...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**

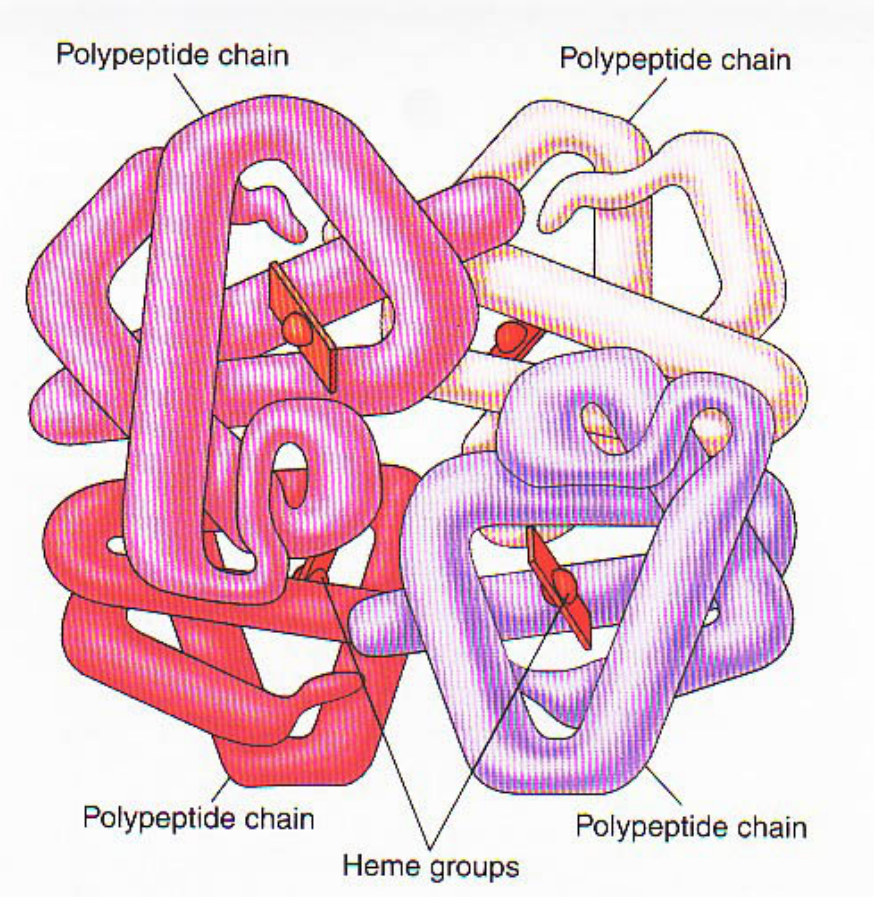
IV. *Homeostasis* LS ch 1, DC Module 1

- **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

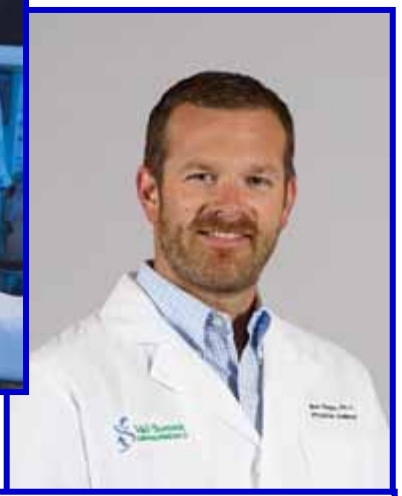
Structure* begets *function!
Structure* gives rise to *function!
Structure & *function* are inseparable!



Preoperative Diagnoses: R Knee

Degenerative Joint Disease (DJD) = arthritis

Varus malalignment = bow-leg



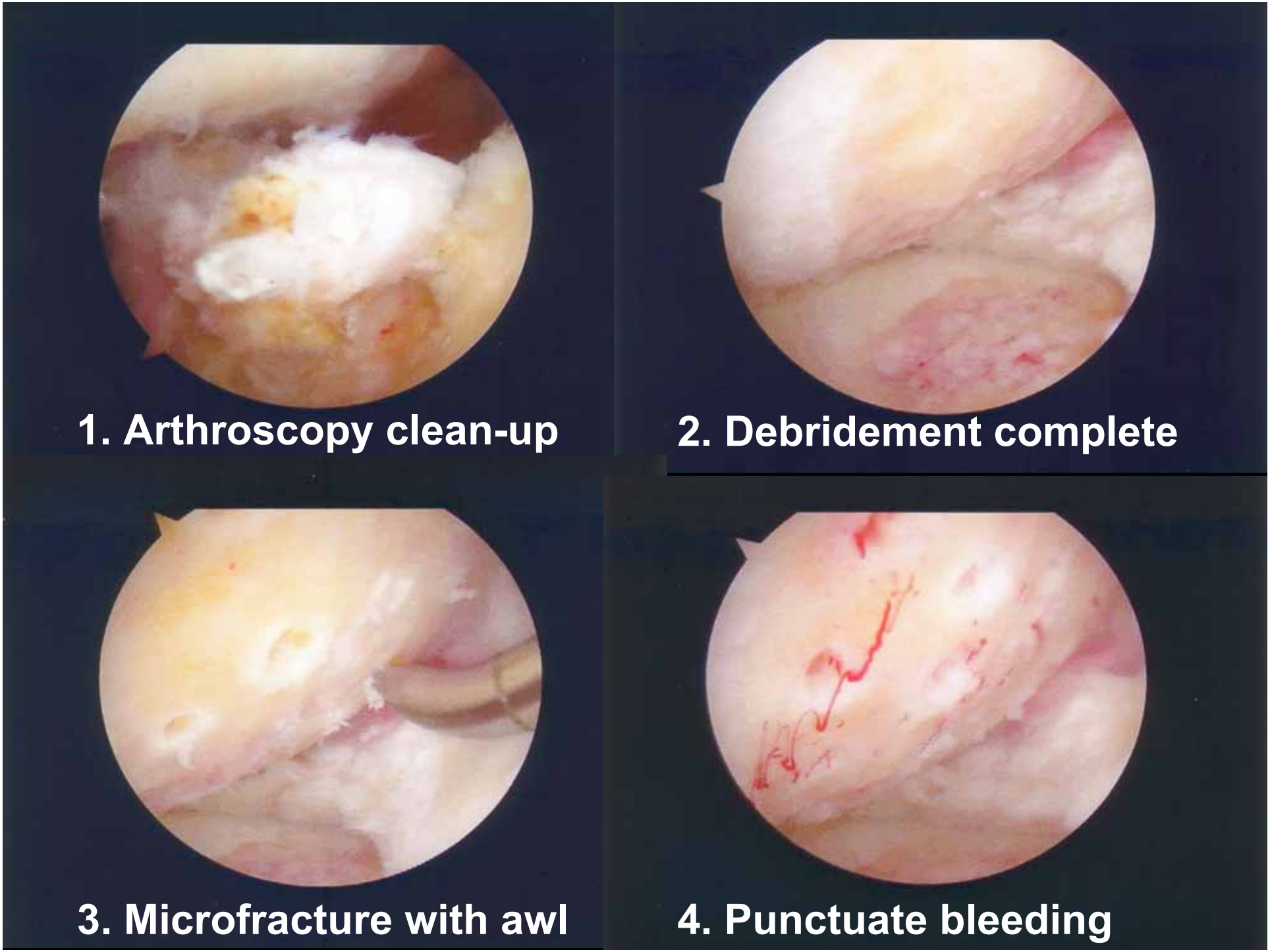
William Sterett, MD
Ben Hogan, PAC
Vail Summit Orthopedics

Procedures:

Arthroscopy & microfracture
High Tibial Osteotomy (HTO)
Packing bone graft substitute

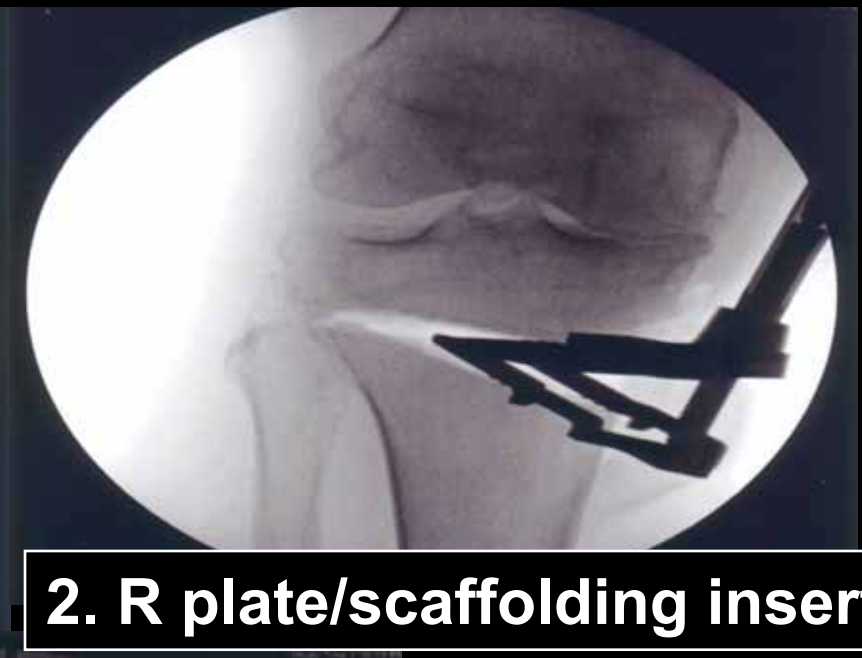
Blocks/Medications:

Femoral n. block
General anesthesia
IV Morphine, Oral Oxycontin + Oxycodone, Tylenol, Injectable Lovenox (enoxaparin Na)


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



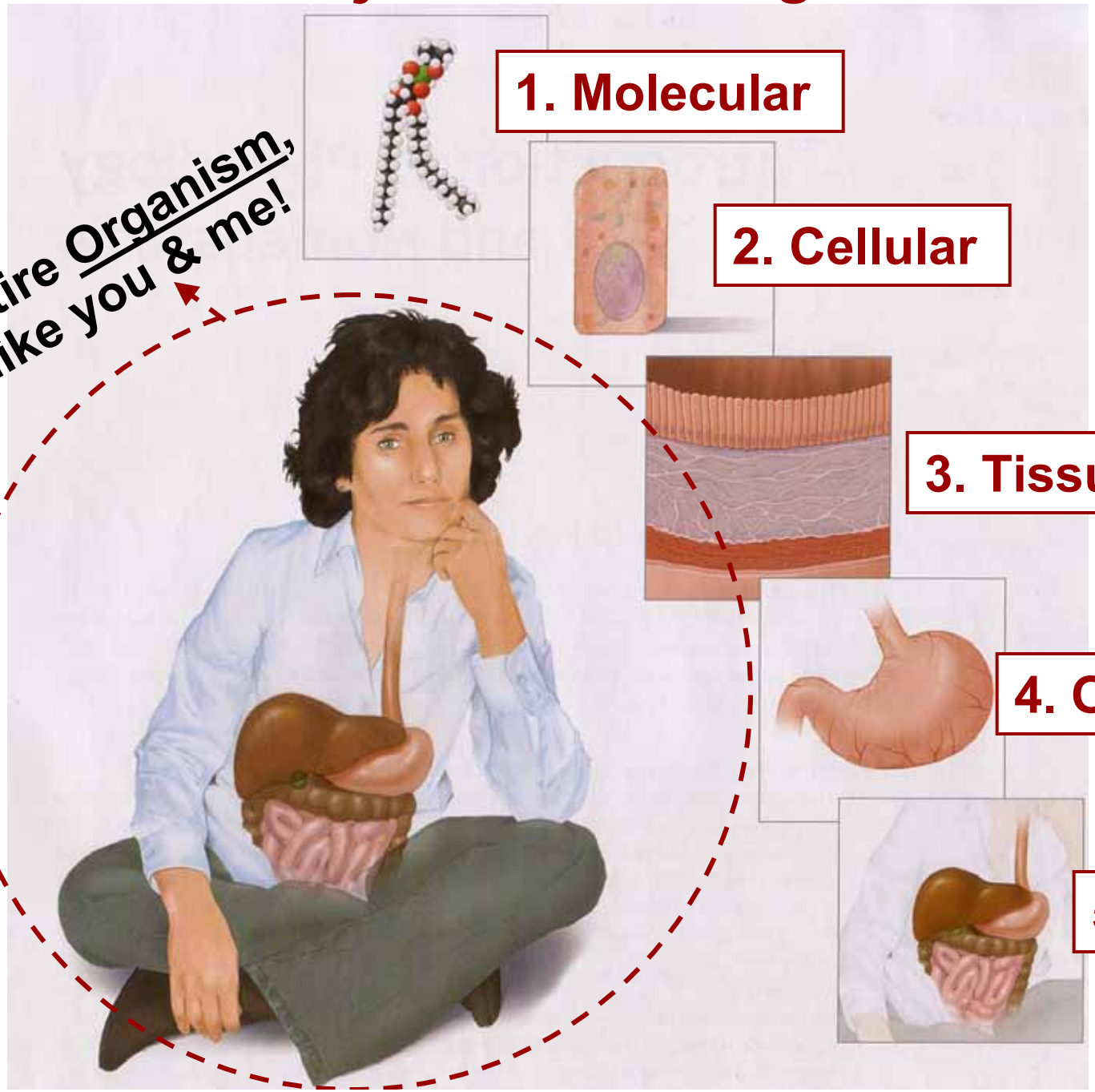
2. R plate/scaffolding insert

3. Align, stabilize w/screws & pack defect

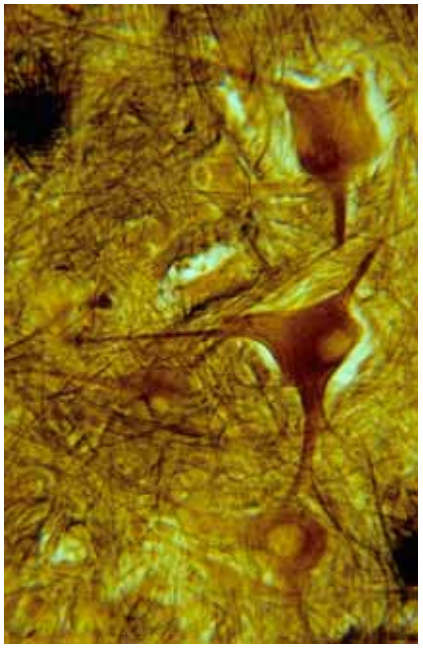
Post-Operative Reality: 10 d injectable anti-coagulant, 3 wk oral anti-coagulant, 4 wk CPM machine, non-wt bearing 8 wk,12 wk PT, 3-5 d/wk,...

CPM ≡ Torture Device

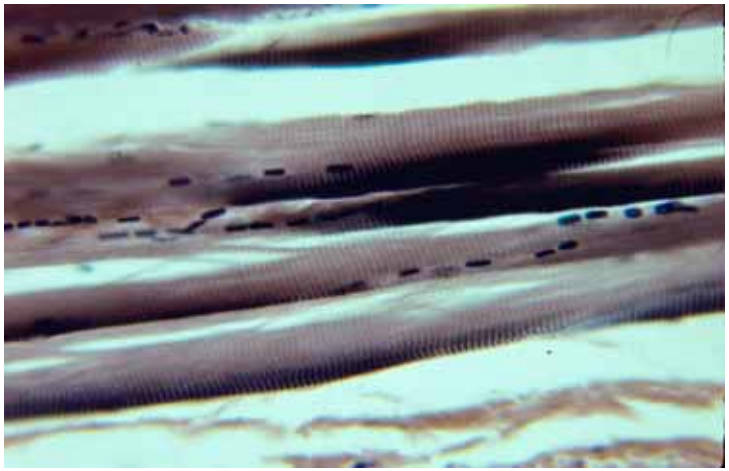
Body Levels of Organization



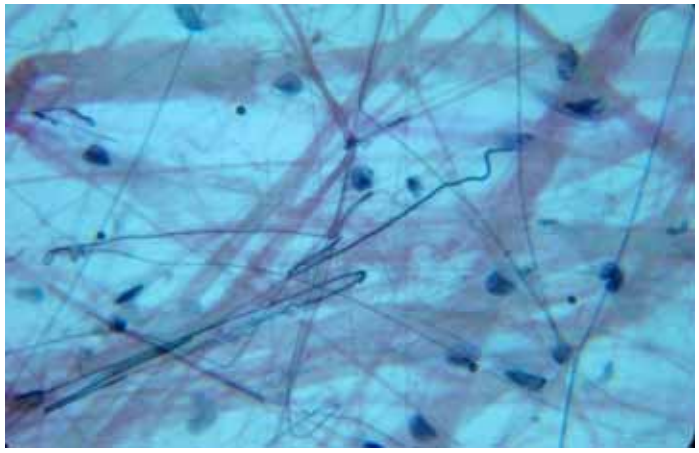
LS fig 1-1 p 2



Nerve conducts



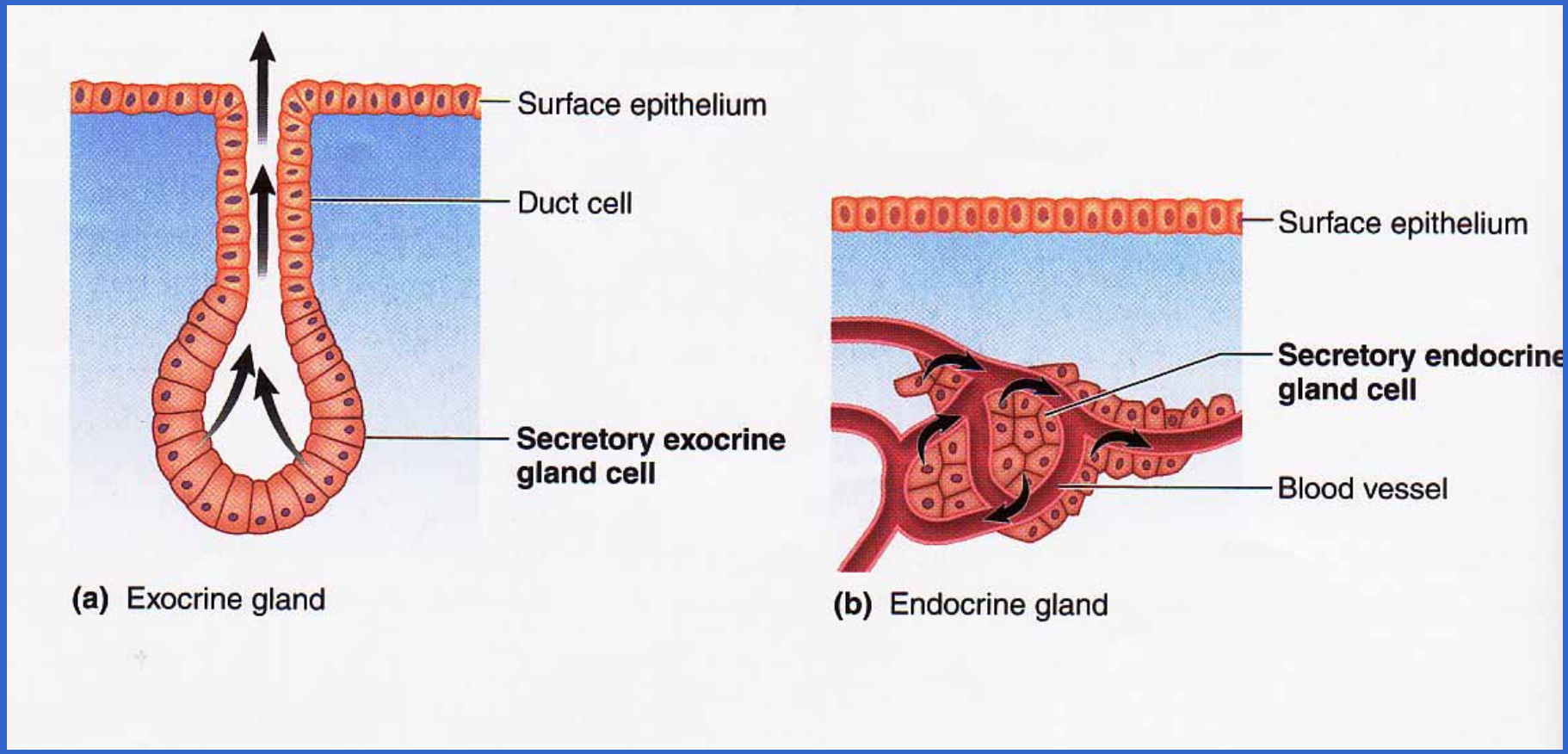
Muscle contracts



Connective connects!!

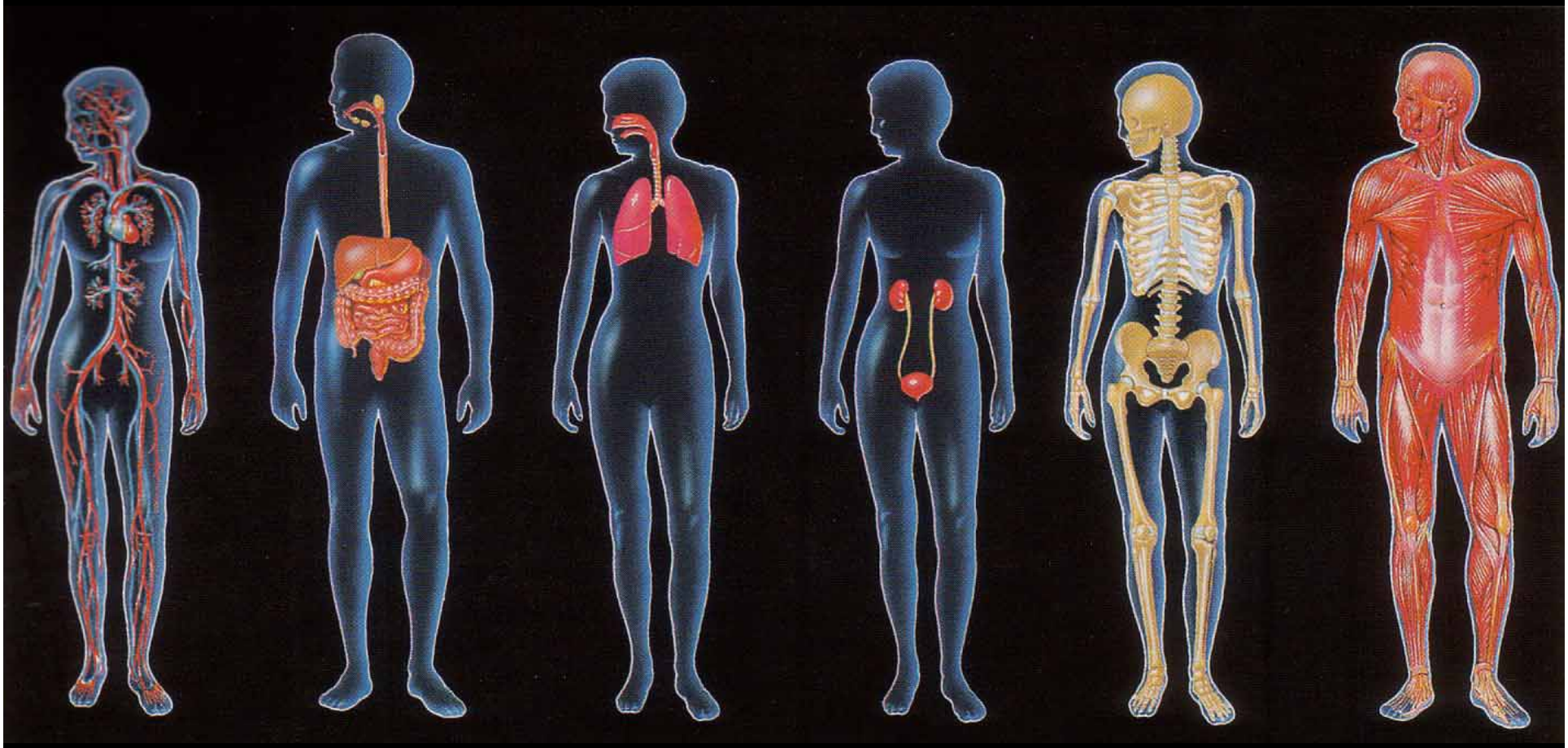
Epithelial covers

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

BI 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***: Course website UO Biology *vs.* Blackboard *http://blogs.uoregon.edu/bi121/fall-2014/*

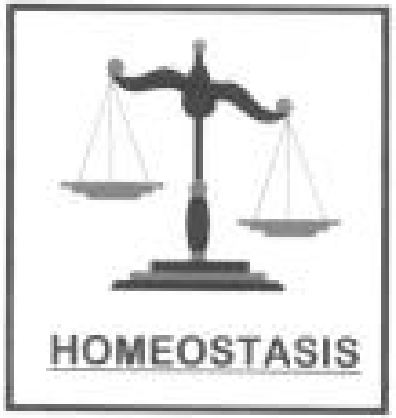
II. ***Homeostasis*** LS ch 1, DC Module 1
- A. ***What?*** Maintenance of ECF LS p 8
- B. ***Where?*** ECF = Plasma + Interstitium + ? LS fig 1-4 p 8
- C. ***Homeostatic Balances?*** LS p 9, DC pp 5-6
- D. ***Why?*** Cell survival! LS fig 1-5 p 9, DC p 5
- E. ***Physiology in the News*** H_2O? Are we 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

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

milieu interieur?

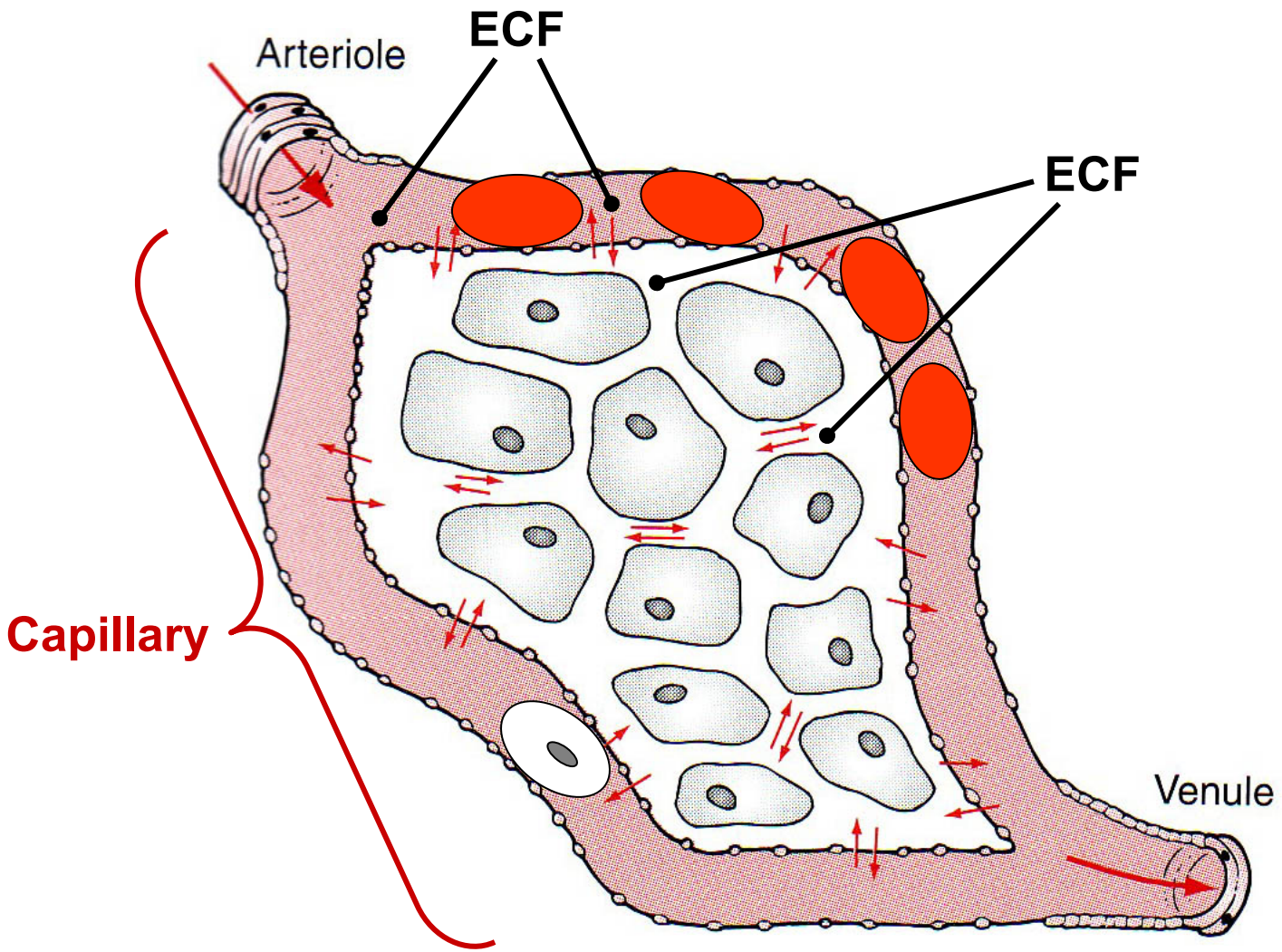
Claude Bernard



100 trillion cells working intimately

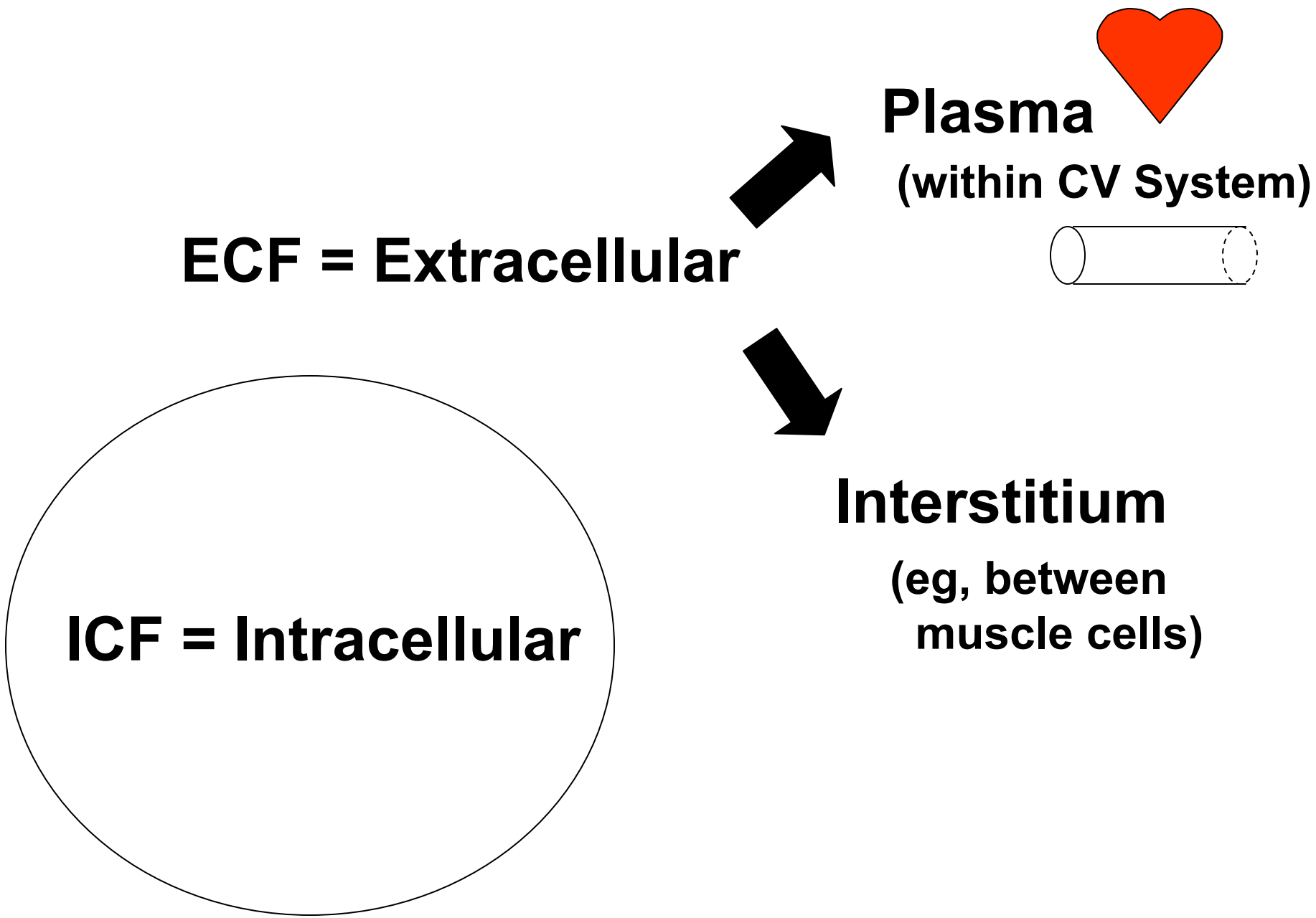
Walter B. Cannon

Where is extracellular fluid?



As long as <u>between/outside</u> cells, ECF everywhere?

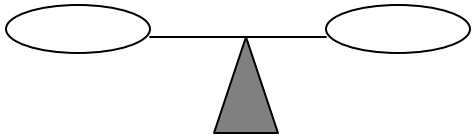
G&H 2011


Plasma
(within CV System)
ECF = Extracellular
Interstitium
(eg, between
muscle cells)
ICF = Intracellular

Dr. Evonuk's 6 Balances

Metabolic

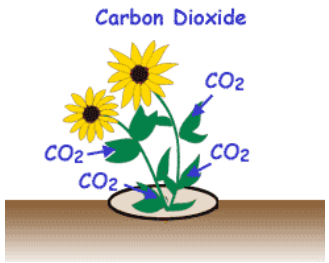
ANA- CATA-



H_2O

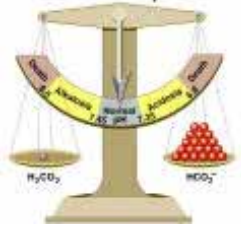
T°C

O_2/CO_2



$Ion^{+/-}$

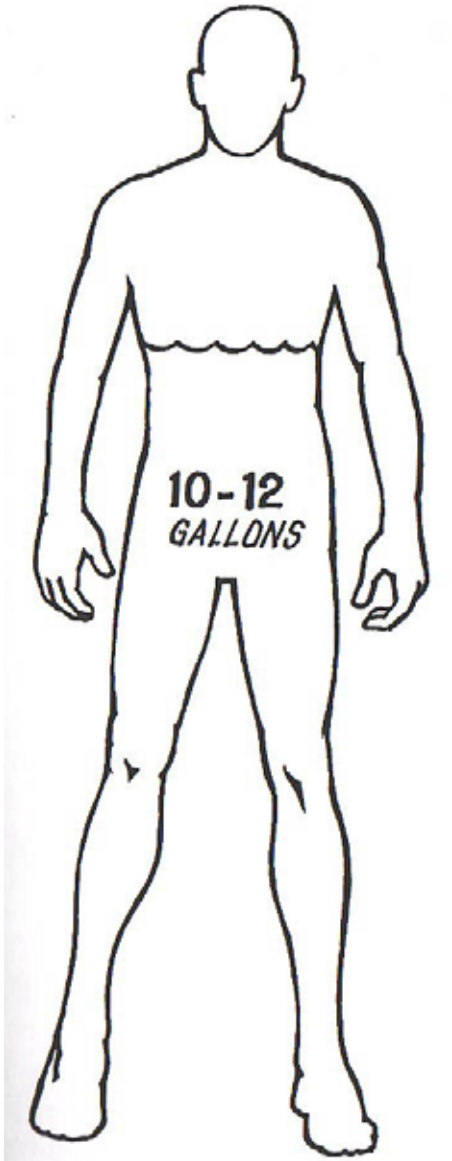
pH



Drink about 1 L per 1000 calories energy expenditure!!

Human ~ 2/3 H_2O

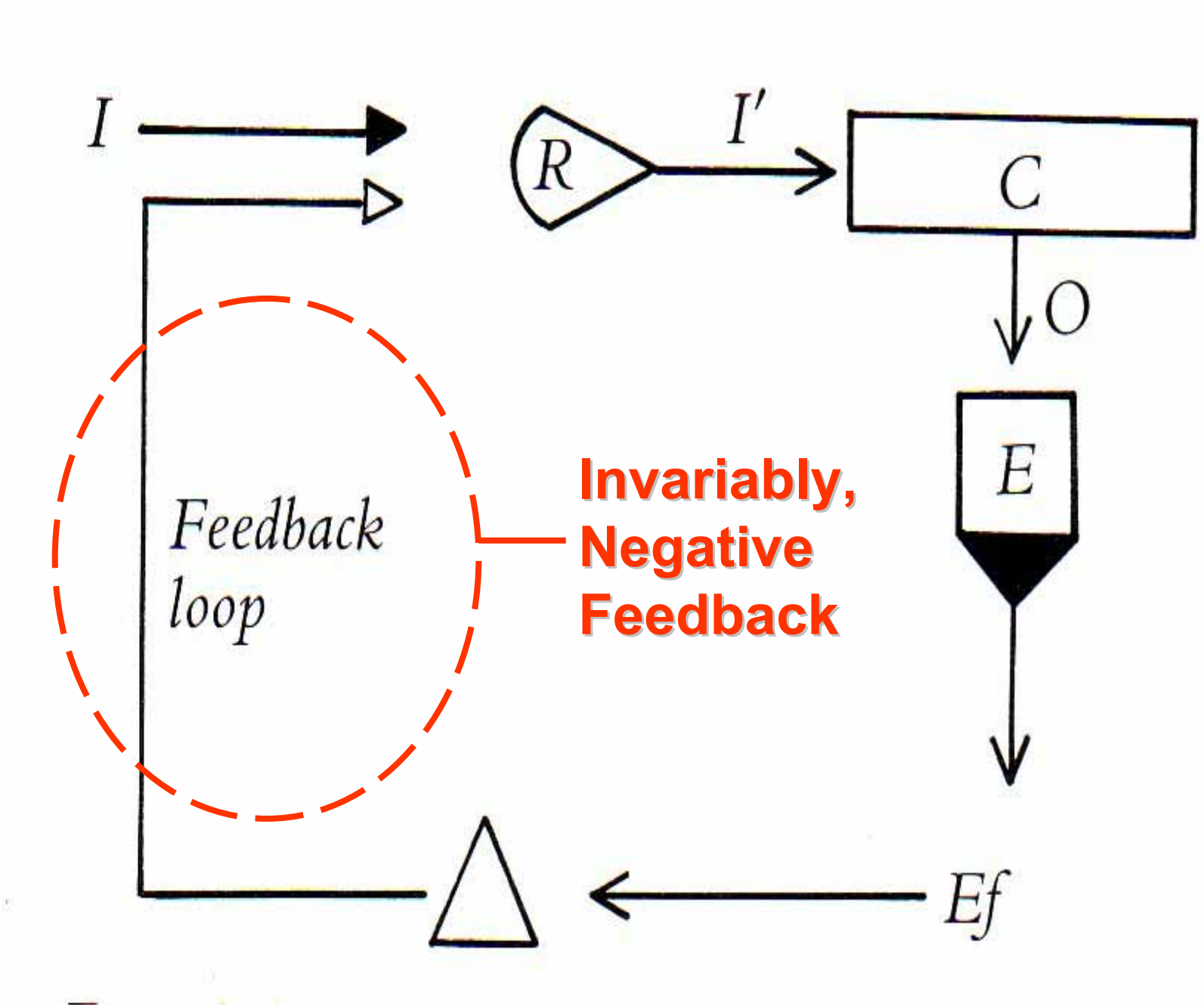
~ 60 – 70 %



150 lb /68 kg

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

= ~40 – 48 kg H_2O

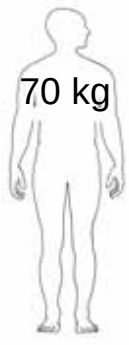

I
R
I′
C
O
E
Feedback
loop
Invariably,
Negative
Feedback
Ef

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

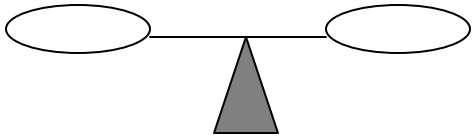
Interstitium = 11L
Plasma = 3L

H_2O

INPUT

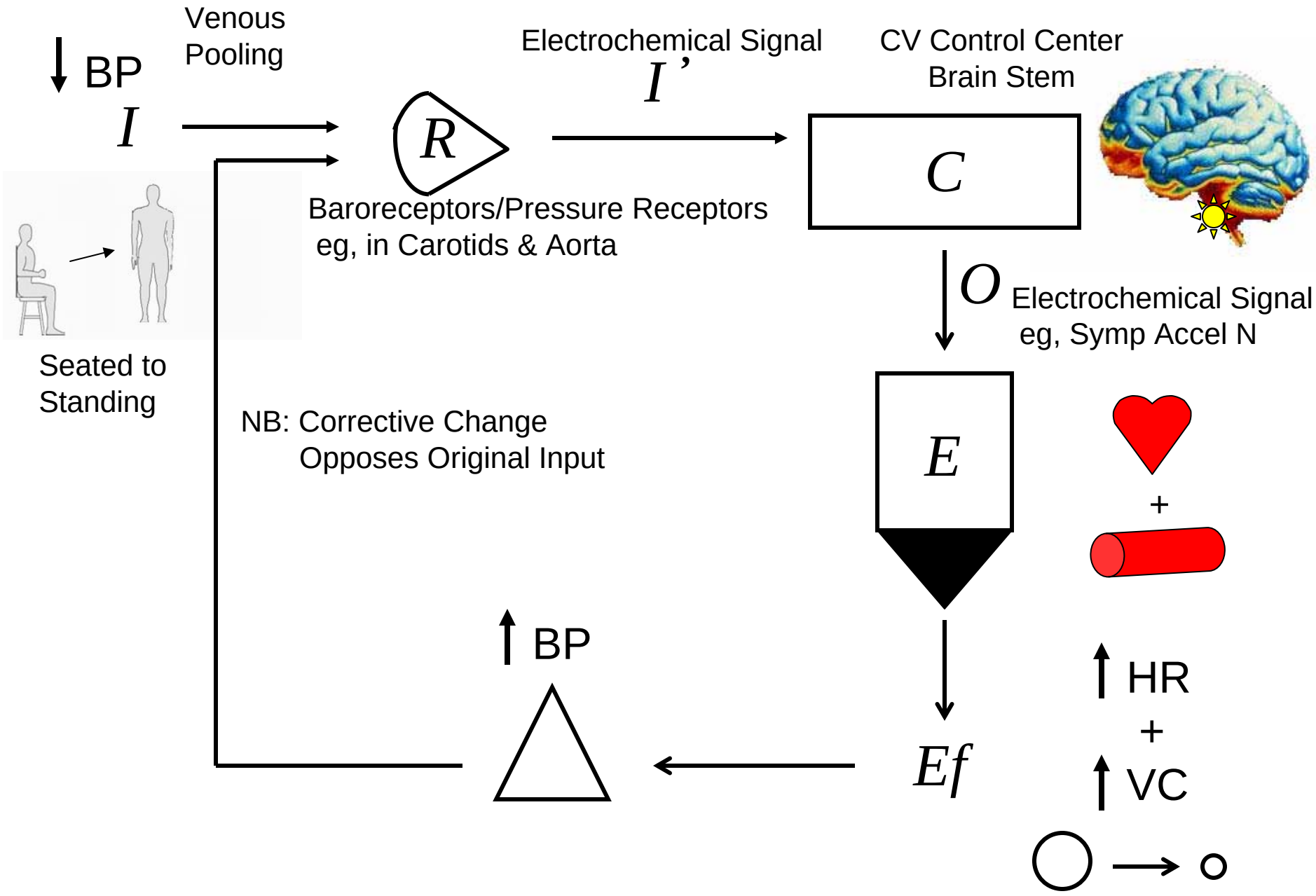
Dietary Drink	1200 mL
Dietary Eat	400 mL
Oxidation	400 mL
Total =	2000 mL ✓

BALANCE!



OUTPUT

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


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
+
Ef
HR
+
VC
BP
Seated to Standing
NB: Corrective Change
Opposes Original Input

BI 121 Lecture 3 Anatomy & Physiology Lab Thurs! Fun again...

I. *Announcements* Sign roster? OSA Voting. Q? Office hr?

II. *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 ≡ Membranous, cytoplasmic specialty shops!
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?

III. *Anaerobic vs Aerobic Metabolism Overview* Many sources!
Mathews & Fox 1976...LS 2012 pp 26-33, fig 2-15 p 33

IV. *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

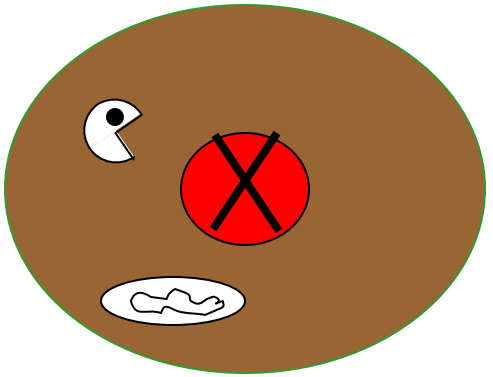
E. How does DNA differ from RNA? pp A-20 thru A-22

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

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

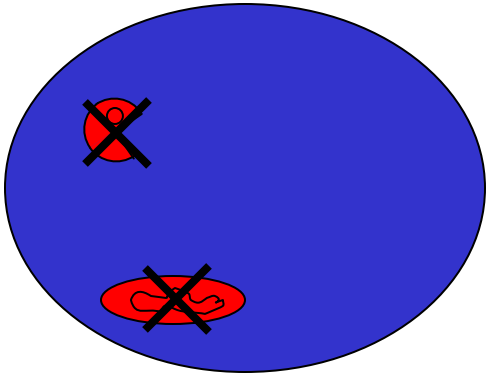
Cytoplasm = Cell - Nucleus

[Extract nucleus; includes organelles]



Cytosol = Cytoplasm - Organelles

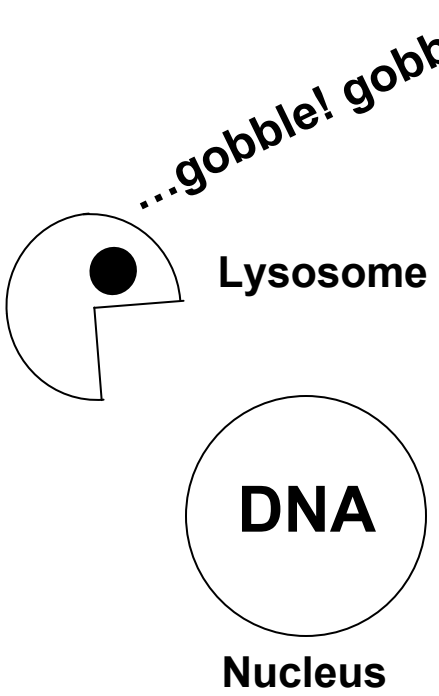
[Extract organelles; complex gel-liquid]



Why Compartments? Advantage?

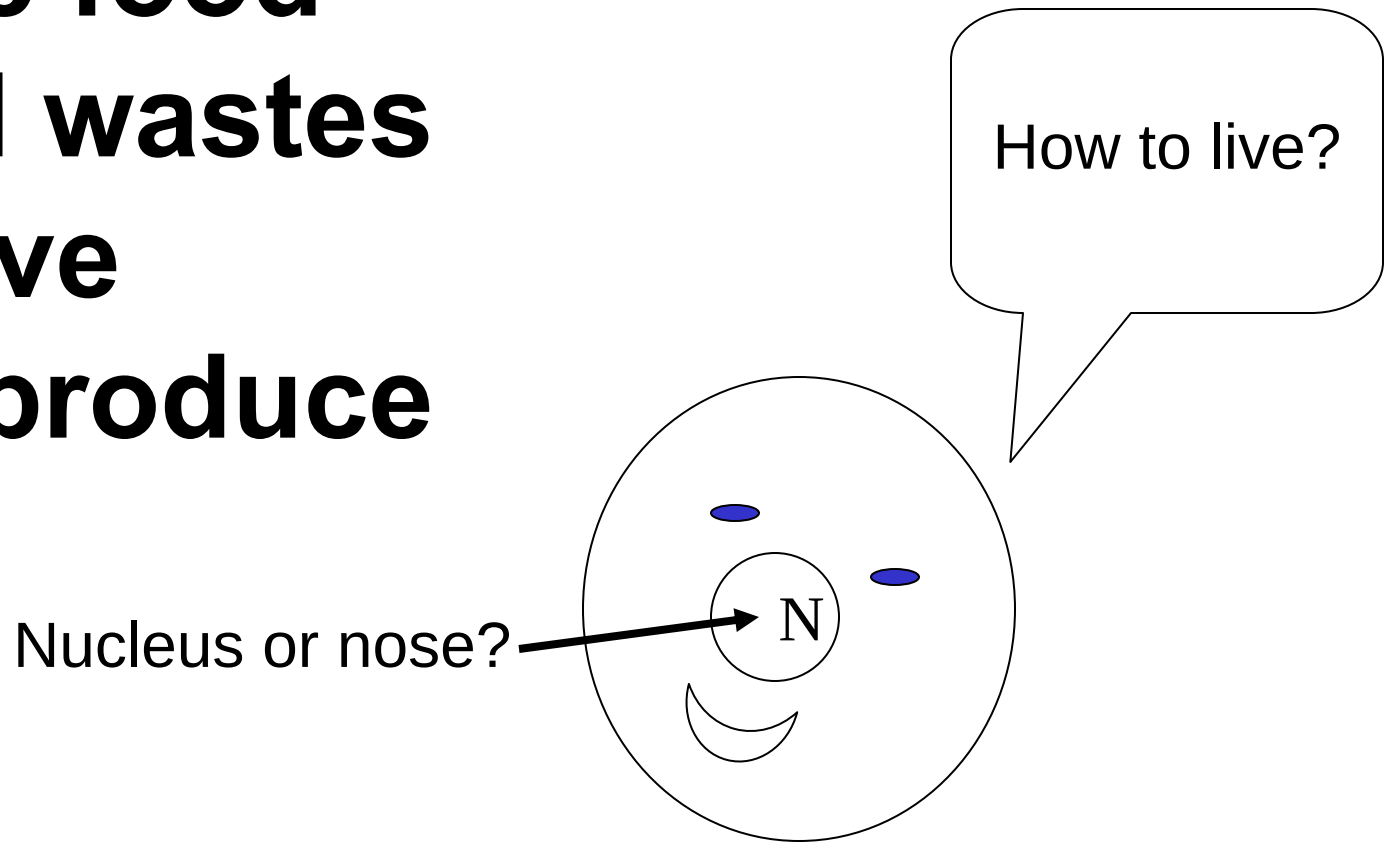
<u>*Incompatible*</u> reactions can take place

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



Basic Cell Survival Skills?

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



1 e.g. Cell of 100 Trillion!

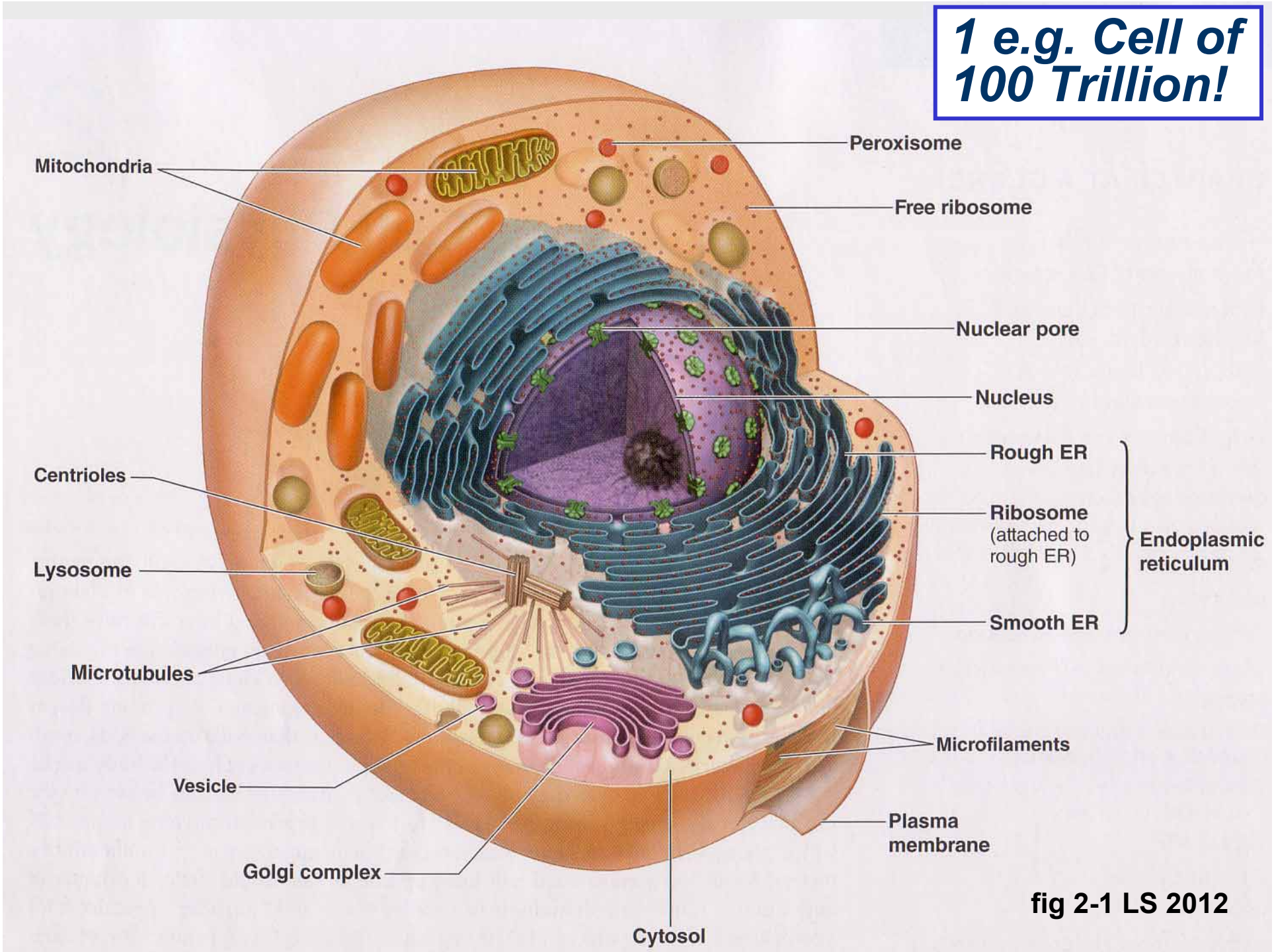


fig 2-1 LS 2012

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

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

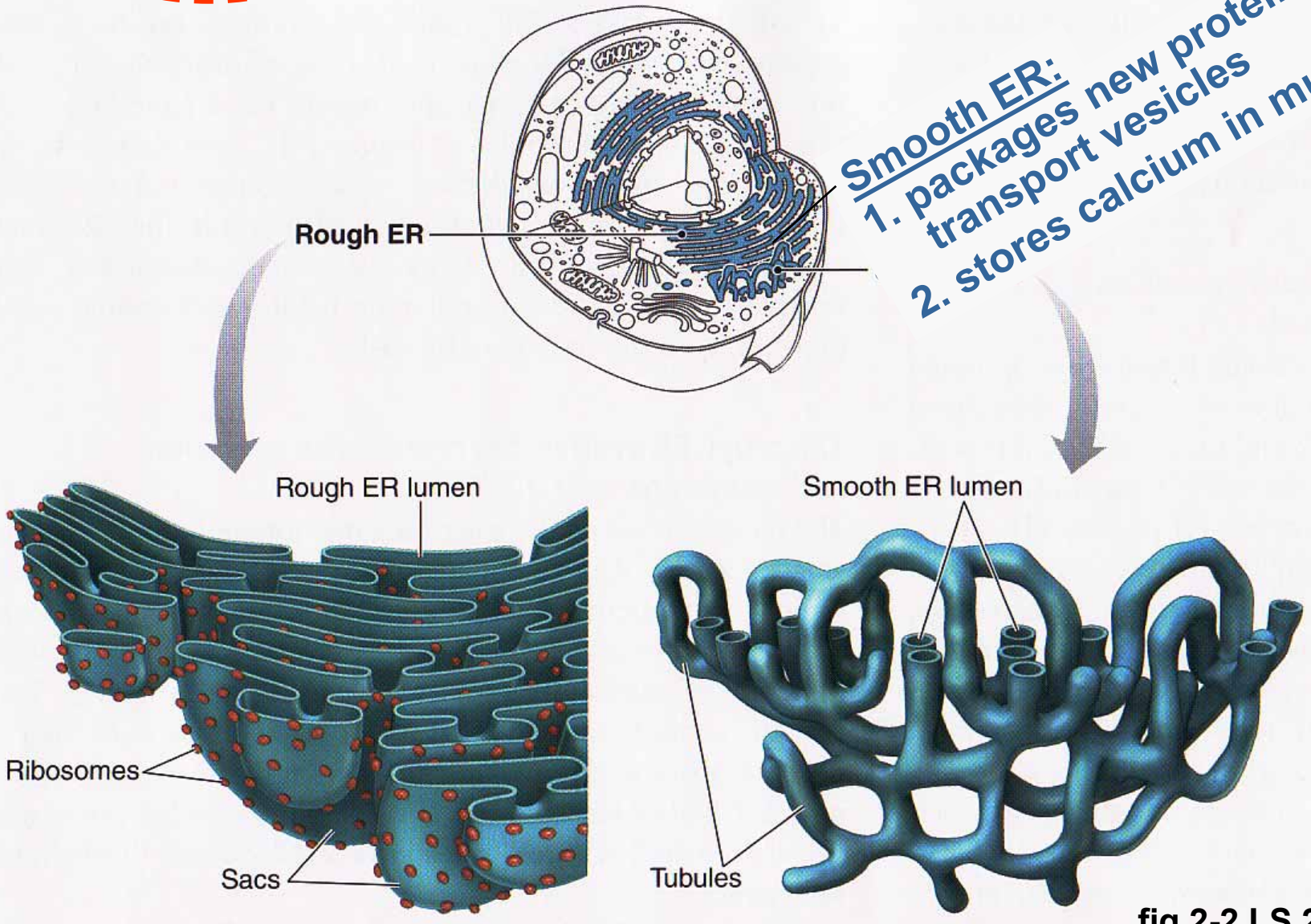


fig 2-2 LS 2012

Secretion of Proteins Produced by ER

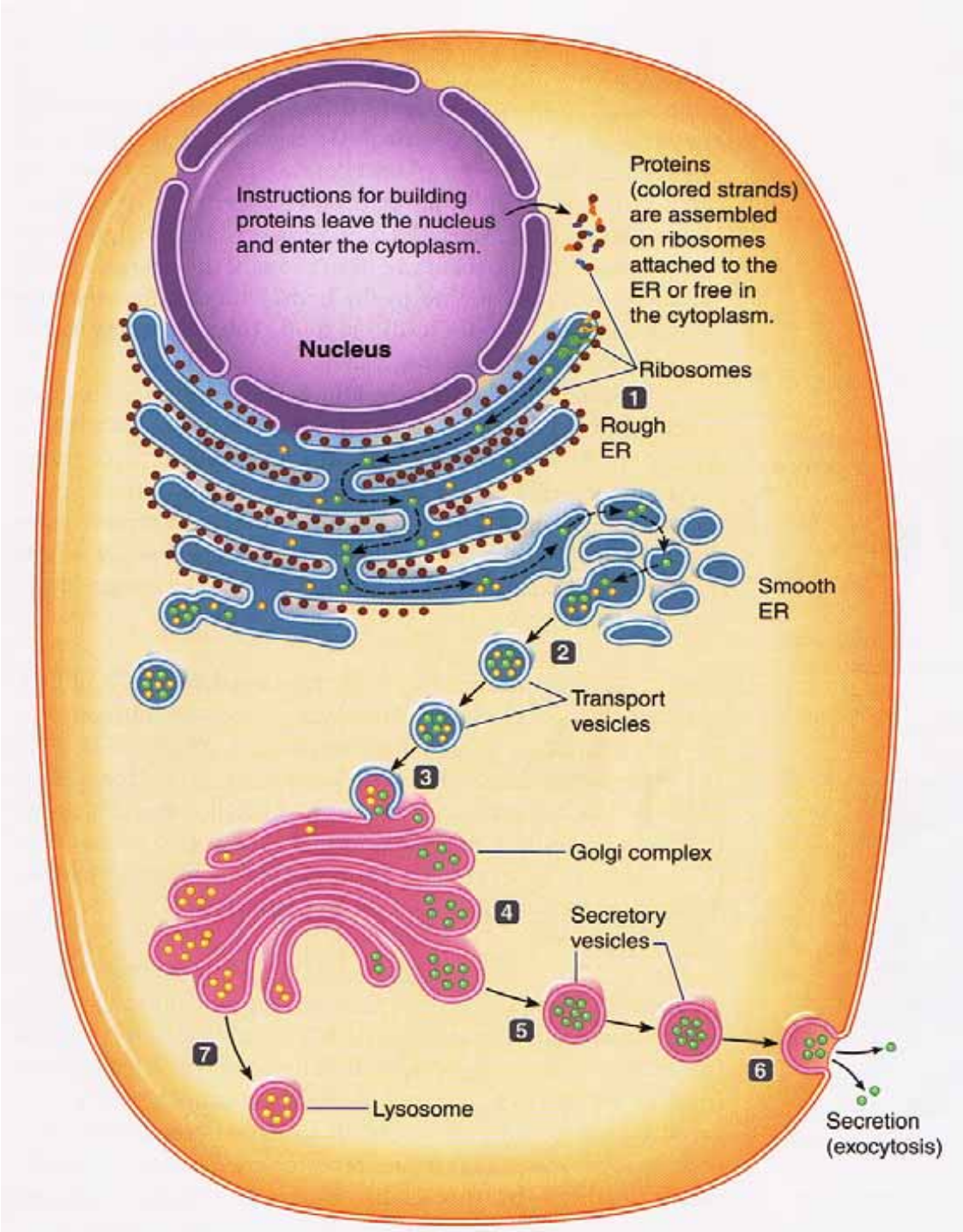


fig 2-3 LS 2012

Lysosomes *vs.* *Peroxisomes*

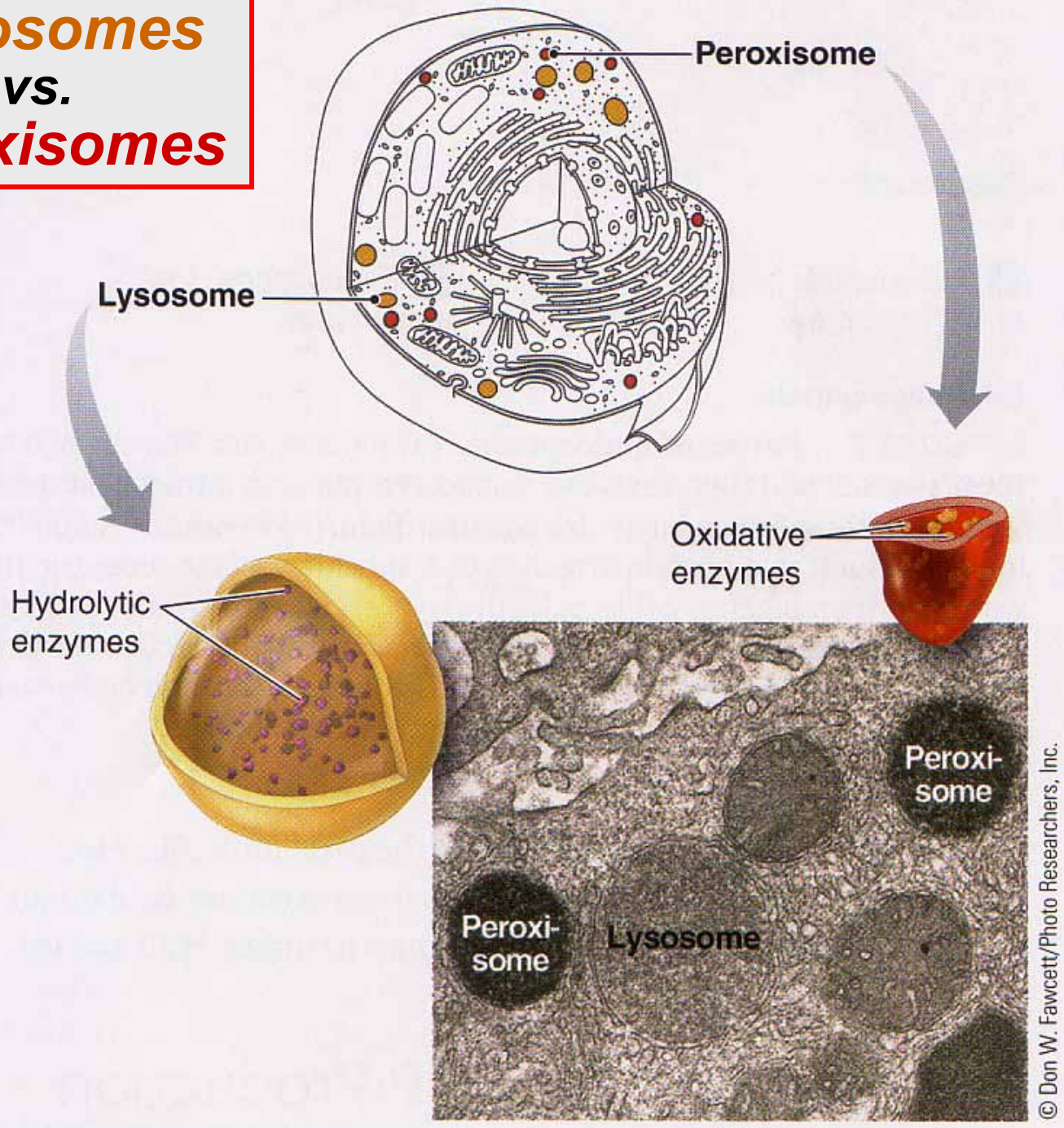
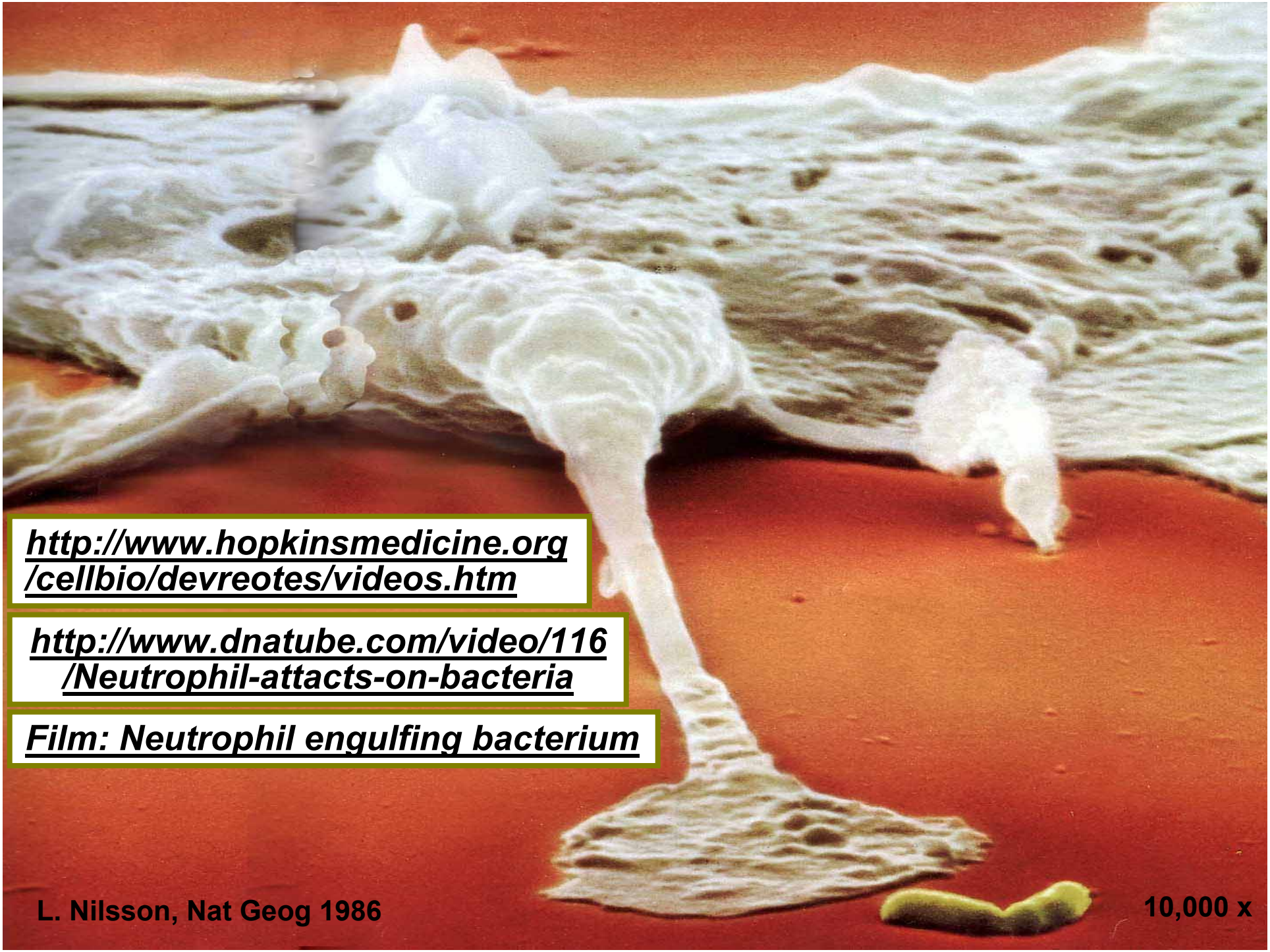
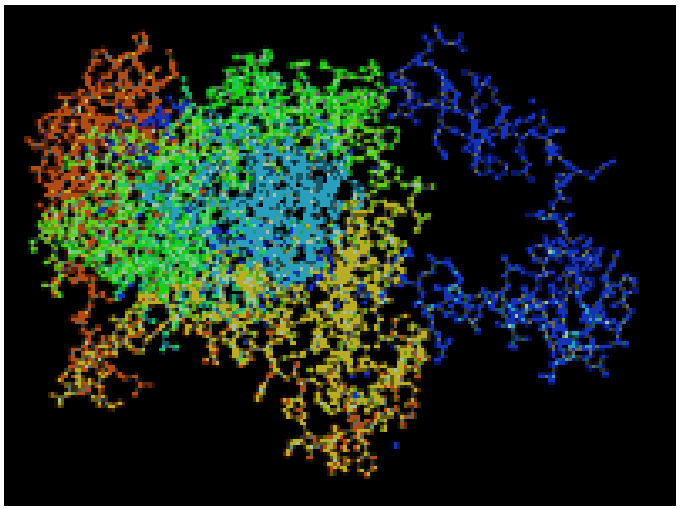


fig 2-6 LS 2012


http://www.hopkinsmedicine.org/cellbio/devreotes/videos.htm
http://www.dnatube.com/video/116/Neutrophil-attacts-on-bacteria
Film: Neutrophil engulfing bacterium
L. Nilsson, Nat Geog 1986
10,000 x

Catalase Enzyme Reaction in Peroxisomes Neutralize Toxin at Production Site!



$$2H_2O_2 \xrightarrow{\textit{Catalase}} 2H_2O + O_2$$

Mitochondria: Energy Organelles

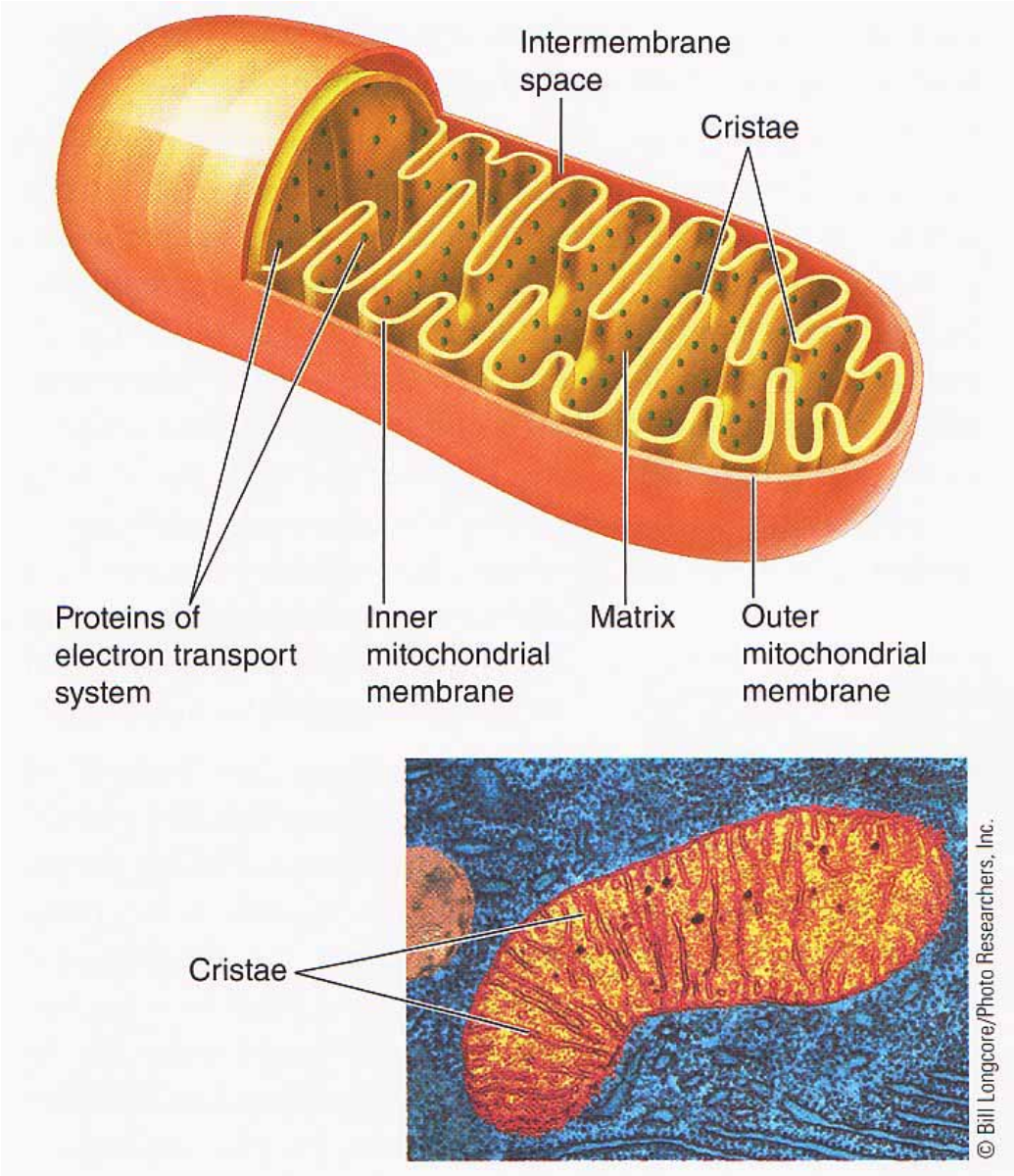
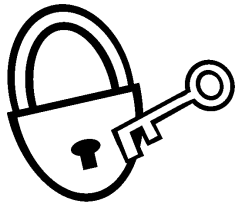


fig 2-8 LS 2012

Bl 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. ***Physiology in the News + Connections*** **Mom's eggs execute dad's mitochondria? What's a vault?** ***Science News***

III. ***Anaerobic vs Aerobic Metabolism Summary***
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

IV. ***Cytoskeleton*** **LS 2012 fig 2-17, 2-18 + LS 2006 fig 2-20**

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

4 oz → 3 oz

Deck of Cards

or

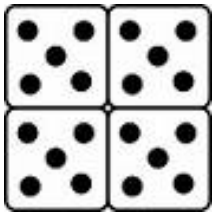
≡ 1 c

≡

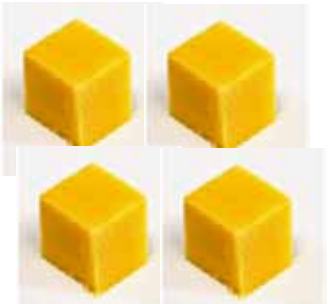
http://blogs.uoregon.edu/bi121/fall-2014/

raw → cooked

≡ 1/3 c

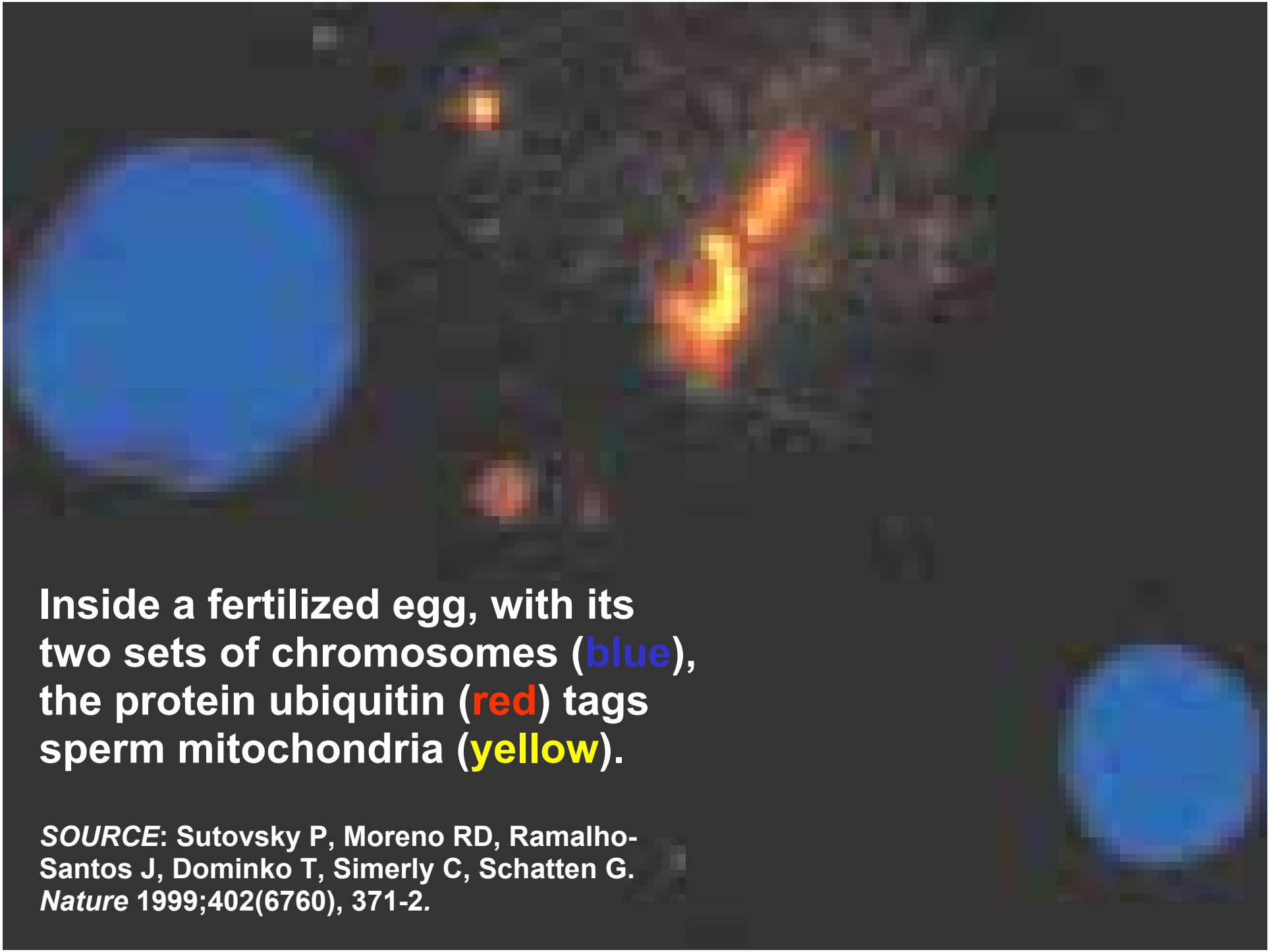


≡ 1 oz



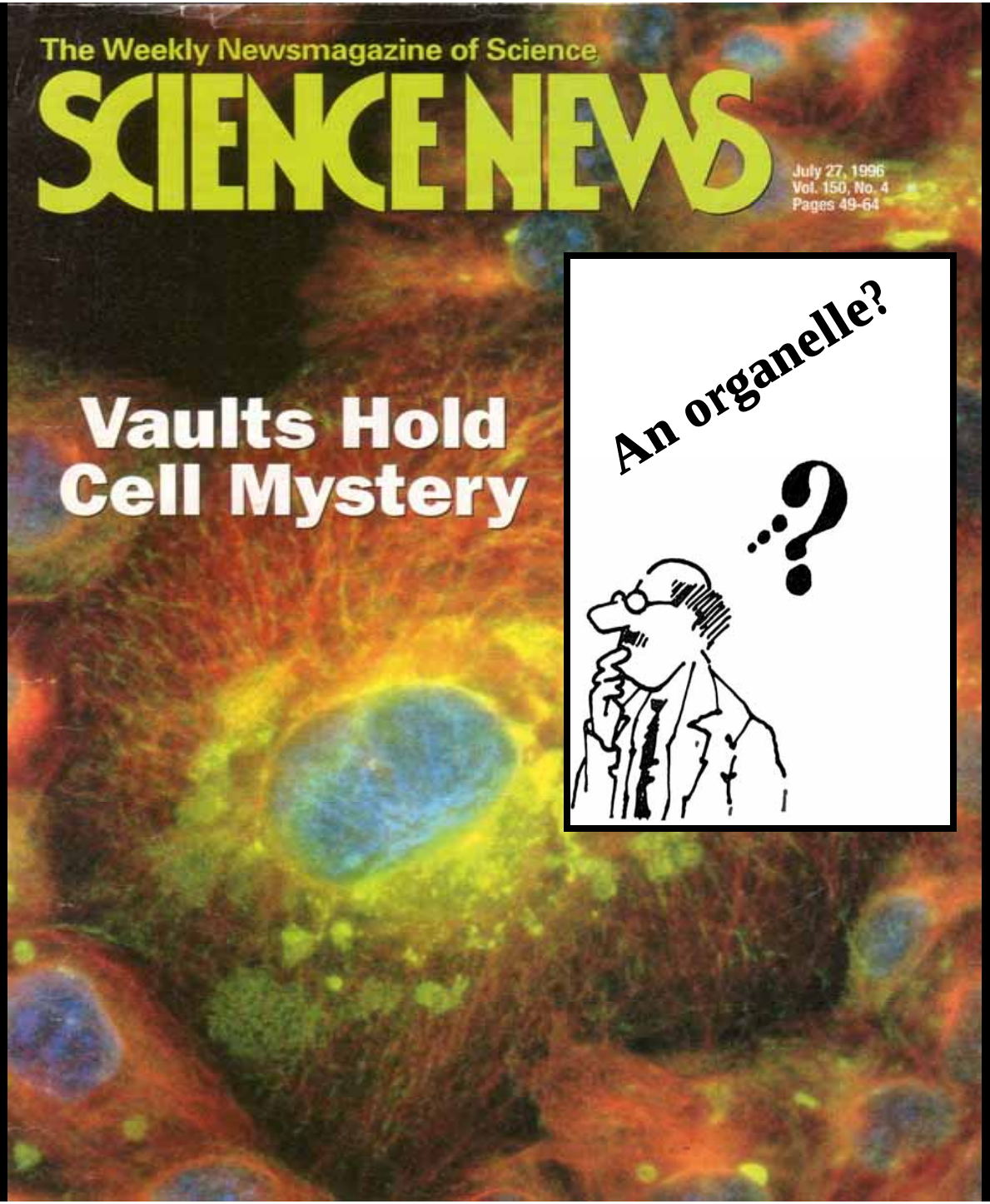
≡ ¼ c

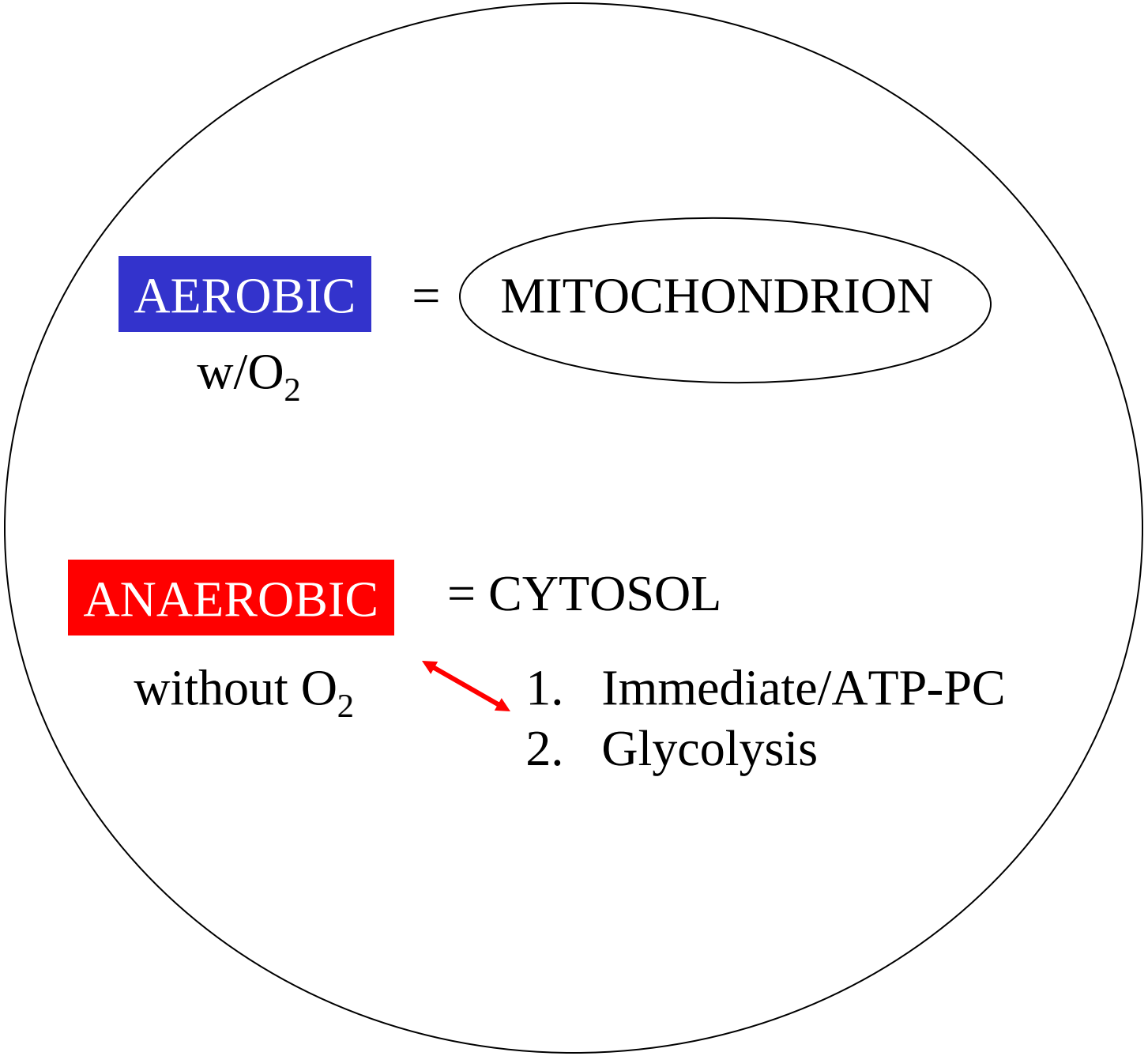
≡1.5 oz

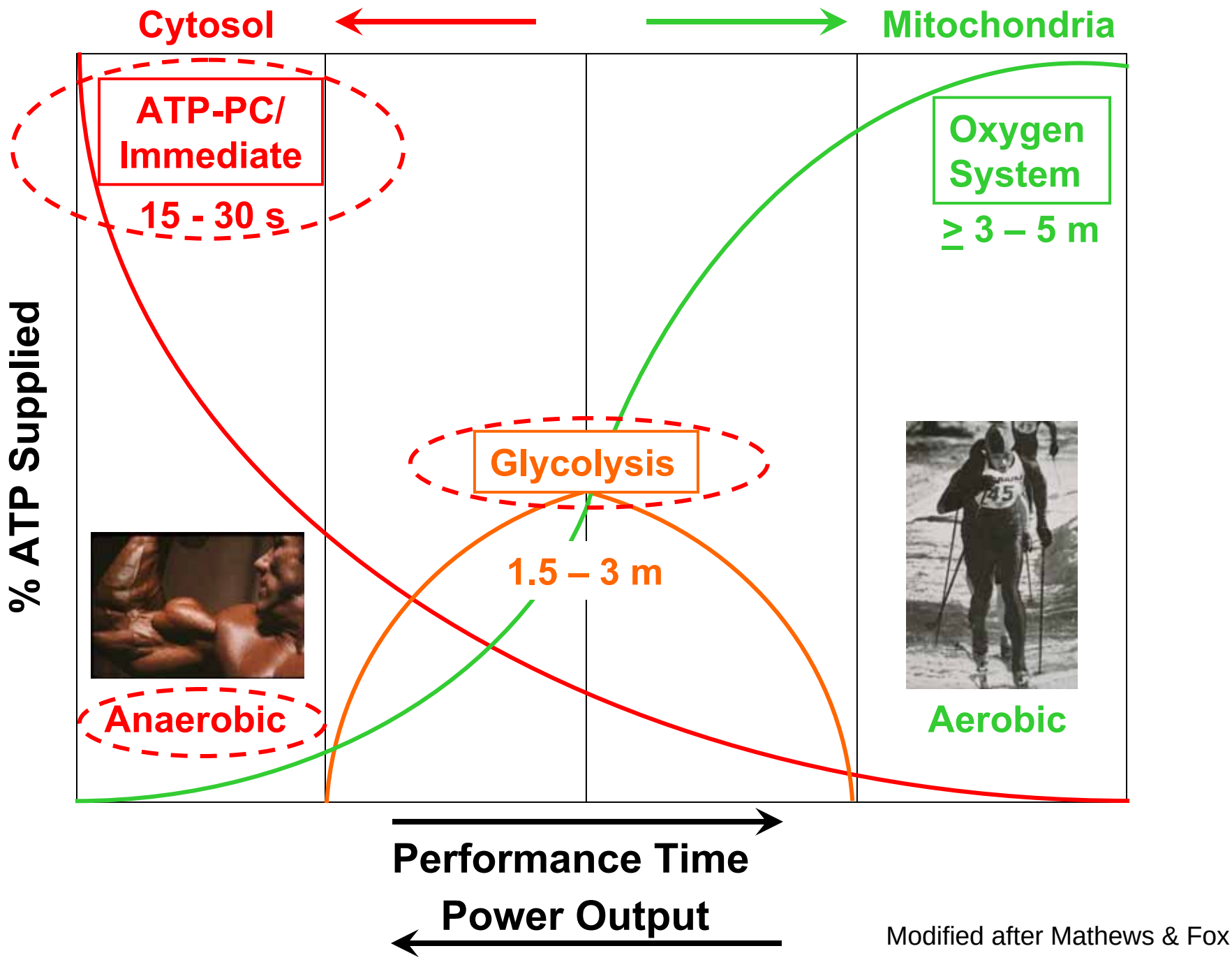


Inside a fertilized egg, with its two sets of chromosomes (blue), the protein ubiquitin (red) tags sperm mitochondria (yellow).

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


The Weekly Newsmagazine of Science
SCIENCE NEWS
July 27, 1996
Vol. 150, No. 4
Pages 49-64
Vaults Hold Cell Mystery
An organelle?

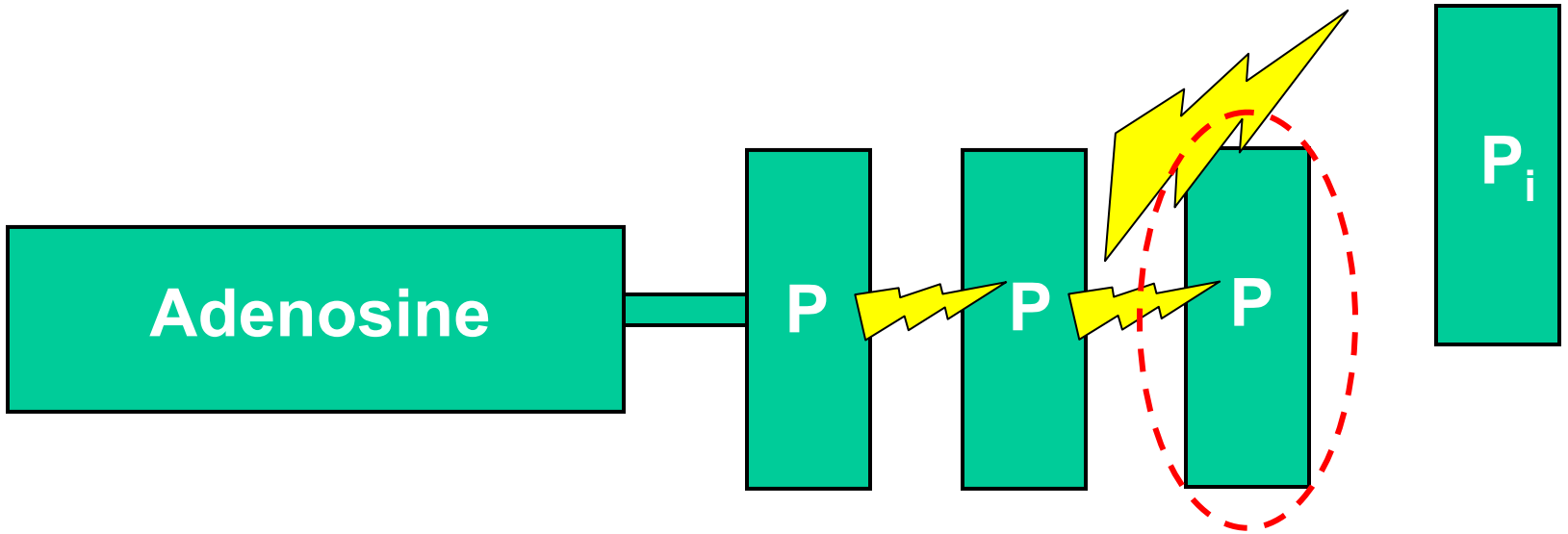

AEROBIC
=
MITOCHONDRION
w/O_2
ANAEROBIC
= CYTOSOL
without O_2
1. Immediate/ATP-PC
2. Glycolysis



Modified after Mathews & Fox

Cleave One High Energy Phosphate Bond To Do Work!!

7 – 10
KiloCalories/KCal

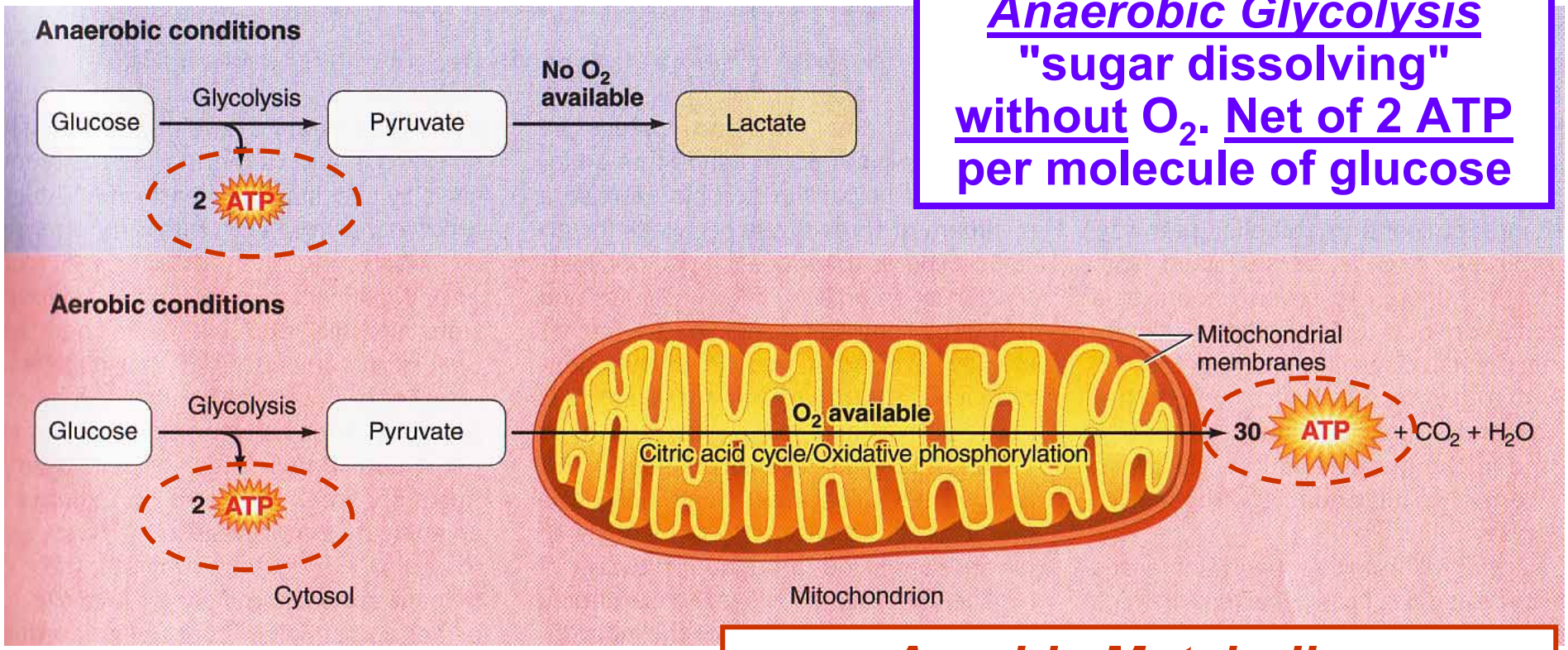


1. *Synthesis of Macromolecules*
2. *Membrane Transport*
3. *Mechanical Work*

Make big things from little things!

Move things! Microscopic! ⟷ Move things! Macroscopic!

Anaerobic vs. Aerobic Metabolism

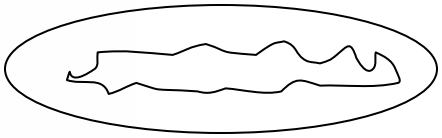


Anaerobic Glycolysis
"sugar dissolving" without O_2. Net of 2 ATP per molecule of glucose

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

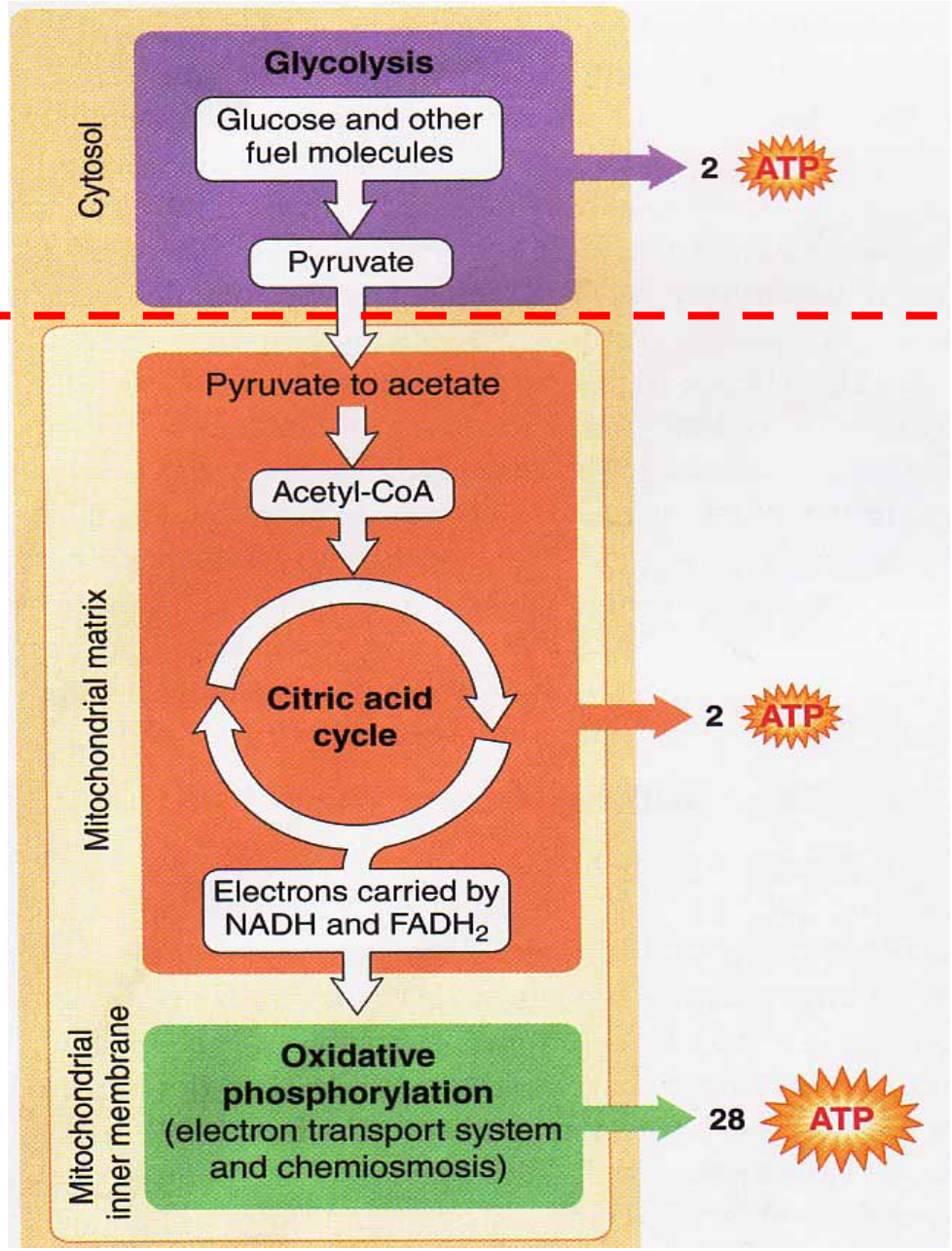
Immediate/ATP-PC

PRIMARY FUEL	ACTIVITY	% AEROBIC (Oxidative Energy System)	% ANAEROBIC (Immediate & Non-Oxidative Energy Systems)	TIME (Min:Sec)
	Marathon Cross-Country Skiing	100	0	135:00
	10-K Run	90	10	29:00
FAT, CARBOHYDRATE & PROTEIN (Small Amounts)	3-Mile Run	80	20	14:00
	2-Mile Run 800-Meter Swim	70	30	
		60	40	9:00
	1-Mile Run			3:45
CARBOHYDRATE (Glucose & Glycogen)	Boxing 200-Meter Swim	50	50	
	Circuit Weight Training	40	60	
	Soccer Lacrosse	30	70	1:30
	Tennis	20	80	0:50
ATP, ADP & Creatine Phosphate (CP)	Basketball Volleyball 200-Meter Dash Football	10	90	0:20
	Conventional Weight Training	0	100	0:10

Stages of Cellular Metabolism/Respiration

Anaerobic
Glycolysis
Cytosol

Aerobic
Metabolism
Mitochondria

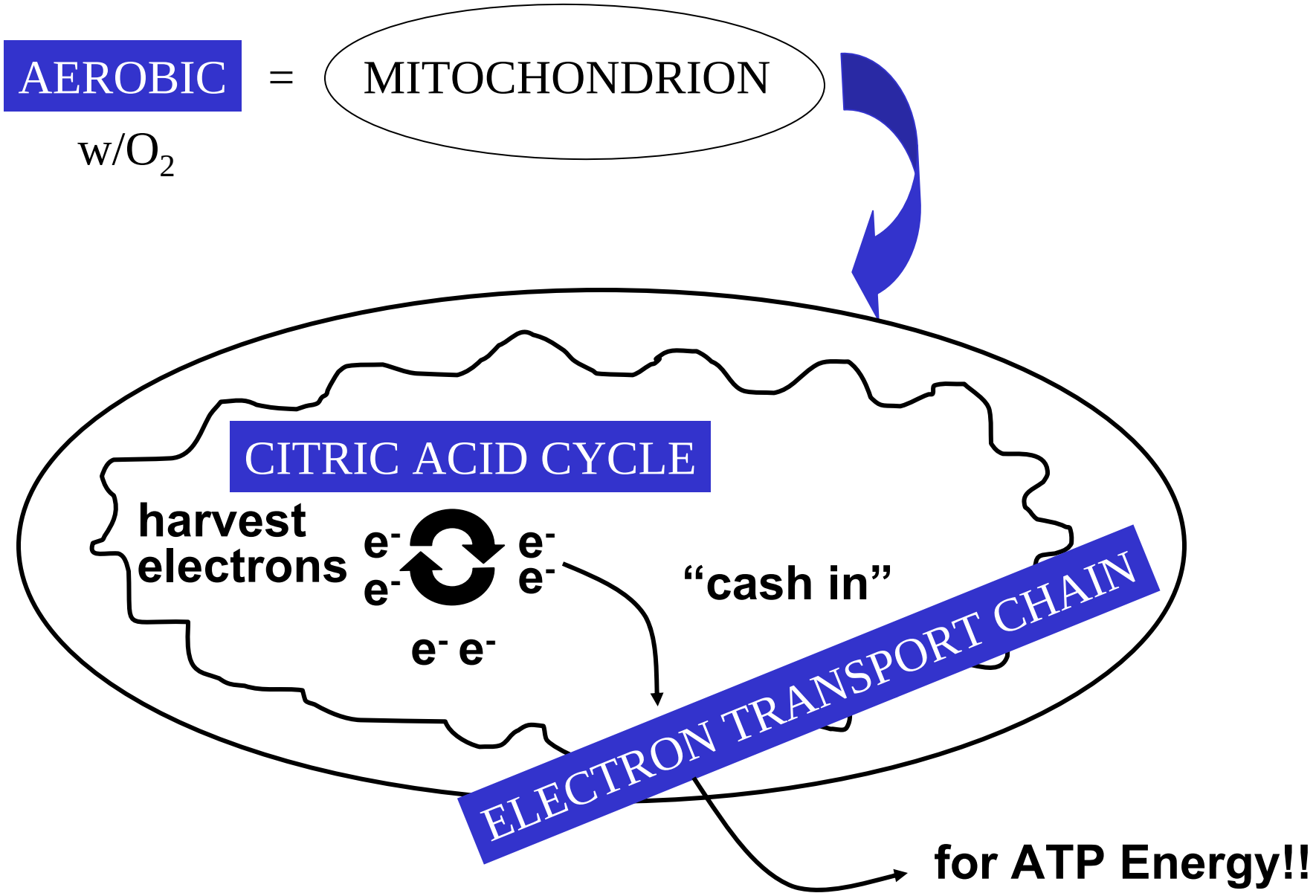


Matrix

Inner Membrane

fig 2-9 LS 2012

Goals of Aerobic Metabolism



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

BI 121 Lecture 5

Nutrition Lab Thursday! More fun...

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

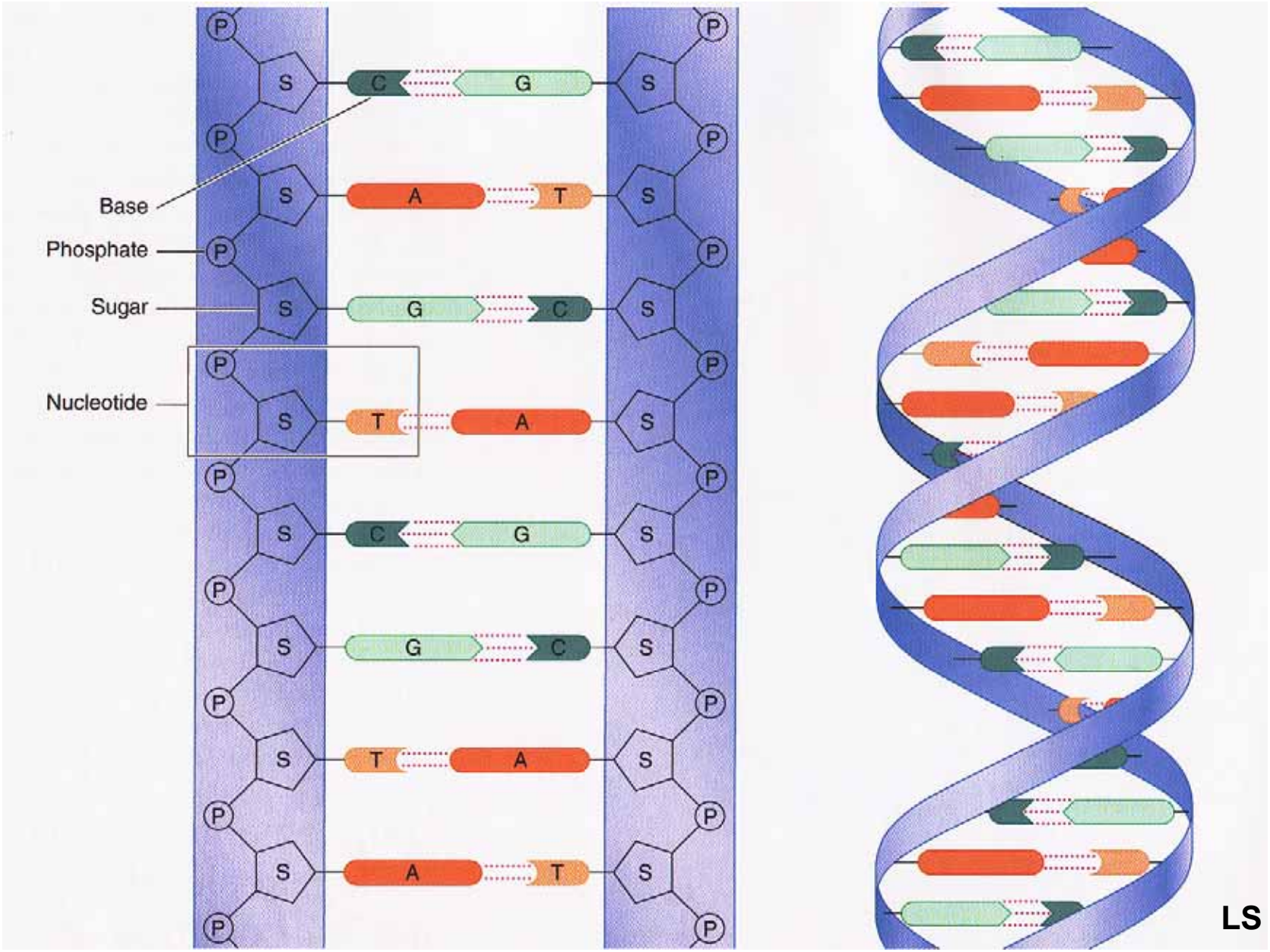
II. ***Introduction to Genetics*** **LS 2012 ch 2 p 20-1 + Appendix C**

- **A. What's a gene? Where located? Why important? p A-18, fig C-2, C-3**
- **B. How does information flow in the cell? fig C-6**
- **C. How does DNA differ from RNA? pp A-20 thru A-22**
- **D. Genetic code? pp A-22, A-23**
- **E. How & where are proteins made? fig C-7, C-9**
- **F. Class skit: Making proteins @ ribosomes!**

III. ***Nutrition Primer*** **Sizer & Whitney (S&W) Sci Lib**

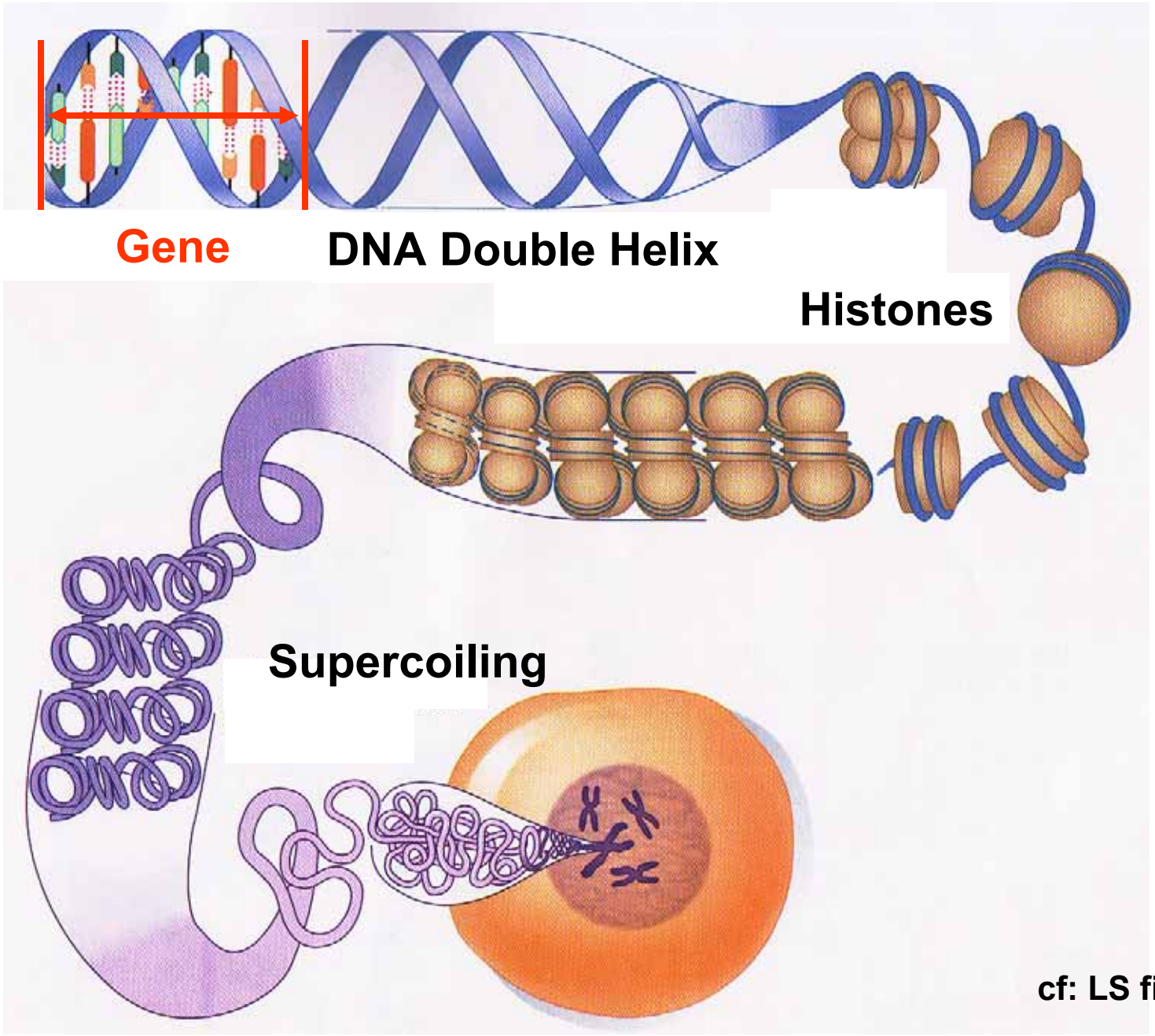
- **A. Essential Nutrients: H_2O, 1^0 Carbohydrates, 2^0 Fats, 3^0 Proteins, Vitamins, Minerals; Macro- vs Micro-?**
- **B. Dietary Guidelines: USDA, AICR, Eat Like the *Rainbow*!**
- **C. Diet or exercise? Diet composition & endurance?Fasting? Zuti & Golding 1976; Sacks *AHA NPAM Council* 2009; AMDR? Adjusted Macronutrient Distribution Range!**
- **D. *Beware of Nutrition Quackery* S. Kleiner & Monaco 1990!**

What does DNA look like? Double-helix!!



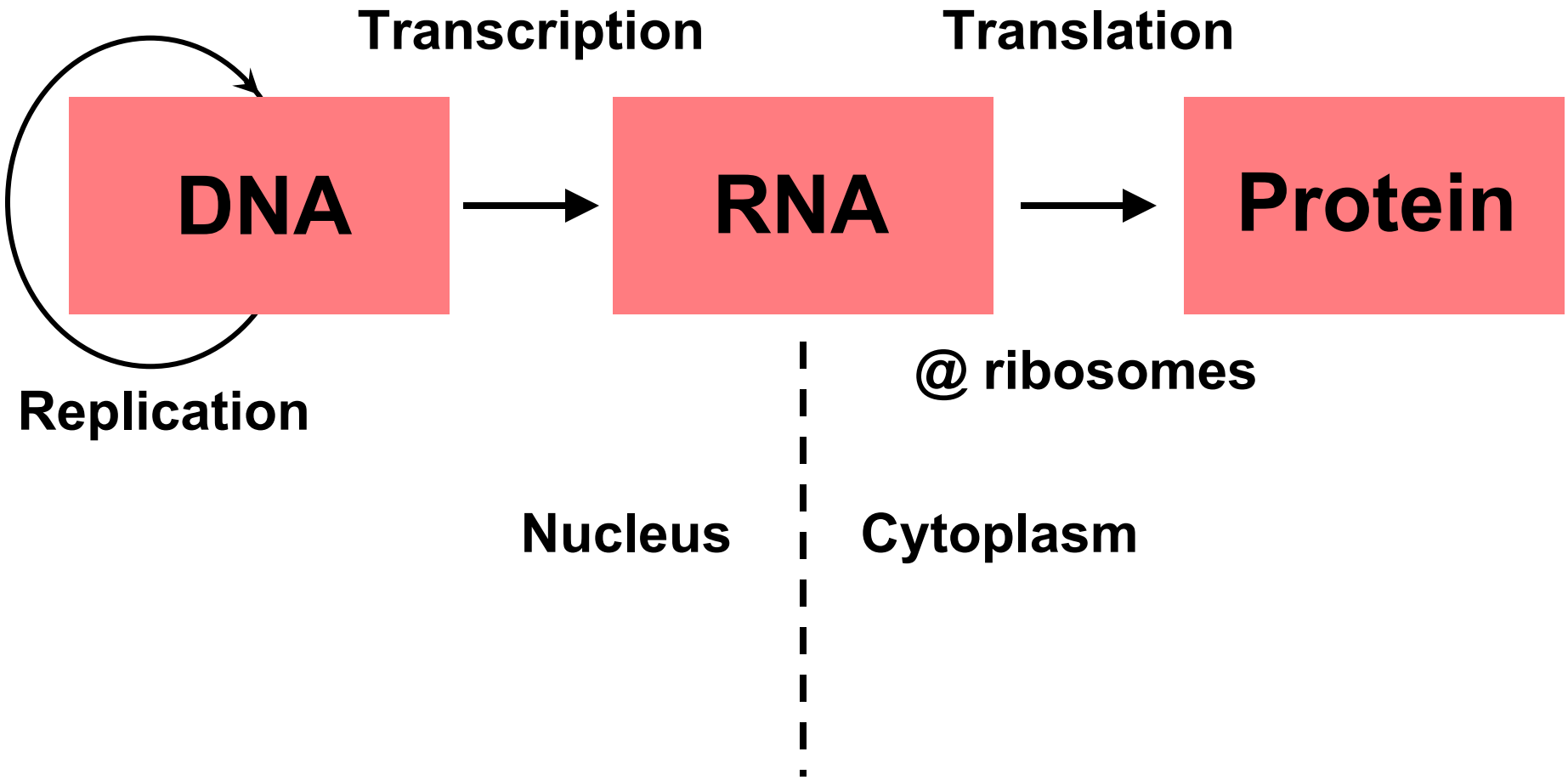
LS fig C-2

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*?

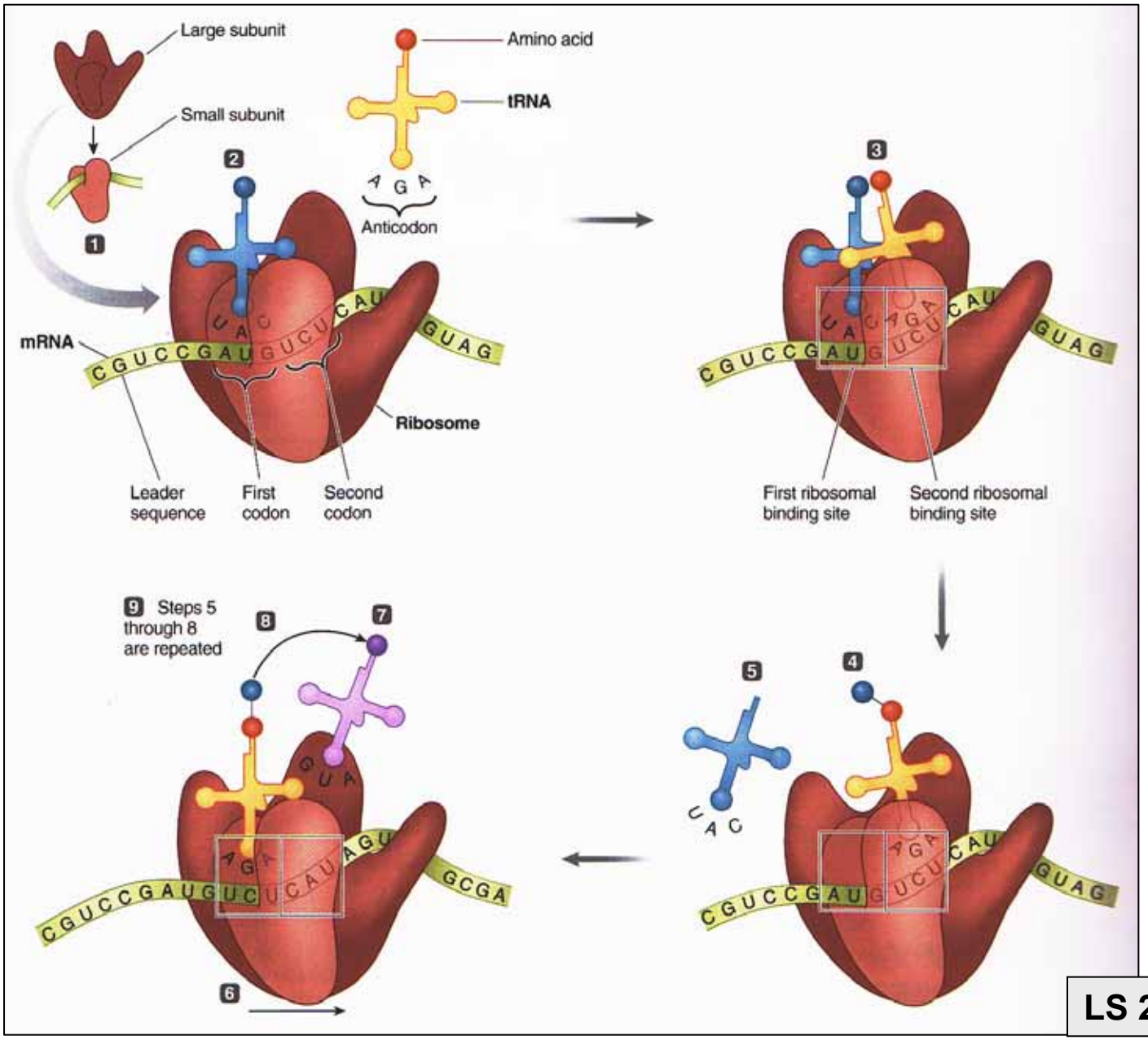
1. Double-stranded
2. Deoxyribose (without oxygen)
3. A, T, C, G
   Thymine
4. Self-replicative (can copy itself)
5. Nucleus (+mitochondria)

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

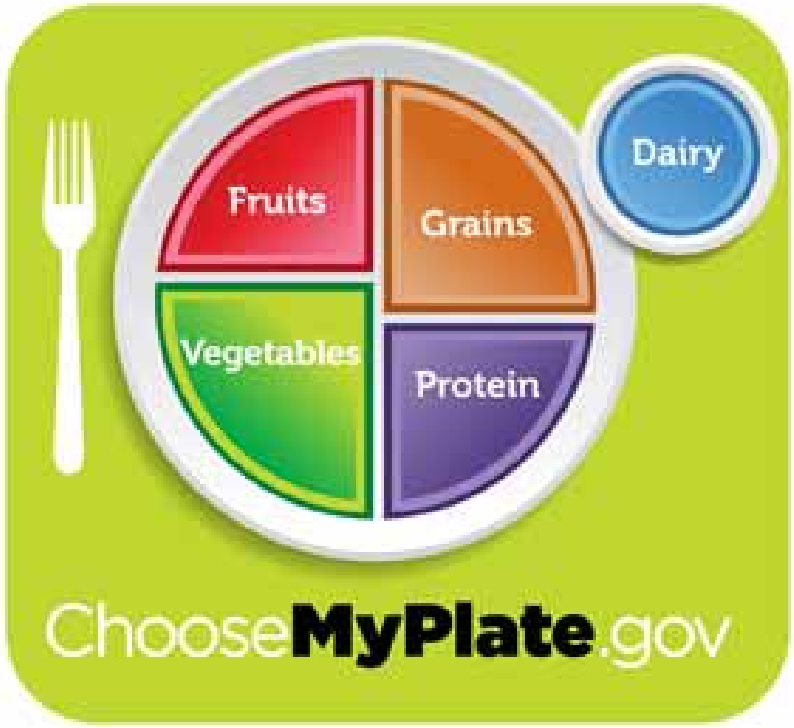
Macronutrients	Sample Food Sources
H_2O/Water	Water, other drinks, fruits & vegetables
✓ 1^0 Carbohydrates	Grains, vegetables, fruits, dairy products
✓ 2^0 Fats/Triglycerides/Lipids	Meats, full-fat dairy products, oils
✓ 3^0 Proteins	Meats, legumes, dairy vegetables
Micronutrients	***NB*: Need only minute 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*

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,…**

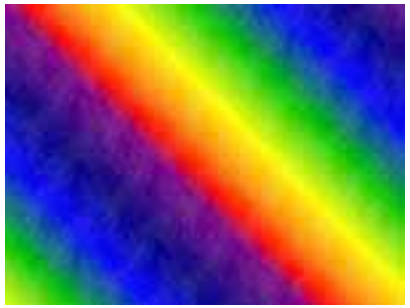
Diet & Health Guidelines for Cancer Prevention

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.

BI 121 Lecture 6 Nutrition Lab 3 today! More fun about me...

I. ***Announcements*** **Nutrition Lab Today! *Got Data?* Q? If you want notebook to study for Exam I on Oct 28th, turn in prior lecture next Tuesday, Oct 21st. Sample Exam Q.**

II. ***Nutrition Connections*** **Sizer & Whitney (S&W) Sci Lib + DC**

- **A. Diet or exercise? Diet composition & endurance?Fasting? Zuti & Golding 1976; Sacks *AHA NPAM Council* 2009; AMDR? Adjusted Macronutrient Distribution Range!**
- **B. *Beware of Nutrition Quackery* S. Kleiner & Monaco 1990!**

III. ***Gastrointestinal Physiology*** **DC Module 3 pp 17-23, LS ch 15+**

- **A. Steps of digestion, hydrolysis central theme LS pp 437- 9**
- **B. What's missing? LS fig 15-1 p 438**
- **C. GI = Donut? GI secretions: What? Where? Why? LS p 438**
- **D. How is the gut controlled?**
- **E. Organ-by-organ review A&P LS tab 15-1 pp 440-1 +...**
- **F. Zymogen? = Inactive precursor LS fig 15-9 p 452...**
- **G. Accessory organs? Pancreas, Liver, Recycling! pp 457-63**
- **H. Small intestine? Ulcers? LS fig 15-20,15-22 pp 467-8 *http://www.cdc.gov/ulcer* *Beyond the Basics* LS p 456**
- **I. Large intestine? LS fig 15-24 pp 472-4**

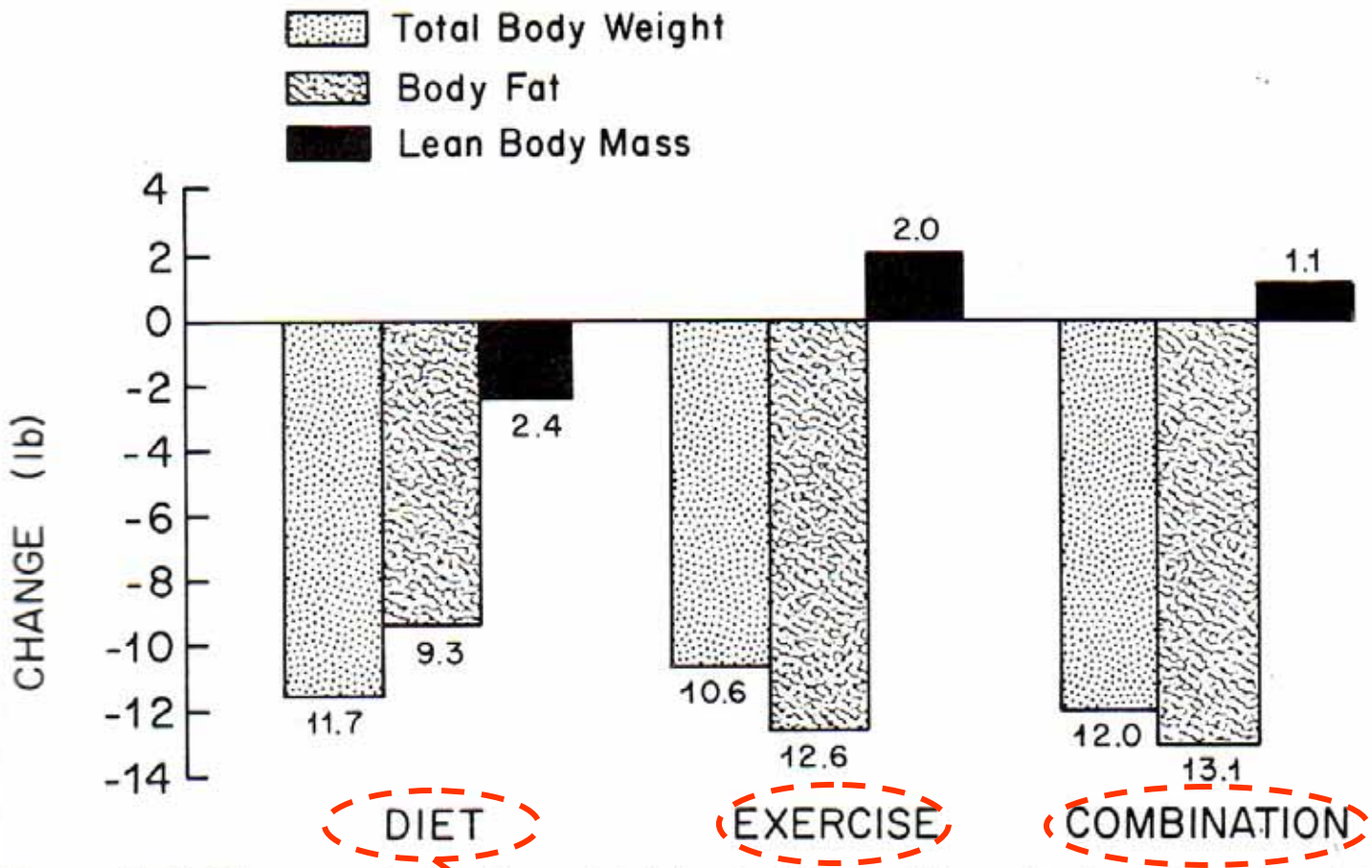
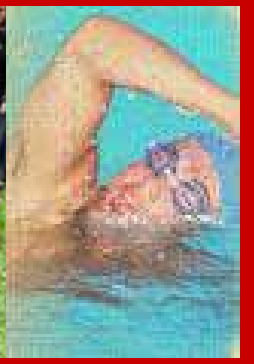


Figure 4–9. Changes in body weight, body fat, and lean body weight for diet, exercise, and combination groups. (From Zuti W. B., and Golding, L. A.: Comparing diet and exercise as weight reduction tools. **Phys. Sportsmed.** 4:49–53, 1976.)

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



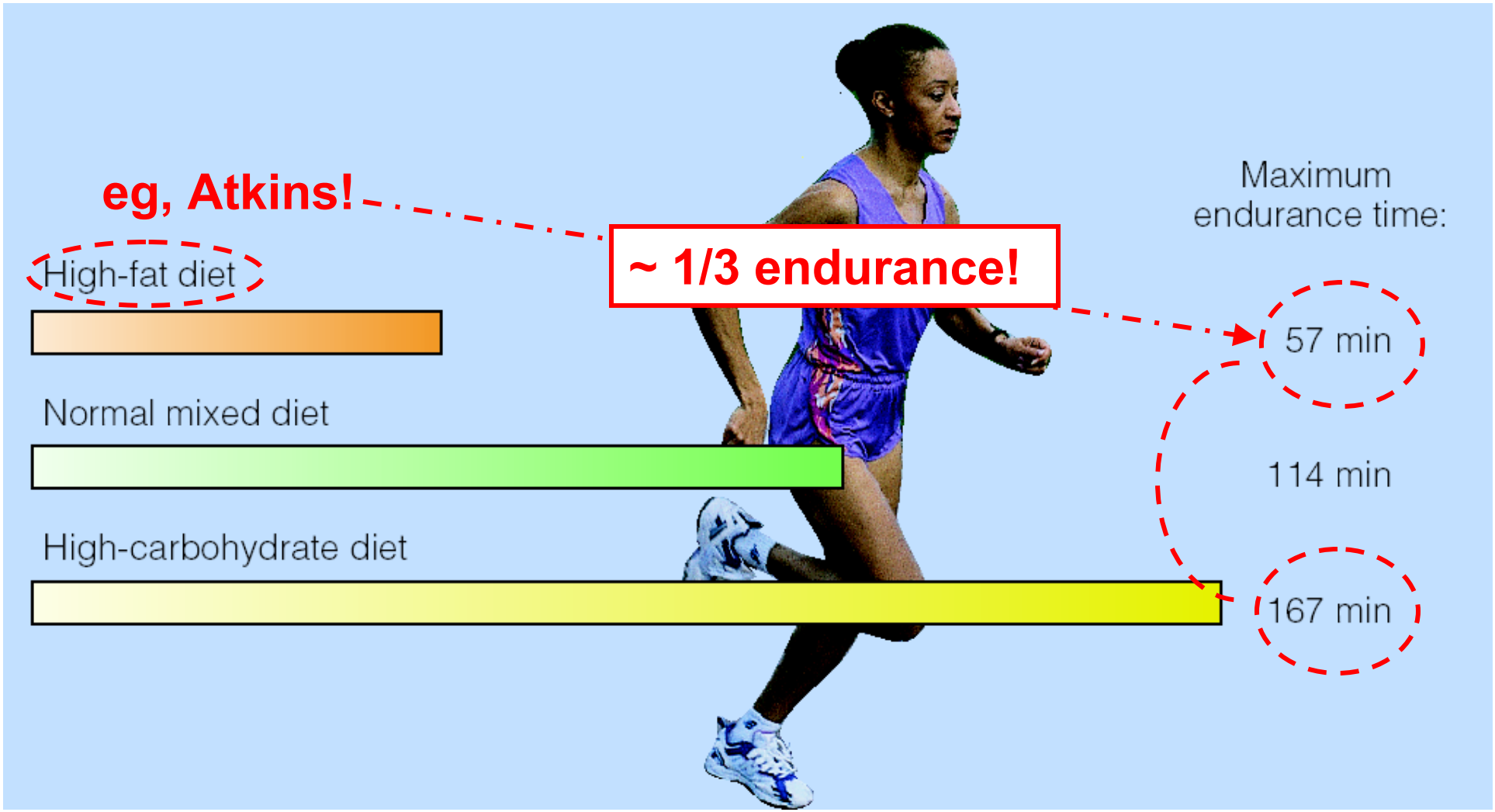
AMERICAN COLLEGE OF SPORTS MEDICINE
FOUNDED 1954
AMERICAN COLLEGE of SPORTS MEDICINE

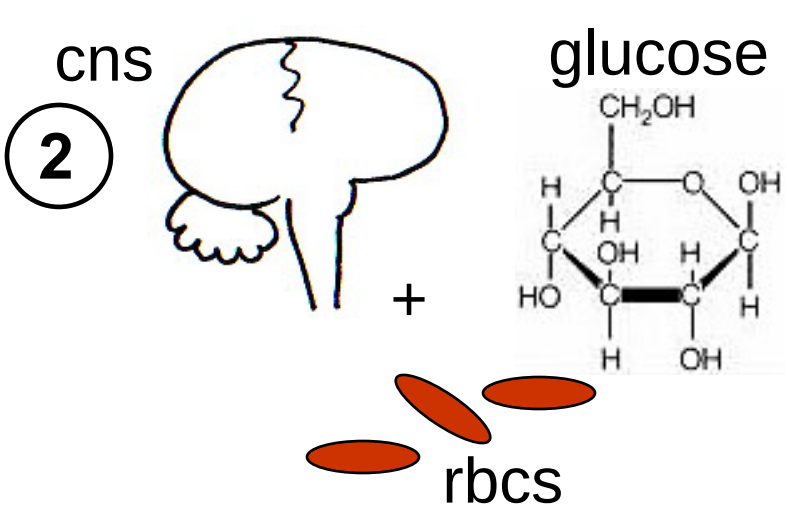



Exercise is better than dieting in lowering body fat & preserving muscles!



Dietary Composition & Physical Endurance

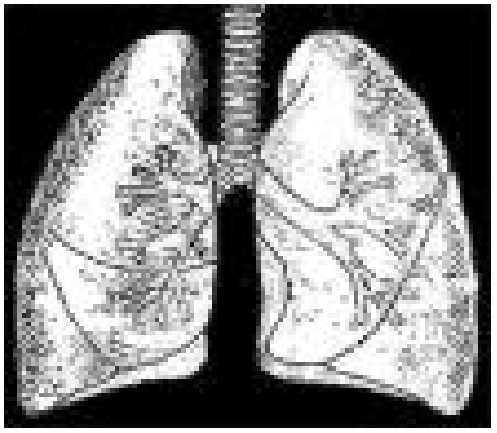




Negative Effects of Low Carbohydrate

1

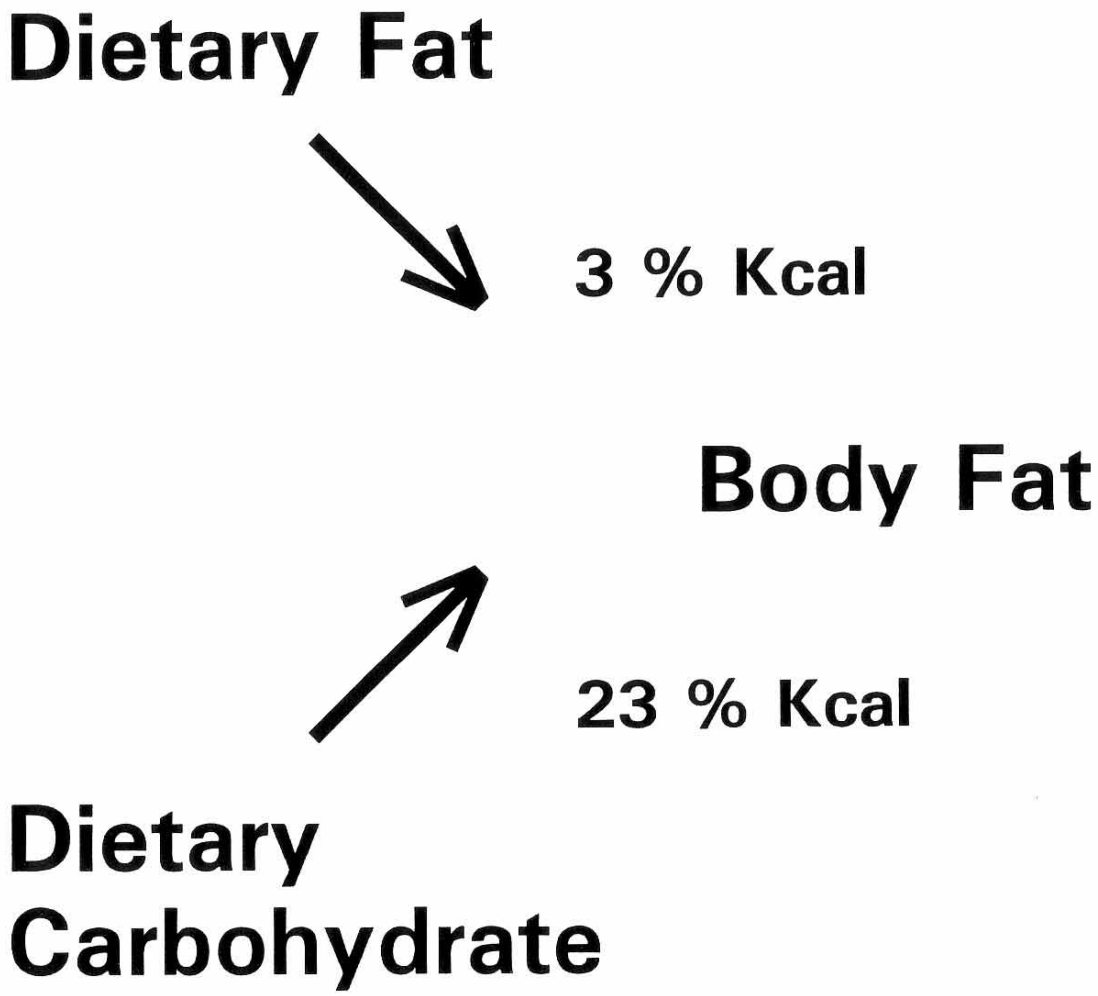
4



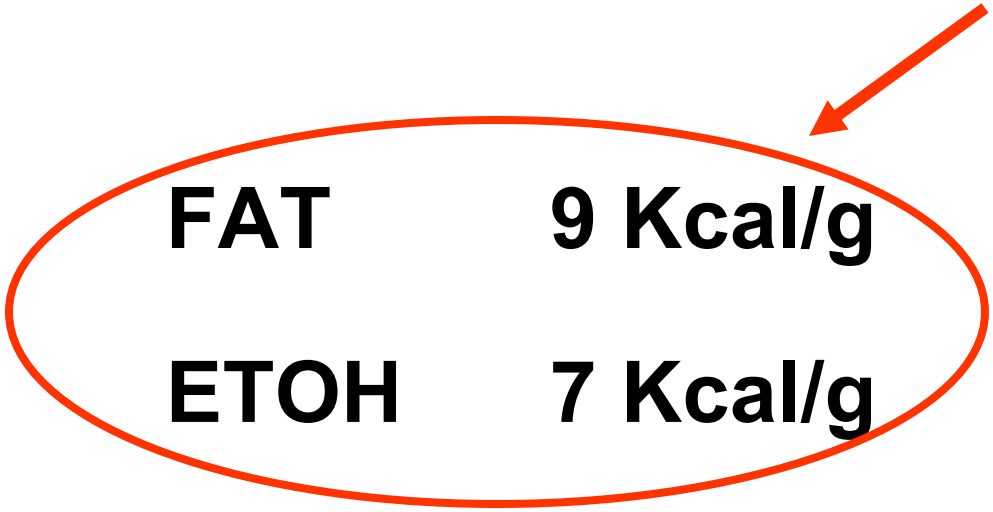
1. ↑ fatigue/exhaustion central & peripheral!
2. ↓ glucose – brain+spinal cord, rbcs thrive upon.
3. ↓ variety which reduces intake of phytochemicals, vitamins, minerals & fiber.
4. ↑ risk of respiratory infections.

+ gall stones,
↓ thermoregulation...

We're better at storing fat vs carbohydrate!



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



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

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

60-day Fast???

Lost 60 lb!! Wow!!

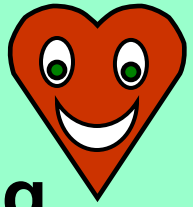
Yet

>3/4 { **26 lb Water**
20 lb Lean Body Mass

14 lb Fat

Fat < ¼ total wt loss!

Dr. Sacks' Conclusions:



We conclude that healthful diets with varying emphases on carbohydrate, fat & protein levels can all achieve clinically meaningful weight loss & maintenance of weight loss over a 2-yr period. The results give people who need to lose weight the flexibility to choose a diet that they can stick with, as long as it's heart healthy. Such diets can also be tailored for individuals based on their personal & cultural preferences & in this regard may have the best chance for long-term success.

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

Energy Nutrient	*% Total Calories*
Carbohydrate	45-65%
Fat	20-35%
Protein	10-35%

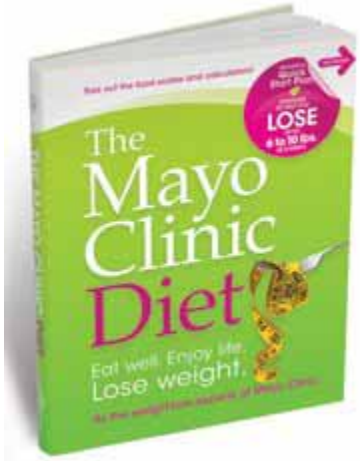
Kleiner's & Monaco's Top 10 Hit List for Nutrition Quackery

1. Treatment based on unproven theory calling for non-toxic, painless therapy.
2. Author's/purveyor's credentials aren't recognized in scientific community.
3. No reports in scientific, peer-reviewed literature but rather mass media used for marketing.
4. Purveyors claim medical establishment is against them & play on public's paranoia about phantom greed of medical establishment.
5. Treatments, potions, drugs manufactured according to secret formula.
6. Excessive claims promising miraculous cures, disease prevention or life extension.
7. Emotional images rather than facts used to support claims.
8. Treatments require special nutritional support including health food products, vitamins and/or minerals.
9. Clients are cautioned about discussing program to avoid negative.
10. Programs based on drugs or treatments not labeled for such use.

NOT PEER-REVIEWED =

TRADE BOOKS

PEER-REVIEWED = TEXTS → RESEARCH



AHA + DASH + MAYO CLINIC

LOWER CARBOHYDRATE

LOWER FAT

ELIMINATE CALORIES or FOOD GROUPS ENCOURAGE FASTING

ADEQUACY BALANCE CONSISTENCY & MODERATION

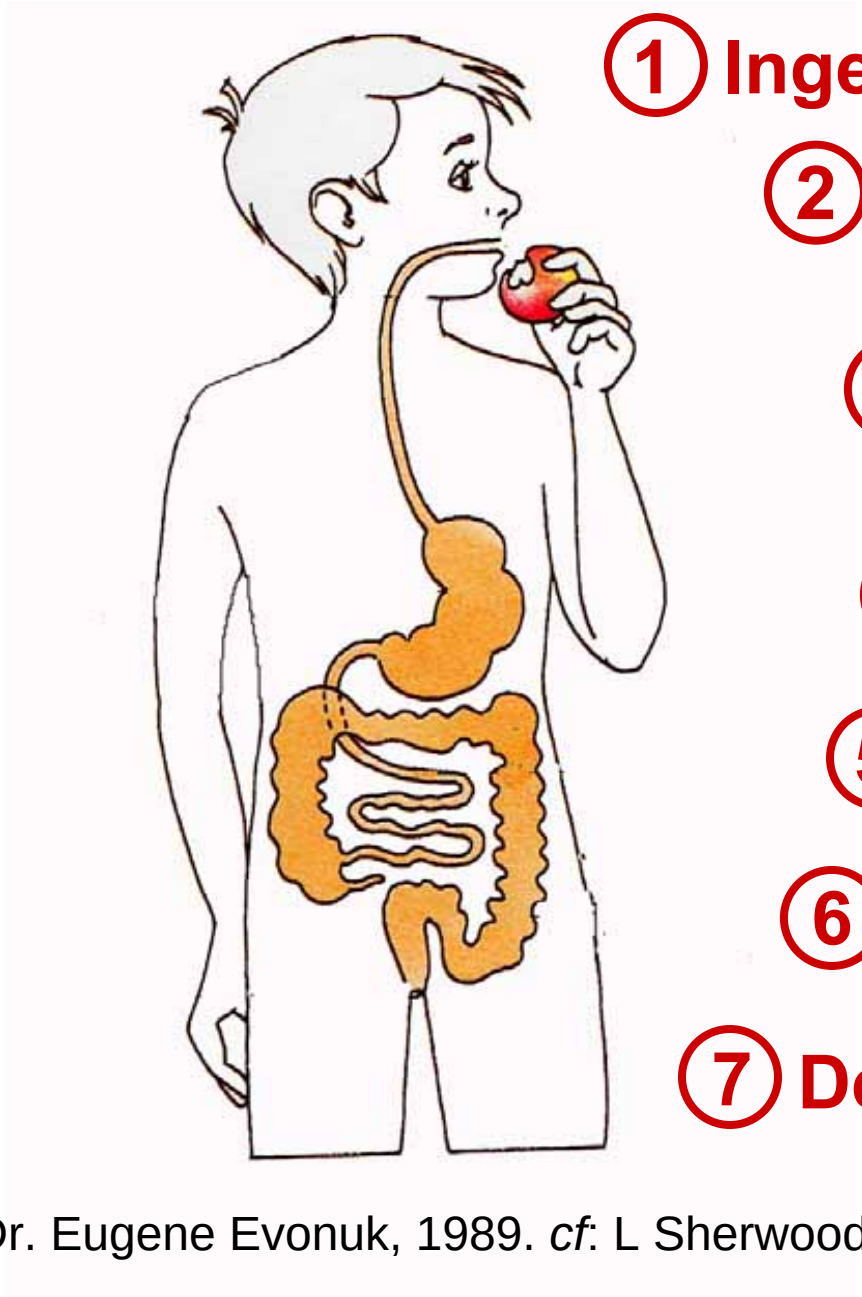
5 times per wk? ≡ 106,600 calories/yr ≡ ± 30.5 lb fat/yr

≡

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

Better choices!

Digestion Steps

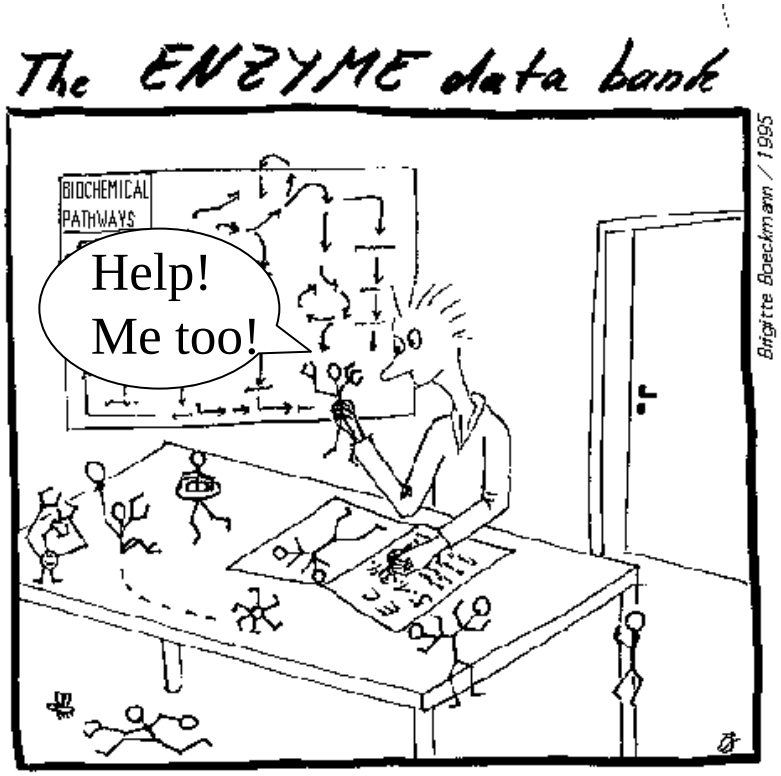


1. Ingestion
2. Mechanical Digestion
3. Chemical Digestion
4. Peristalsis
5. Absorption
6. Storage
7. Defecation

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

Hydrolysis of Energy Nutrients

+

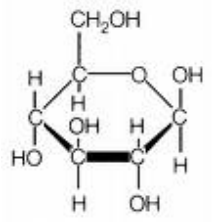


H_2O + Enzyme

Polymer to Monomer (Many to One)

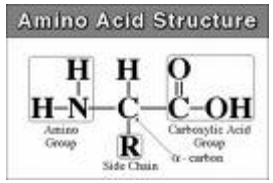
…Central-linking theme!!

Carbohydrate

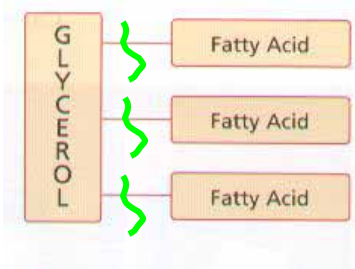


Glucose

Protein
+
Fat

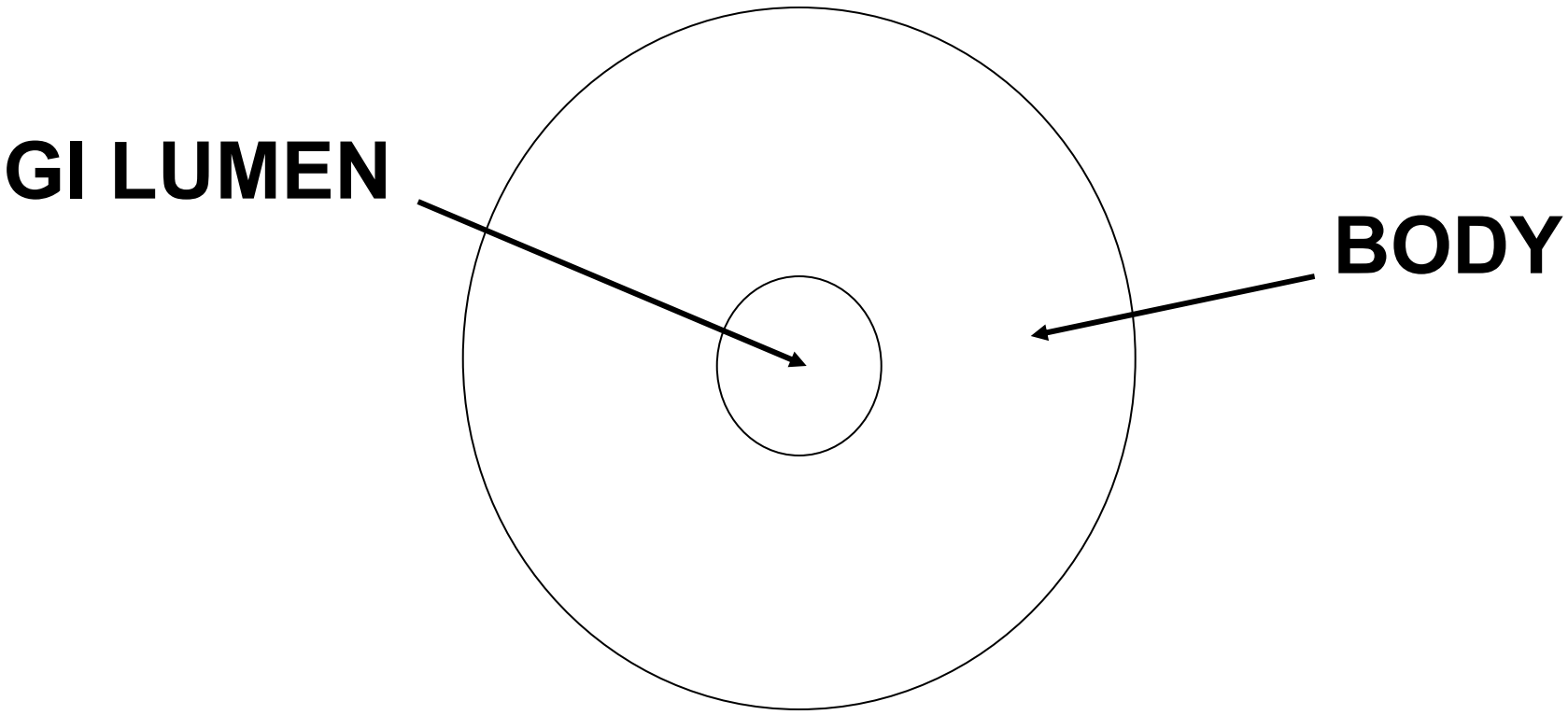


Amino Acids



Fatty Acids
+
Glycerol

GI-DONUT ANALOGY



BI 121 Lecture 7 **Exam I one week from today! I'll be ready!...**

I. ***Announcements*** Lab Notebooks? Q? from last time?

II. ***GI Physiology Connections*** DC Module 3 pp 17-23, LS ch 15+

- A. How is the gut controlled? Common control mechanisms
- B. Gut layers LS fig 15-2 pp 439- 43 → DC p 23 ↷
- C. GI secretions: What? Where? Why? LS p 438
- D. Organ-by-organ review A&P LS tab 15-1 pp 440-1 +...
- E. Zymogen? = Inactive precursor LS fig 15-9 p 452...
- F. Accessory organs? Pancreas, Liver, Recycling! pp 457-63
- G. Small intestine? Ulcers? LS fig 15-20,15-22 pp 467-8
  http://www.cdc.gov/ulcer ***Beyond the Basics*** LS p 456
- H. 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+…

Common Control Mechanisms

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

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

4. Liver-Gall Bladder

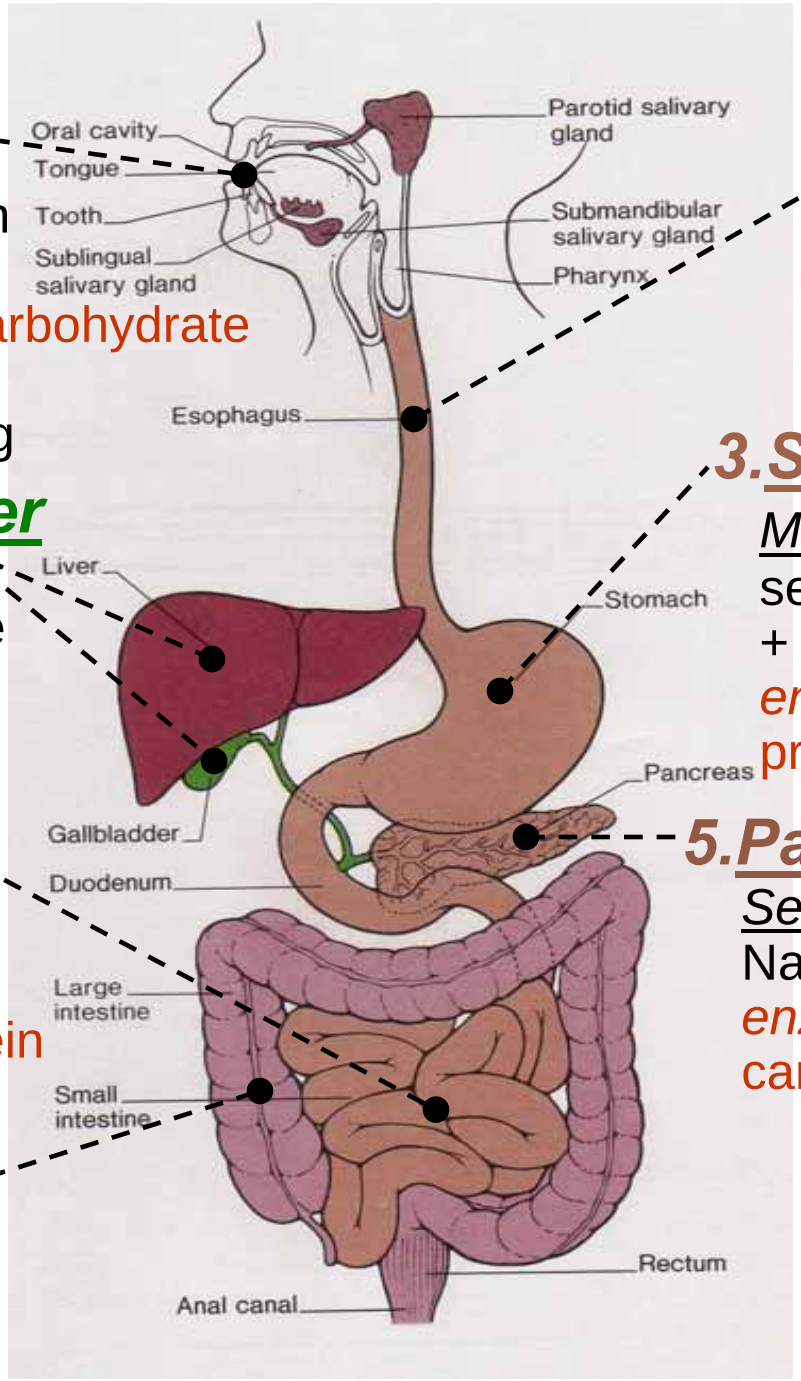
Emulsification =
detergent action of bile
+ secretion

6. Small Intestine

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

7. Large Intestine

Dehydration
secretion + absorption
storage + peristalsis



2. Esophagus

Rapid transit
peristalsis
secretion mucus

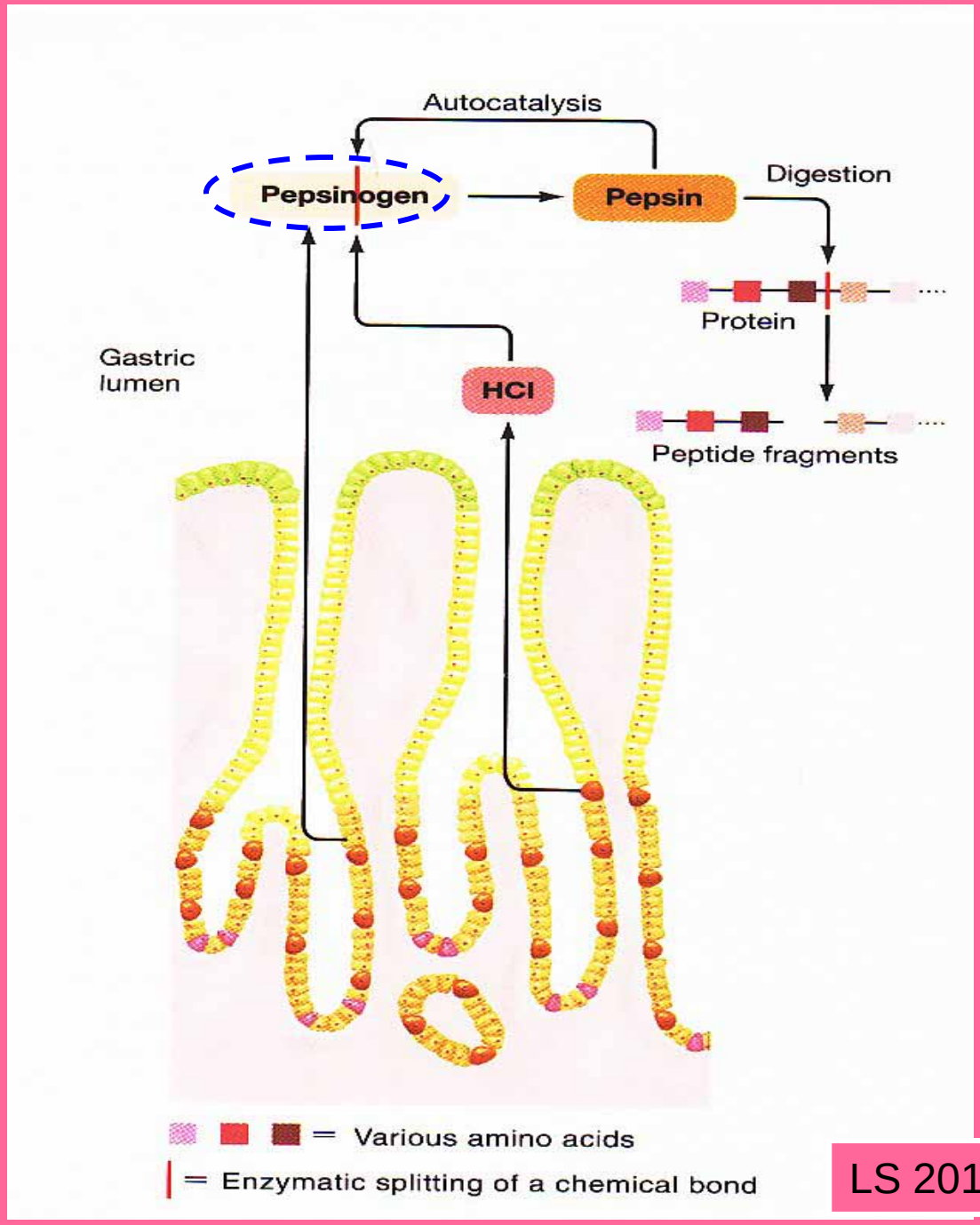
3. Stomach

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

5. Pancreas

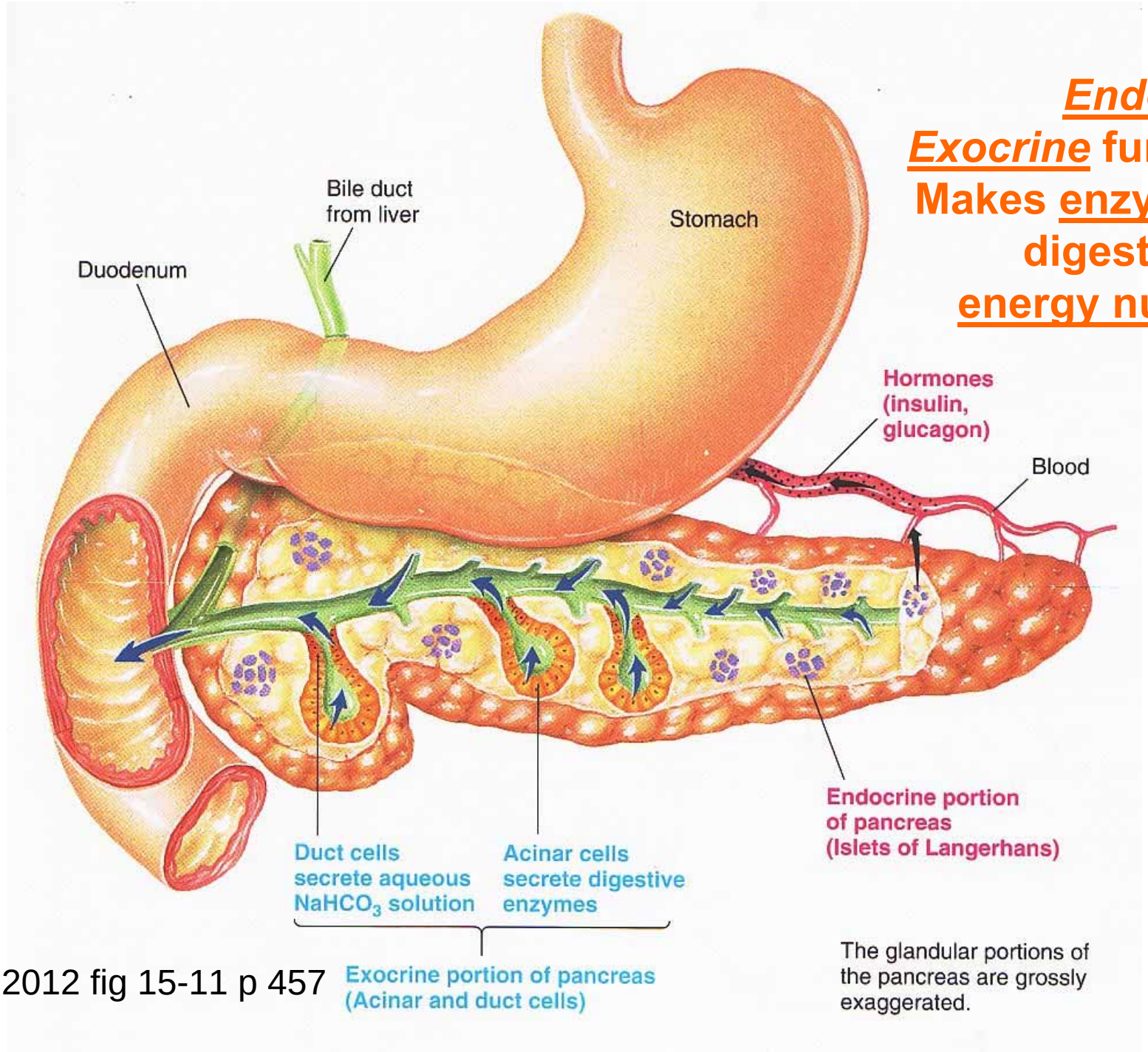
Secretion mucus +
$NaHCO_3$ + enzymes
enzymatic digestion:
carbohydrate, fat, protein

Zymogen= an inactive precursor

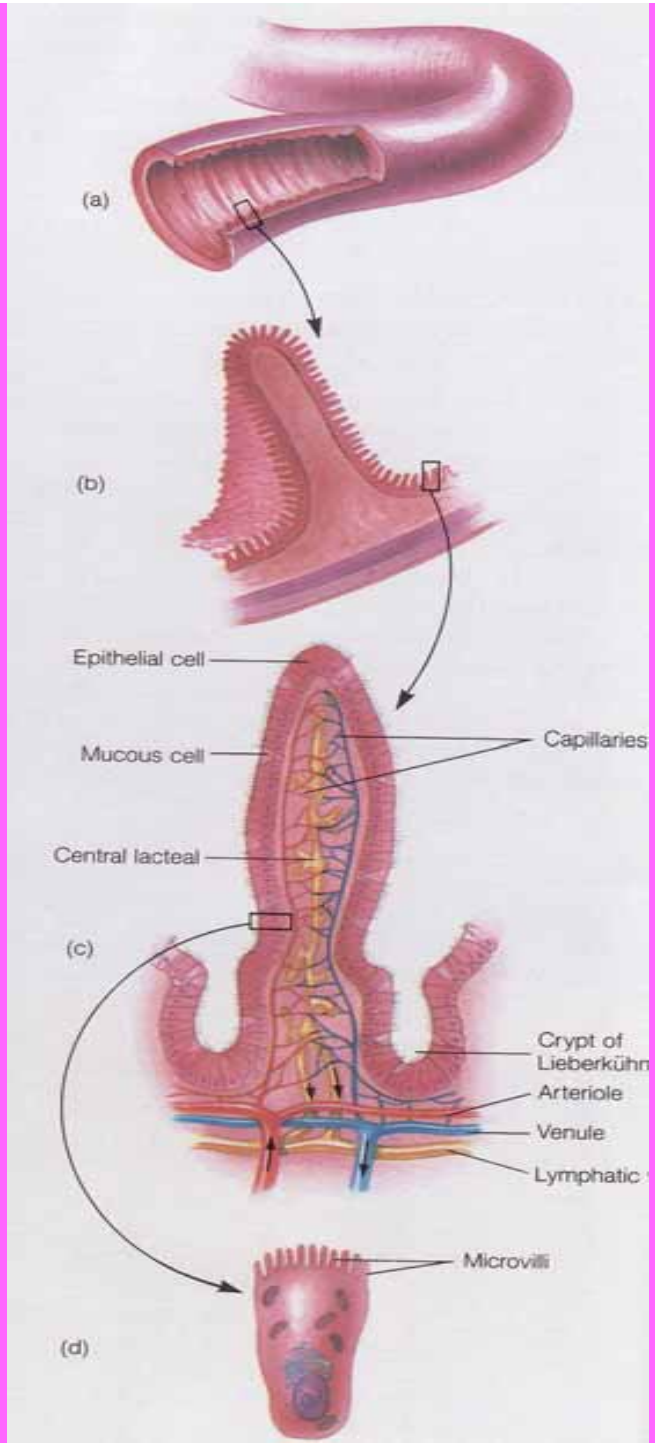


LS 2012 fig 15-9 p 452

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



LS 2012 fig 15-11 p 457

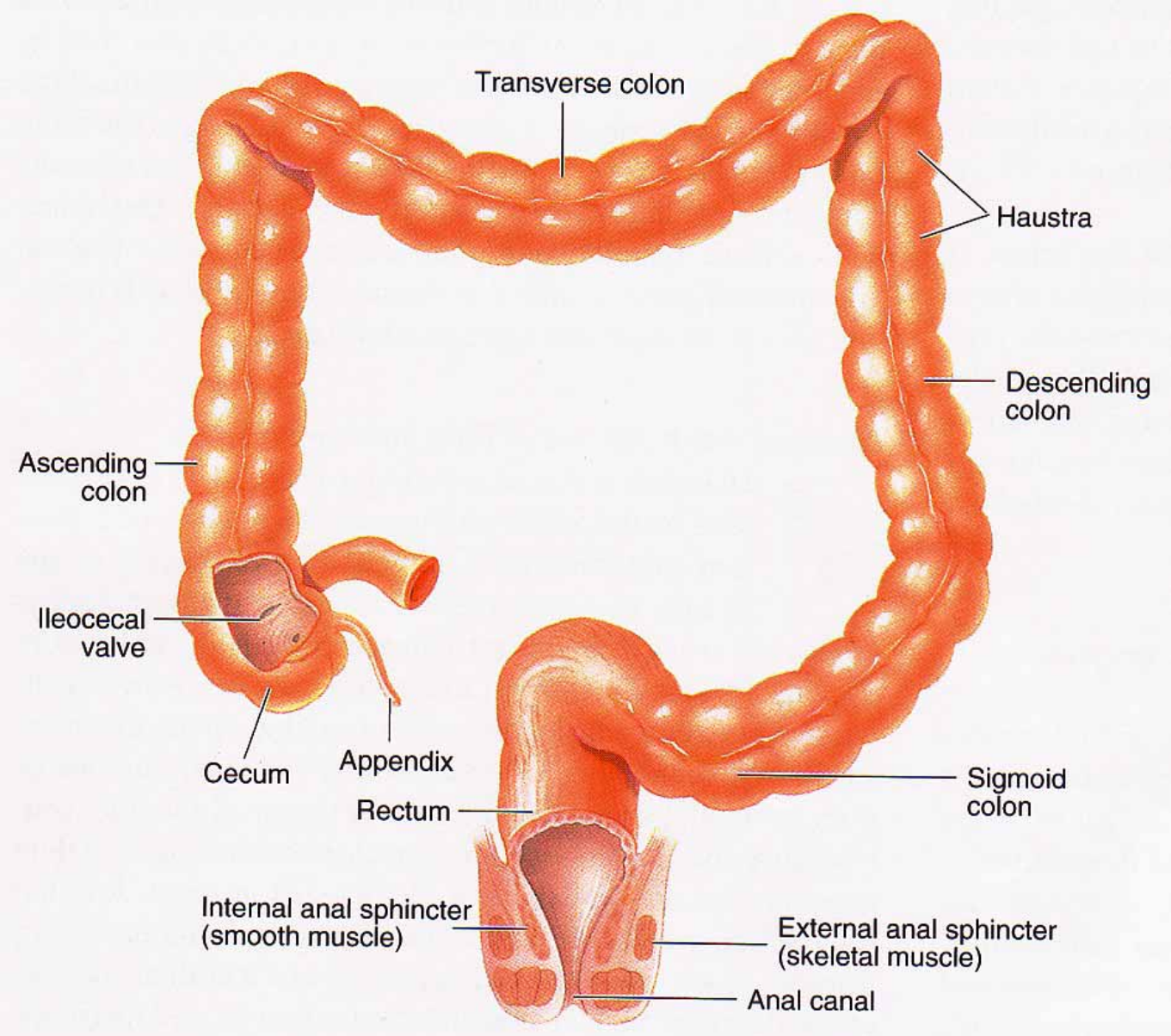


LS 2012 fig 15-20 p 467

Ulcer Facts

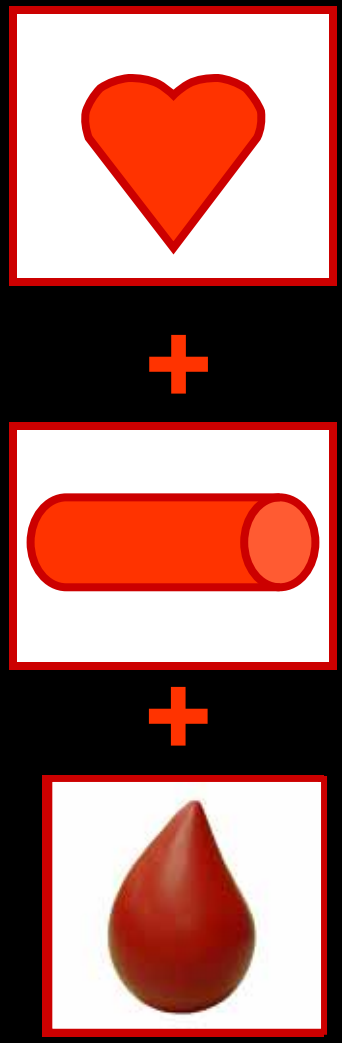
- Most ulcers are caused by an infection, not spicy food, acid or stress.
- The most common ulcer symptom is burning pain in the stomach.
- Your doctor can test you for *H. pylori* infection.
- Antibiotics are the new cure for ulcers.
- Eliminating *H. pylori* infections with antibiotics means that your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

Large Intestine Structure & Function



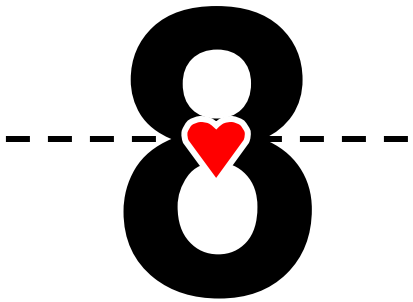
LS 2012 fig 15-24 p 472

Cardiovascular (CV) = Heart + Vessels + Blood!

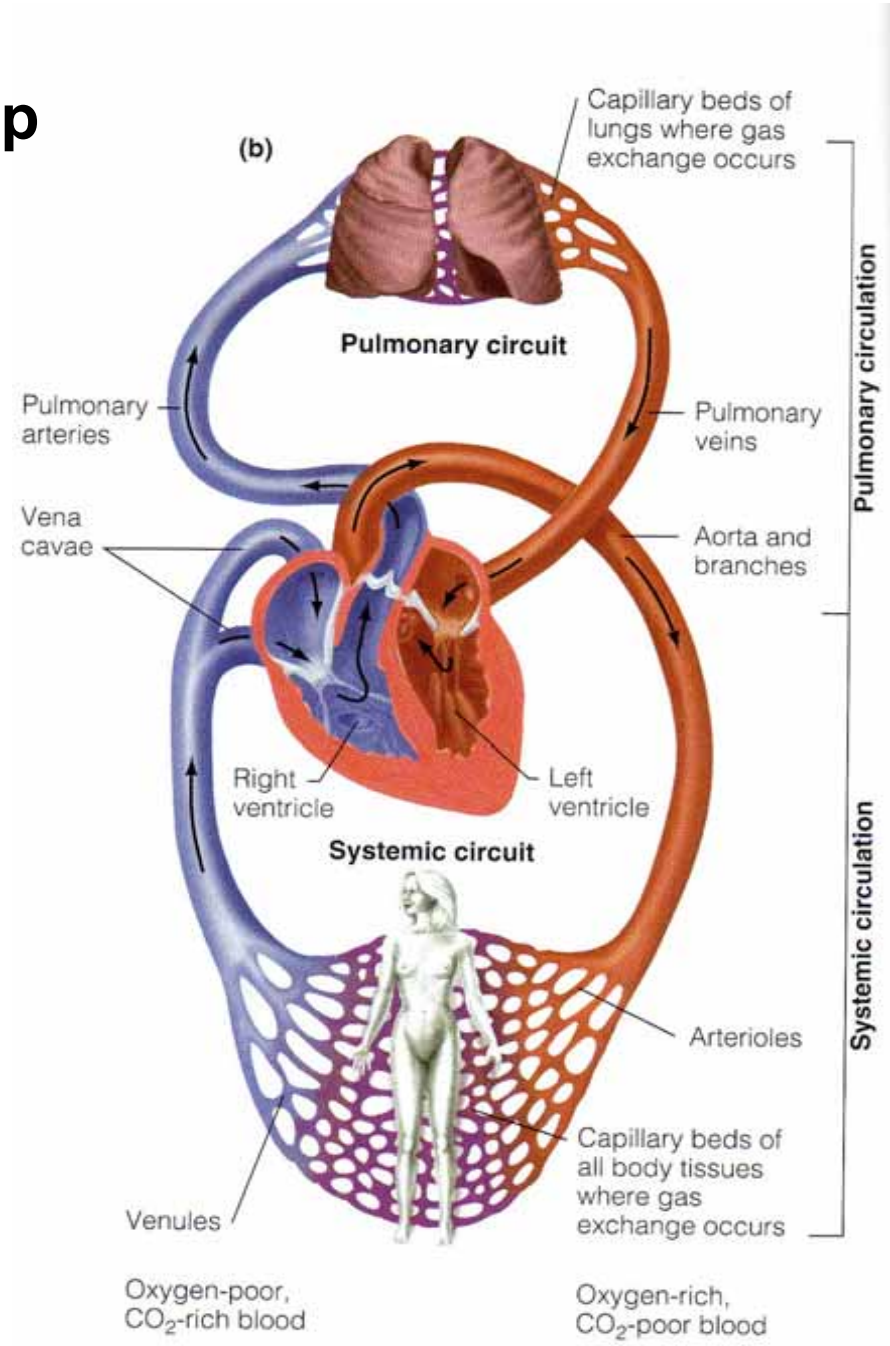


NB: Figure-8 loop

Pulmonary

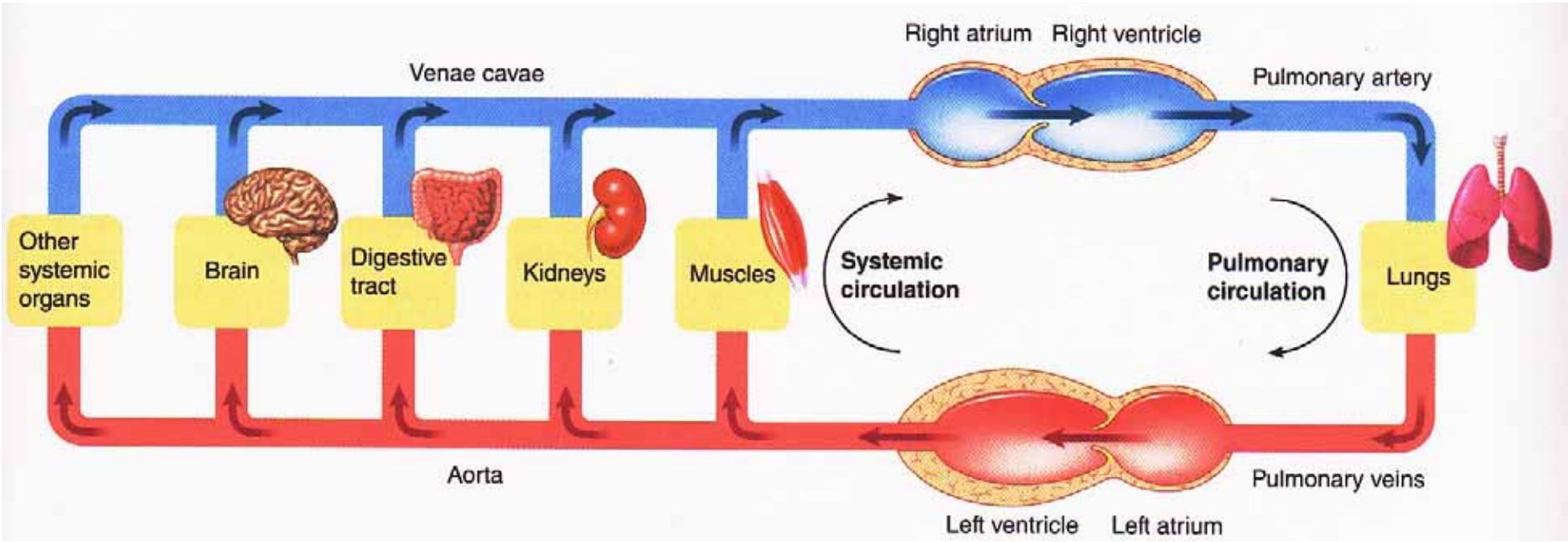


Systemic



D Chiras 2013 fig 4-1b

Dual Pump Action & Parallel Circulation



LS 2012 fig 9-2b p 231

BI 121 Lecture 8

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

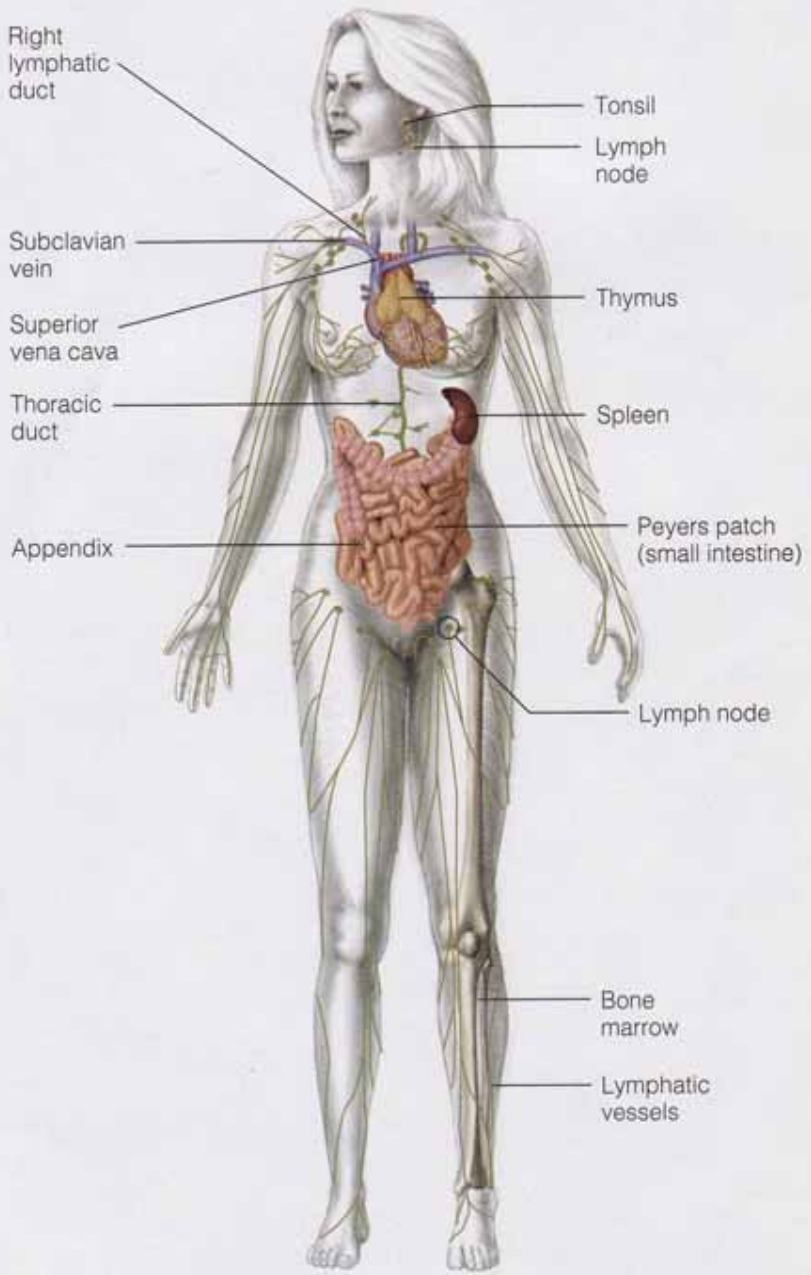
I. ***Announcements*** **Exam I next session; 12 n lab section go directly to 129 Huestis (HUE). All others here (100 WIL)!**
Review: Sunday, 6 pm here (100 WIL)! Lab notebooks. Q?

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!**

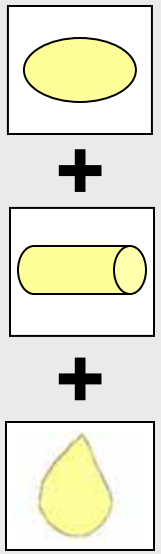
IV. ***CV Pathophysiology & Risk Reduction*** **LS ch 9, 10 +…**

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?



Lymphatic System

1. **Lymph Nodes**
2. **Vessels**
3. **Lymph**

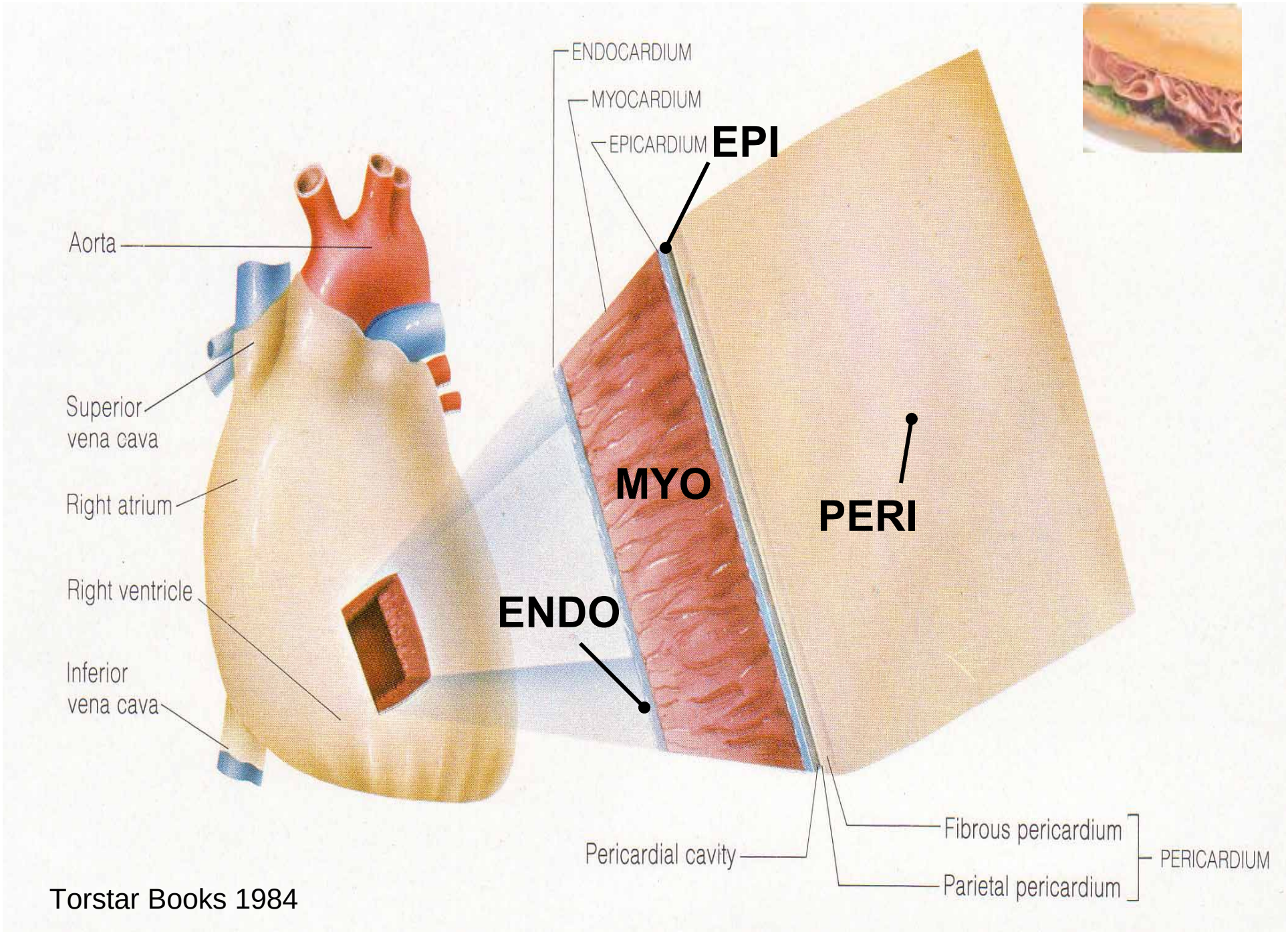


No pump!

DC 2003

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

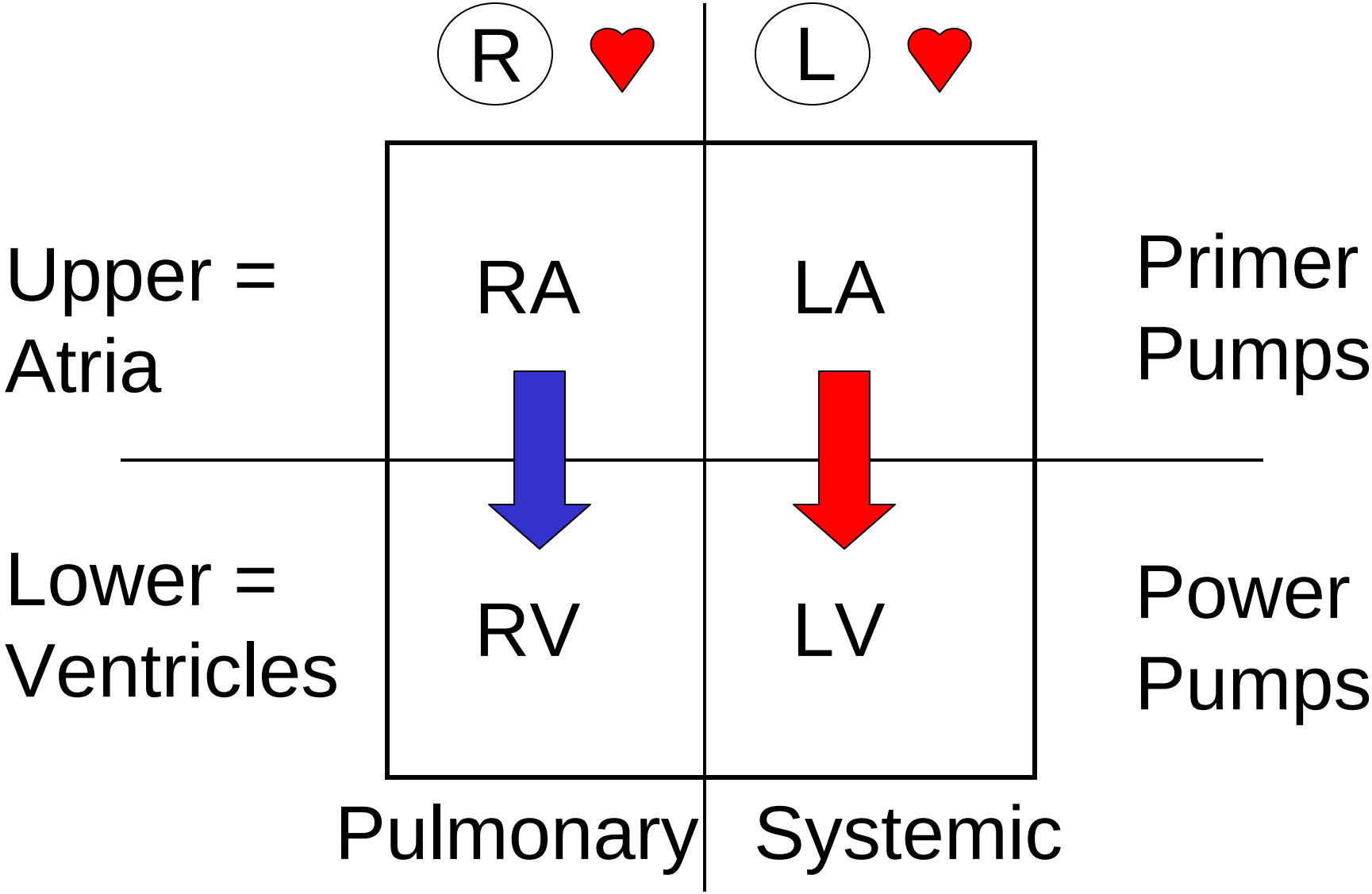
LS 2012 fig 10-21 p 283



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

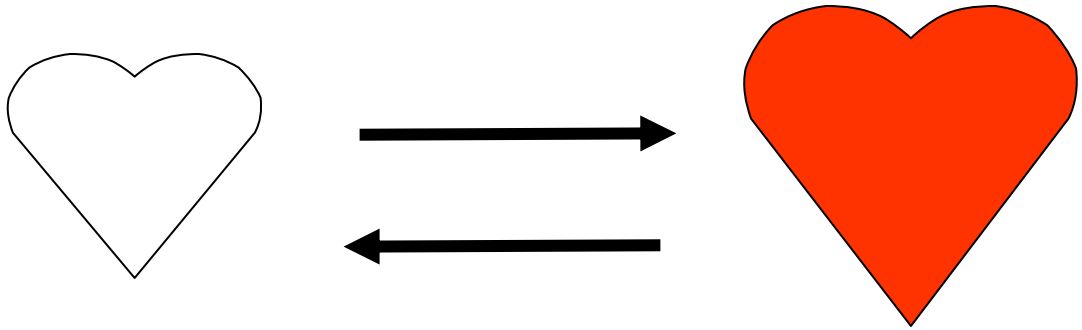
Cardiac Cycle

Systole

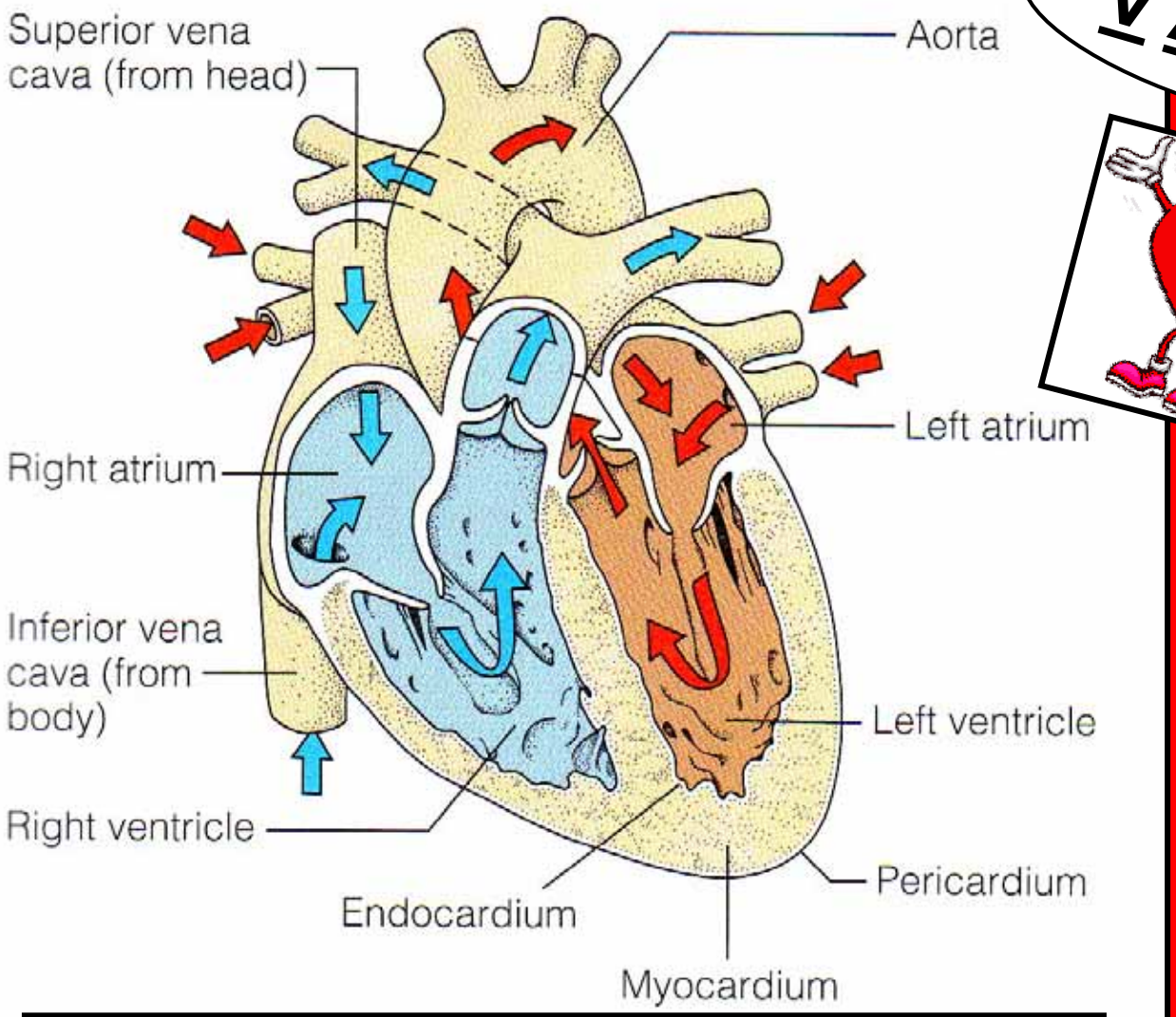
Contract
& Empty

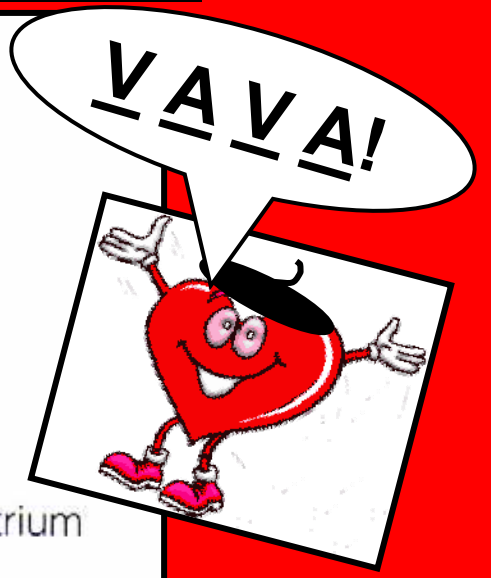
Diastole

Relax
& Fill



Veins → Atria → Ventricles → Arteries





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

LS2007

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

CVDs

AMI

CVA

TIA

HTN

PVD

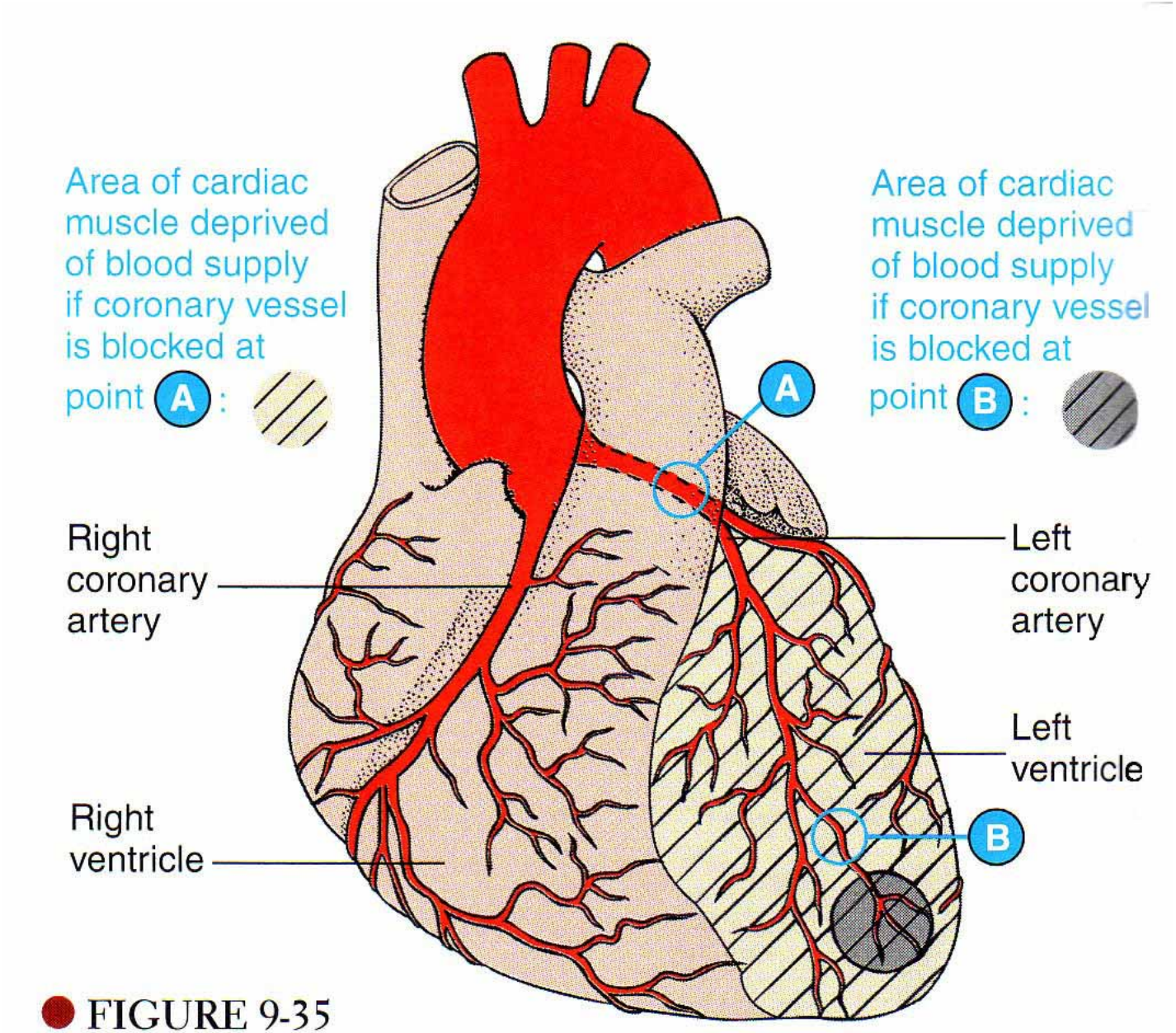
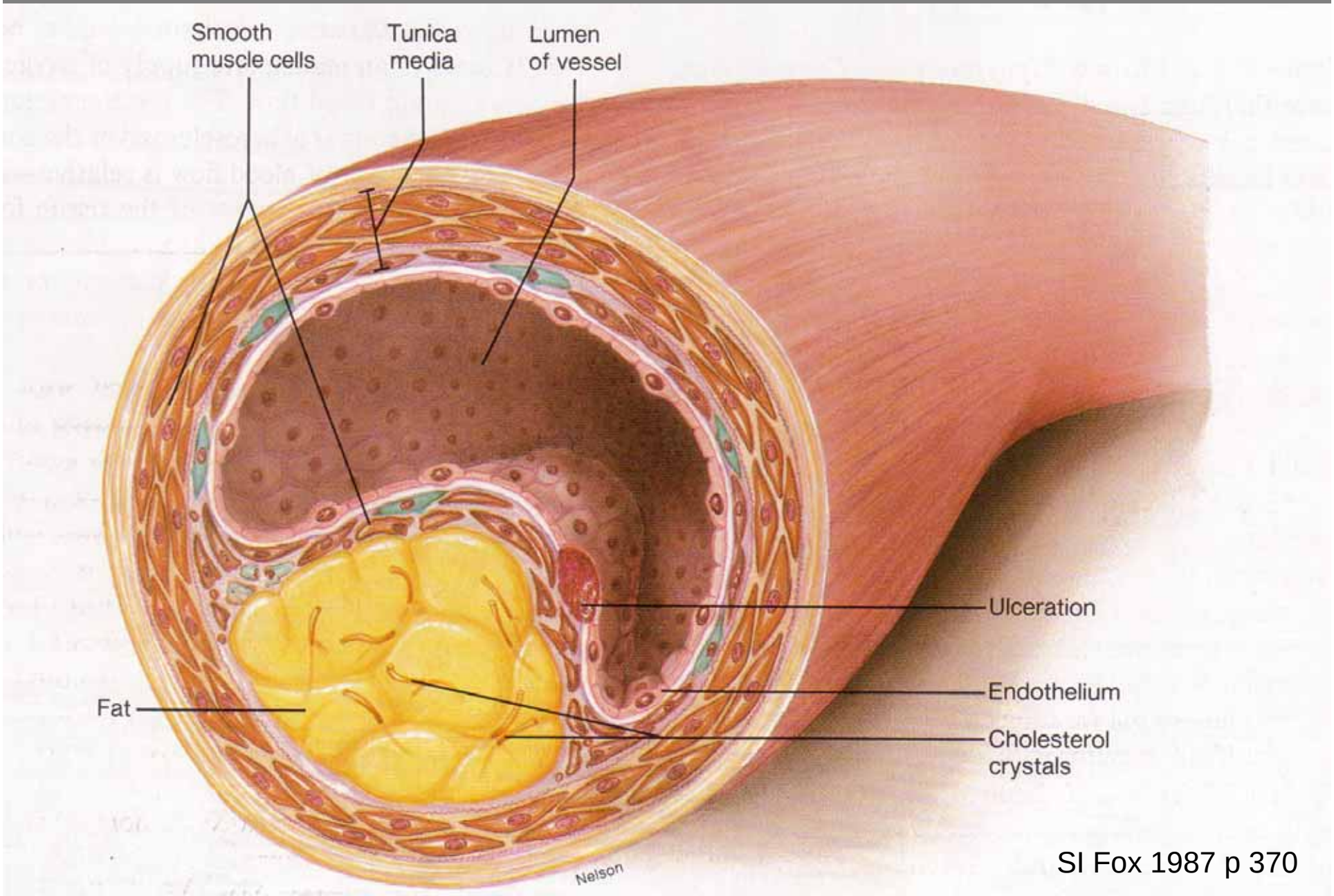


FIGURE 9-35

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

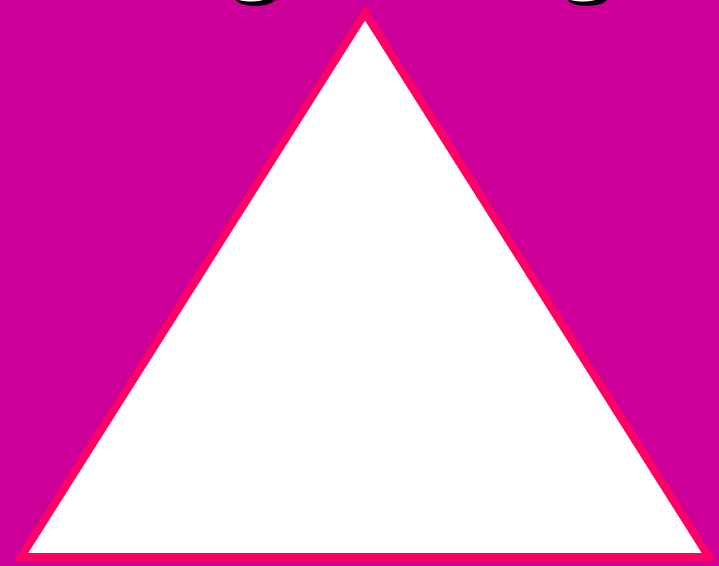
L Sherwood 2004 p 336



SI Fox 1987 p 370

Treatment Triad

NB: Last blasted resort!!

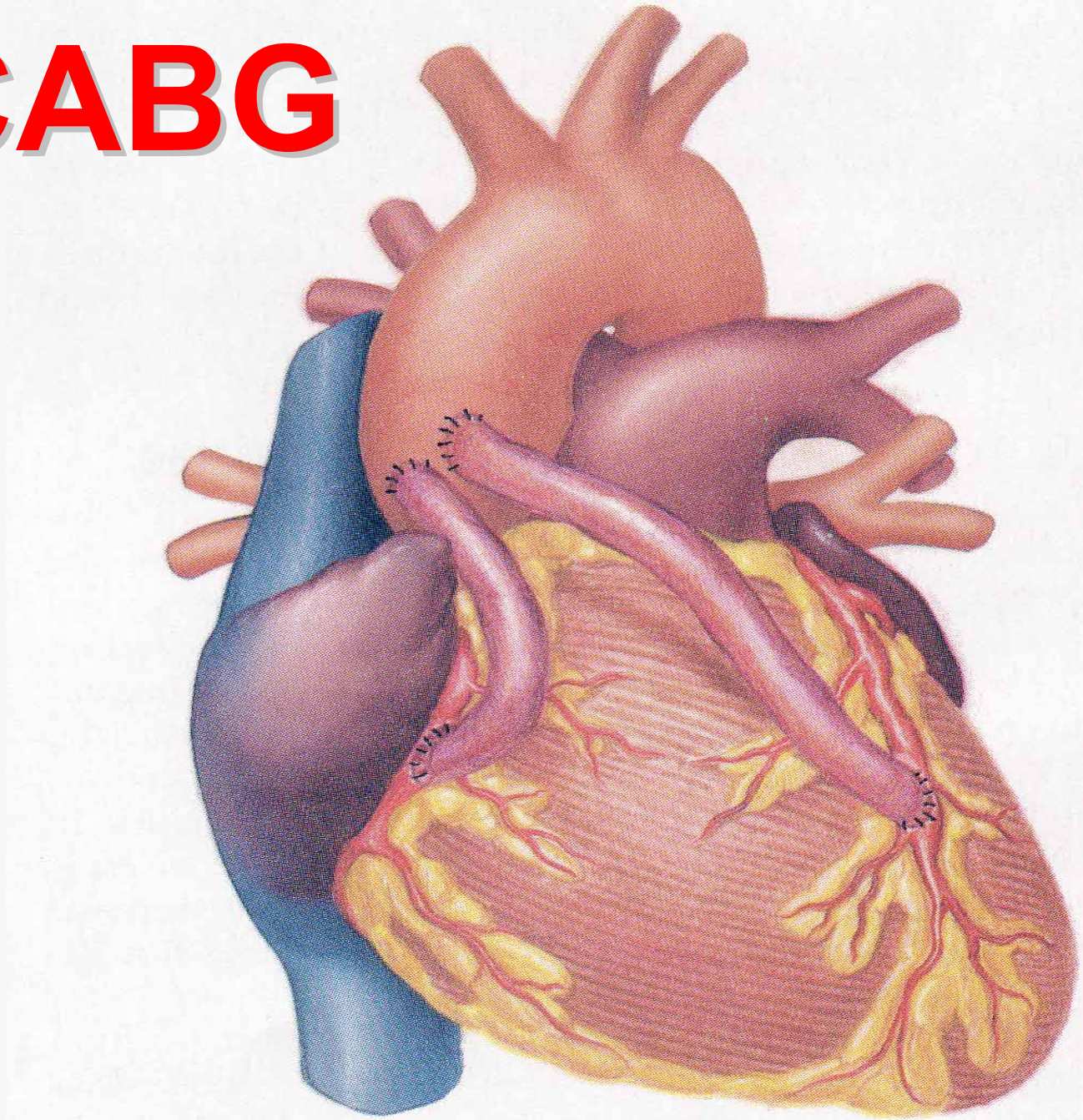


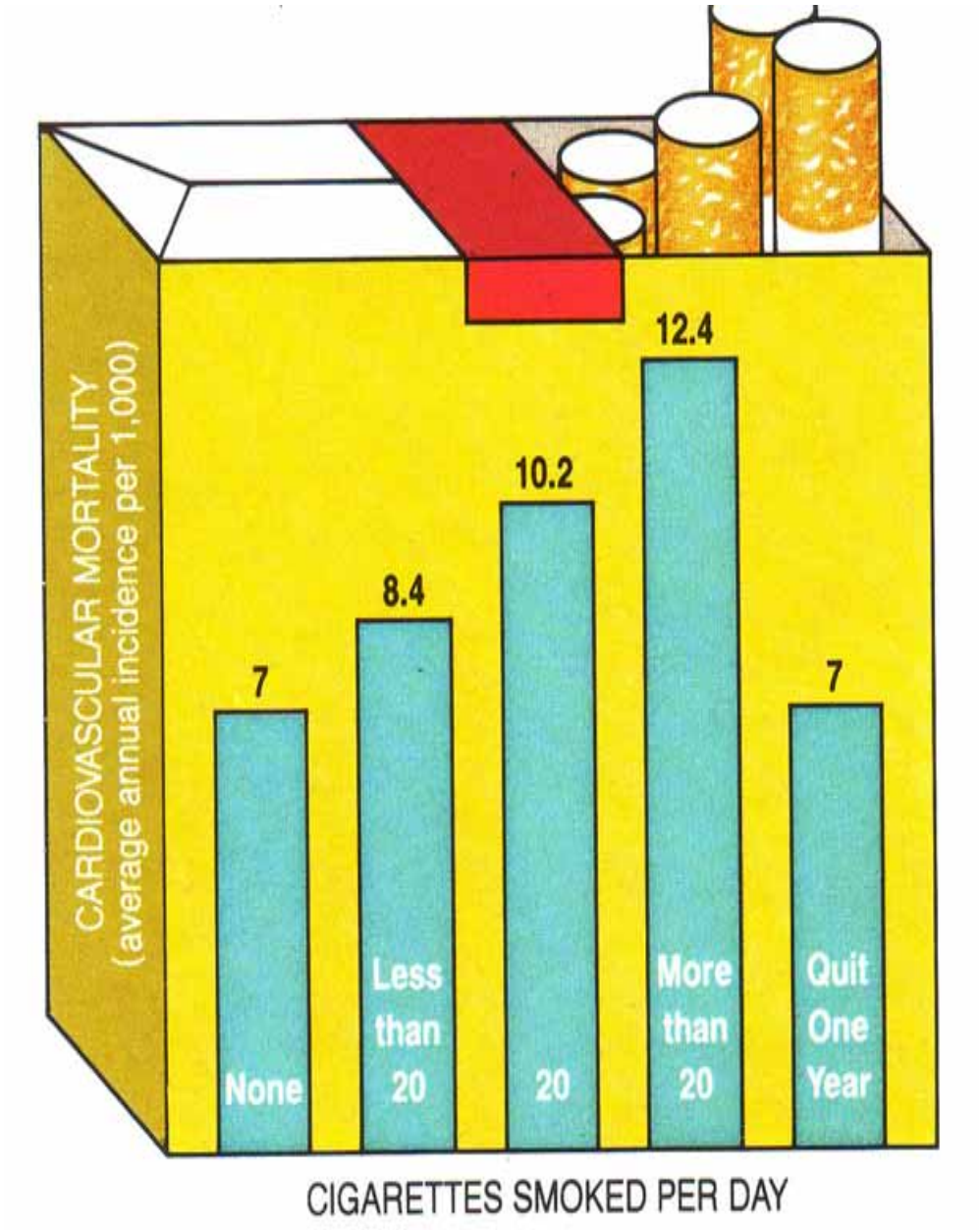
Drugs/Surgery

Dietary Modification

Exercise

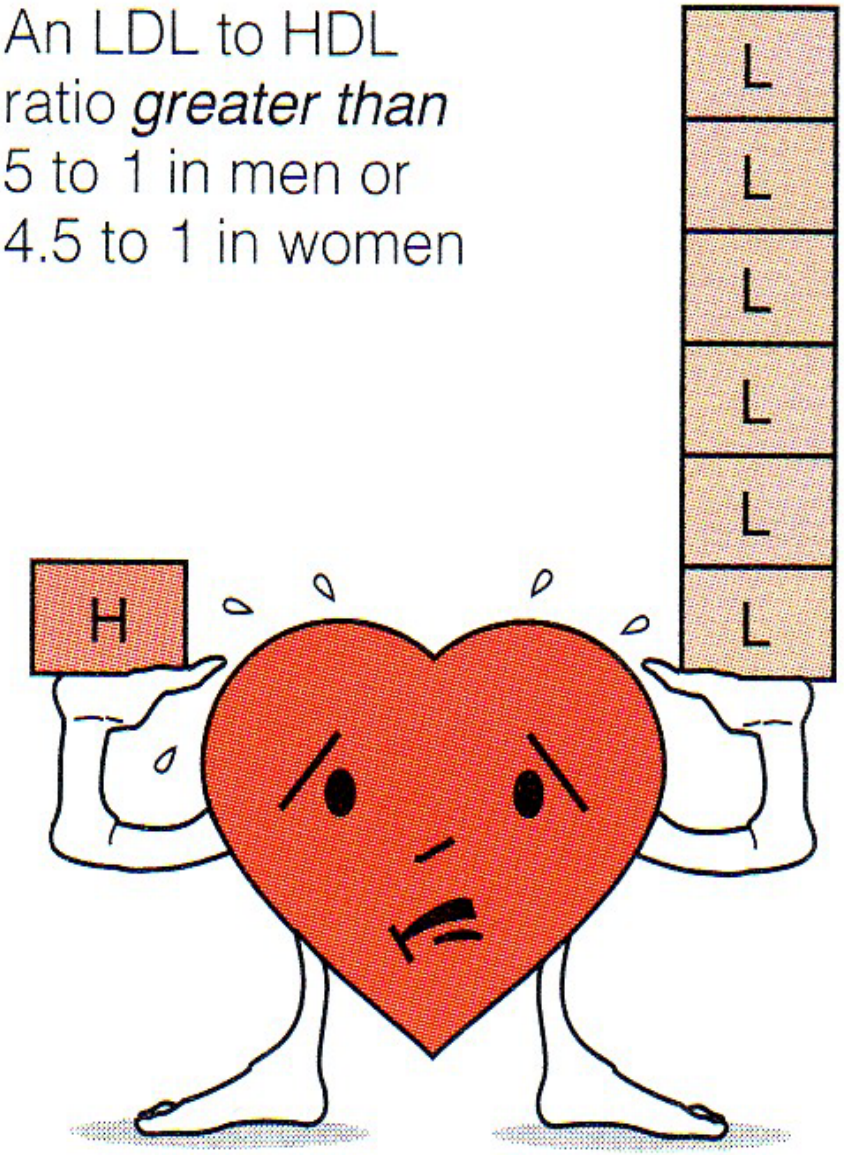
CABG



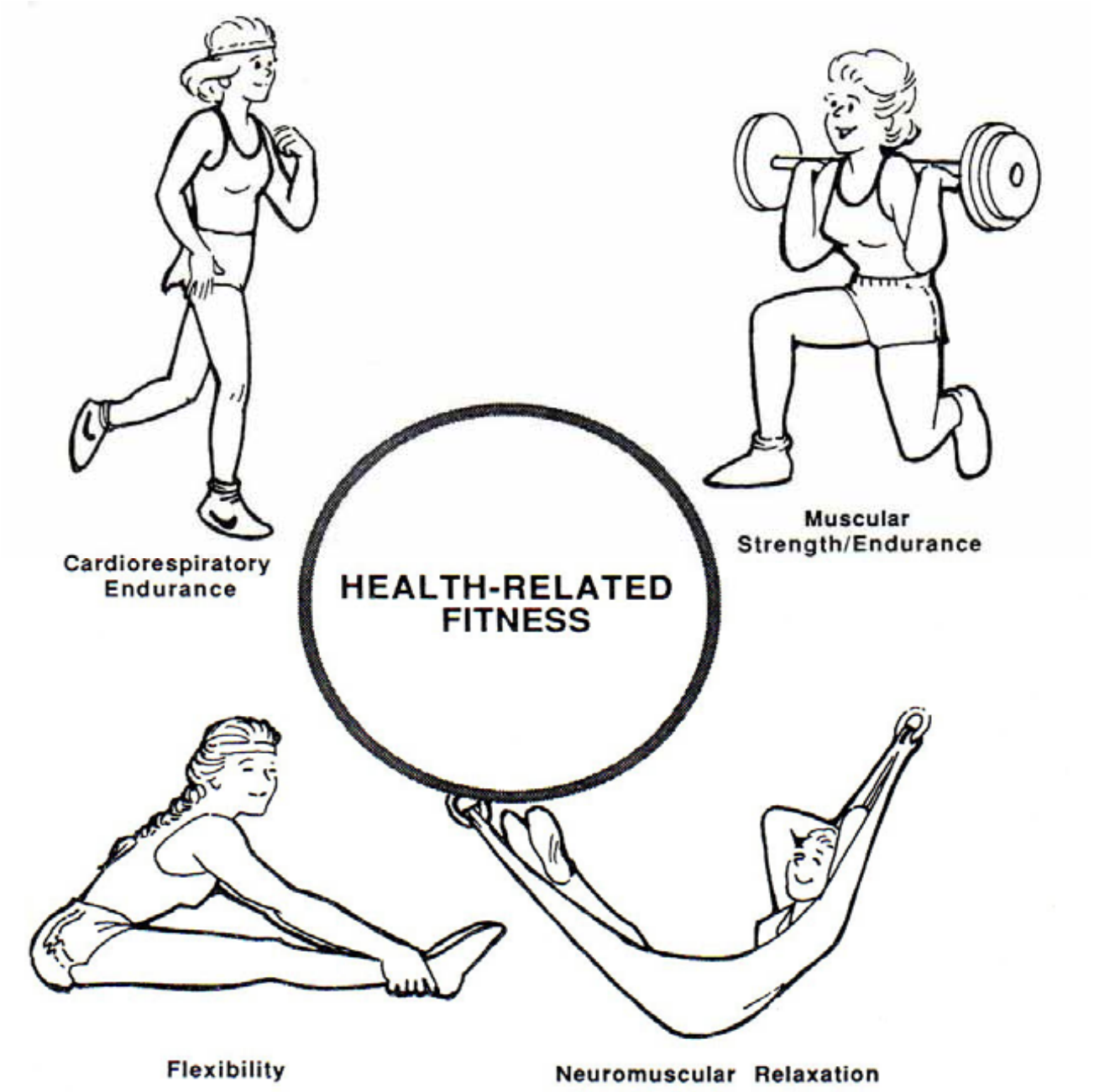

CARDIOVASCULAR MORTALITY
(average annual incidence per 1,000)
7
8.4
10.2
12.4
7
None
Less than 20
20
More than 20
Quit One Year
CIGARETTES SMOKED PER DAY

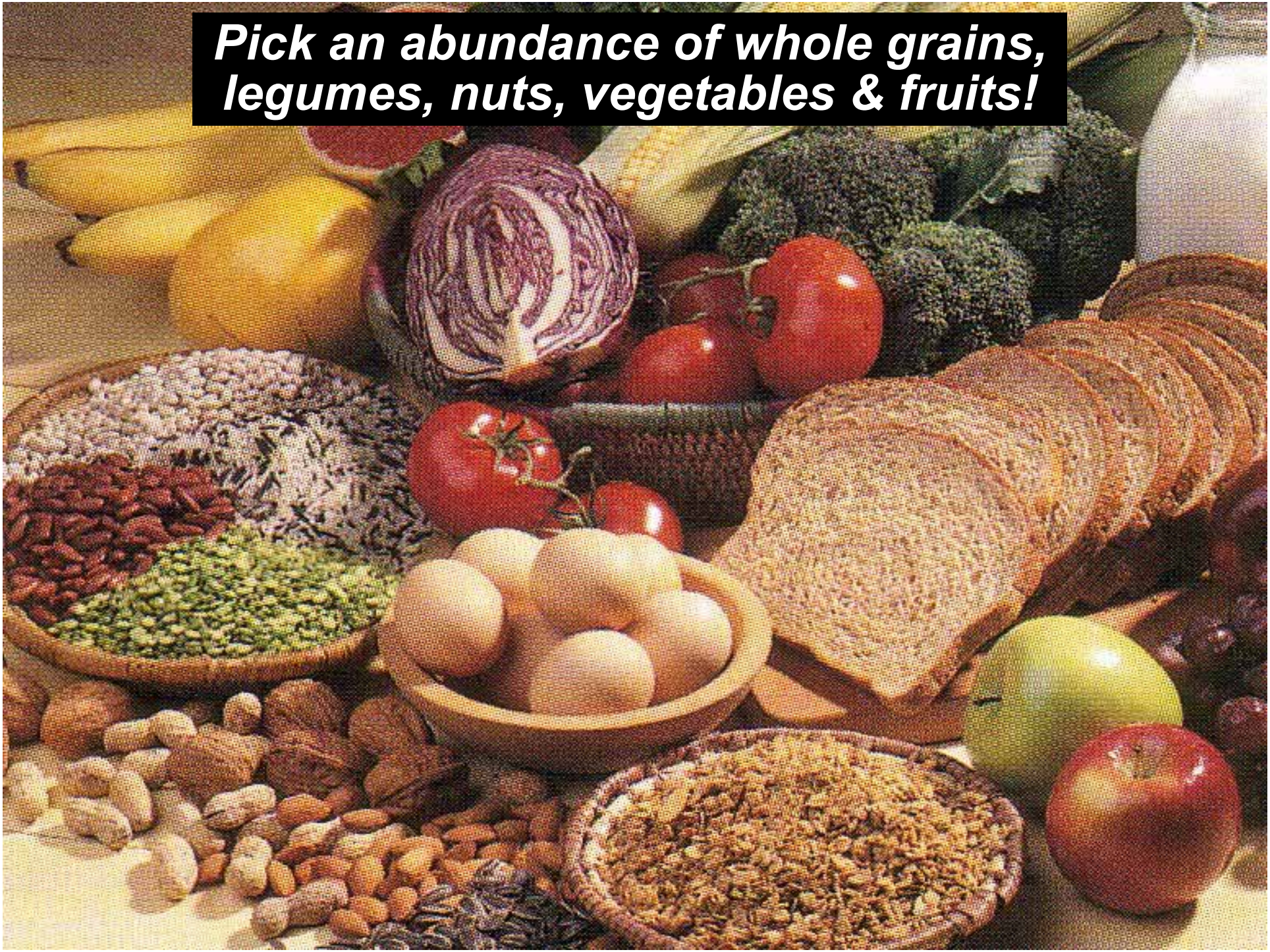

KA-BOOM!
300/200
Hg

An LDL to HDL ratio *greater than* 5 to 1 in men or 4.5 to 1 in women

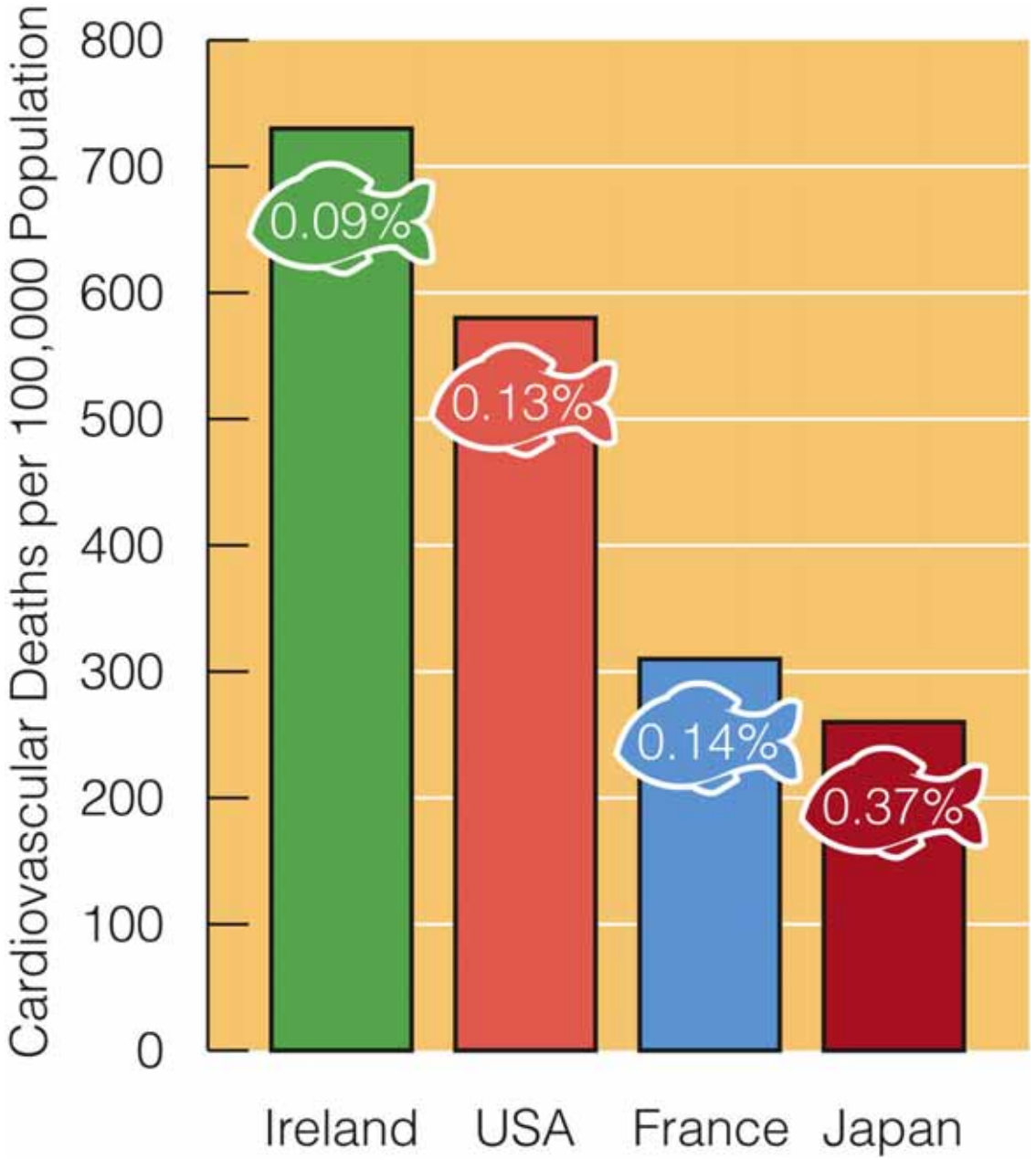


Increased risk of heart disease


HEALTH-RELATED FITNESS
Cardiorespiratory Endurance
Muscular Strength/Endurance
Flexibility
Neuromuscular Relaxation


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?

H A P O C