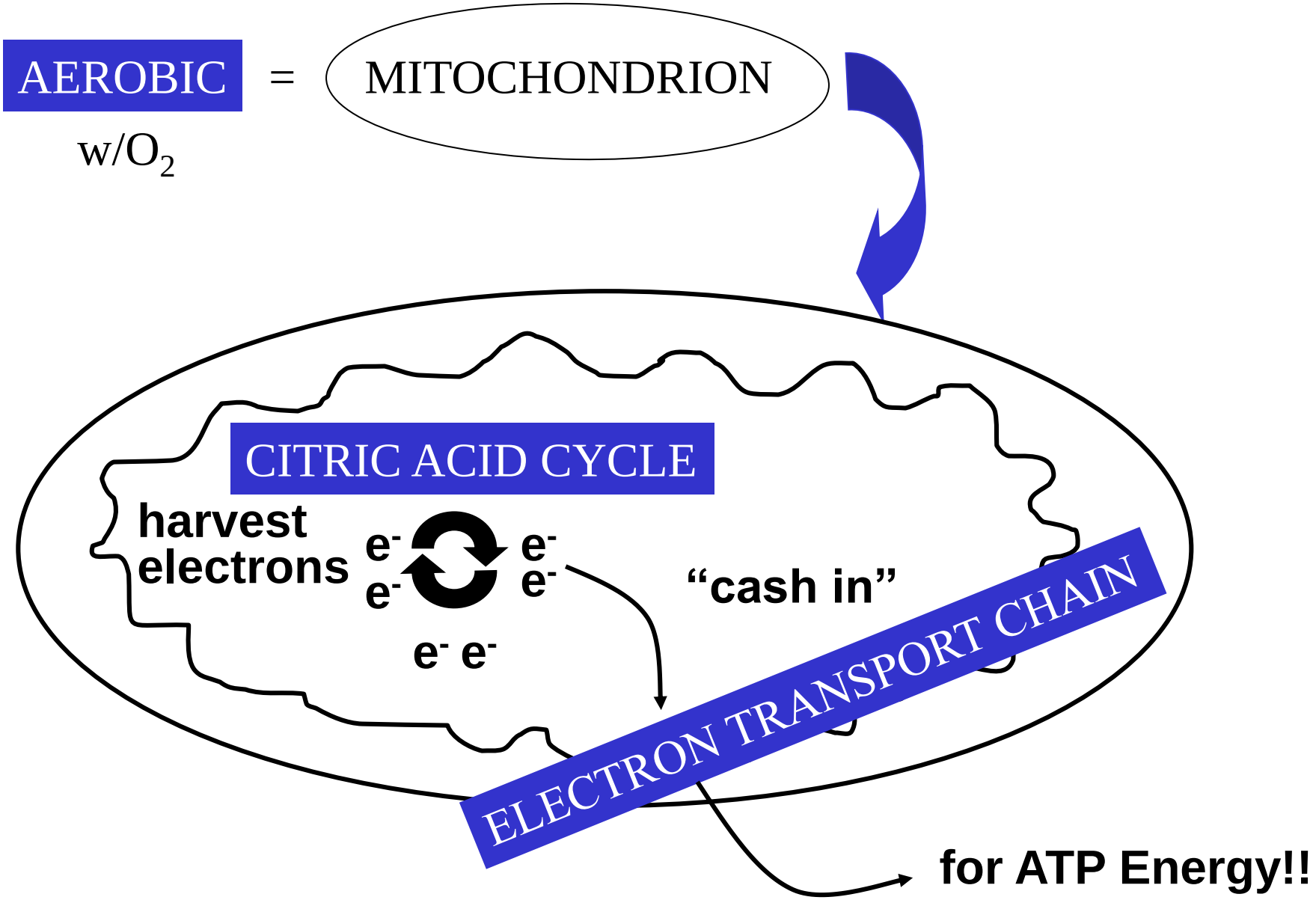
CYTOSOL

Glycolysis

Immediate/ATP-PC



Goals of Aerobic Metabolism



BI 121 Lecture 5

DietOrganizer Easy to use diet software **More fun...**

I. ***Announcements*** **Nutrition Analyses this Thursday!**
Please record diet on p 3-7 LM & begin analysis using
https://www.supertracker.usda.gov/ **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!

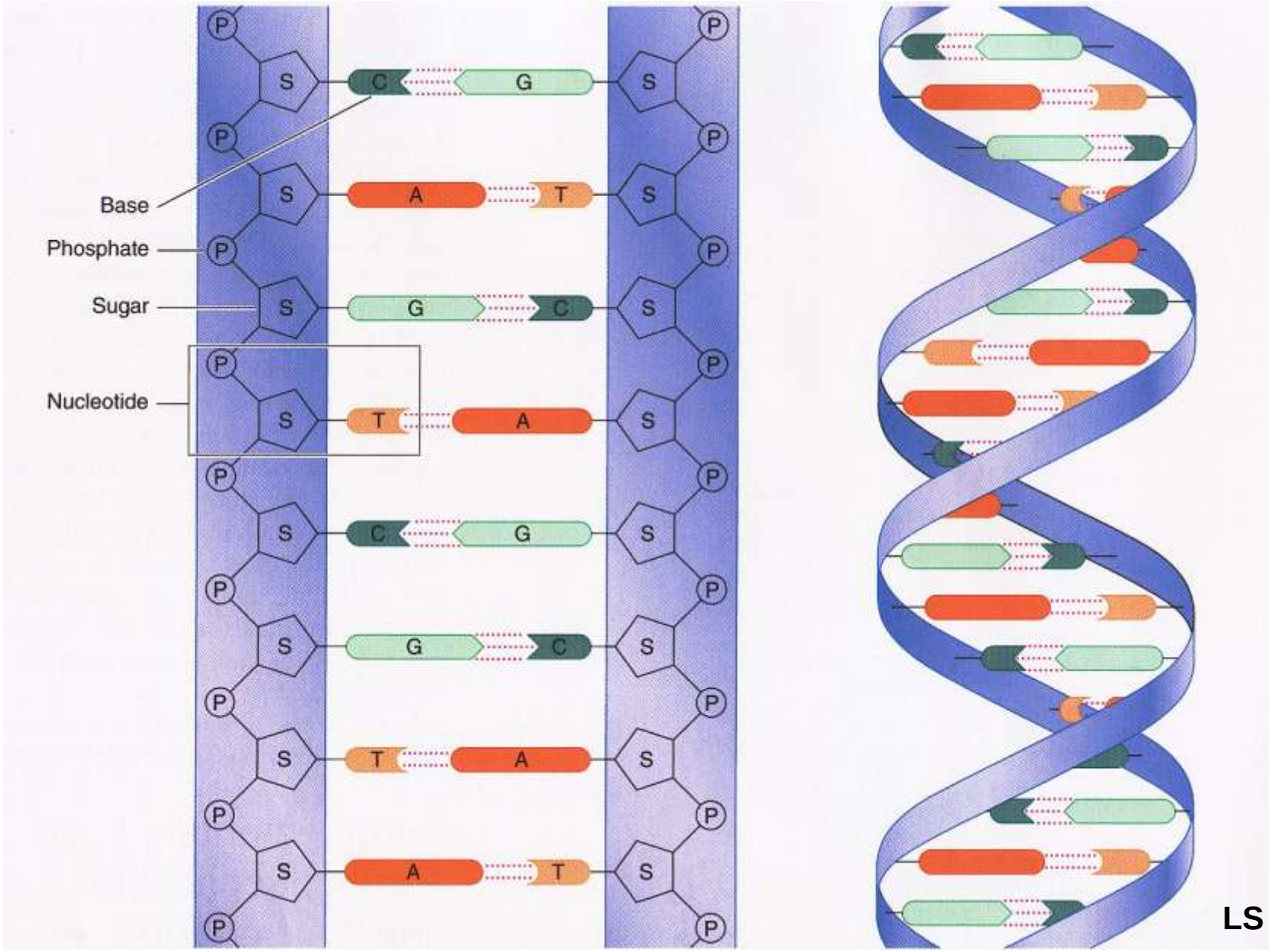
III. ***Nutrition Primer*** **Sizer & Whitney (S&W) Sci Lib**
- A. Essential Nutrients: H_2O, 1^0 Carbohydrates, 2^0 Fats, 3^0 Proteins, Vitamins, Minerals; Macro- vs Micro-?
- B. ***Blue Zones?*** US AMDR? Adjusted Macronutrient Dist… Pondering Paleo, Marlene Zuk, *Nutrition Action* Sep 2015.
- C. Dietary Guidelines: USDA, AICR, Eat Like the ***Rainbow***!
- D. Diet or exercise? Diet composition & endurance? Zuti & Golding 1976! Fasting?
- E. *Beware of Nutrition Quackery* S. Kleiner & Monaco 1990!

IV. ***Nutrition in the News*** **Gain weight by drinking calories?**

V. ***Introduction to Digestion*** **Steps + hydrolysis**

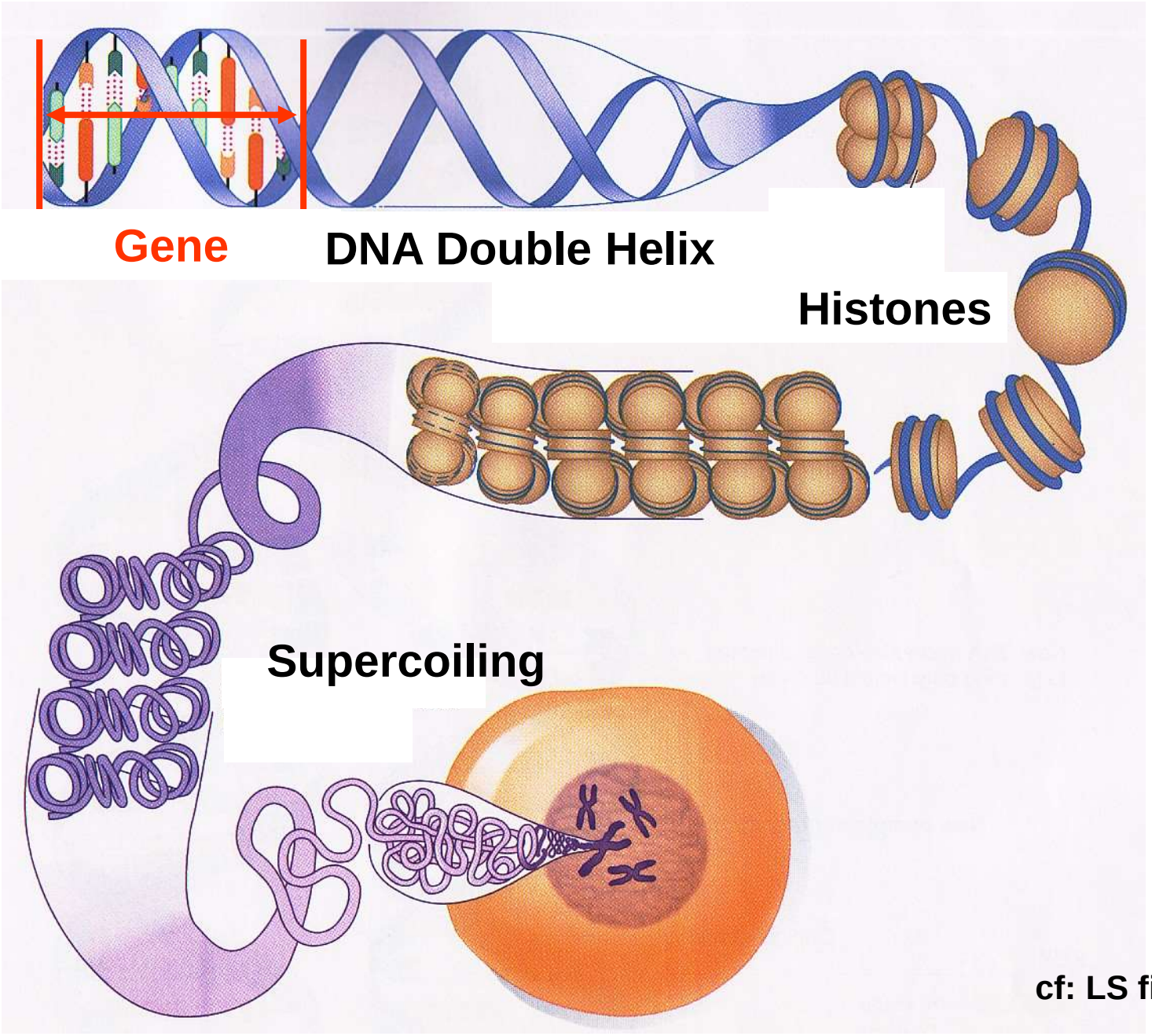
What are DNA's major functions?
Heredity + Day-to-Day Cell Function

What does DNA look like? Double-helix!!



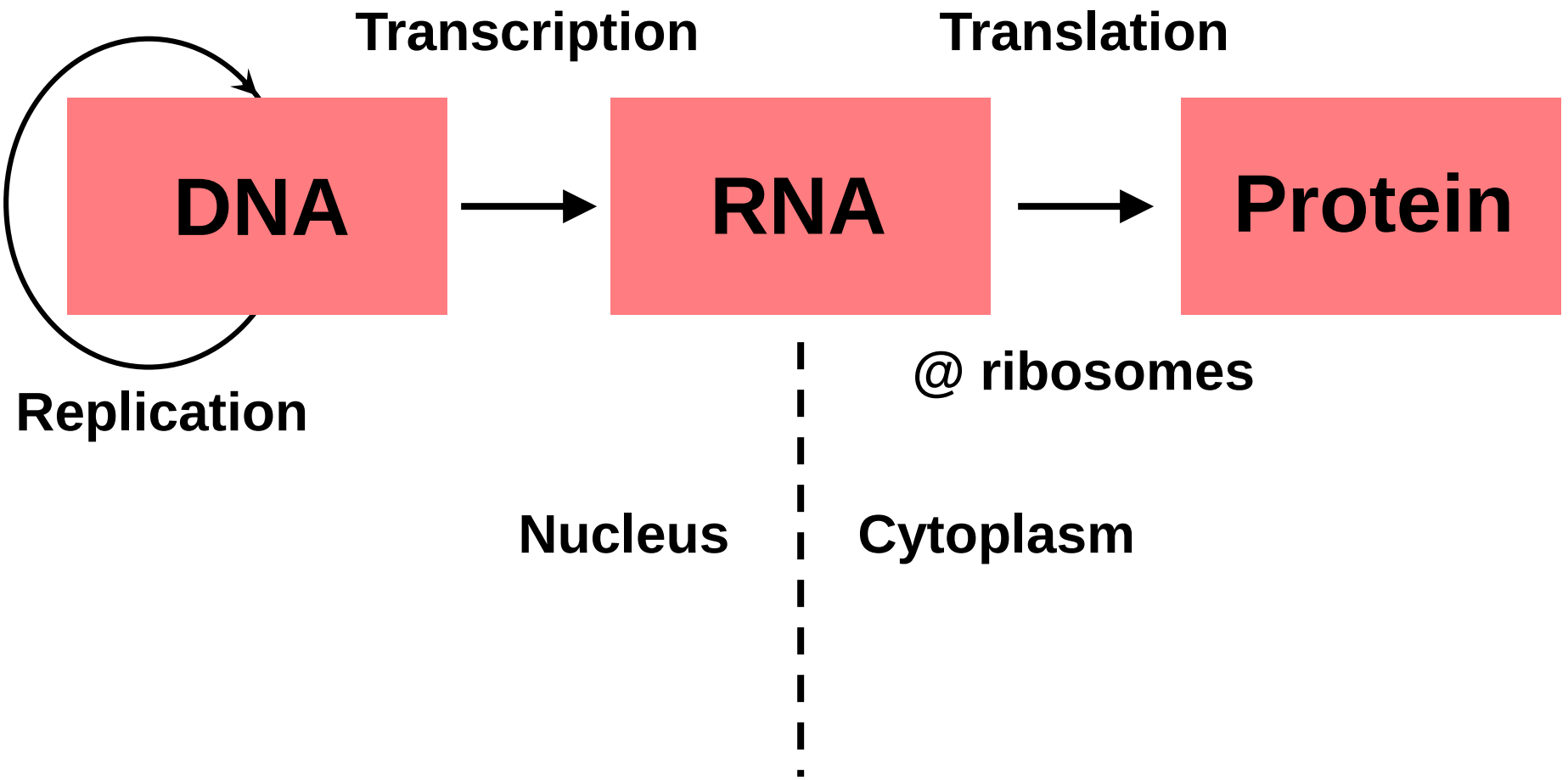
LS fig C-2

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



cf: LS fig C-3

What does DNA do, day-to-day?



cf: LS fig C-6

DNA vs *RNA*?

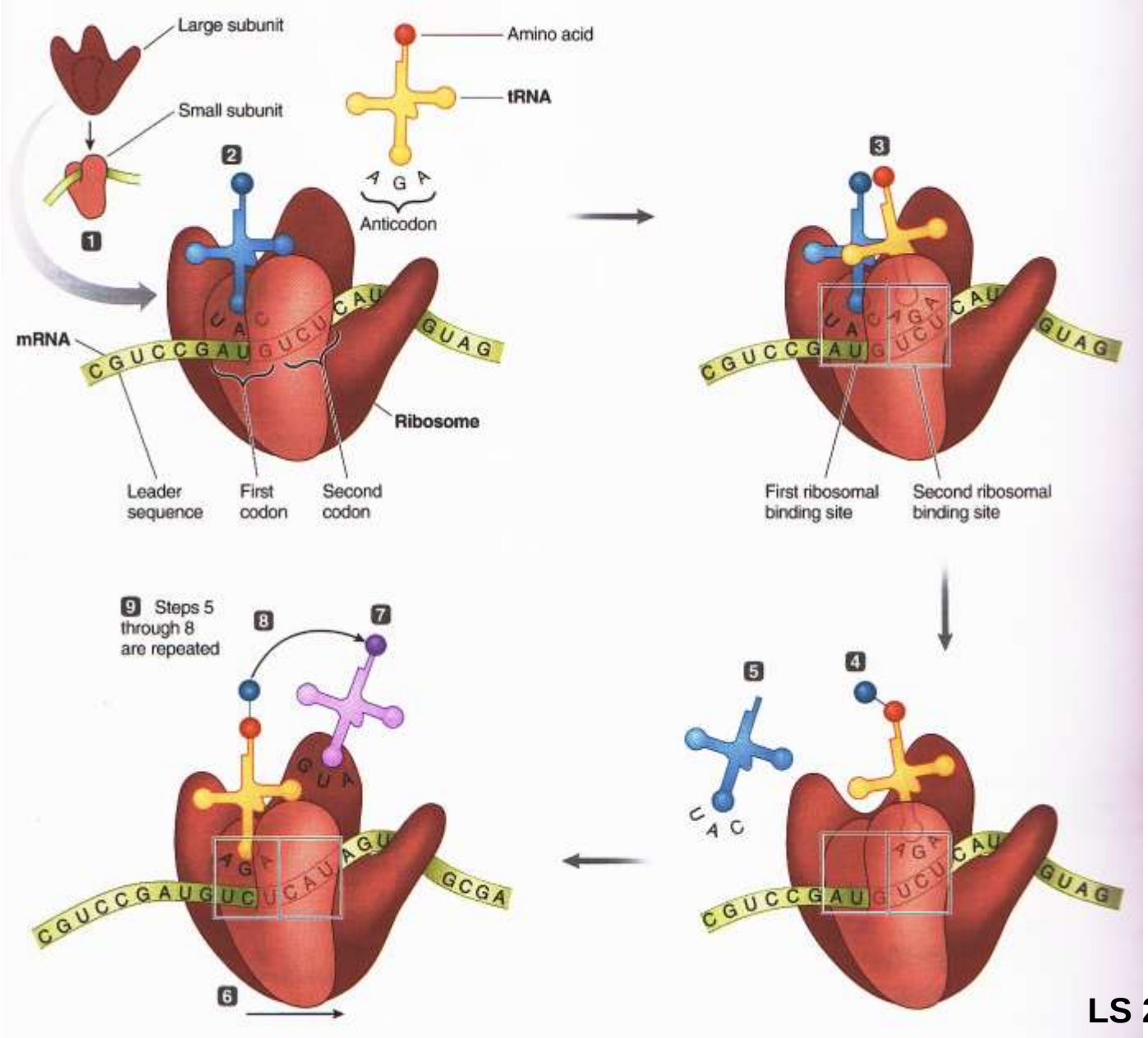
1. Double-stranded
2. Deoxyribose (without oxygen)
3. A, T, C, G
   Thymine
4. Self-replicative (can copy itself)
5. Nucleus (+mitochondria)

1. Single-stranded
2. Ribose (with oxygen)
3. A, U, C, G
   Uracil
4. Needs DNA as template
5. 1^0 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



LS 2012 fig C-7

Macronutrients & Micronutrients Essential for Life

Macronutrients	Sample Food Sources
H_2O/Water	Water, other drinks, fruits & vegetables
↗ 1^0 Carbohydrates	Grains, vegetables, fruits, dairy products
↗ 2^0 Fats/Triglycerides/Lipids	Meats, full-fat dairy products, oils
↗ 3^0 Proteins	Meats, legumes, dairy vegetables
Micronutrients	***NB*: Need only minute quantities!**
Vitamins (A, D, E, K; C + B)	Vegetables, vegetable oils, fruits, citrus, grains, dairy
Minerals (K^+, Na^+, Ca^{2+}, Mg^{2+} Fe^{2+}, Zn^{2+},…)	Fruits, vegetables, grains, nuts, dairy, meats, processed foods

↗ *Energy nutrients = yield ATP*

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

Plant-based!

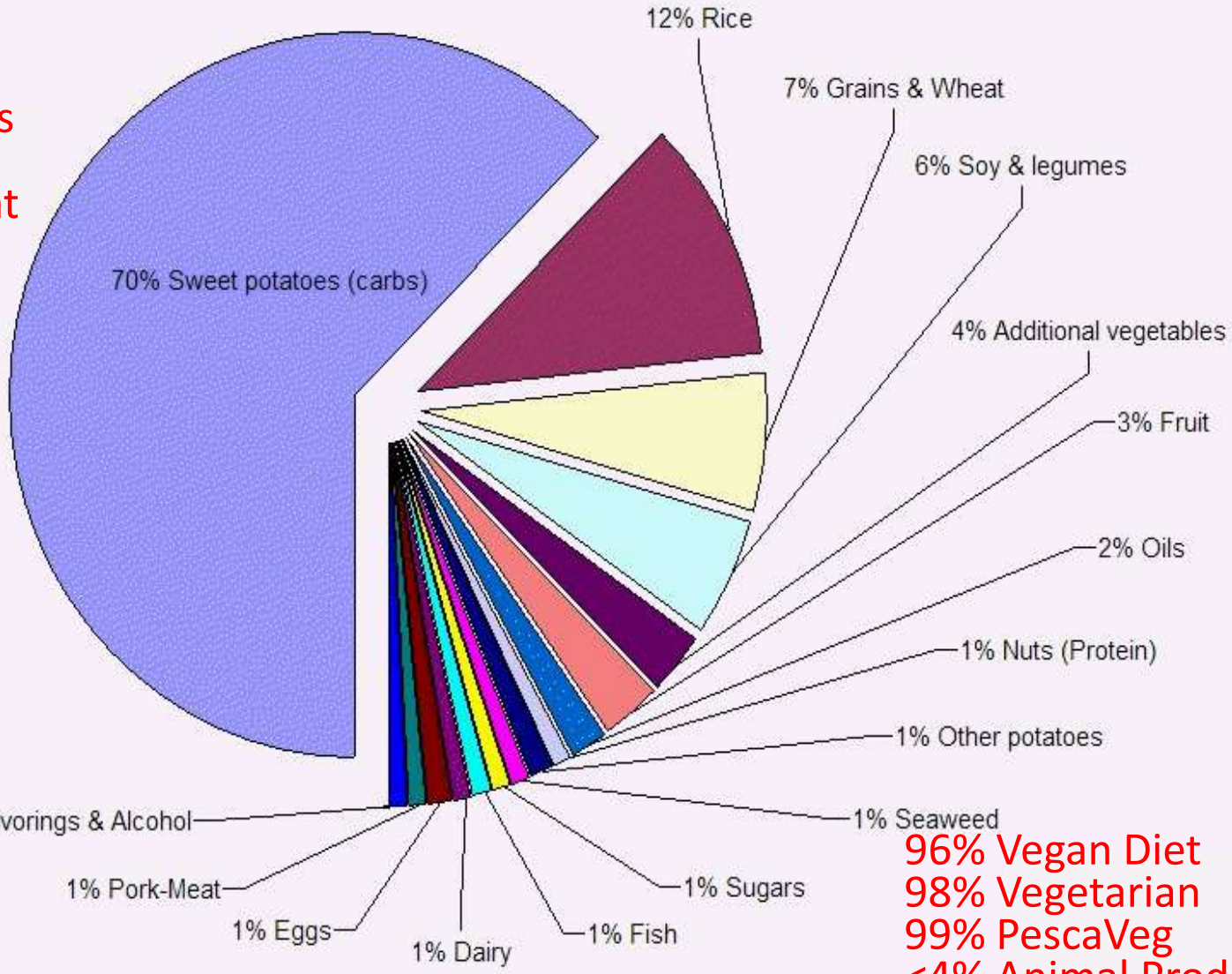
1. Eat a little bit better!
2. Move a little bit more!
3. Socialize more!
4. Strong sense of purpose!

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

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.

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

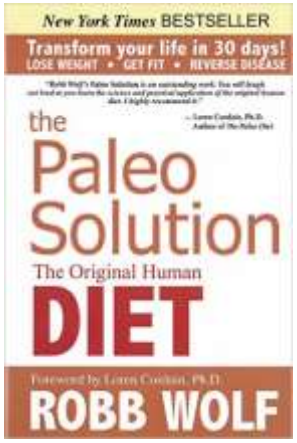
BI 121 Lecture 6 Nutrition Lab 3 today! More personal data…

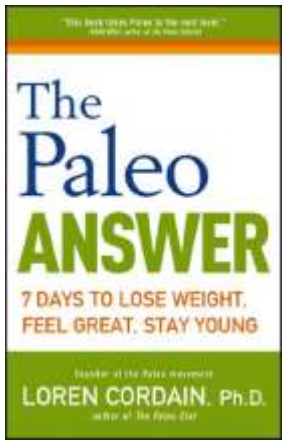
I. ***Announcements*** **Data + flash drive for today's lab! Q?**
If you want notebook to study for Exam I on Tues Oct 24th turn in prior to lecture next Tues Oct 17th. Sample Exam Q?

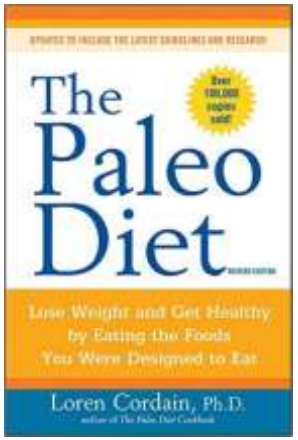
II. ***Nutrition Connections + Nutritional Physiology in the News***
- A. ***Pondering Paleo*****. Animal sources, inflammation & disease?**
- B. **Lifestyle modifications & reducing disease risk?**
- C. **Shake the salt habit! *UC Berkeley Newsletter*.**
- D. **Drink Your Calories? *Public Employees Benefit* …**
- E. ***Dietary Guidelines*****: USDA, AICR, Eat Like the *Rainbow*!**
- F. **Diet or exercise better? Diet composition & endurance? Zuti & Golding 1976! Fasting? Complications.**
- G. ***Beware of Nutrition Quackery*** **S. Kleiner & Monaco 1990!**

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-Donut analogy + Control mechanisms. Dr. Brilla @ WWU**
- E. **Gut secretions LS p 438, 440-1**
- F. **Organ-by-organ review LS tab 15-1 pp 440-1 + DC fig 3-1**

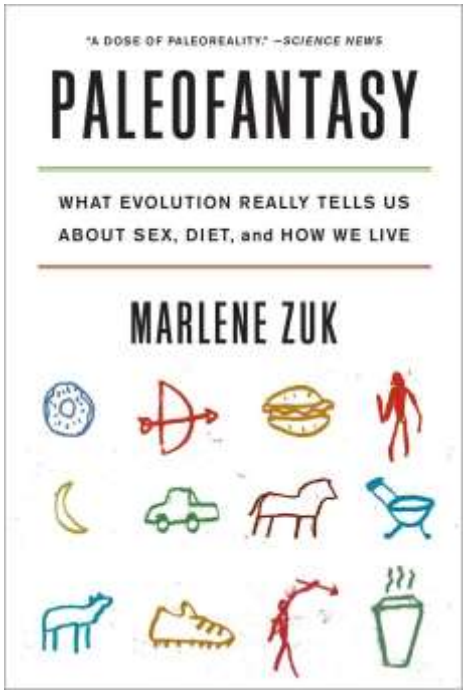
Pondering Paleo?



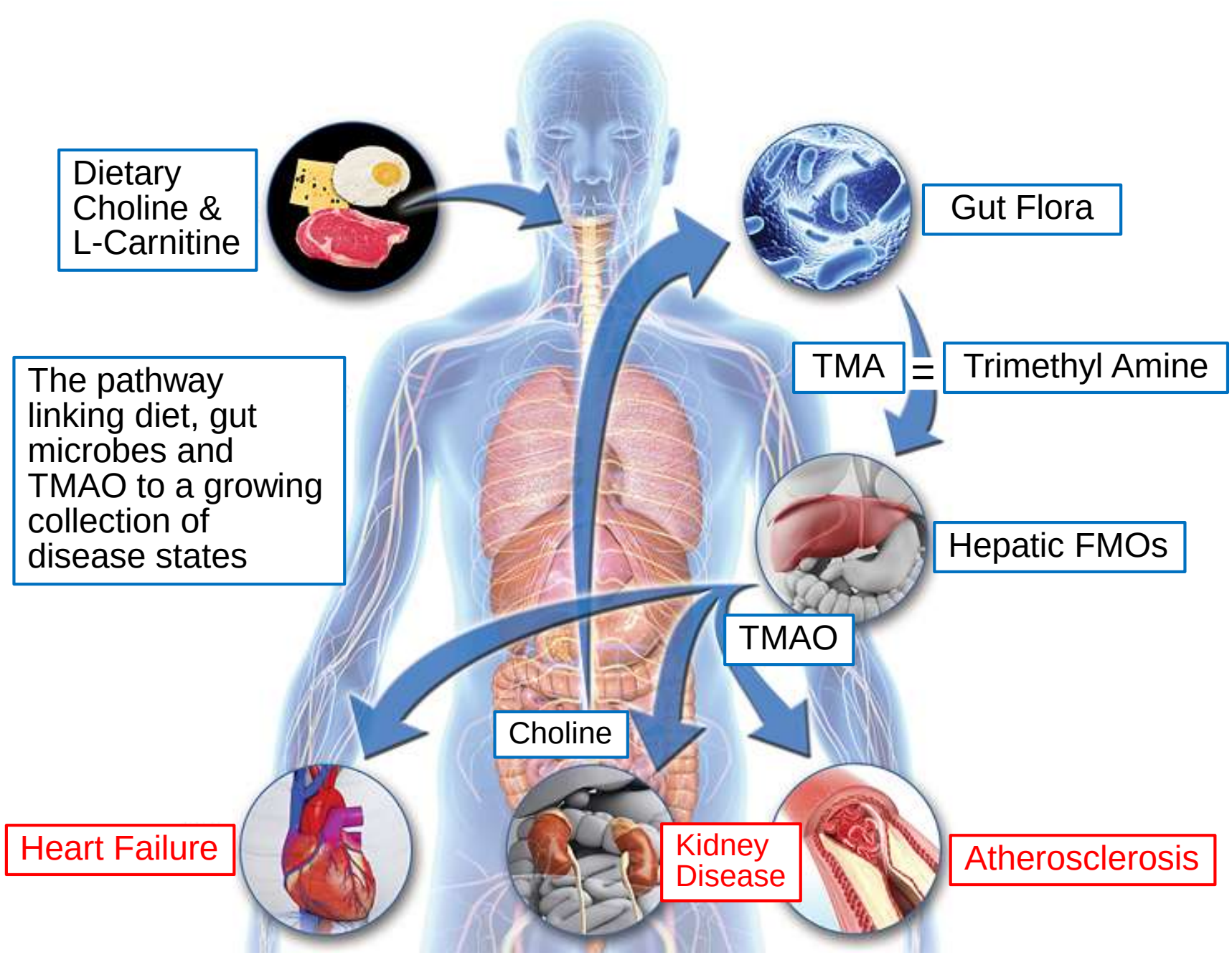




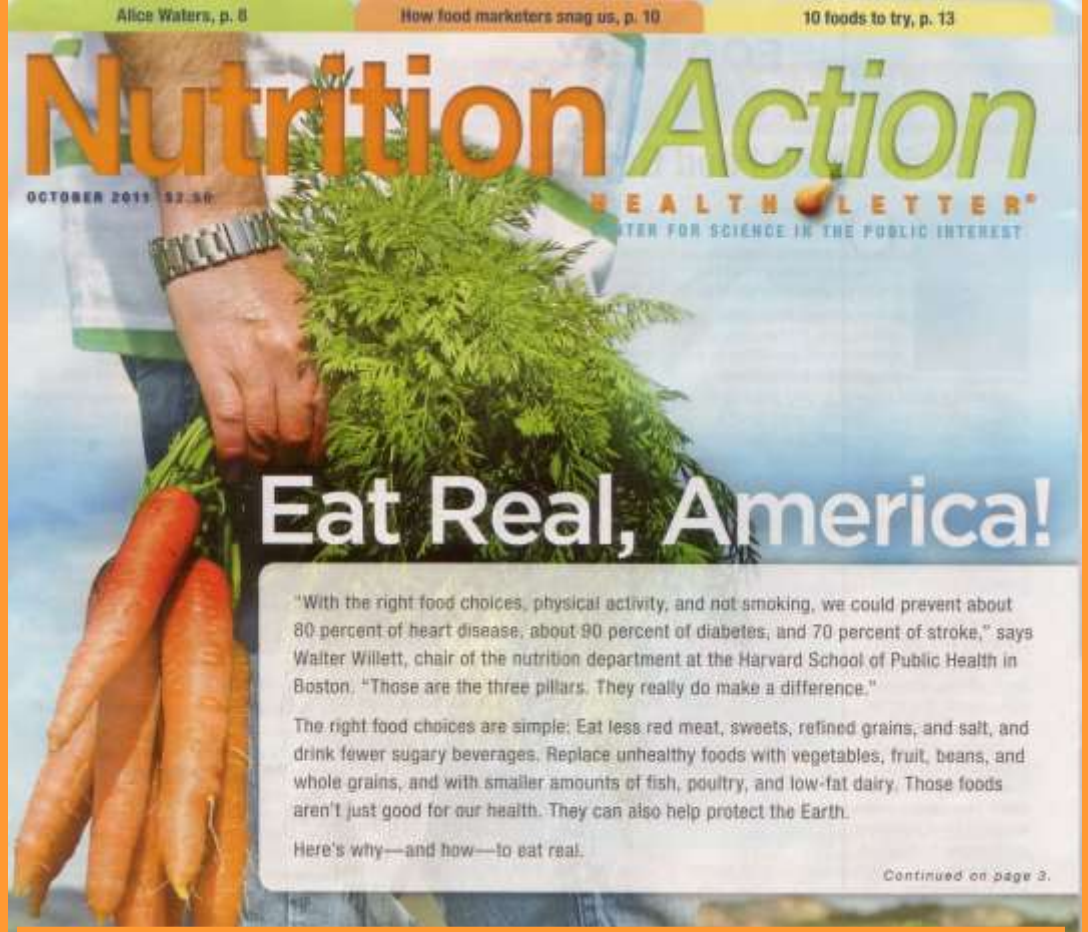
Evolutionary Biologist
Behavioral Ecologist
U Minnesota



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



http://www.nejm.org/doi/full/10.1056/NEJMoa1109400#t=article



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

More Reasons to Shake the Salt Habit

① ↓blood vessel vasodilation w/in 30 min by ingesting 1500 mg Na+!

② ↑Ca^{2+} excretion ↑bone loss, risk of osteoporosis & fractures.

③ May directly impair kidney function & ↑risk of kidney stones.

④ GI cancer risk, inflammation?

UCB Wellness Letter Jun 2011 p 5

5 times per wk? ≡ 106,600 calories/yr ≡ ± 30.5 lb fat/yr

≡

Starbucks Cinnamon Dolce Latte, whipped cream *Venti (20 oz.)*	410 calories
Jogging	50 min.

Better choices!

PEBB 2011

MyPlate launched June 2, 2011

2. **Focus on fruits. Whole fruit preferable to juice, but any fruit counts! Fill ½ your plate with fruits & vegetables!**

3. **Make at least ½ 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 ½ your plate with fruits & vegetables!**

4. **Go lean with protein. Keep protein to < ¼ plate! Nuts, beans, peas, seeds, poultry, lean meat, seafood,…**

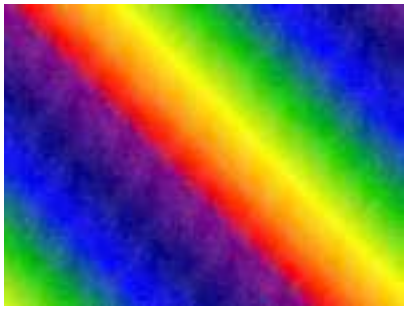
Diet & Health Guidelines for Cancer Prevention

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

And <u>always</u>, remember...

Do not smoke or use tobacco in any form.

American Institute for Cancer Research (AICR)



Eating the Rainbow Hawaiian Style!!

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

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

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

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

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

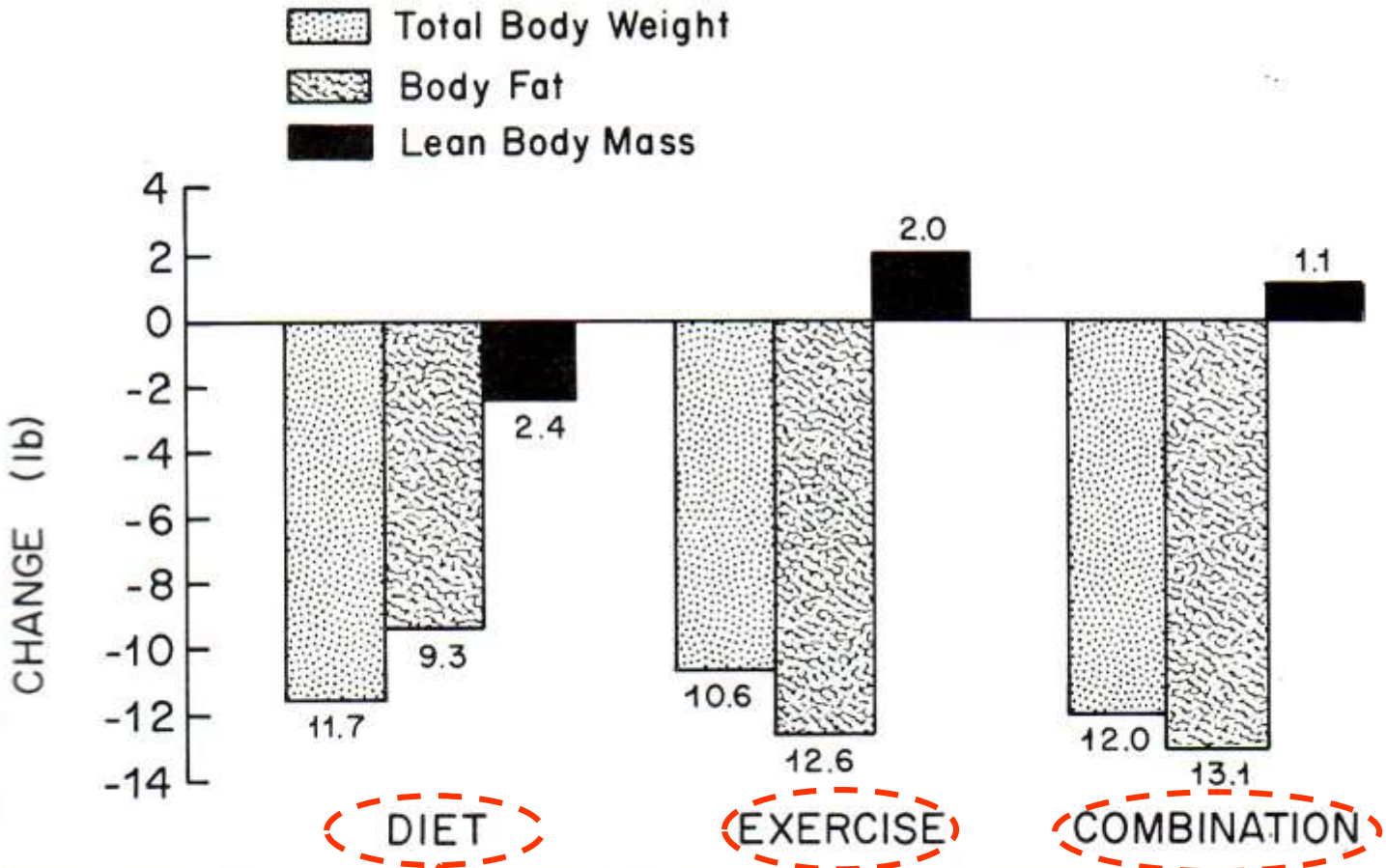
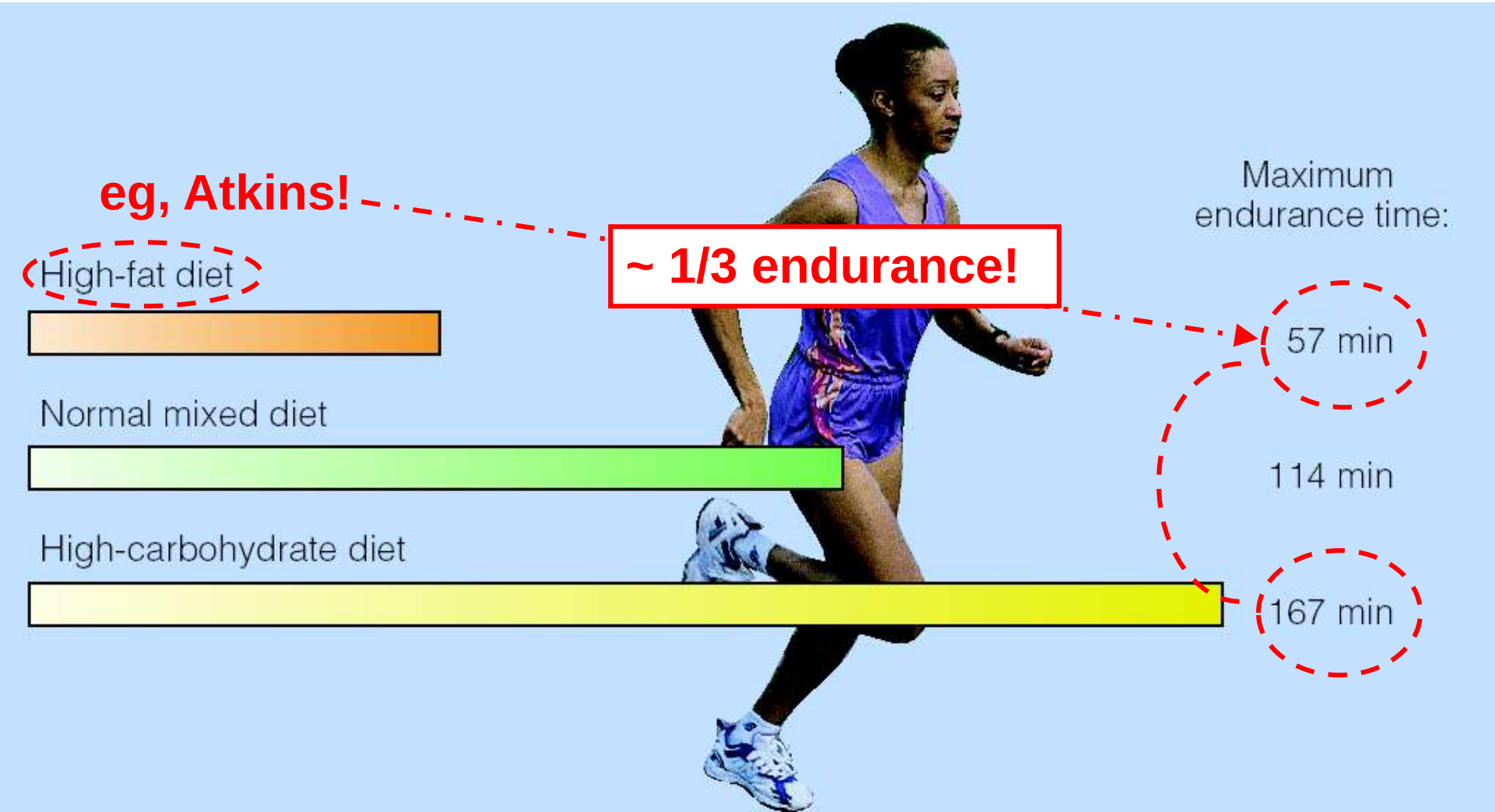


Figure 4–9. Changes in body weight, body fat, and lean body weight for diet, exercise, and combination groups. (From Zuti W. B., and Golding, L. A.: Comparing diet and exercise as weight reduction tools. **Phys. Sportsmed.** 4:49–53, 1976.)

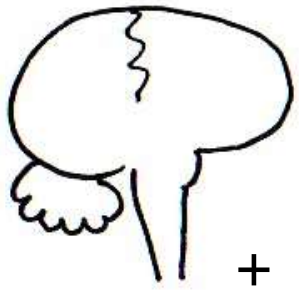
***NB*: Each group 500 kcal deficit/day, 16 weeks**

Dietary Composition & Physical Endurance



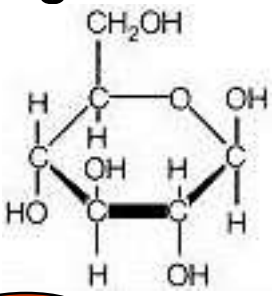
cns

2



+

glucose



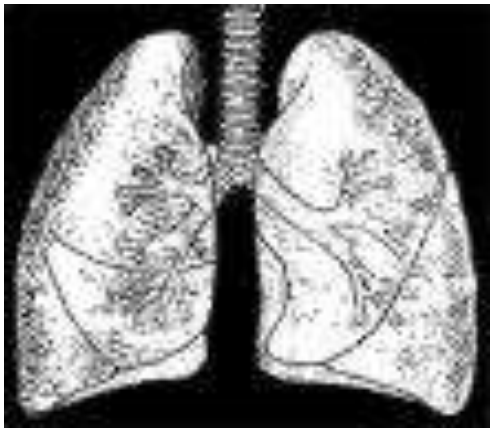
rbcs

3

Negative Effects of Low Carbohydrate

1

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...

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

FAT	**9 Kcal/g**
ETOH	**7 Kcal/g**
CARB	**4 Kcal/g**
PRO	**4 Kcal/g**

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

60-day Fast???

Lost 60 lb!! Wow!!

Yet

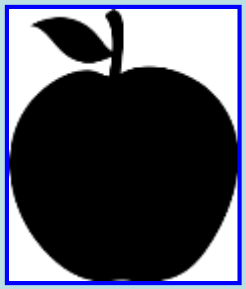
> ¾ **26 lb Water**

20 lb Lean Body Mass

14 lb Fat

Fat < ¼ total wt loss!

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

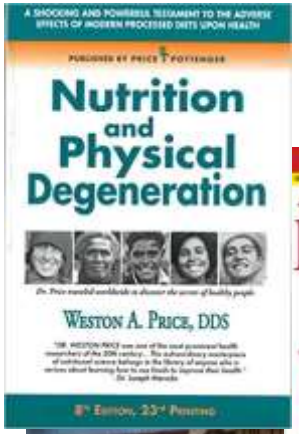
- Eight of 10 ate breakfast daily which may help better manage calories during the day
- Self-monitor, weigh themselves ≥ 1x/wk & many still keep food dairies

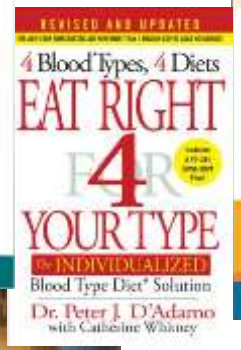
- Much planned physical activity, 60-90 min/d, 1^0 walking + looked for other ways to be active

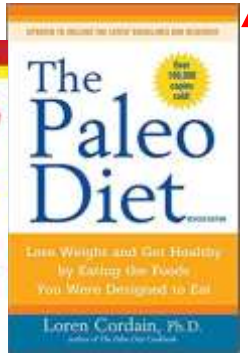
http://www.nwcr.ws/Research/published%20research.htm

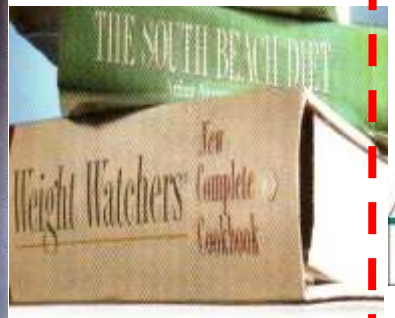
UC Berkeley Wellness Engagement Calendar, September 2013

Which Diets are Best?

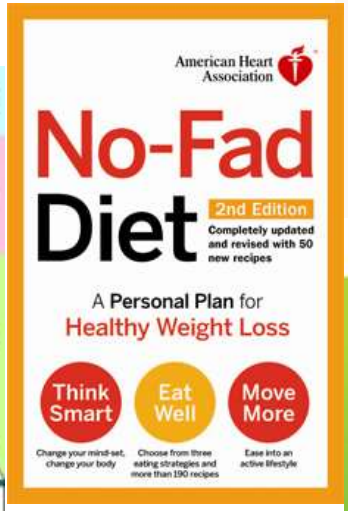


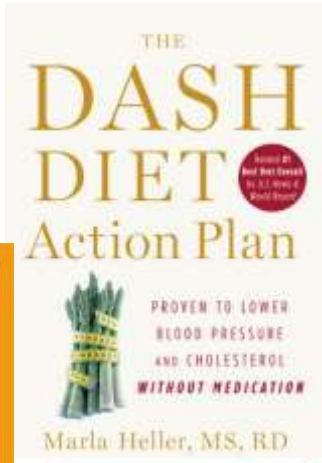


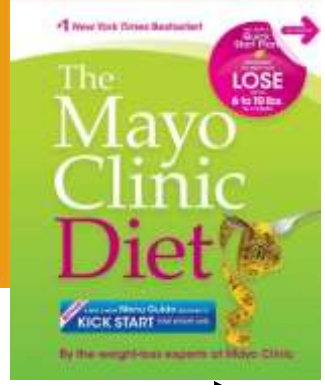




Mediterranean Diet







Not Plant-based
Lower Carbohydrate

Plant-based
Lower Fat

Not Peer-Reviewed =
Trade Book
→ Opinion

Peer-Reviewed =
Text Books
→ Research

BI 121 Lecture 7

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

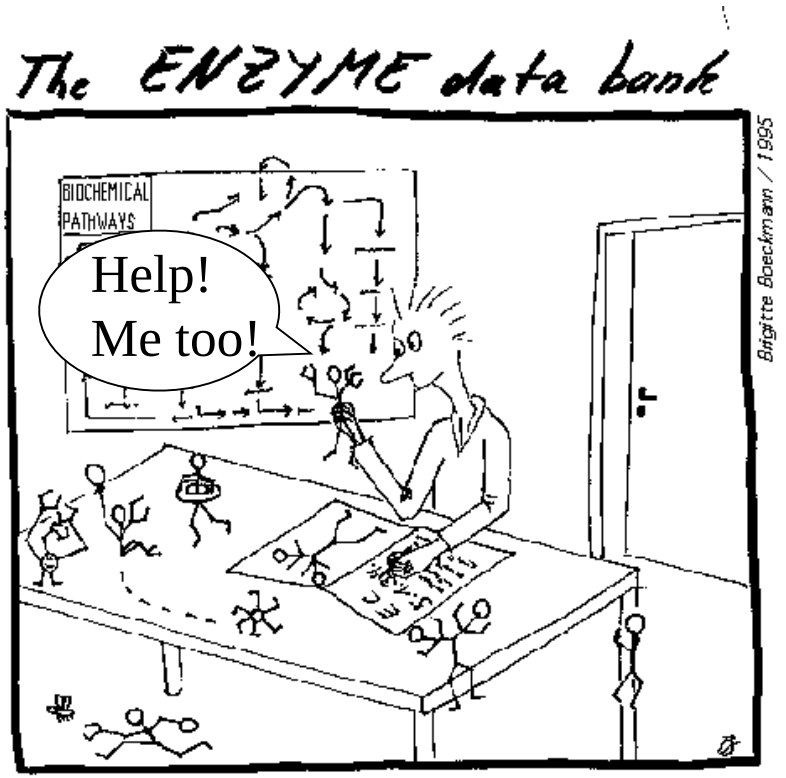
I. ***Announcements*** Exam I one week from today, Oct 24th!
Summary & Review, Sunday Oct 22nd, 6-7:30 pm, here! Q?

II. ***Gastrointestinal Physiology*** DC Module 3 pp 17-23, LS ch 15+
- A. GI = Donut? GI secretions: What? Where? Why? LS p 438
- B. How is the gut controlled?
- C. Organ-by-organ review A&P 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+…

Hydrolysis of Energy Nutrients

+

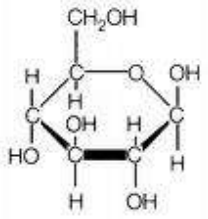


H_2O + Enzyme

Polymer to Monomer (Many to One)

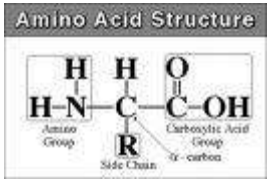
…Central-linking theme!!

Carbohydrate

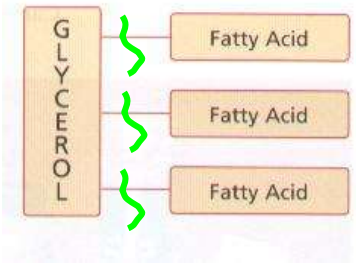


Glucose

Protein
+
Fat

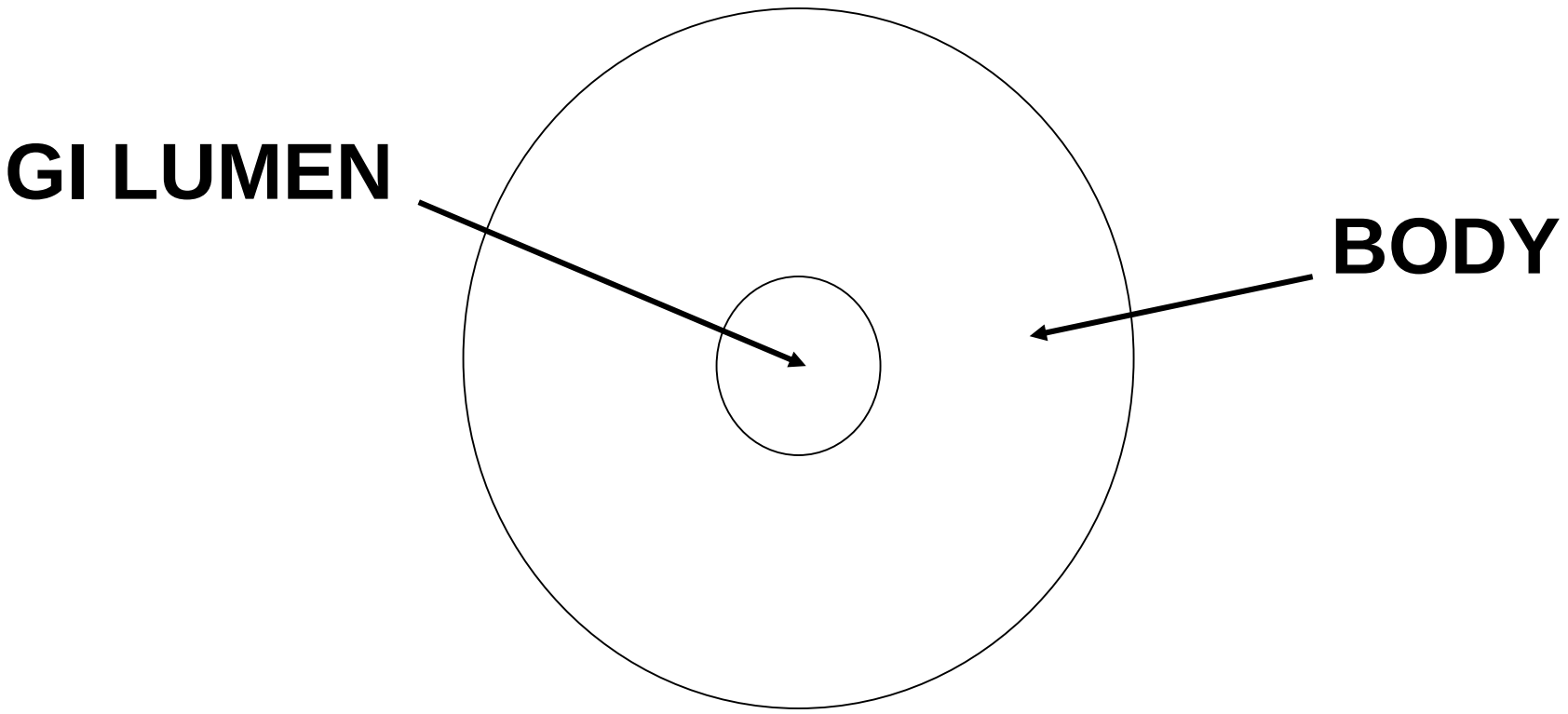


Amino Acids



Fatty Acids
+
Glycerol

GI-DONUT ANALOGY



Gut Secretions

Secretion	***Release Site***
1. Mucus	**into GI Lumen**
2. Enzymes	**into GI Lumen**
3. H_2O, 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!

4. Liver-Gall Bladder

Emulsification =
detergent action of bile
+ secretion

5. Pancreas

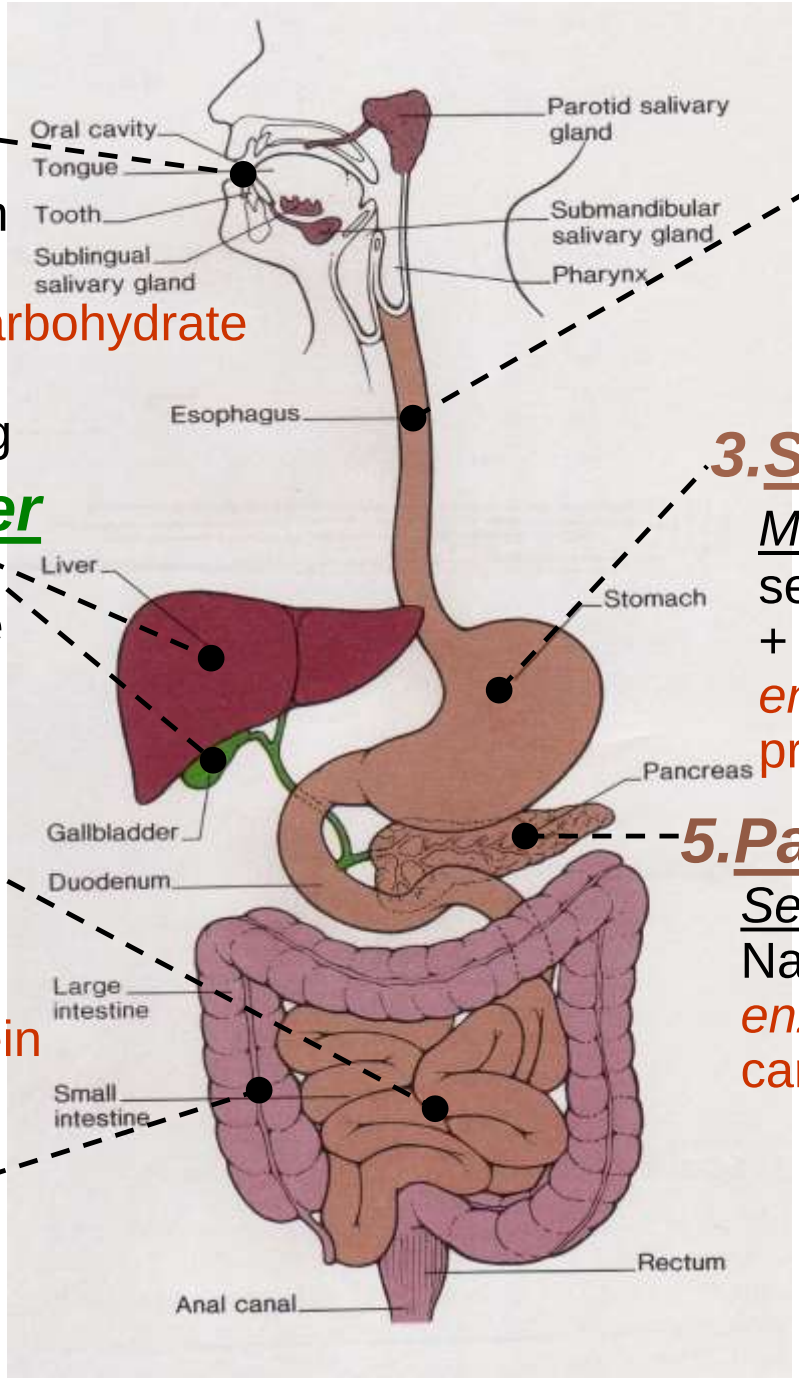
Secretion mucus +
$NaHCO_3$ + enzymes
enzymatic digestion:
carbohydrate, fat, protein

6. Small Intestine

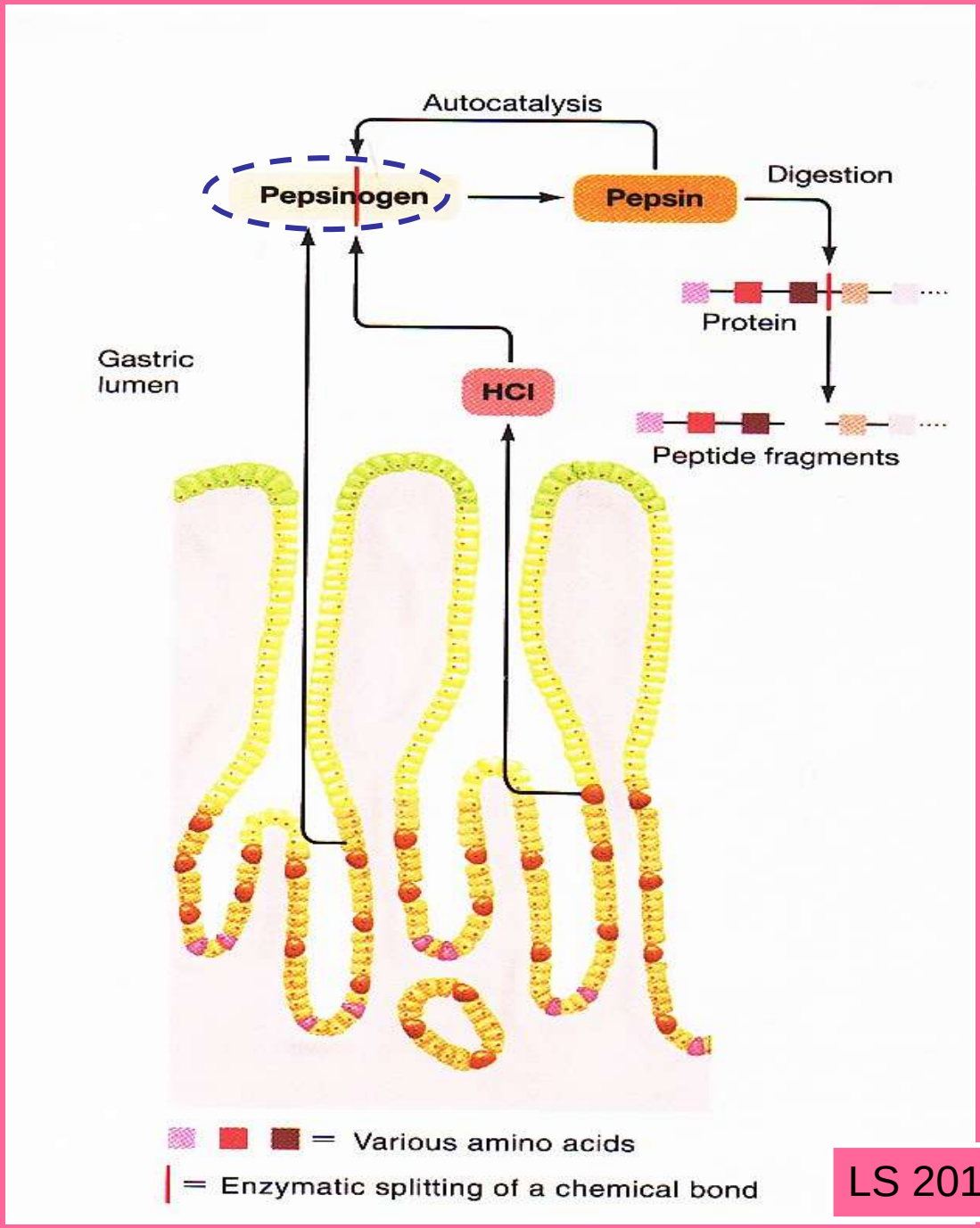
Absorption
Secretion mucus
+ enzymes
enzymatic digestion:
carbohydrate, fat, protein
Peristalsis

7. Large Intestine

Dehydration
secretion + absorption
storage + peristalsis



Zymogen= an inactive precursor



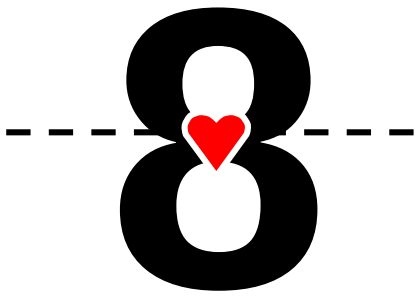
LS 2012 fig 15-9 p 452

Ulcer Facts

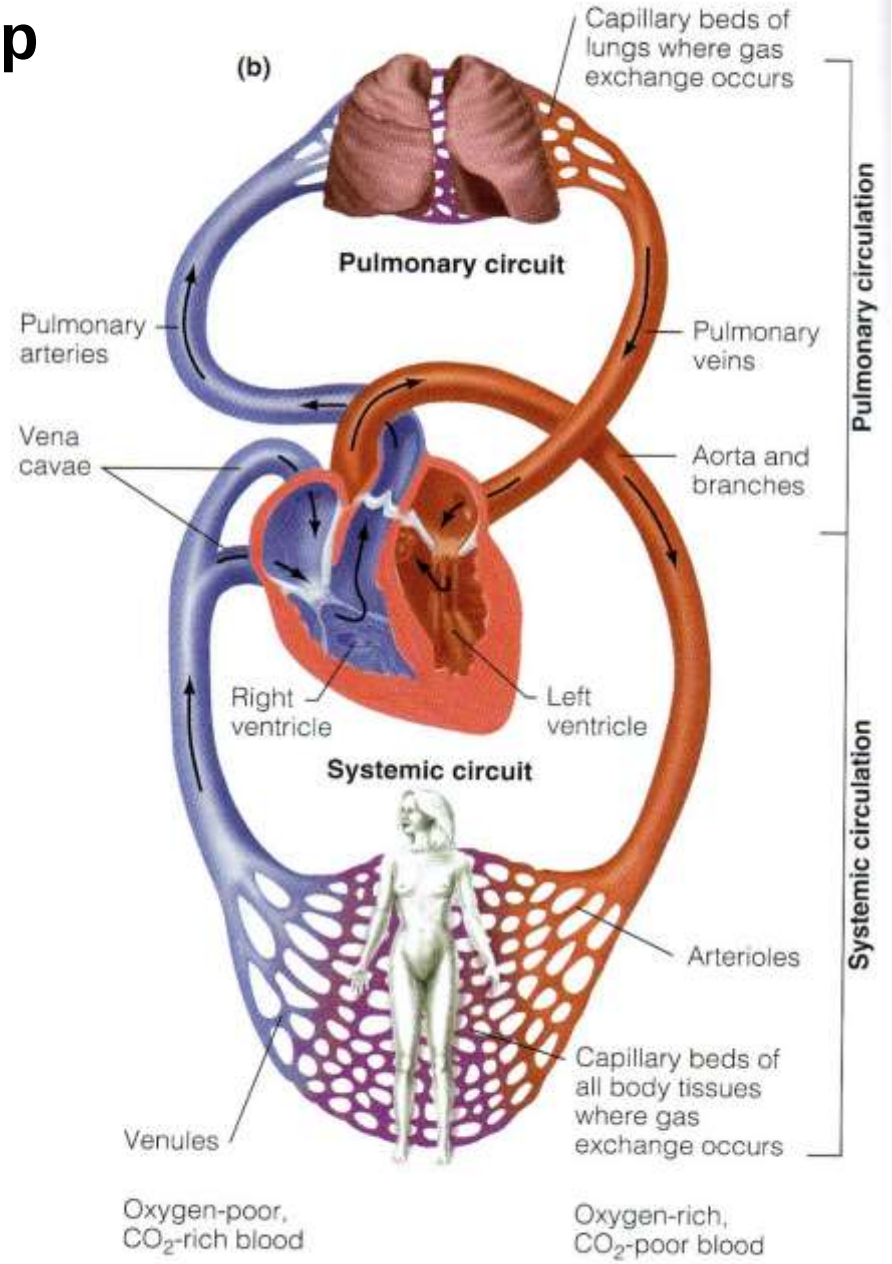
- Most ulcers are caused by an infection, not spicy food, acid or stress.
- The most common ulcer symptom is burning pain in the stomach.
- Your doctor can test you for *H. pylori* infection.
- Antibiotics are the new cure for ulcers.
- Eliminating *H. pylori* infections with antibiotics means that your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

NB: Figure-8 loop

Pulmonary

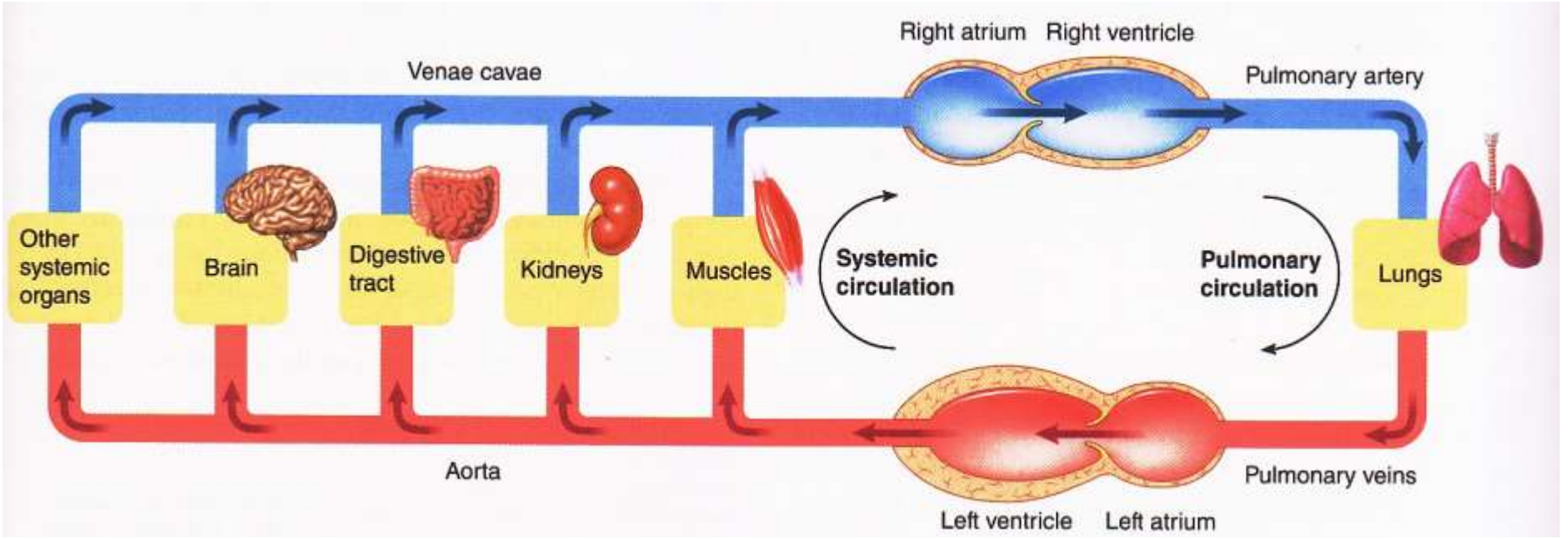


Systemic



D Chiras 2013 fig 4-1b

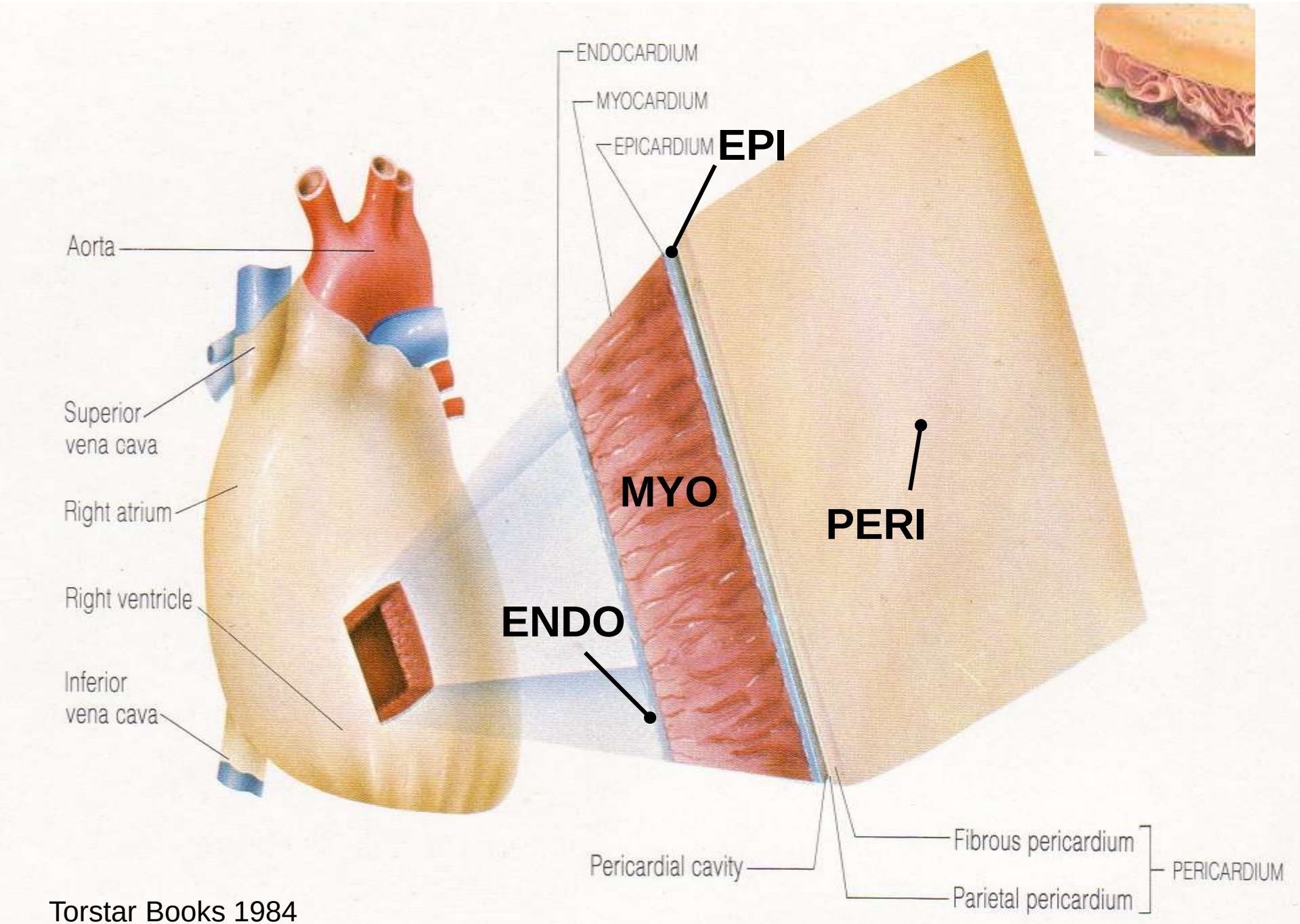
Dual Pump Action & Parallel Circulation



LS 2012 fig 9-2b p 231

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

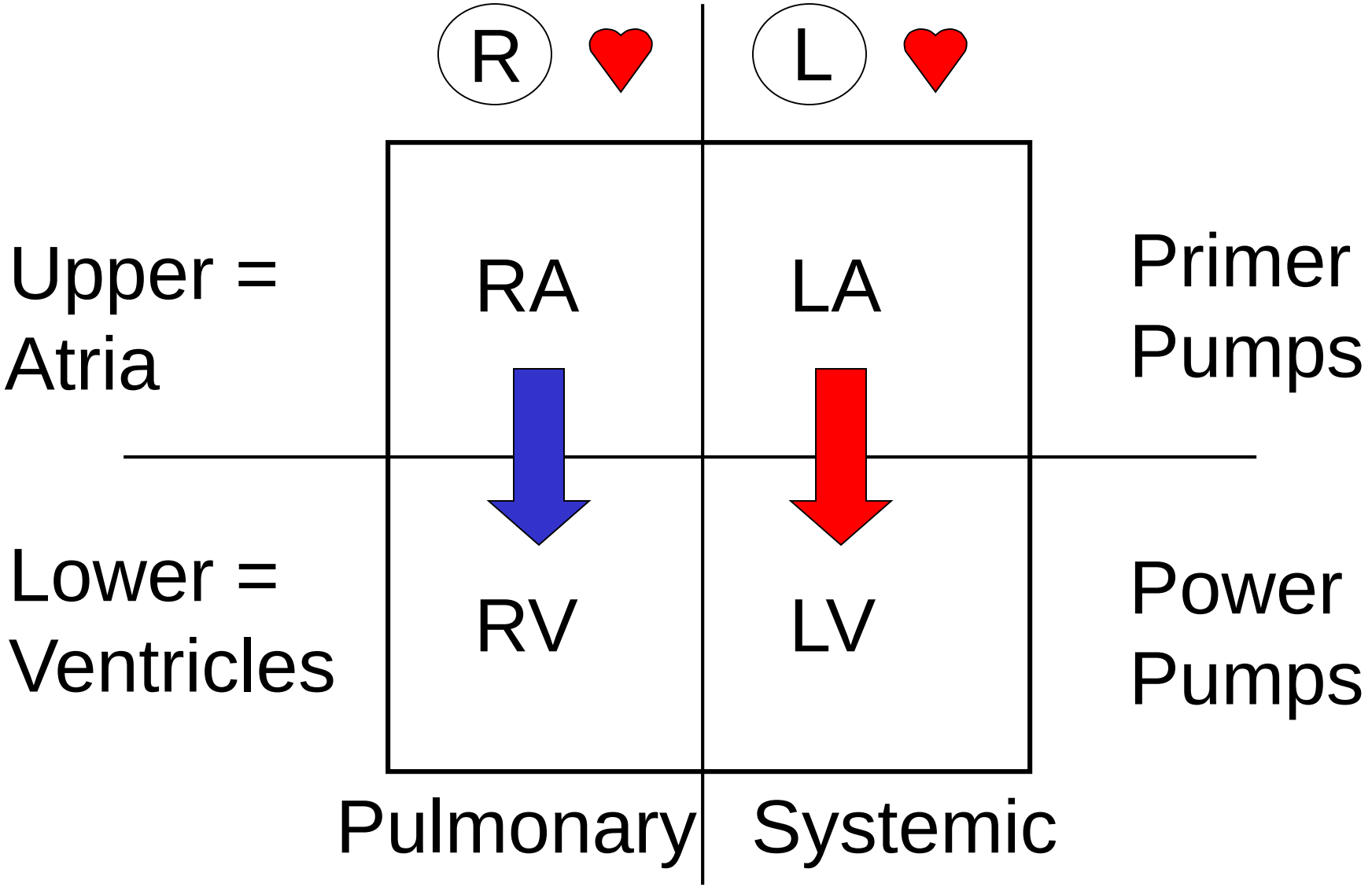
LS 2012 fig 10-21 p 283



Torstar Books 1984

Human ♥ = 4-chambered box?

2 separate pumps?



Human ♥ = 4 unique valves?
2 valve sets?

Semilunar = *Half-moon shaped*

More rigid

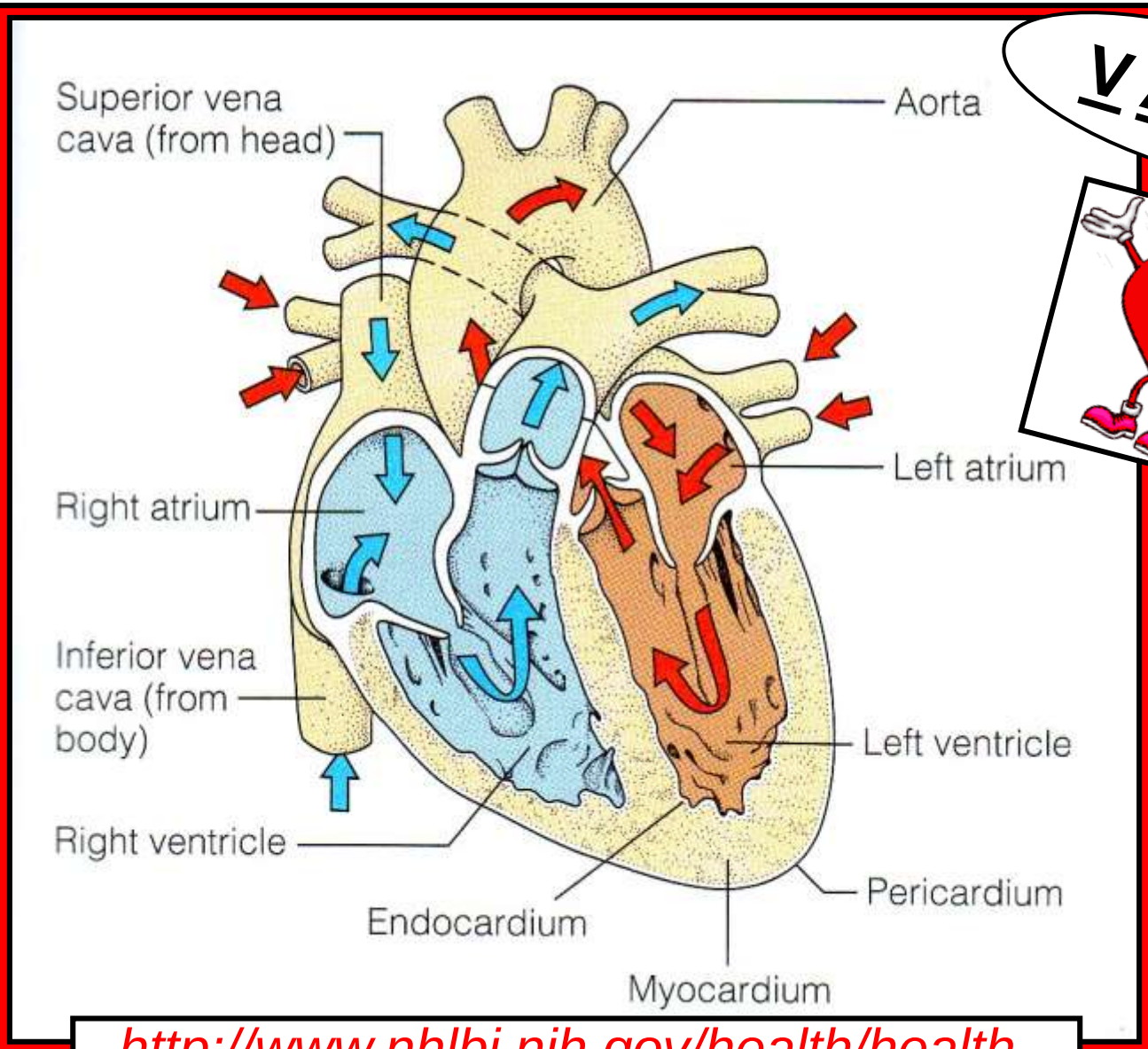
1. Pulmonic/Pulmonary
2. Aortic

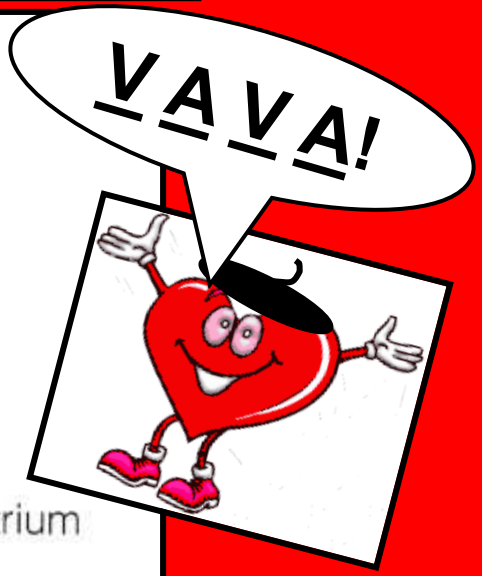
AV = *Atrioventricular*

More flimsy

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

Veins → Atria → Ventricles → Arteries





http://www.nhlbi.nih.gov/health/health-topics/topics/hhw/contraction.html

LS2007

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

BI 121 Lecture 8

I. ***Announcements*** **Exam I next session; 12 n & 1 pm lab sections go directly to 112 HUE & 130 HUE. All others here (100 WIL)! Review: Sunday, 6 pm here! Lab notebooks. Q?**

II. ***Cardiovascular Connections*** **LS 2012 ch 9, Torstar Books+...**

III. ***CV Physiology in News*** **AHA + NHLBI websites. Nic? ACSM, AHA, DHHS Healthy people 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: Exercise, Diet, Drugs+Surgery**
D. **Food choices make a difference? What's HAPOC?**

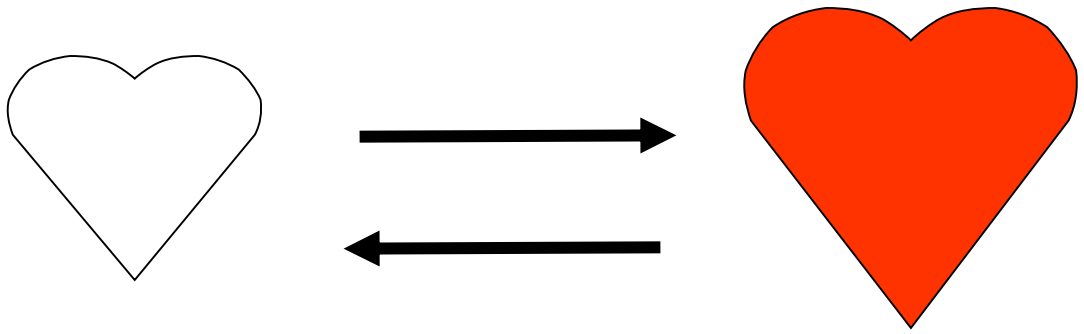
Cardiac Cycle

Systole

Contract
& Empty

Diastole

Relax
& Fill



AMERICAN COLLEGE of SPORTS MEDICINE

Guidelines: Healthy Adults < 65 yr

American Heart Association®
Learn and Live℠

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

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

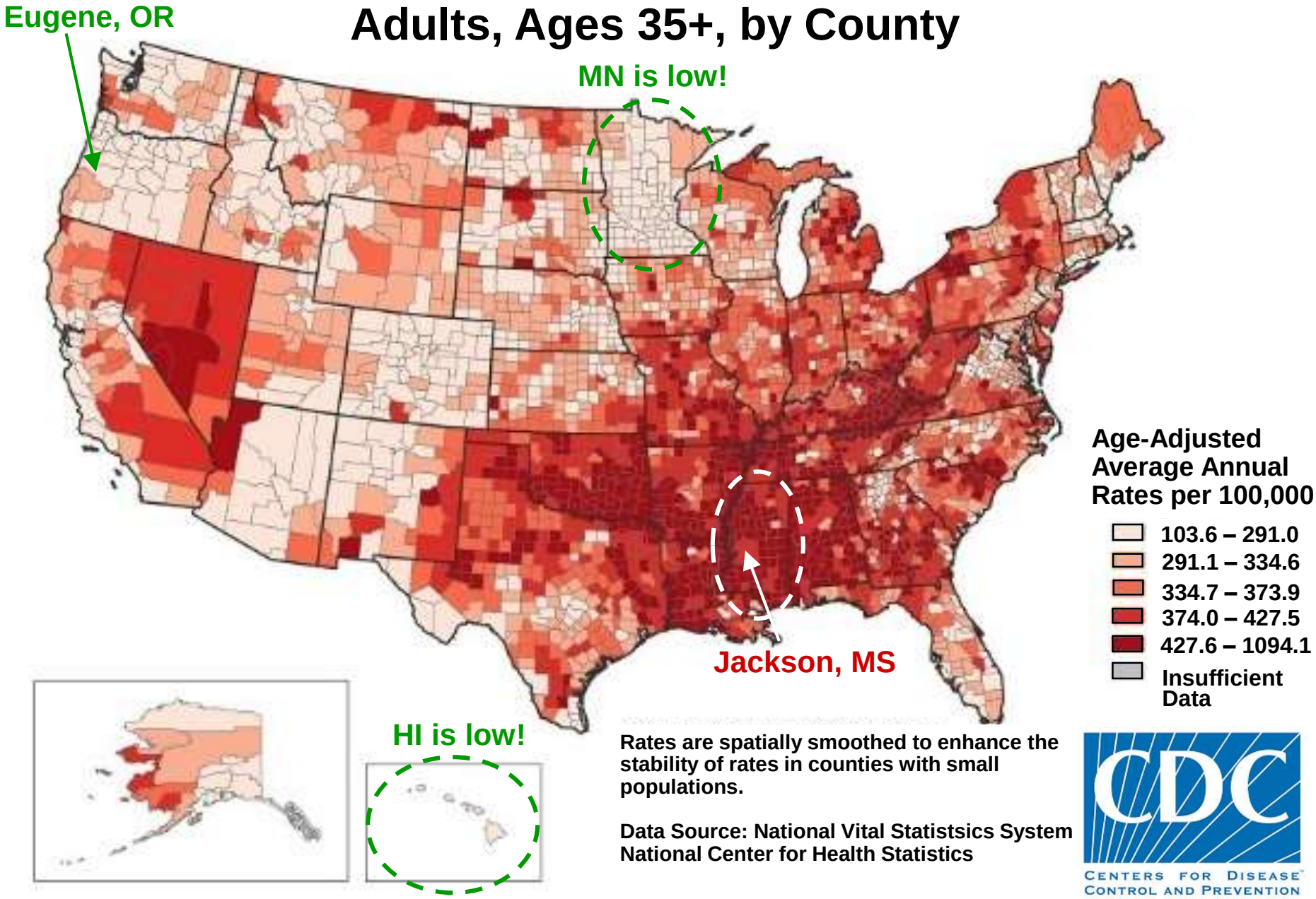
PVD

Did you know?

- **Every 40 seconds, someone has a heart attack in the US!**
- **~630,000 Americans die of heart disease each yr – that's 1 in every 4 deaths. Heart disease is the leading cause of death for both men and women.**
- **Heart disease costs the US ~ $200 billion per yr in health care, medications & lost productivity. By 2035, CVD costs are projected to top $1 trillion annually.**

SOURCE: Heart Disease Facts & Statistics, Centers for Disease Control, Aug 23, 2017.

Heart Disease Death Rates, 2011-2013
Adults, Ages 35+, by County

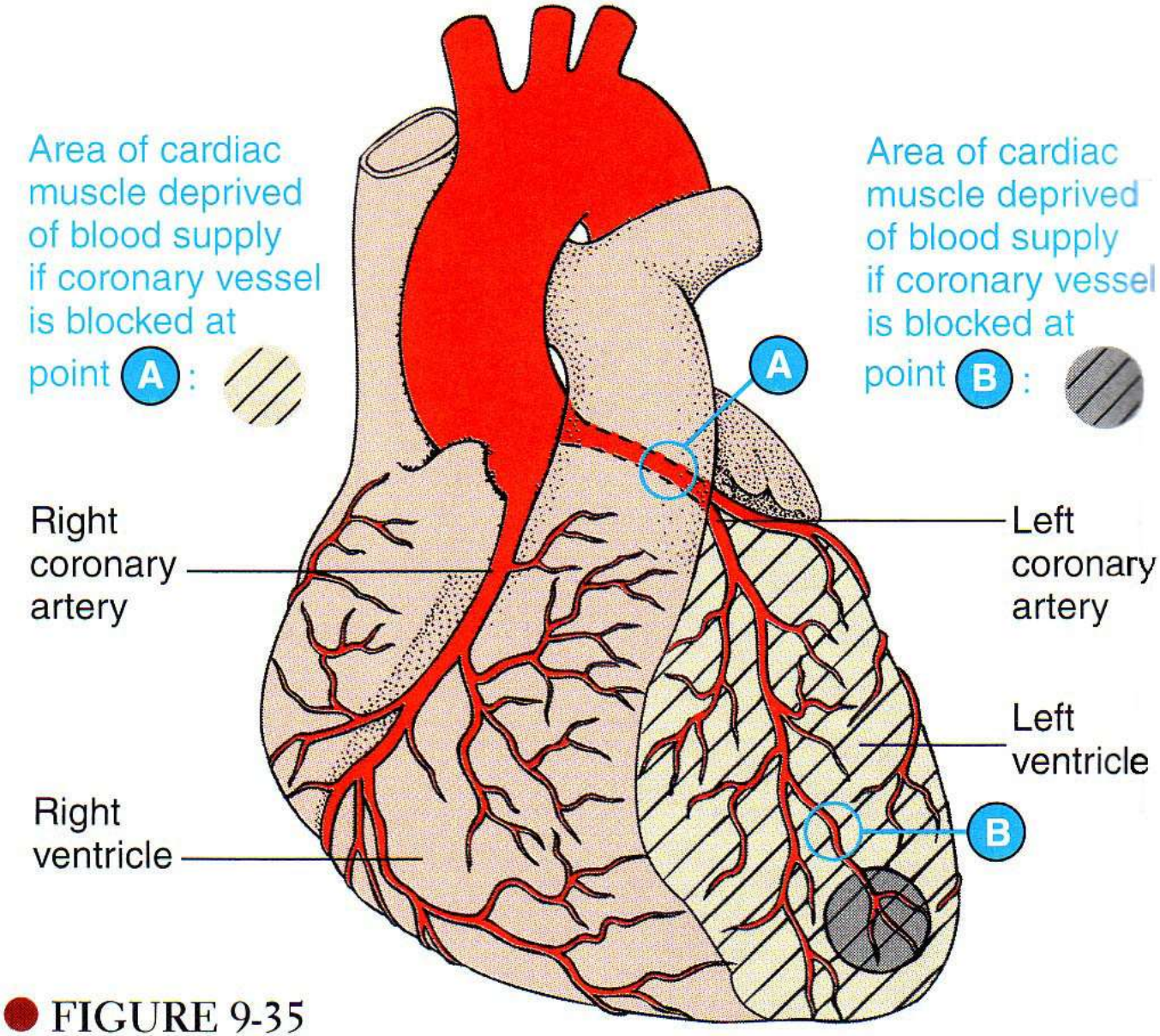


Rates are spatially smoothed to enhance the stability of rates in counties with small populations.

Data Source: National Vital Statistsics System
National Center for Health Statistics

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

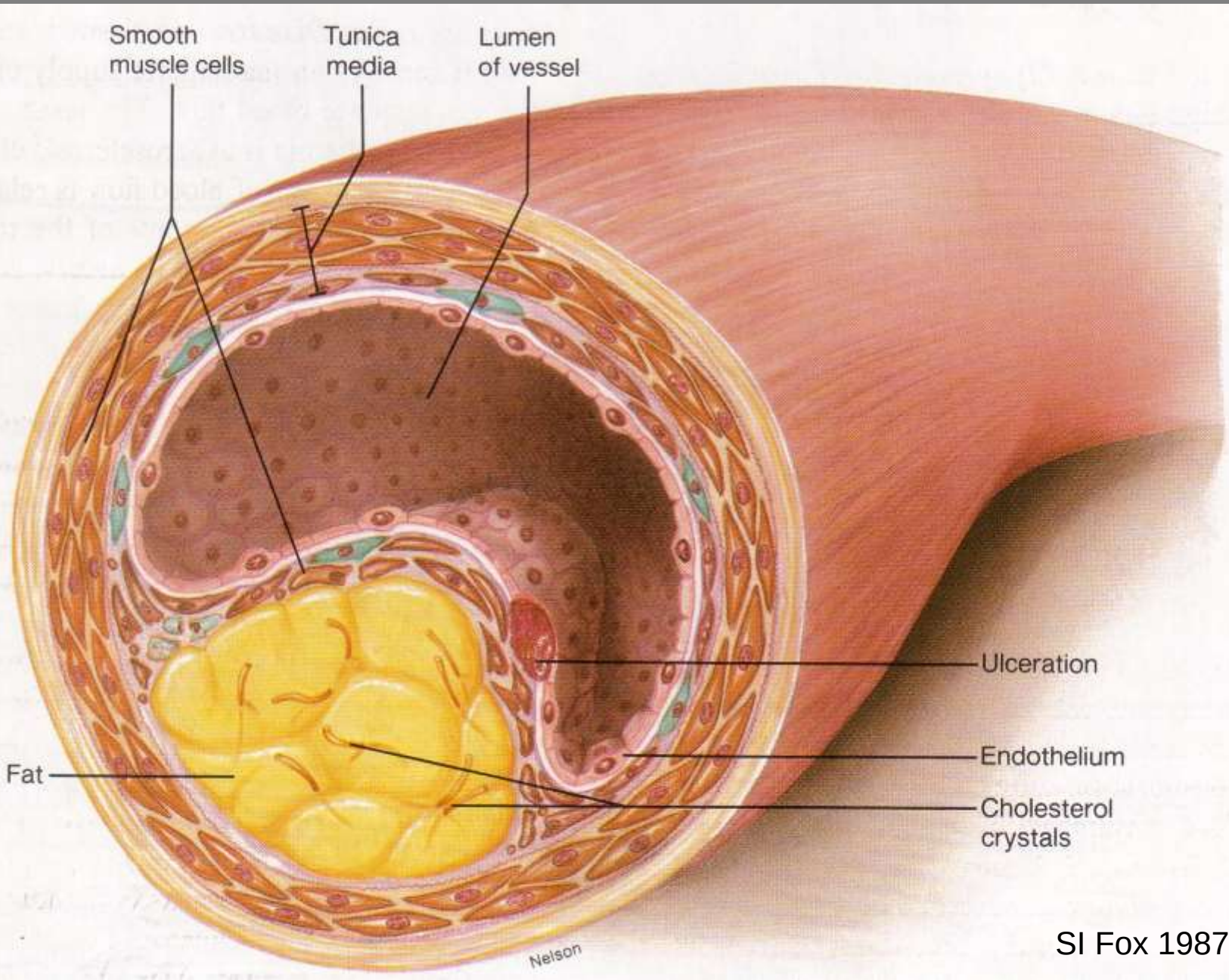
https://www.cdc.gov/dhdsp/data_statistics/fact_sheets/fs_heart_disease.htm



● FIGURE 9-35

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

L Sherwood 2004 p 336

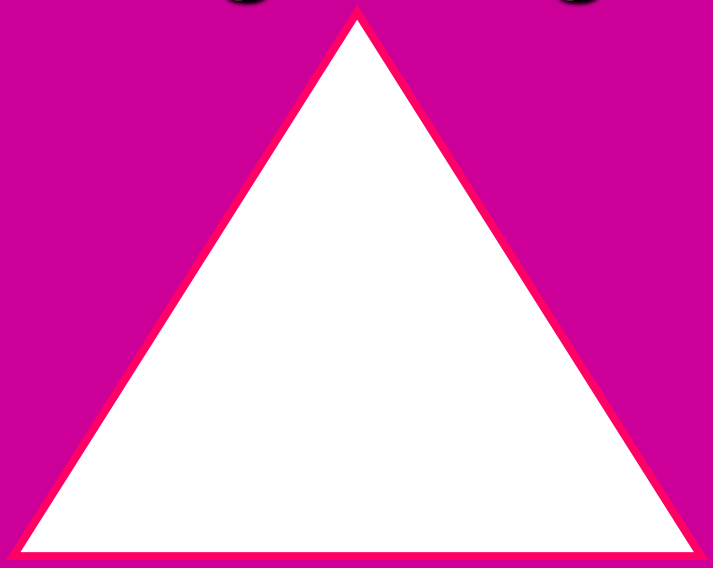


SI Fox 1987 p 370

Treatment Triad

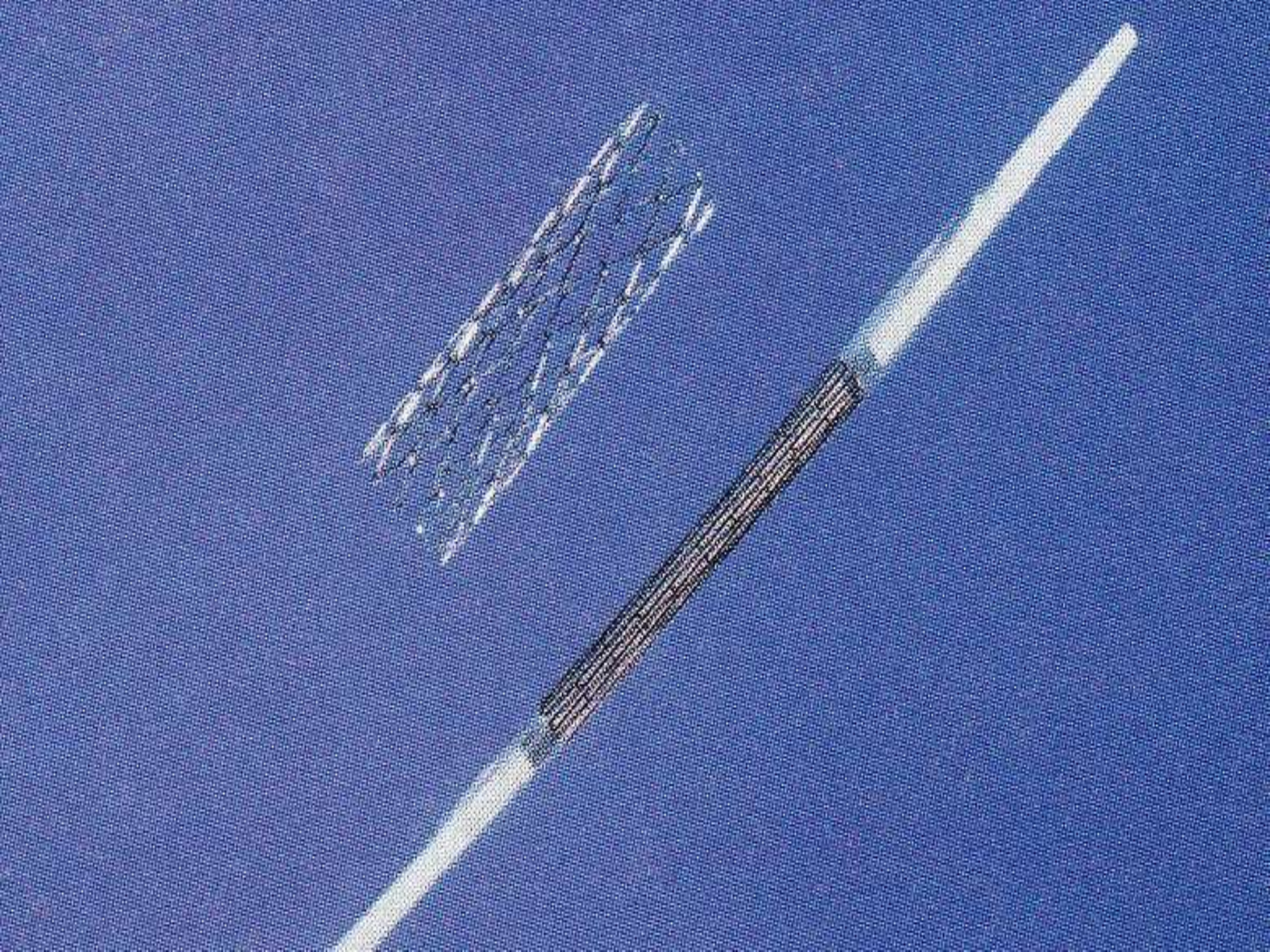
NB: Last blasted resort!!

Drugs/Surgery



Exercise

Dietary Modification



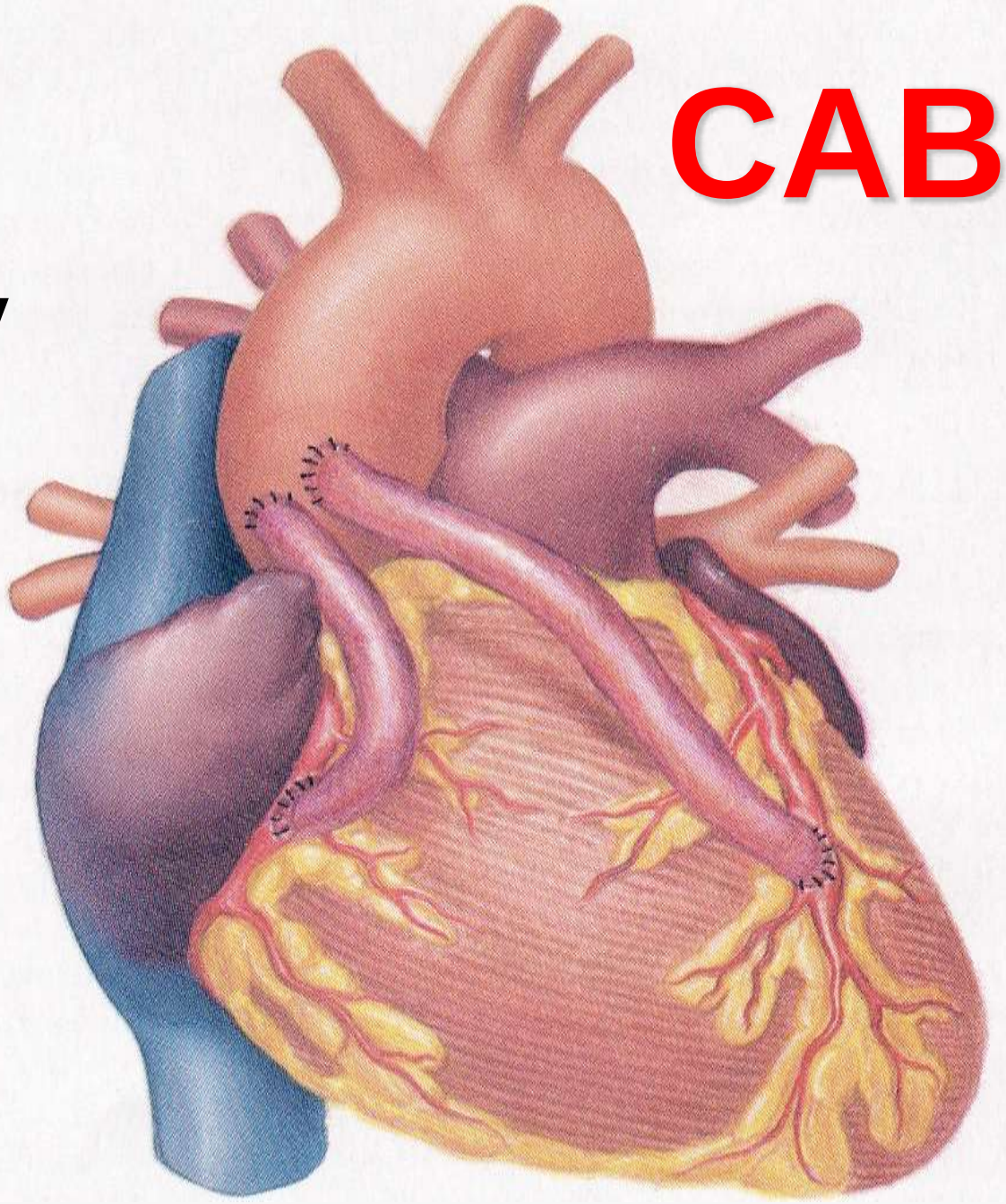
CABG

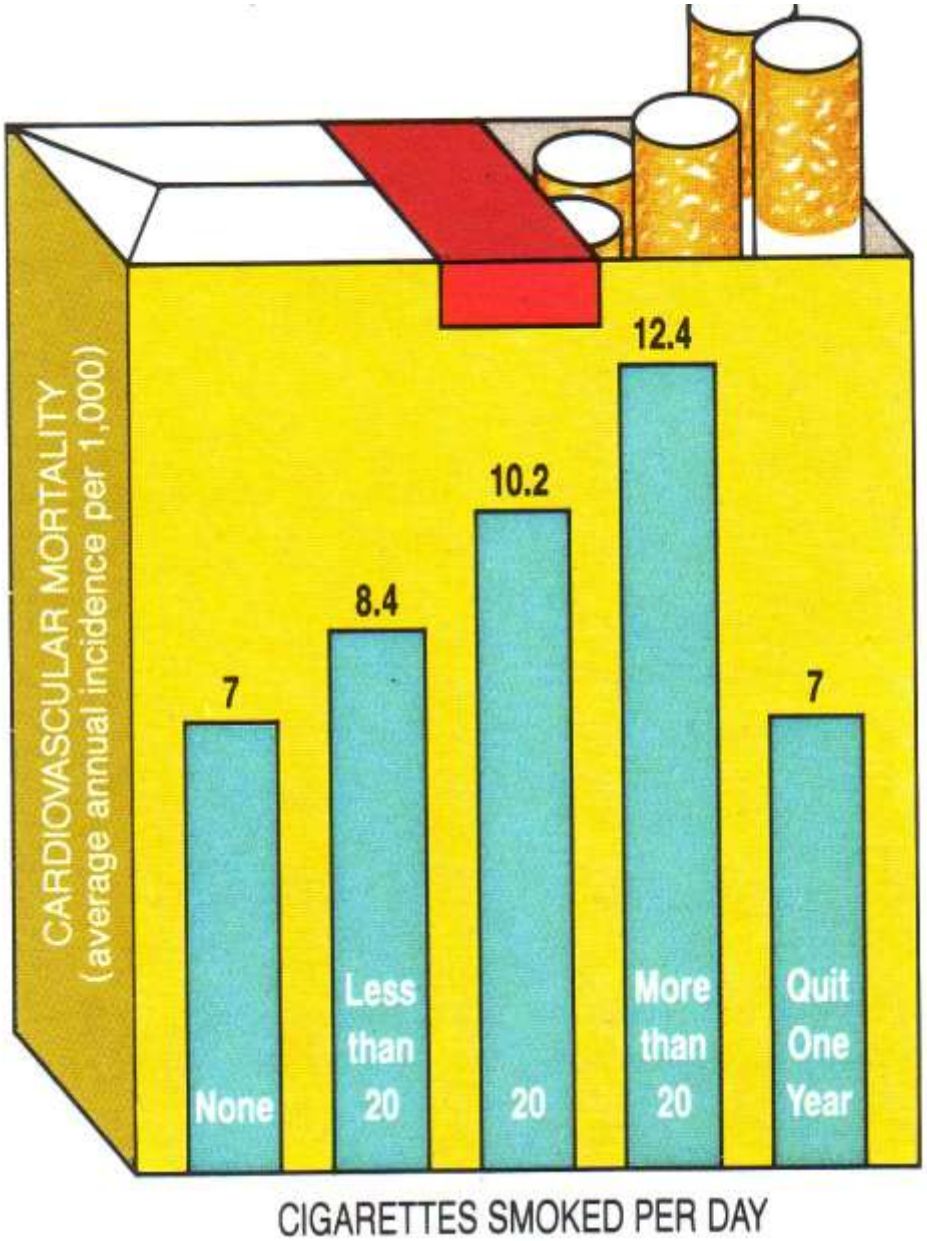
Coronary

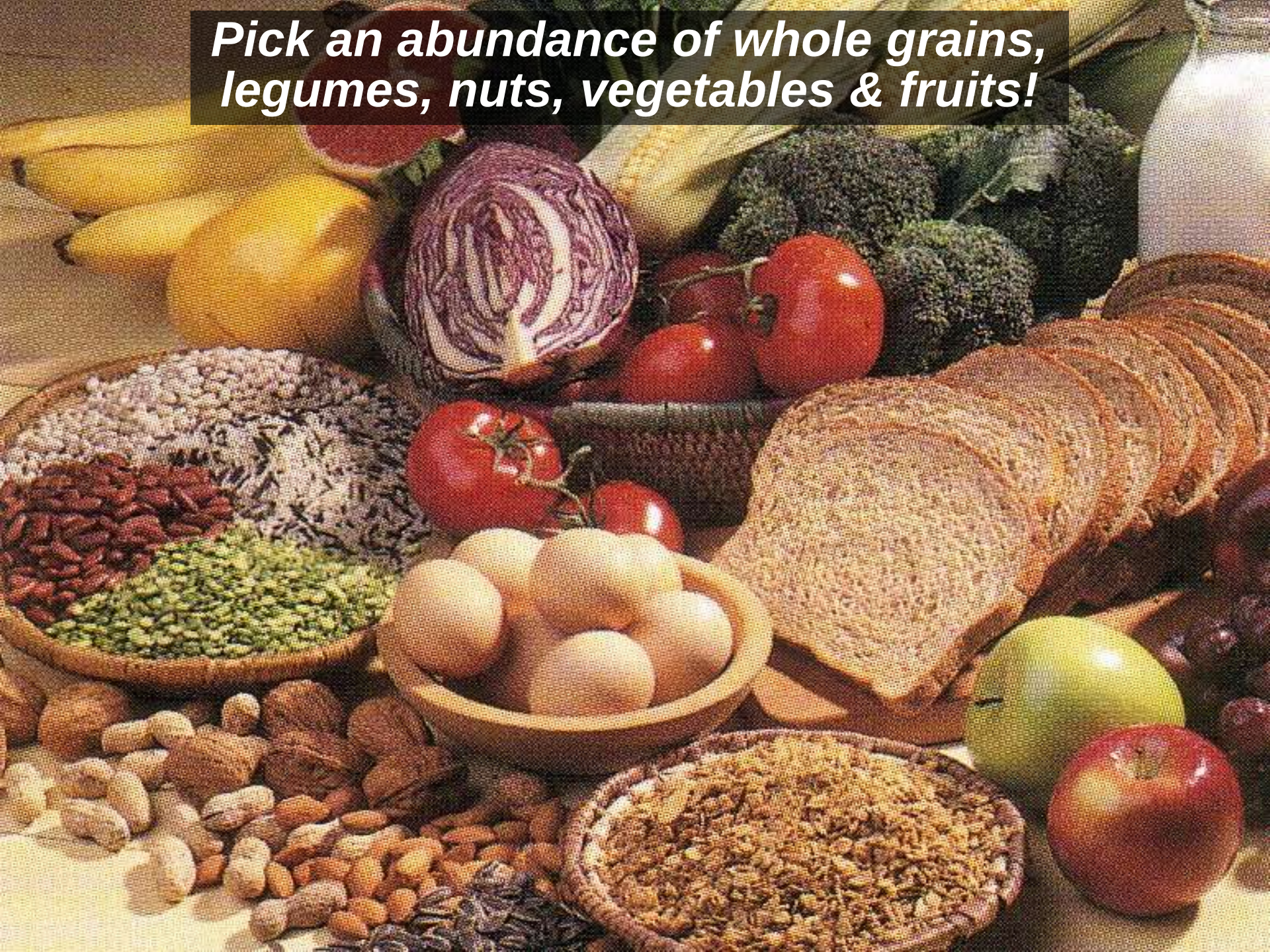
Artery

By-pass

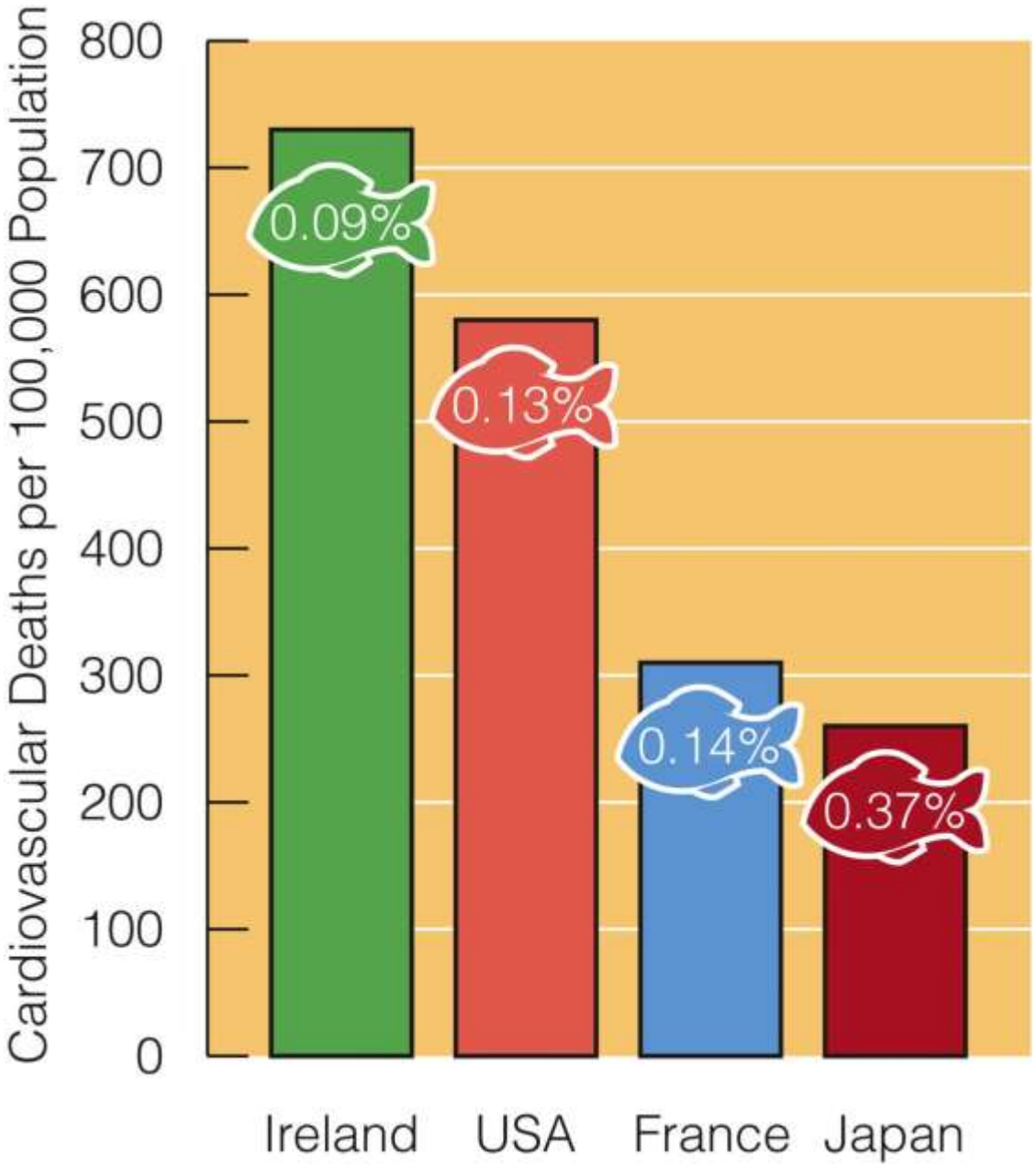
Graft




CARDIOVASCULAR MORTALITY
(average annual incidence per 1,000)
7
8.4
10.2
12.4
7
None
Less than 20
20
More than 20
Quit One Year
CIGARETTES SMOKED PER DAY


Pick an abundance of whole grains,
legumes, nuts, vegetables & fruits!

Fish Oil Intakes & Cardiovascular Death Rates



S&W 2011
fig 5-12 p 167

Healthy Oils to Minimize Atherosclerosis

HAPOC?