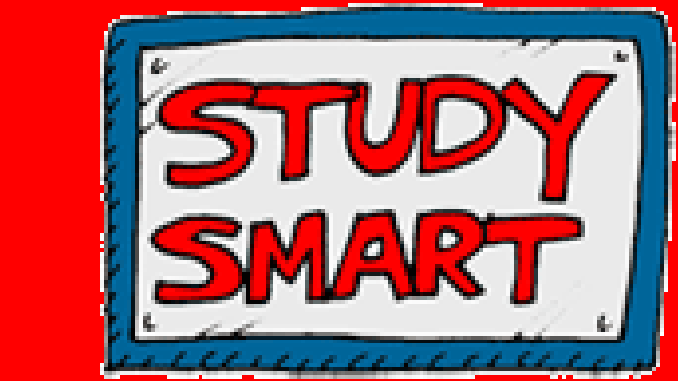
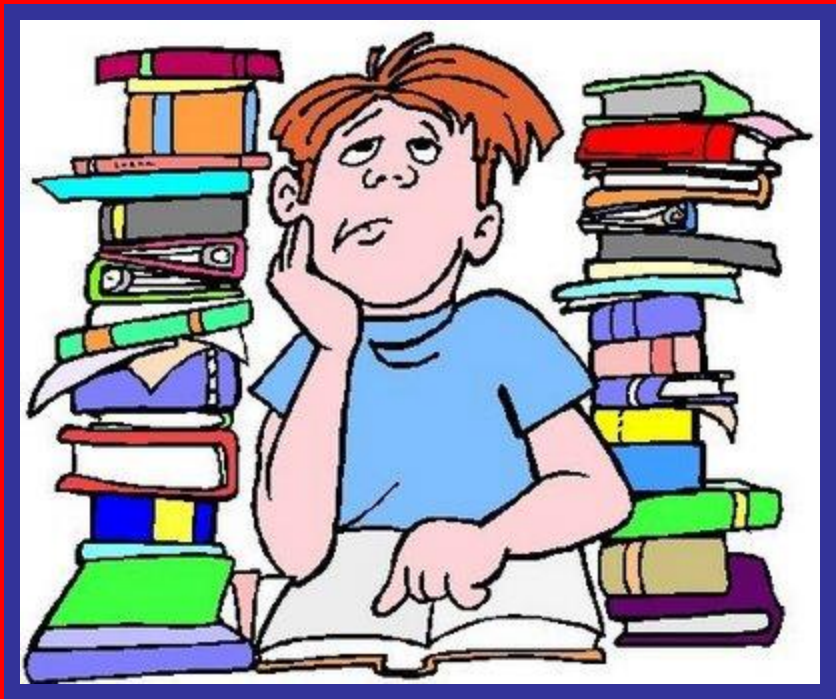
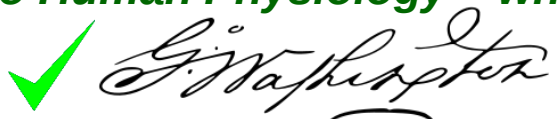
Exam I Review Slides





...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* tomorrow in 130 HUE: 12 n & 1 pm sections. Much fun!!

II. *Introduction*: Staff, office hr, required sources, overview, grading, expectations & success. Anything goes Q?

III. *Human Physiology* LS ch 1, DC Module 1

- **A. What? cf: Anatomy LS p 1**
- **B. Where?Body Levels of Organization LS pp1-6, DC pp1-5**
- **C. How? Different Study Approaches LS p 1**
- **D. Why? Security+Decision-Making Power LS p xxi, DC p v**

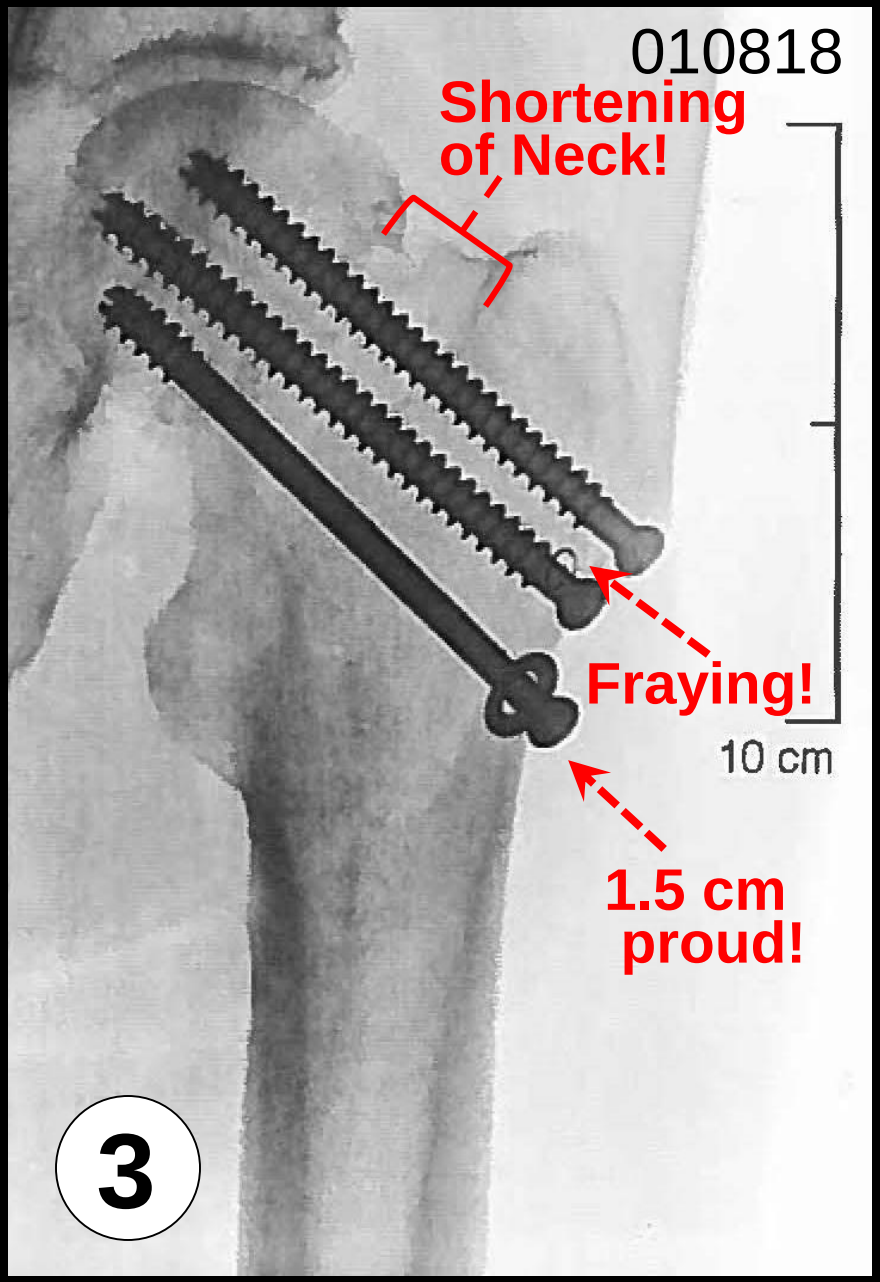
IV. *Homeostasis* LS ch 1, DC Module 1

- **A. What? Maintenance of ECF LS p 8**
- **B. Where? ECF = Plasma + Interstitium LS fig 1-4 p 8**
- **C. How? Simplified Homeostatic Model cf: LS fig 1-7 p 14**
  Balances LS p 9, DC pp 5-6
- **D. Why? Cell survival! LS fig 1-5 p 9, DC p 5**

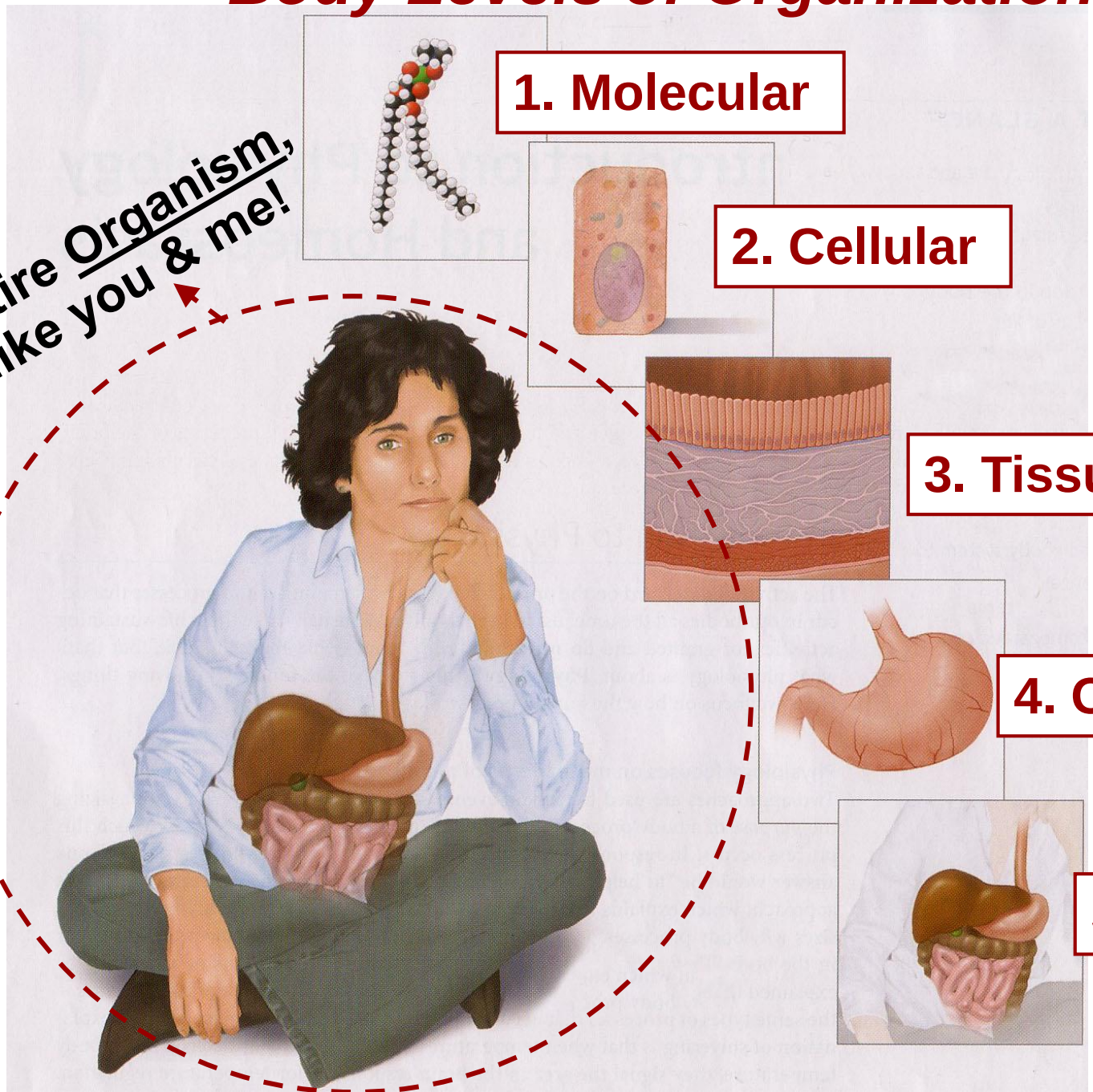
ANATOMY	vs	PHYSIOLOGY
STRUCTURE	vs	FUNCTION
WHAT?	vs	HOW?
WHERE?	vs	WHY?

vs

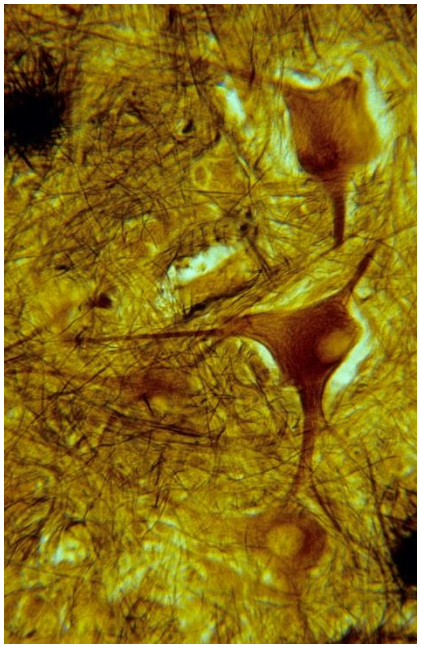
L Hip Osteonecrosis & L Hip Replacement



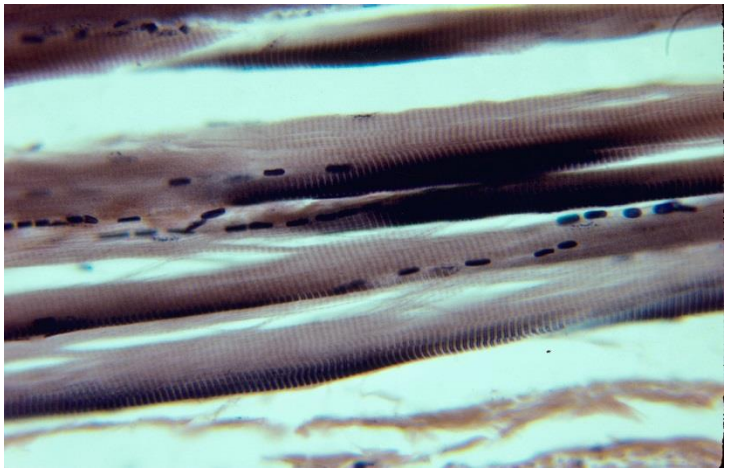
Body Levels of Organization



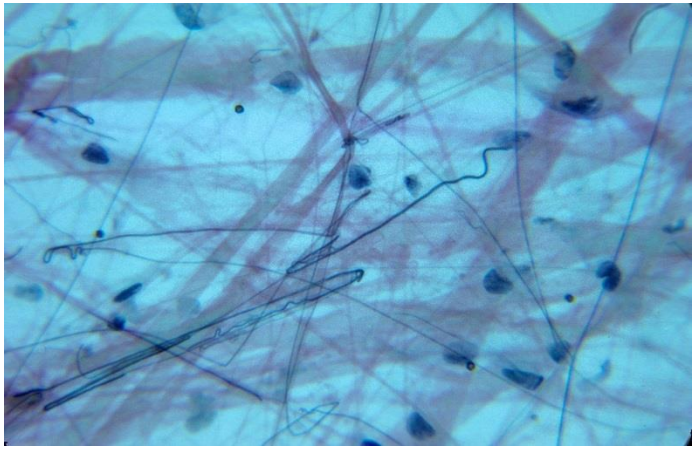
LS fig 1-1 p 2



Nerve conducts



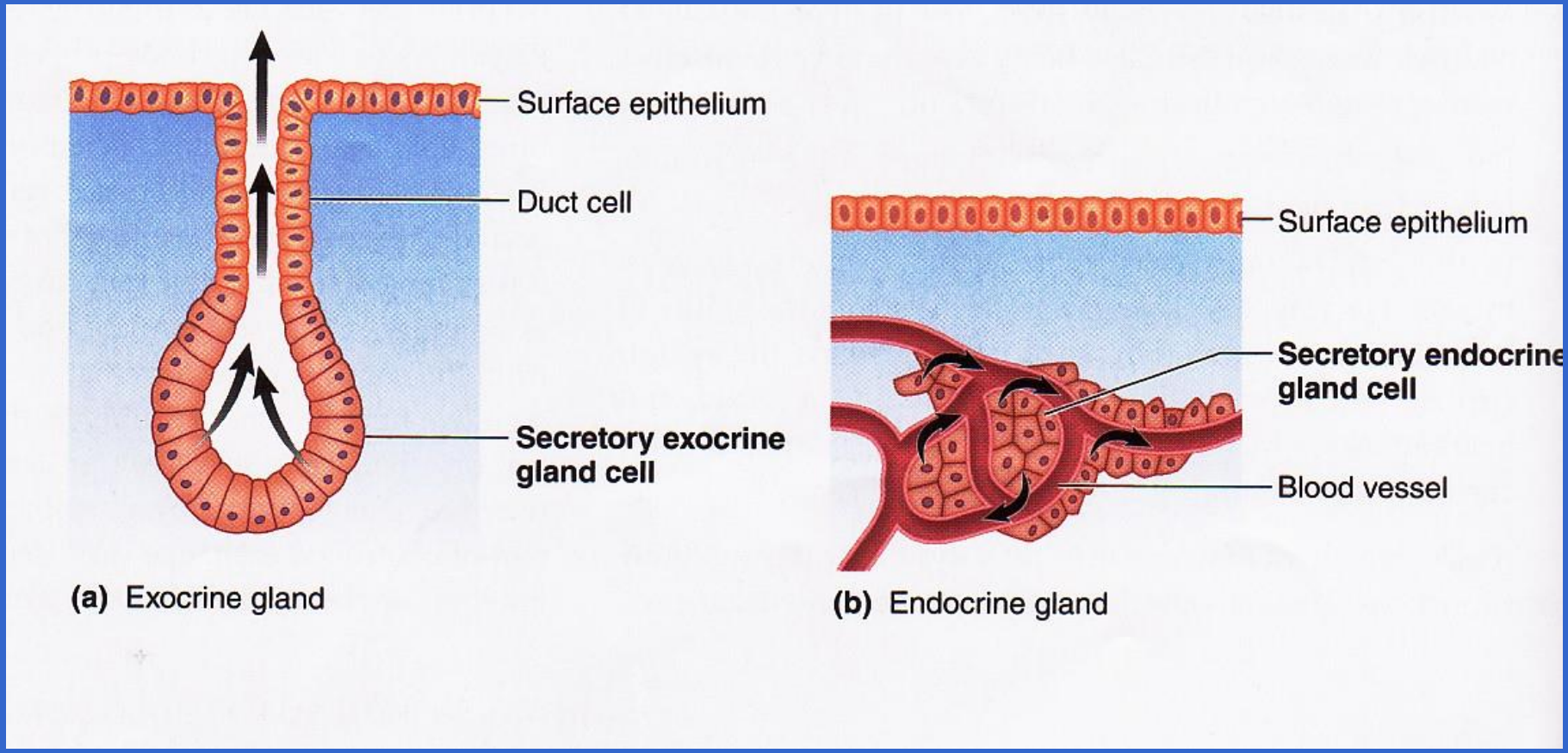
Muscle contracts



Connective connects!!

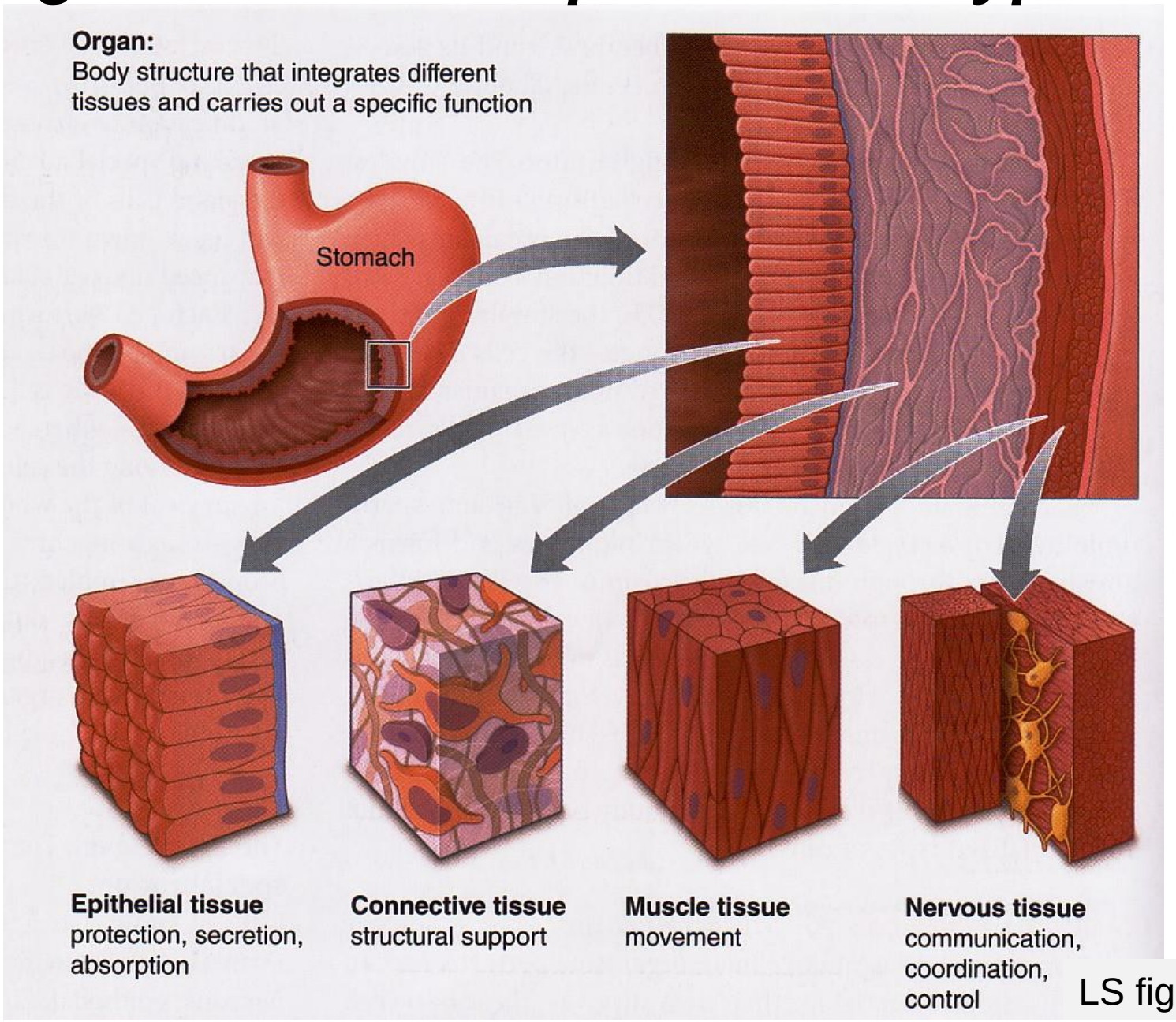
Epithelial covers

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



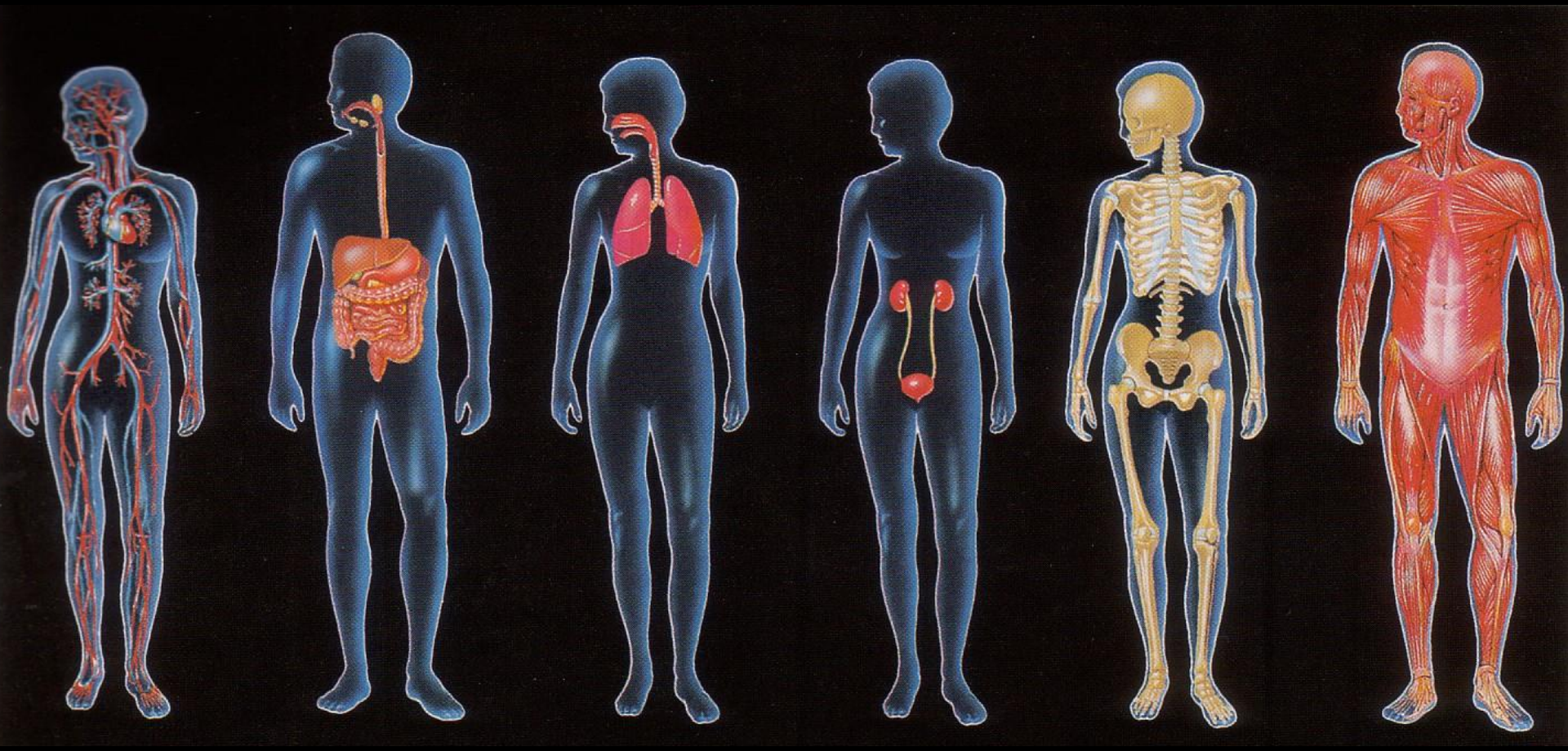
LS fig 1-3 p 4

Organs are made up ≥ 2 tissue types



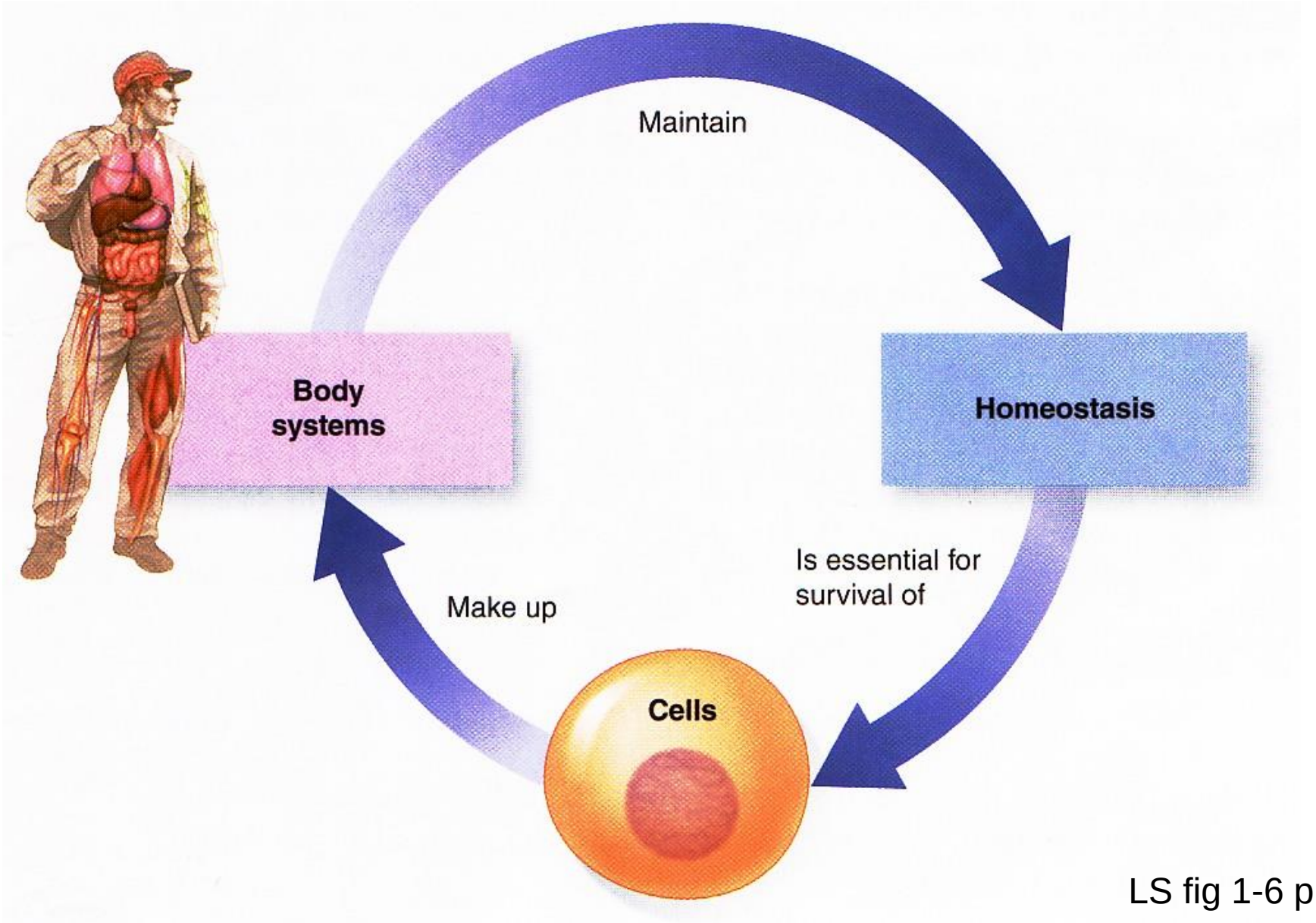
LS fig 1-2 p 4

Which body systems?



LS fig 1-4 p 6

Homeostasis is essential for cell survival!



LS fig 1-6 p 7

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

milieu interieur?

Claude Bernard

100 trillion cells working intimately

Walter B. Cannon

ECF = Extracellular

Plasma

(within CV System)

Interstitium

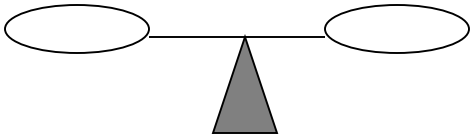
(eg, between muscle cells)

ICF = Intracellular

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

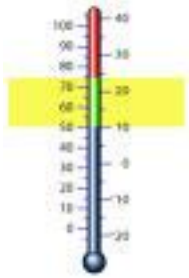
Metabolic

ANA- CATA-



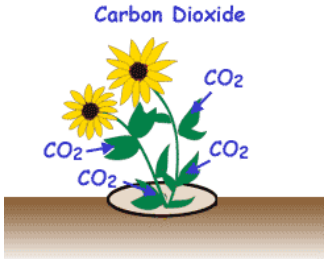
H_2O

T°C



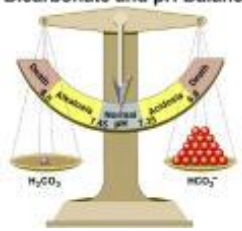
Dr. Evonuk's 6 Balances

O_2/CO_2



$Ion^{+/-}$

pH



Bl 121 Lecture 2

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

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/summer-2019/*

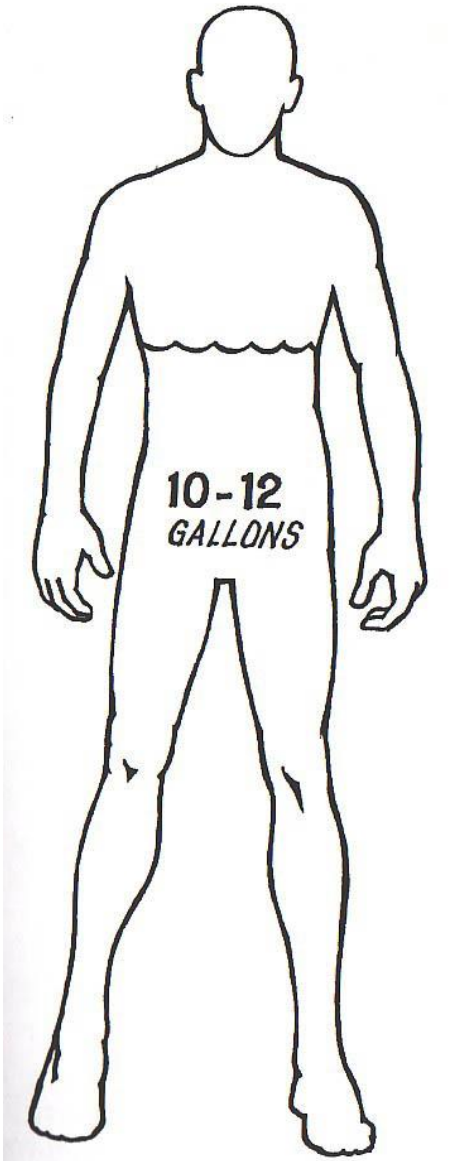
II. ***Homeostasis*** LS ch 1, DC Module 1
   - A. ***What?*** Maintenance of ECF LS p 8
   - B. ***Where?*** ECF = Plasma + Interstitium + ? LS fig 1-4 p 8
   - C. ***Homeostatic Balances?*** LS p 9, DC pp 5-6
   - D. ***Why?*** Cell survival! LS fig 1-5 p 9, DC p 5
   - E. ***Physiology in the News***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

Drink about 1 L per 1000 calories energy expenditure!!

Human ~ 2/3 H_2O

~ 60 – 70 %



150 lb /68 kg

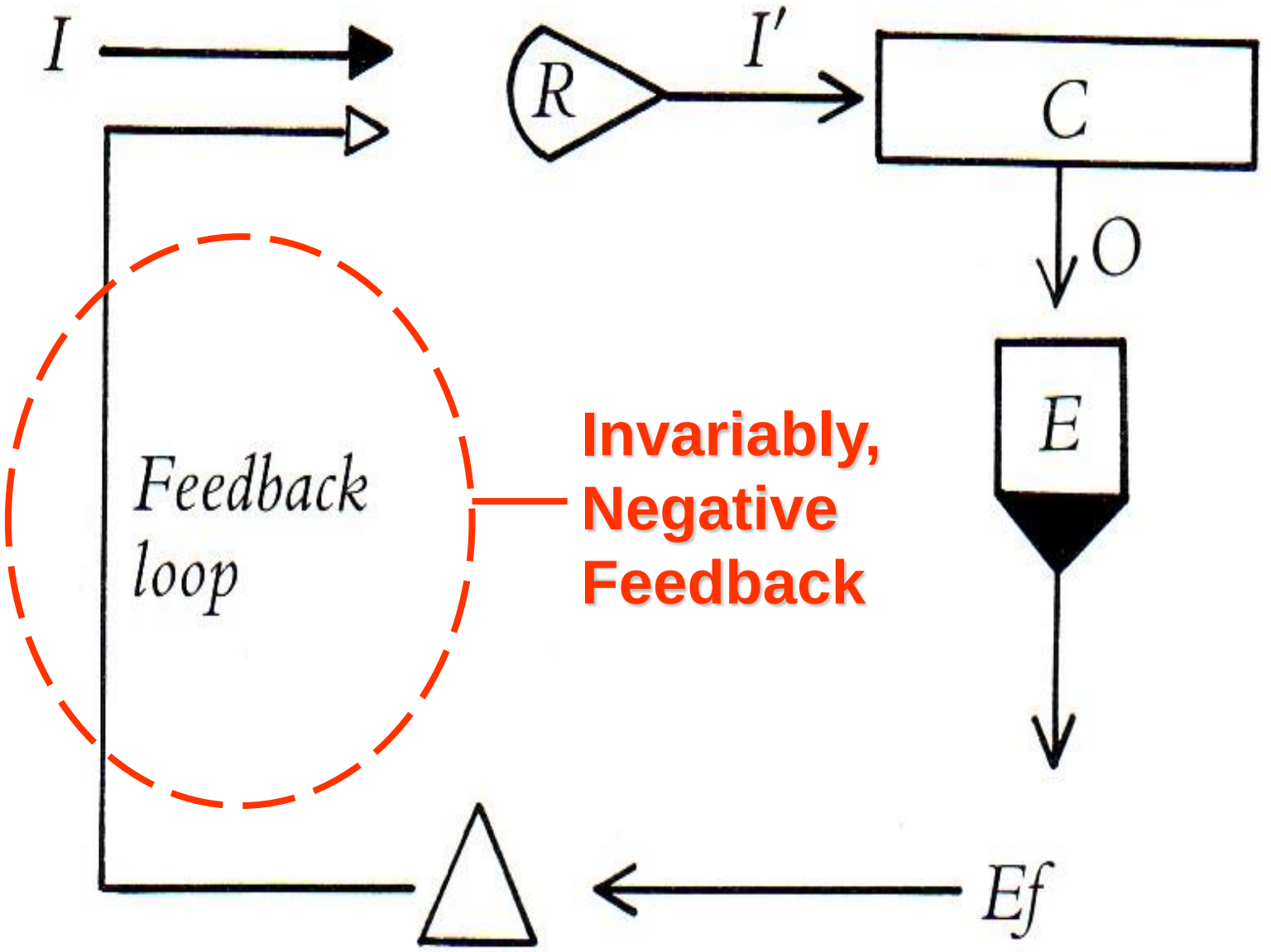
***NB*: So 2000 kcal → drink 2000 mL ≡ 67.63 fl oz ≡ ~ 8 cups!**

= ~40 – 48 kg H_2O

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.

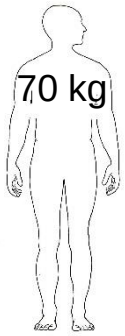

I
R
I′
C
O
E
Feedback loop
Invariably, Negative Feedback
Ef

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

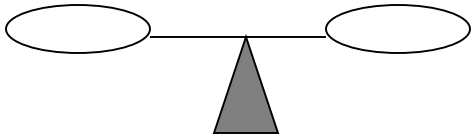
Interstitium = 11L
Plasma = 3L

H_2O

INPUT

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

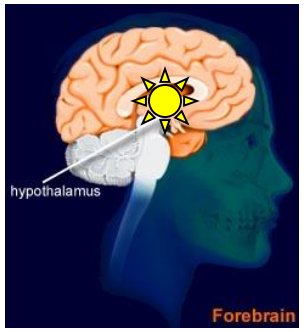
BALANCE!



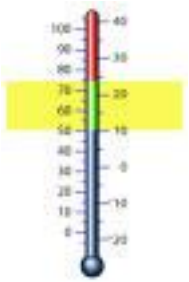
OUTPUT

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

Controller = Hypothalamus with Set Point



ToC



ToC

Lethal

42oC

Protein Denaturation

110oF

Set Point

37oC

98.6oF

35oC

Mild Hypothermia

Profound Hypothermia

33oC

< 30oC

Lethal

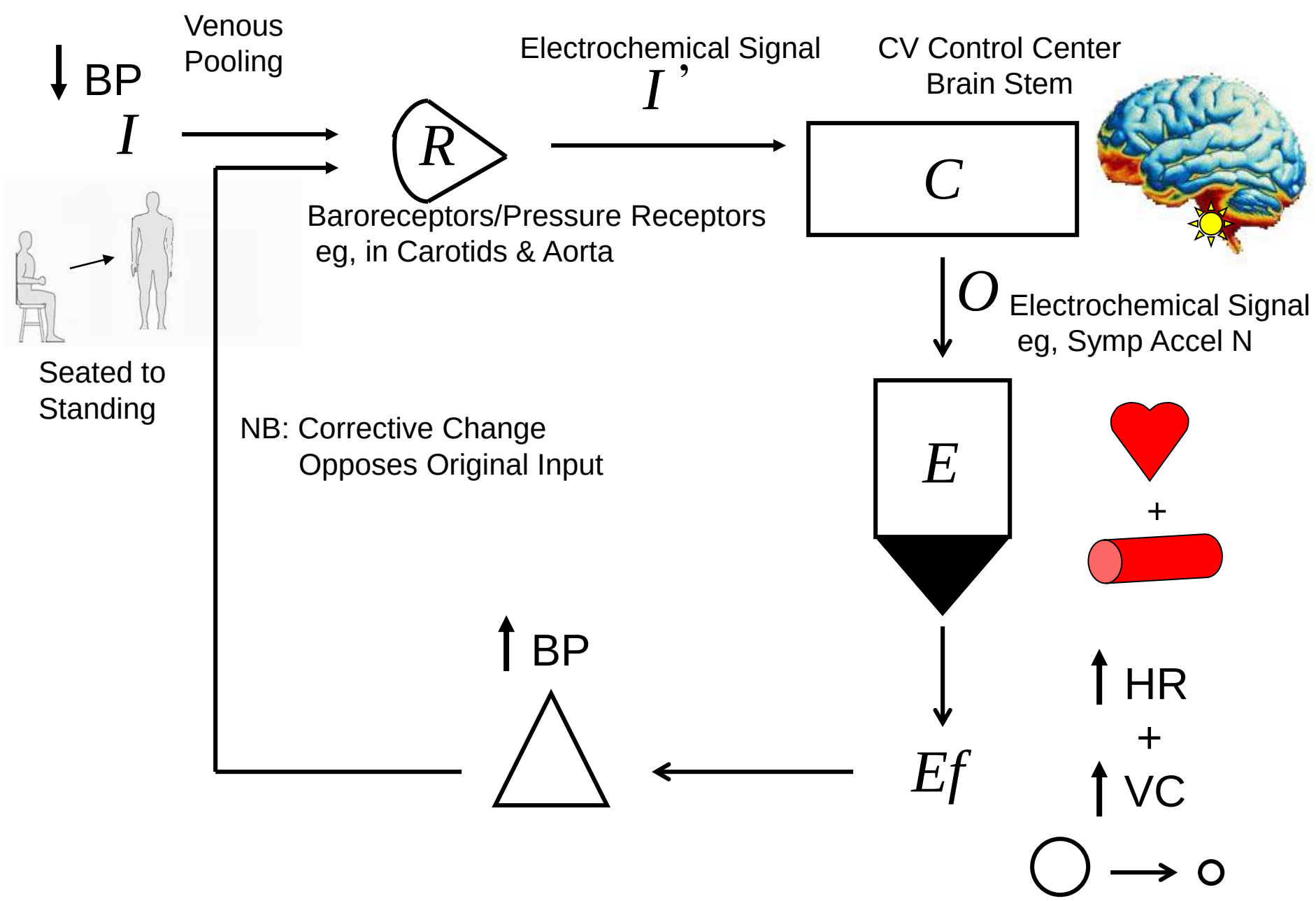
29oC

0600 1400 0600 1400

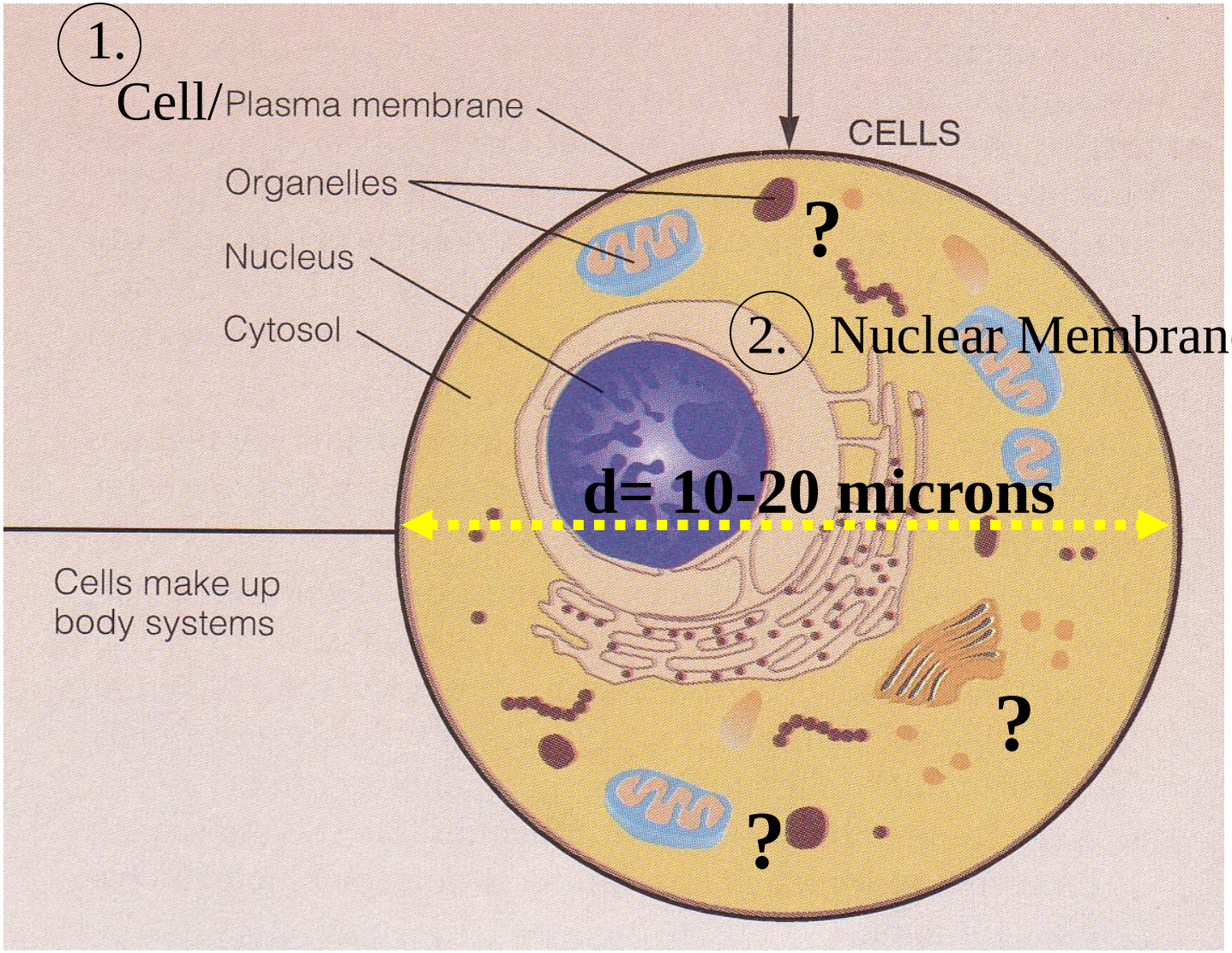
Time of Day

True Diurnal Variation

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


BP
I
Venous Pooling
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

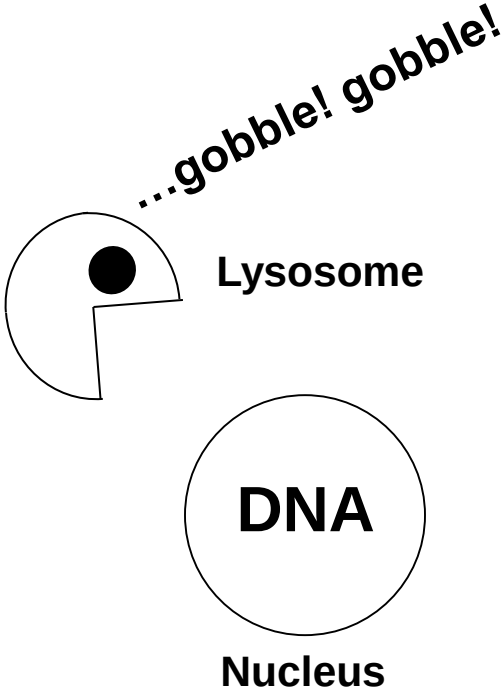
HOW BIG? 100 CELLS LENGTHWISE = 1 mm!!



Why Compartments? Advantage?

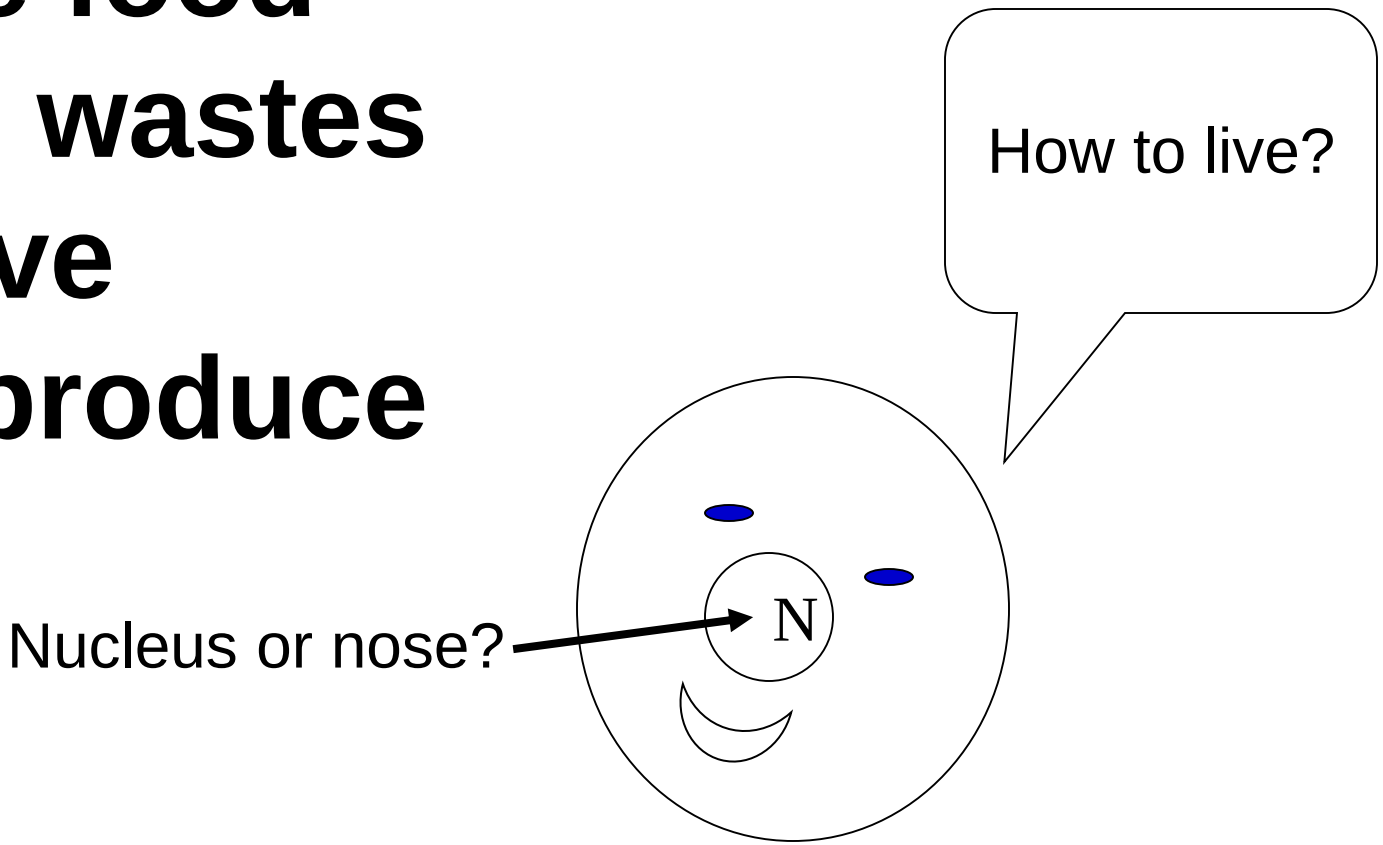
<u>*Incompatible*</u> reactions can take place

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



Basic Cell Survival Skills?

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



…Anatomy & Physiology Lab Thurs! Fun again!

Bl 121 Lecture 3

I. ***Announcements*** Q from last time? Office hr &/or e-mail Q.

II. ***Cell Anatomy, Physiology & Compartmentalization*** LS ch 2
   - A. Cell organelle overview; 100 Trillion!
   - B. 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
   - C. What about vaults? LS 2006, p 32
   - D. ***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

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

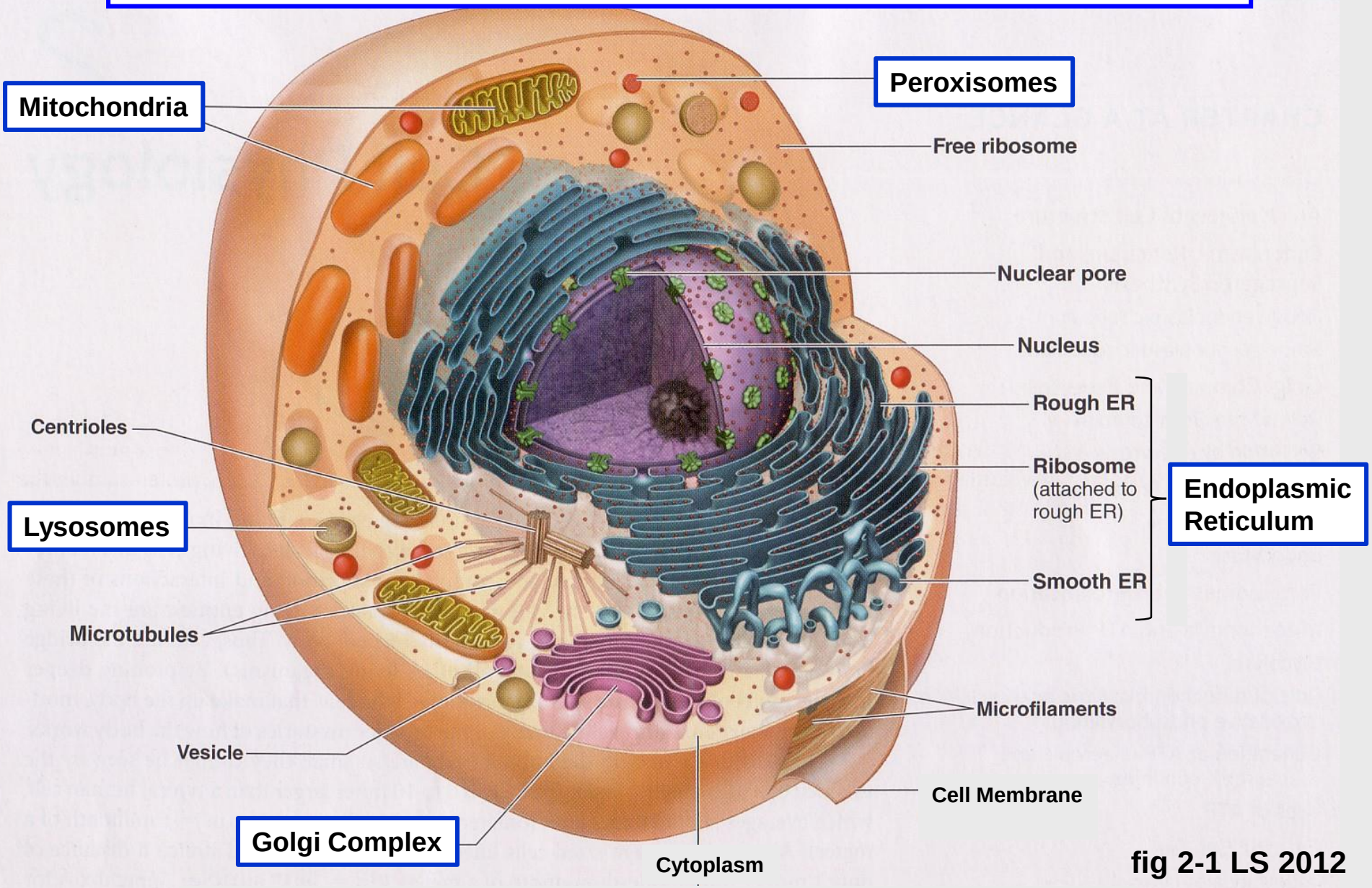


fig 2-1 LS 2012

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

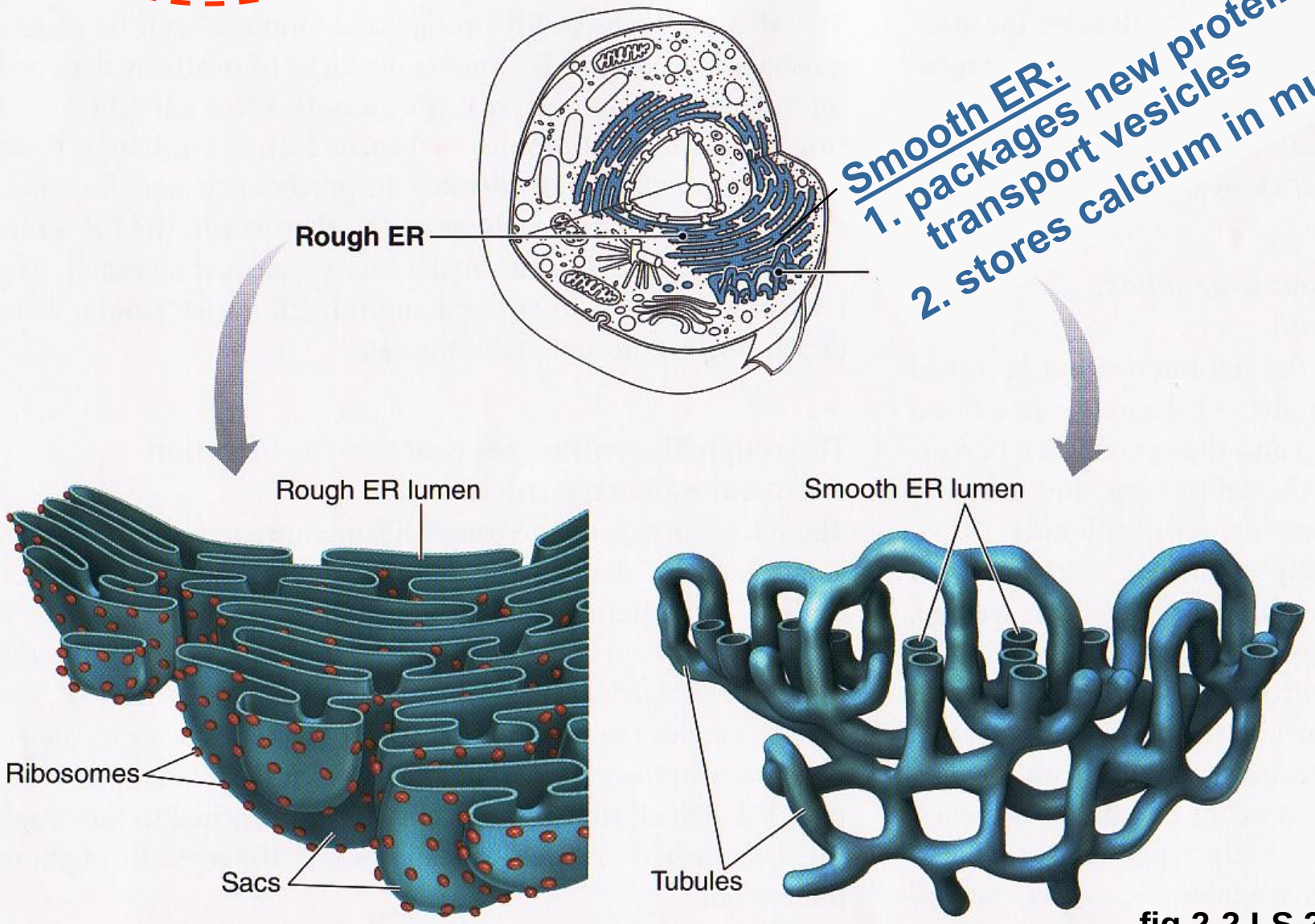
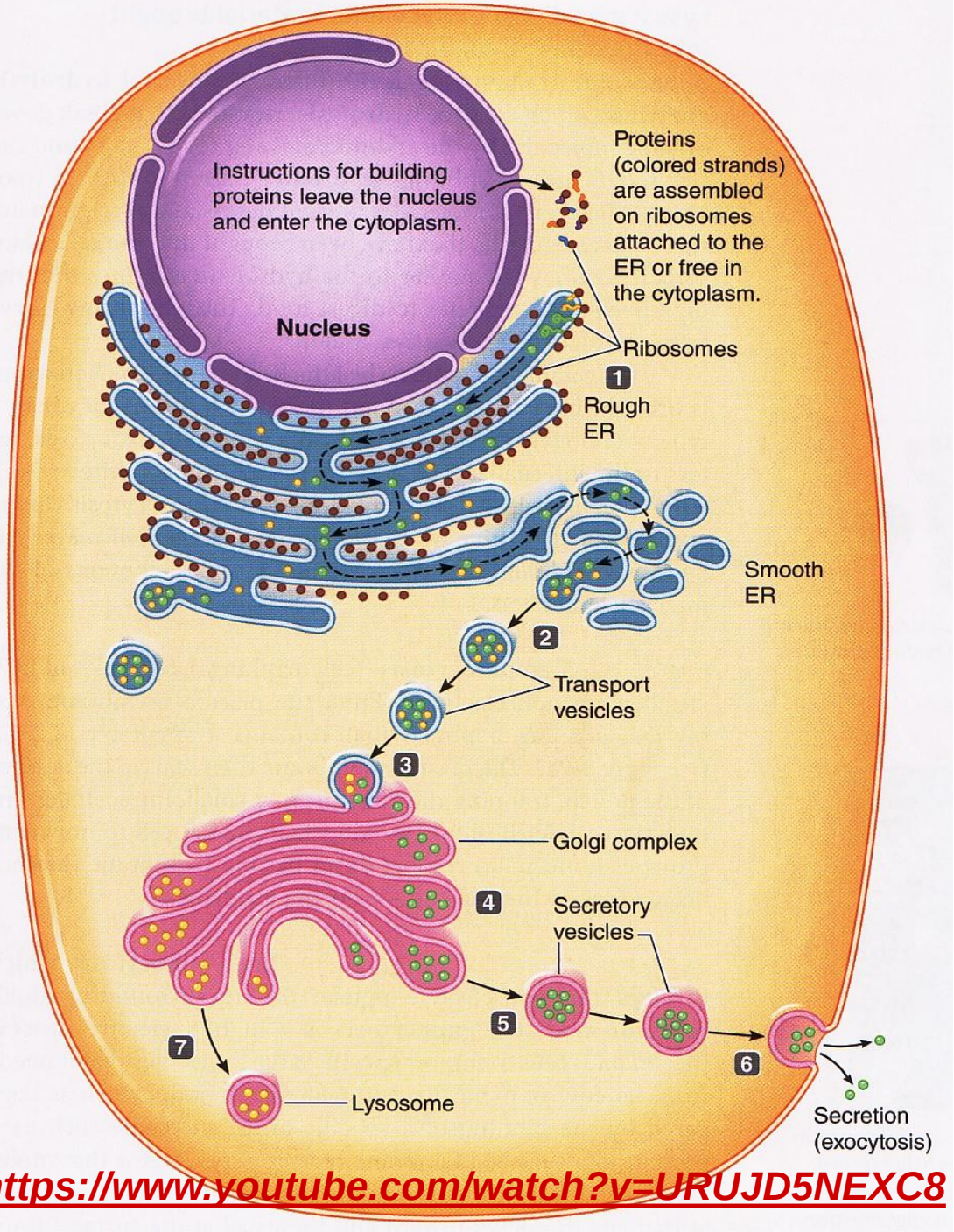


fig 2-2 LS 2012

Secretion of Proteins Produced by ER



https://www.youtube.com/watch?v=URUJD5NEXC8

fig 2-3 LS 2012

Golgi Complex: Final Processing, Packaging & Distribution

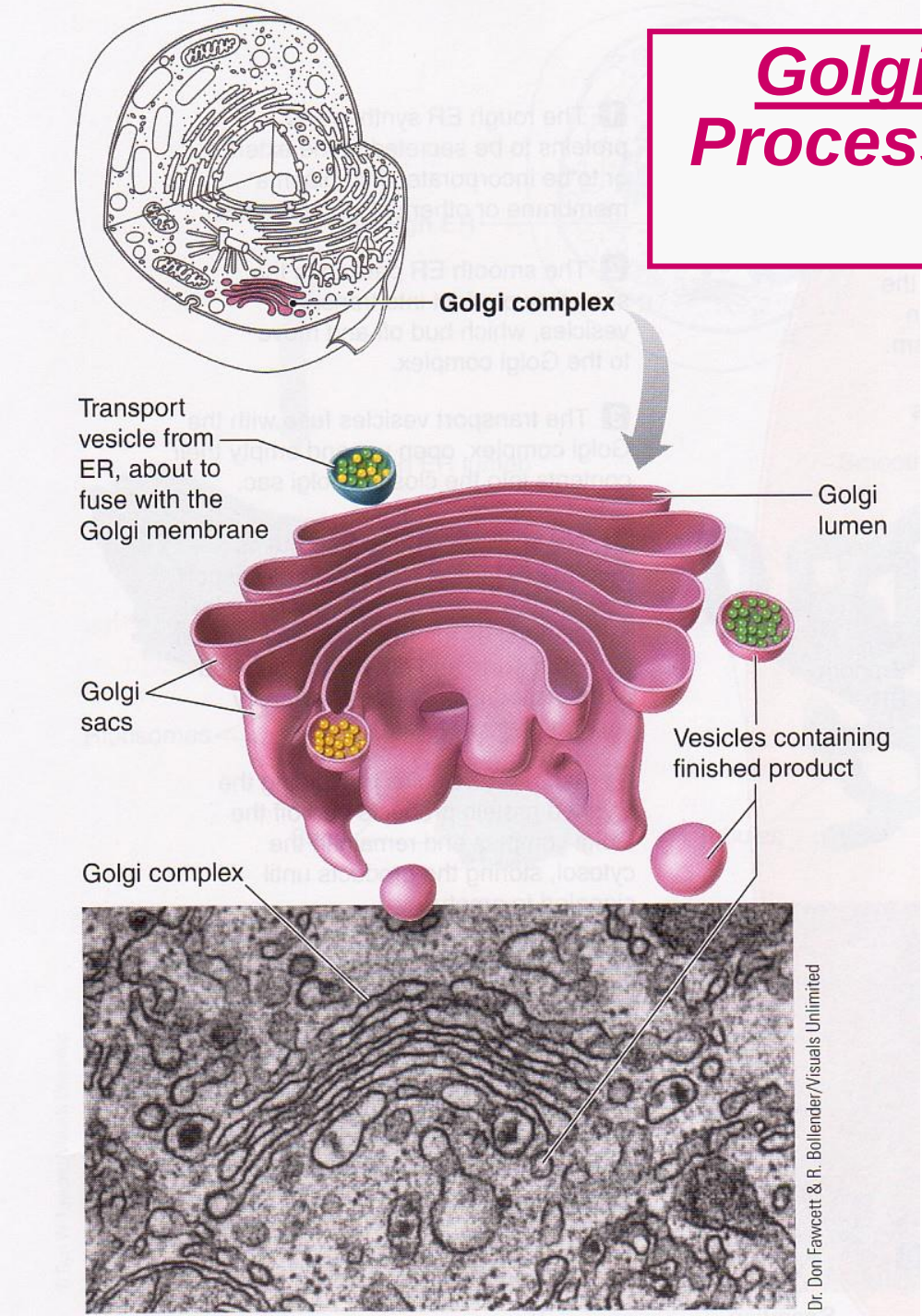


fig 2-4 LS 2012

Lysosomes vs. *Peroxisomes*

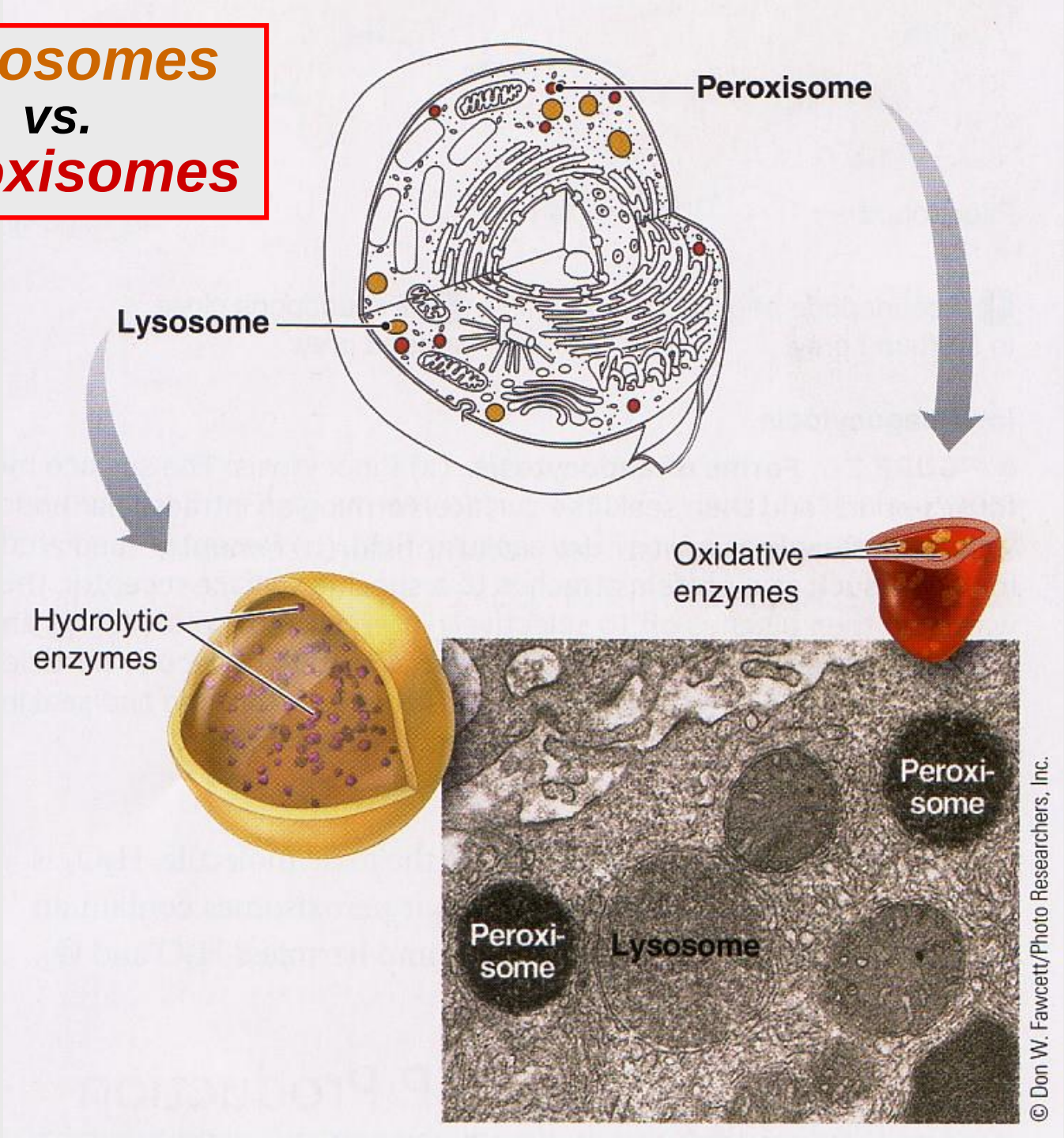


fig 2-6 LS 2012

Phagocytosis: Cell Eating!

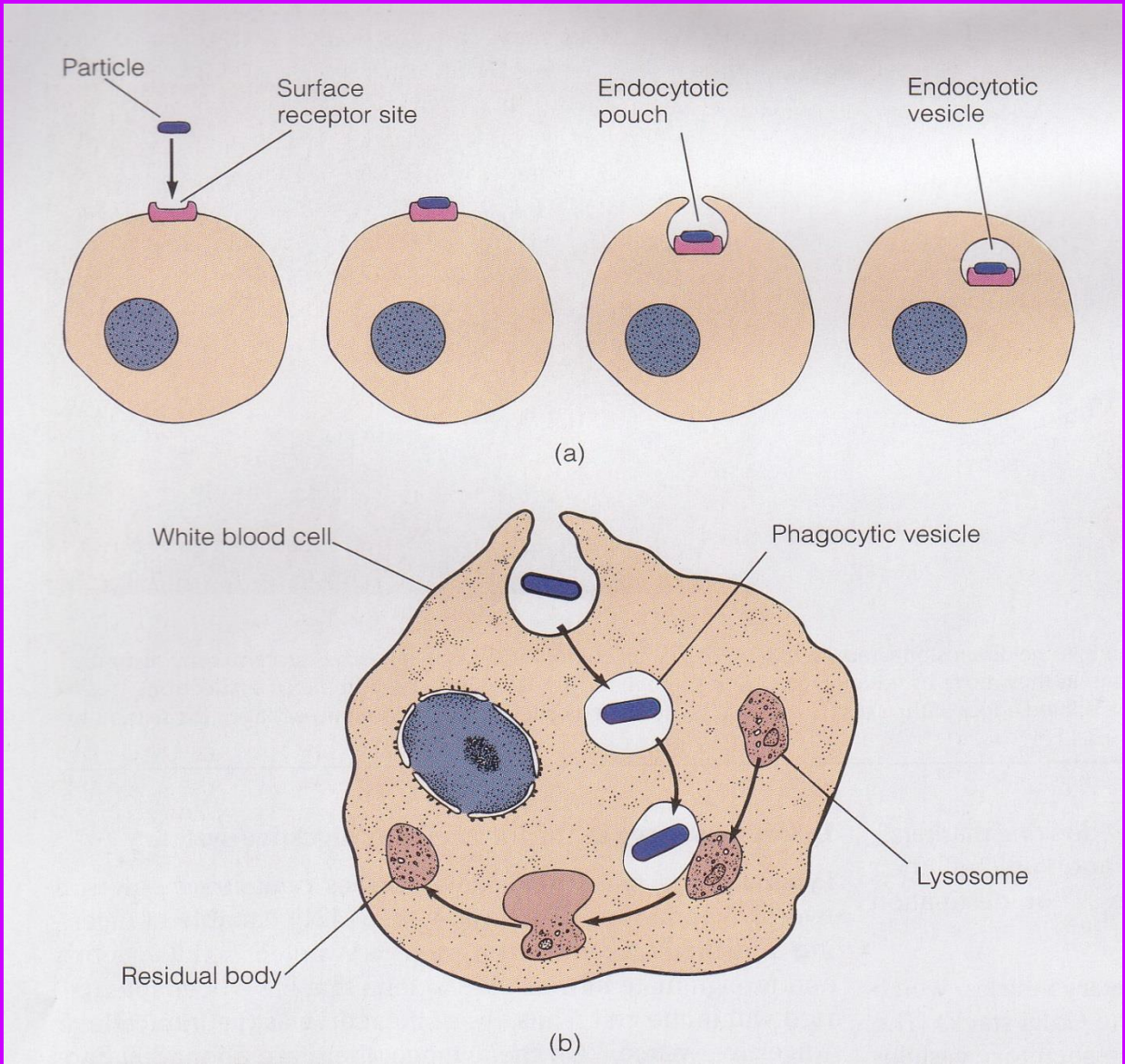
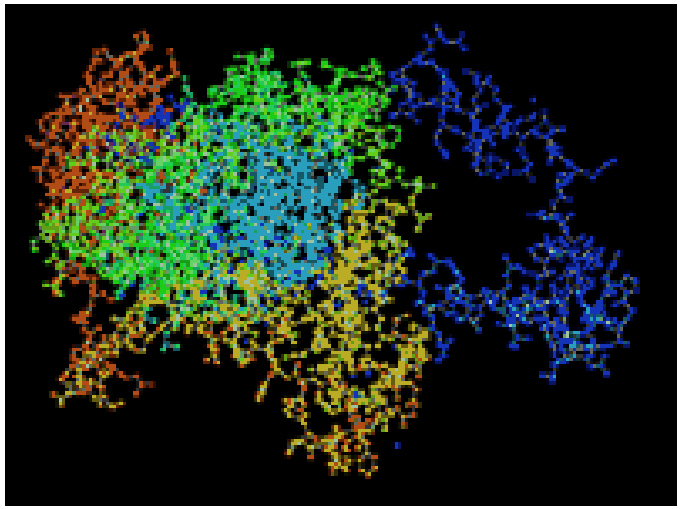


fig 2-7 LS 2006

Catalase Enzyme Reaction in Peroxisomes Neutralize Toxin at Production Site!



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

Mitochondria: Energy Organelles

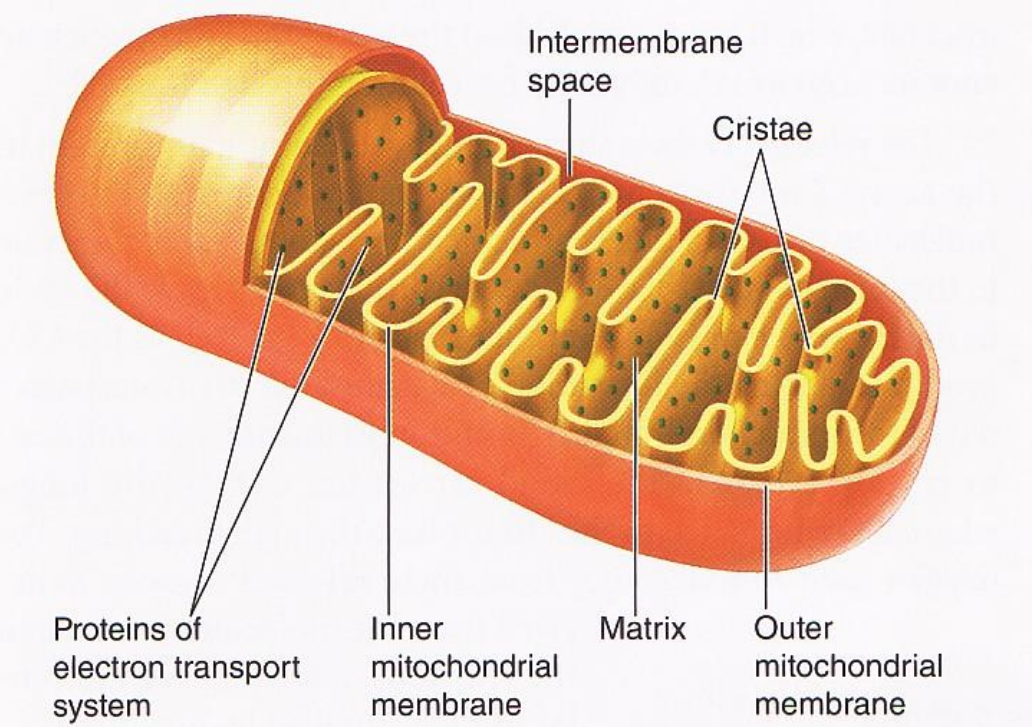


fig 2-8 LS 2012

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.

***SOURCE*: John Travis, *Science News* 2000;157(1), 5.**

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.**

What's in the Vault?

An ignored cell component may often account for why chemotherapy fails

By JOHN TRAVIS

Can you imagine exploring the anatomy of the human body and missing the heart, the organ that sends life-giving blood coursing through the body? Of course not. Or not noticing the brain, the custodian of memories and creator of thoughts? Don't be ridiculous.

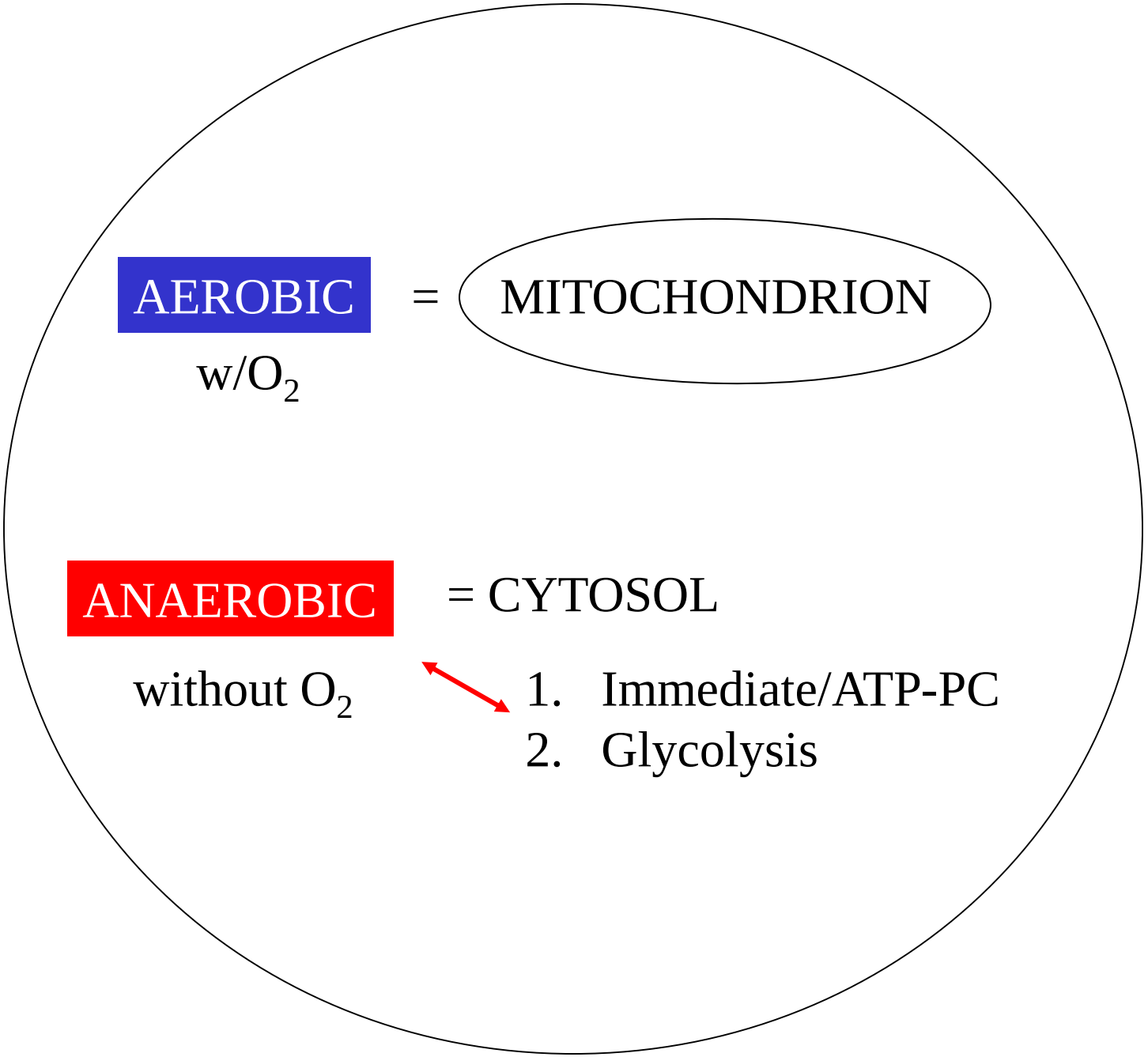
Yet cell biologists may soon have to acknowledge an equally unimaginable oversight in their field. For decades, their powerful microscopes have failed to spot a basic cell component of animals and perhaps any organism with a nucleus. Known as vaults, the barrel-shaped particles are three times the size of ribosomes, the eas-

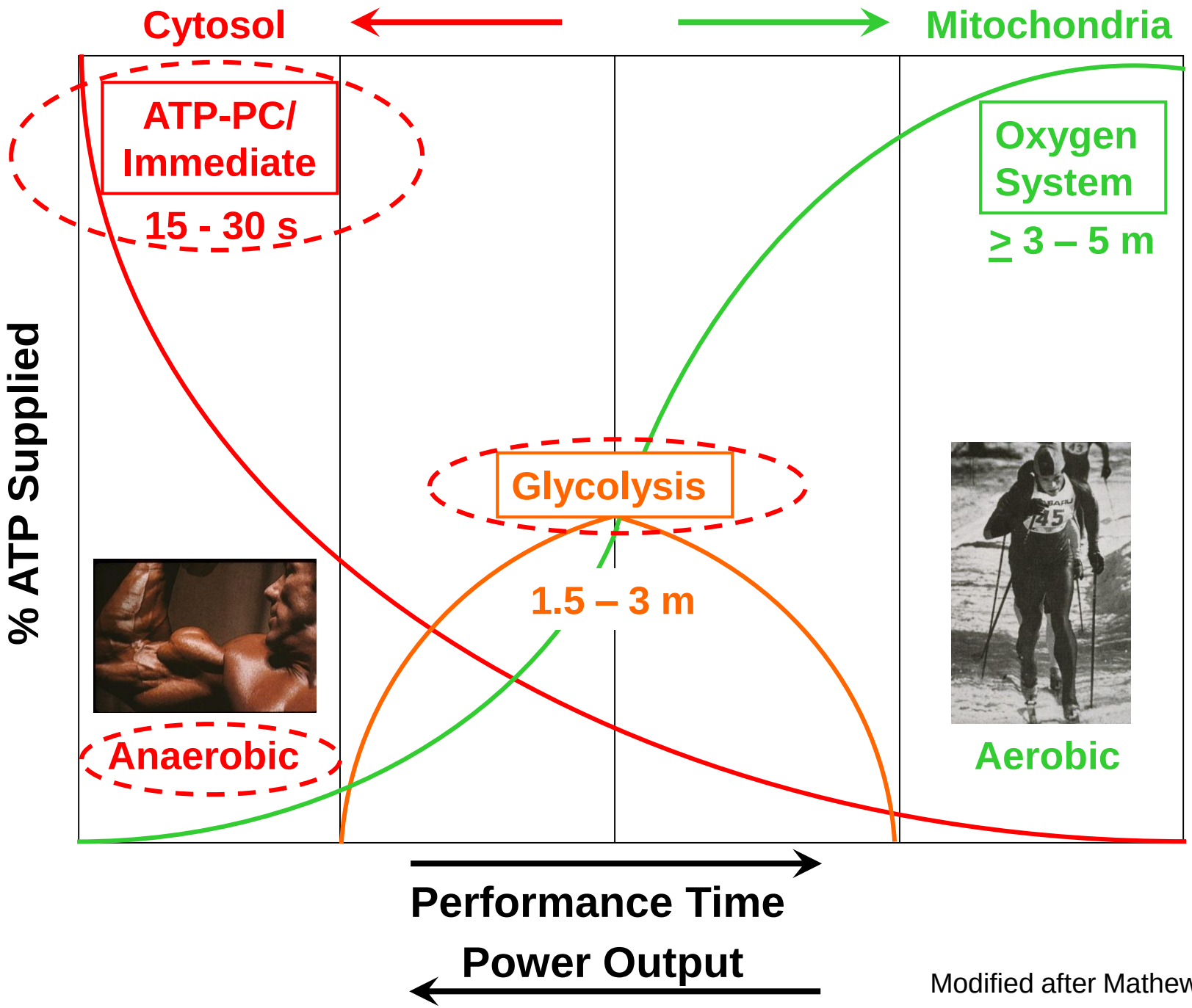
through a microscope. But if it were contaminated with objects that shrug off the stain, that sea would be dotted with white islands. Rome likens the strategy to finding an invisible person by looking for an unexplained shadow in the beam of a spotlight.

To Kedersha's surprise, unstained ovoid objects appeared among her coated vesicles. Since some of the stain settled into furrows on top of the unexpected shapes, the negative staining revealed fine details of the exterior of these mysterious interlopers, including arches that reminded Rome and Kedersha of the coil

us something by this incredible structure. And the one thing we might surmise from the structure [of vaults] is that they might contain something," says Rome.

That shape also hints that vaults may pick up their unknown cargo at the nuclear membrane, the barrier that separates the cell's cytoplasm from its nucleus. The nucleus is a fluid-filled sac containing DNA and the machinery required to translate the instructions encoded by that DNA into molecules called messenger RNA. These mRNA strands, as well as other molecules,

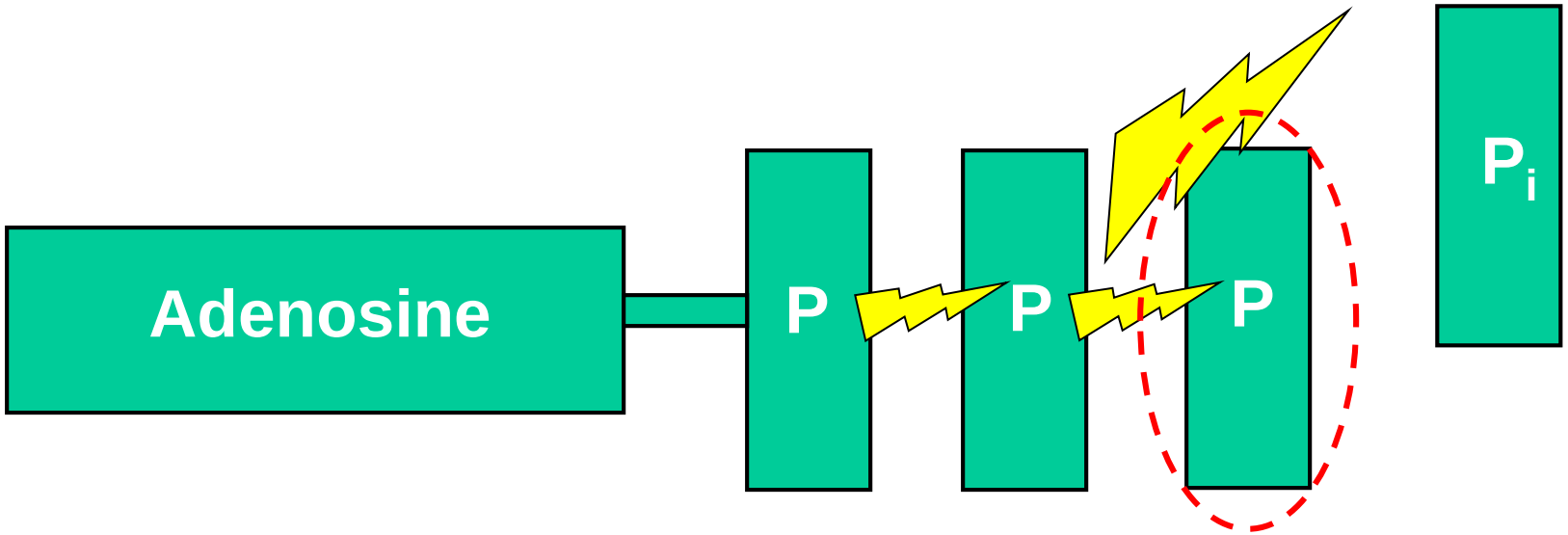

AEROBIC
=
MITOCHONDRION
w/O2
ANAEROBIC
= CYTOSOL
without O2
1. Immediate/ATP-PC
2. Glycolysis



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!

BI 121 Lecture 4

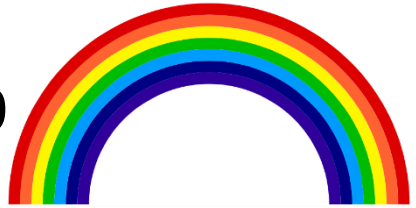
Anatomy & Physiology Lab today!...
Exam I next Wednesday < 4th of July!!

I. ***Announcements*** **Nutrition Analysis Lab next Tuesday! Thanks for recording your diet on p 3-7 in LM. Estimating serving sizes, hints for recording (do sooner vs. later)…Q?**

II. ***Cell Physiology, Mitochondria & Metabolism Connections*** **LS 2012 fig 2-9 thru 2-12, 2-15 +…Mathews & Fox 1976!**

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

- **A. What's a gene? DNA? Why important? pp A-18 thru A-20 +**
- **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!**



IV. ***Nutrition Primer*** **DC Module 2, 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. *Blue Zones?* Pondering Paleo, Marlene Zuk, *NAHL* 2015…**
- **D. Carbohydrate confusion. Minimize what? Simple sugars**

4 oz → 3 oz

or

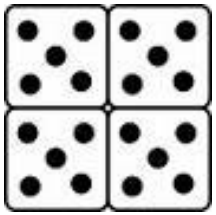
≡ 1 c

raw → cooked

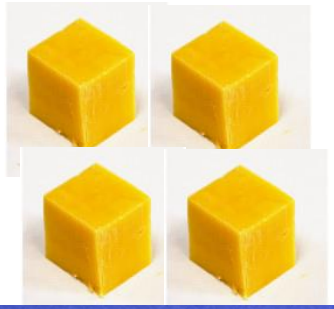
Deck of Cards

≡

≡ 1/3 c



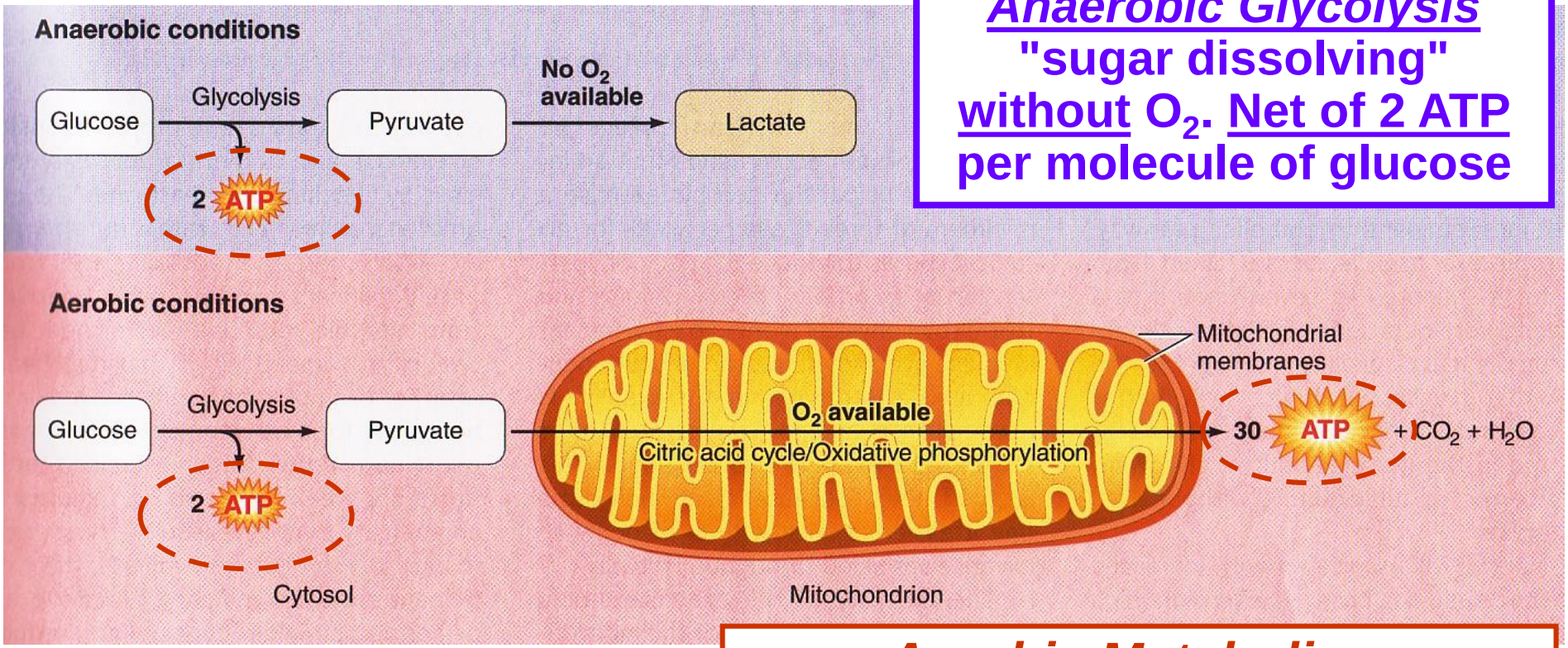
≡ 1 oz



≡ ¼ c

≡ 1.5 oz

Anaerobic vs. Aerobic Metabolism

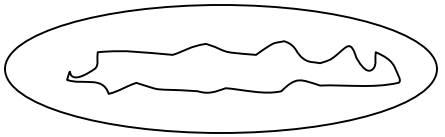


Anaerobic Glycolysis
"sugar dissolving" without O_2. Net of 2 ATP per molecule of glucose

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

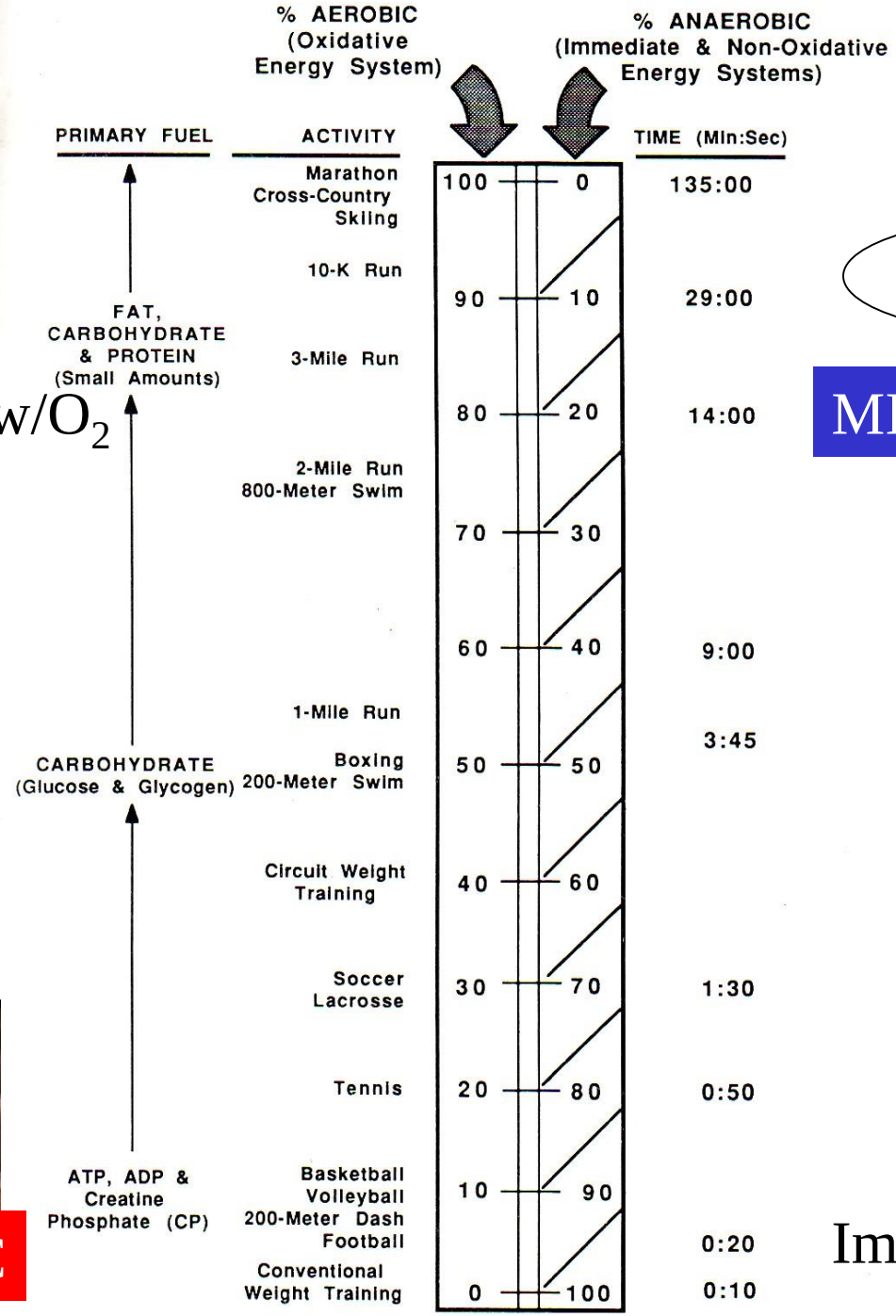
fig 2-15 LS 2012

AEROBIC w/O_2



MITOCHONDRIA

ANAEROBIC

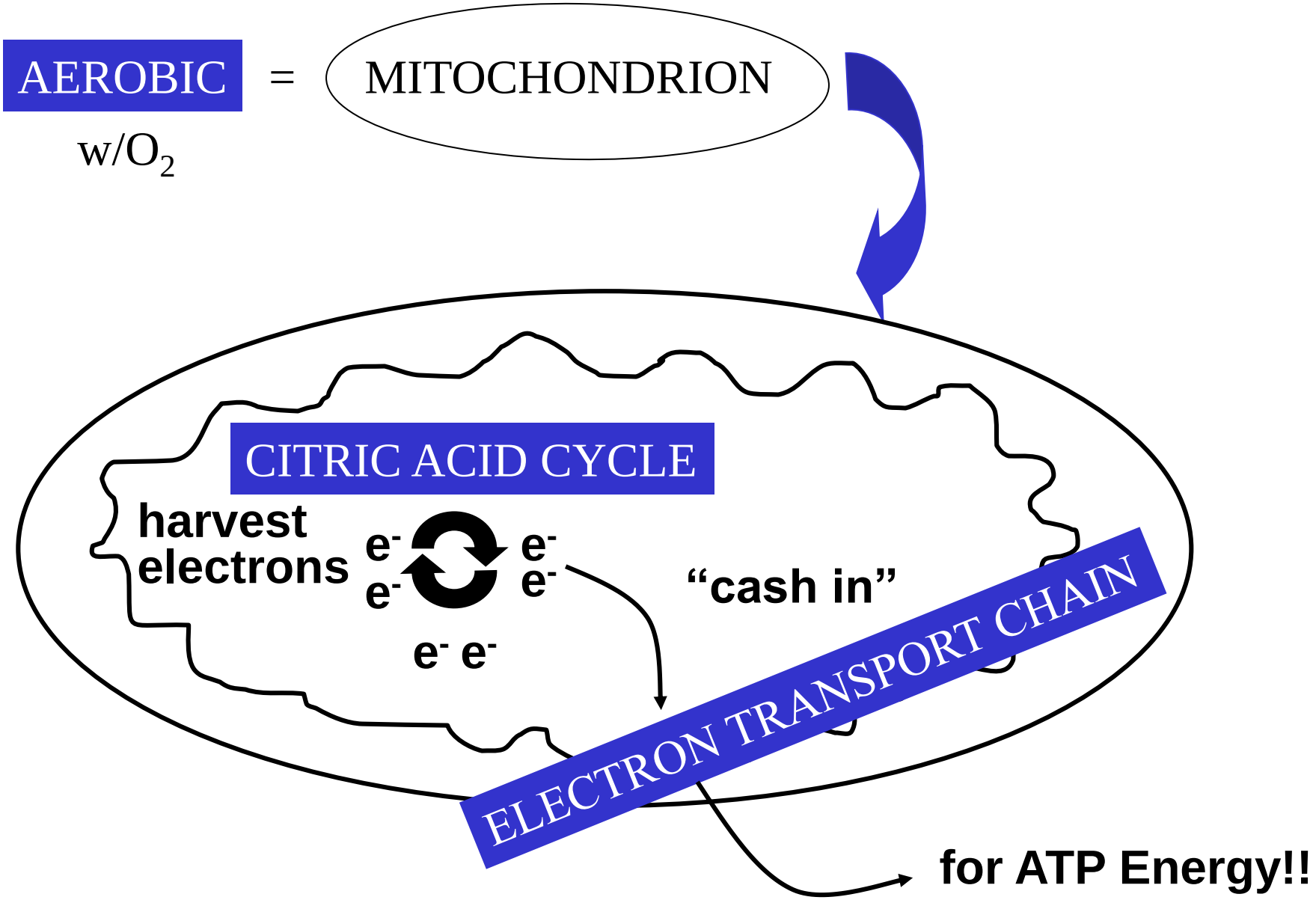


CYTOSOL

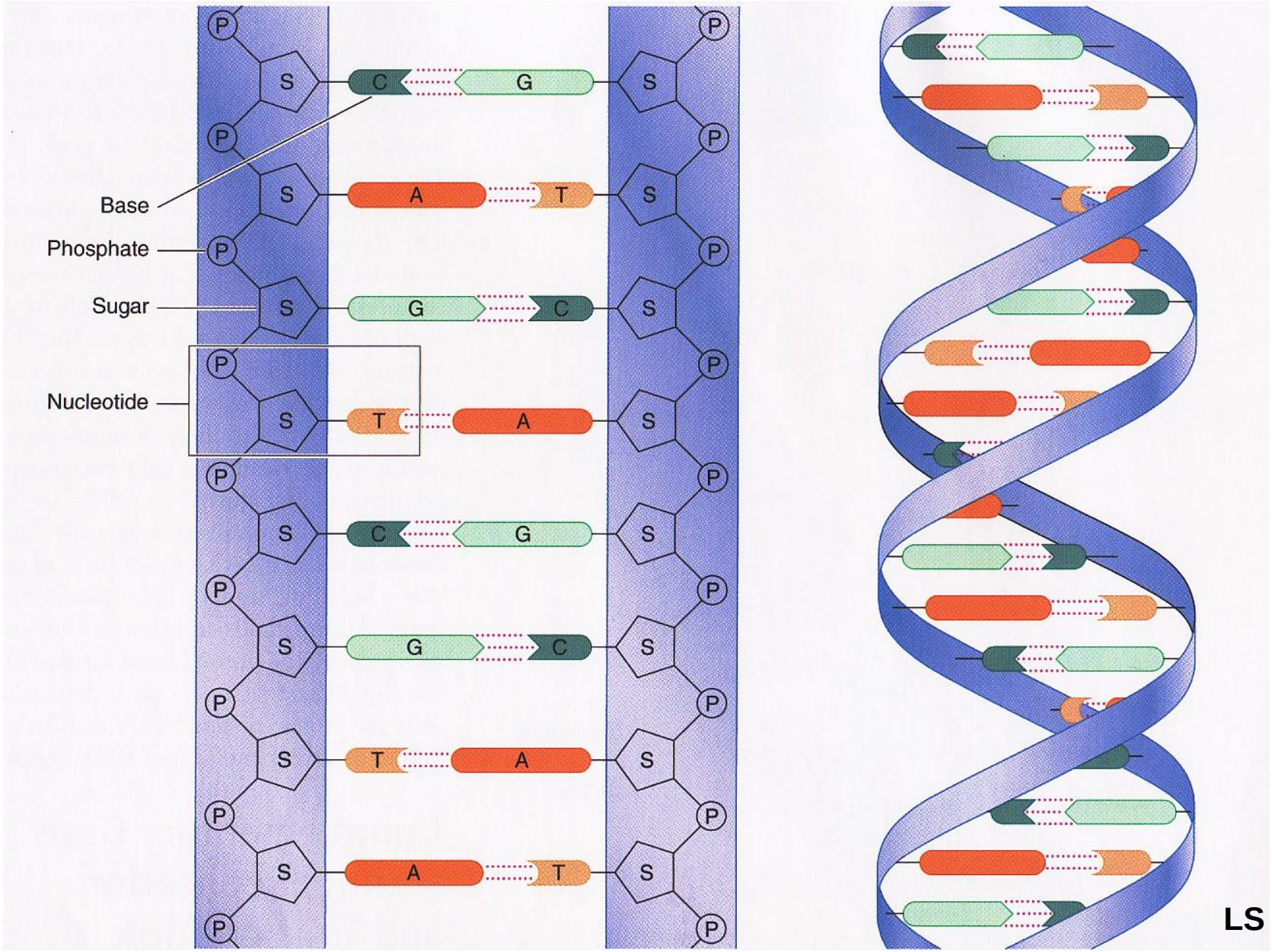
Glycolysis

Immediate/ATP-PC

Goals of Aerobic Metabolism

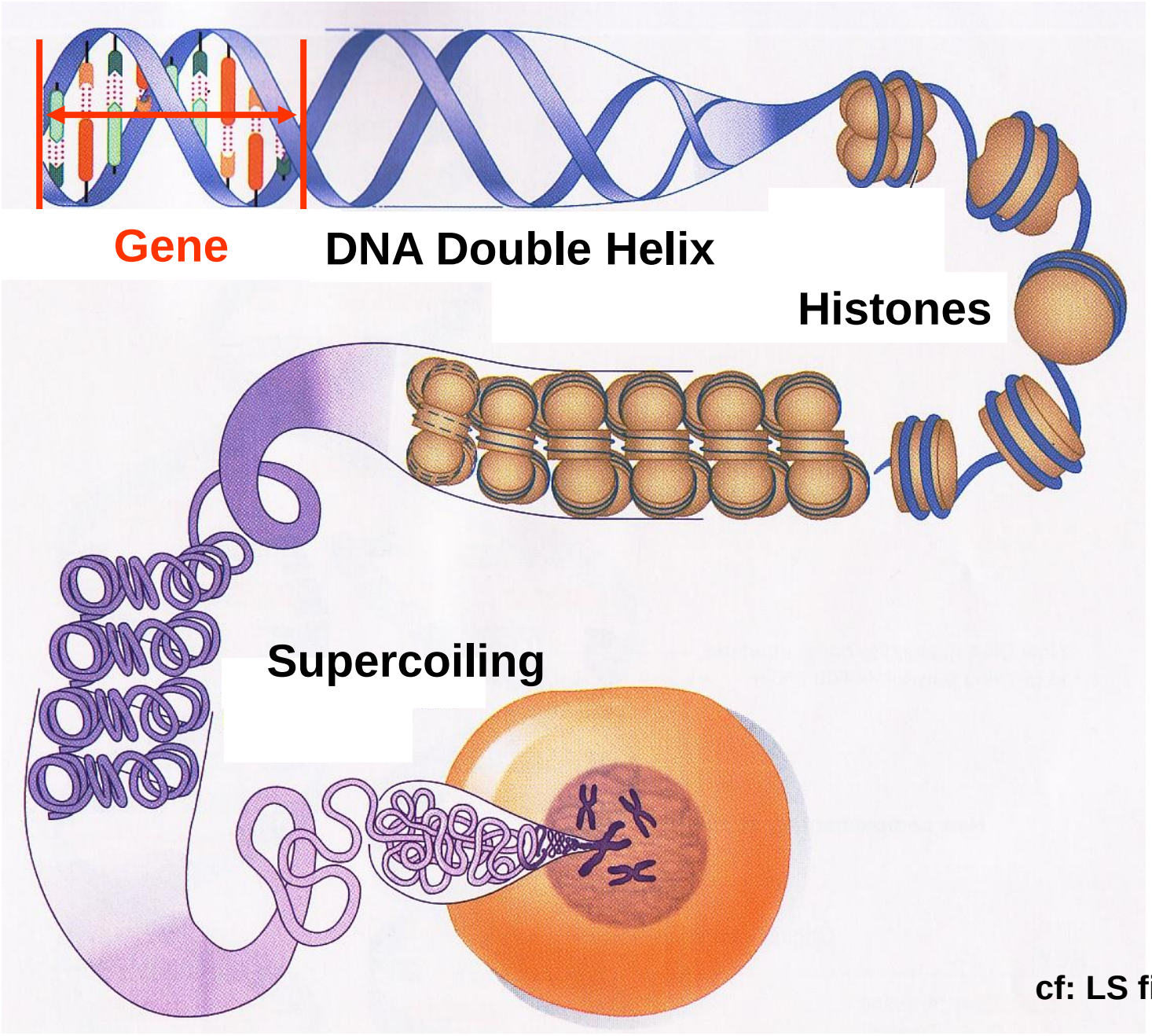


What does DNA look like? Double-helix!!



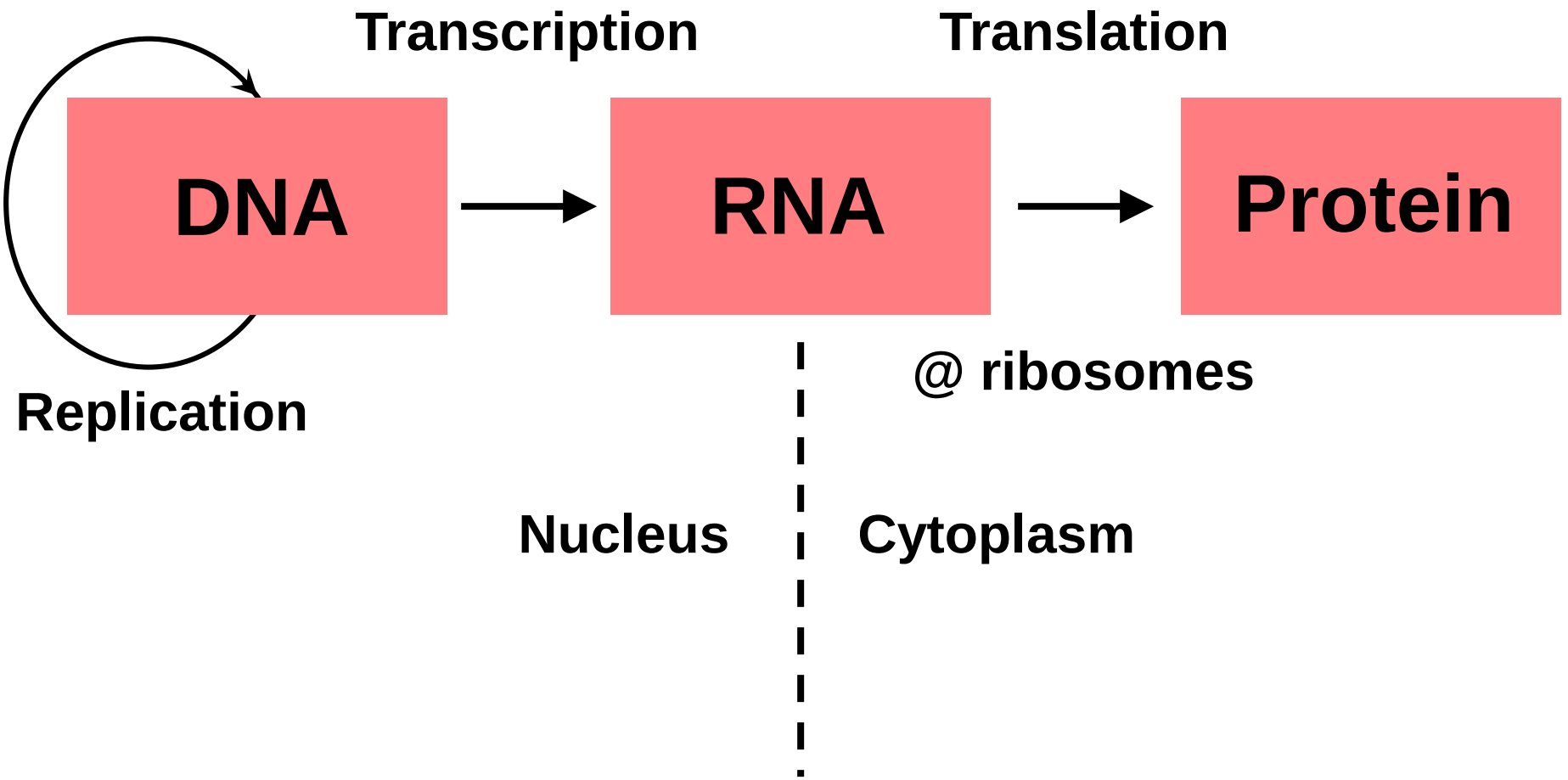
LS fig C-2

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*?

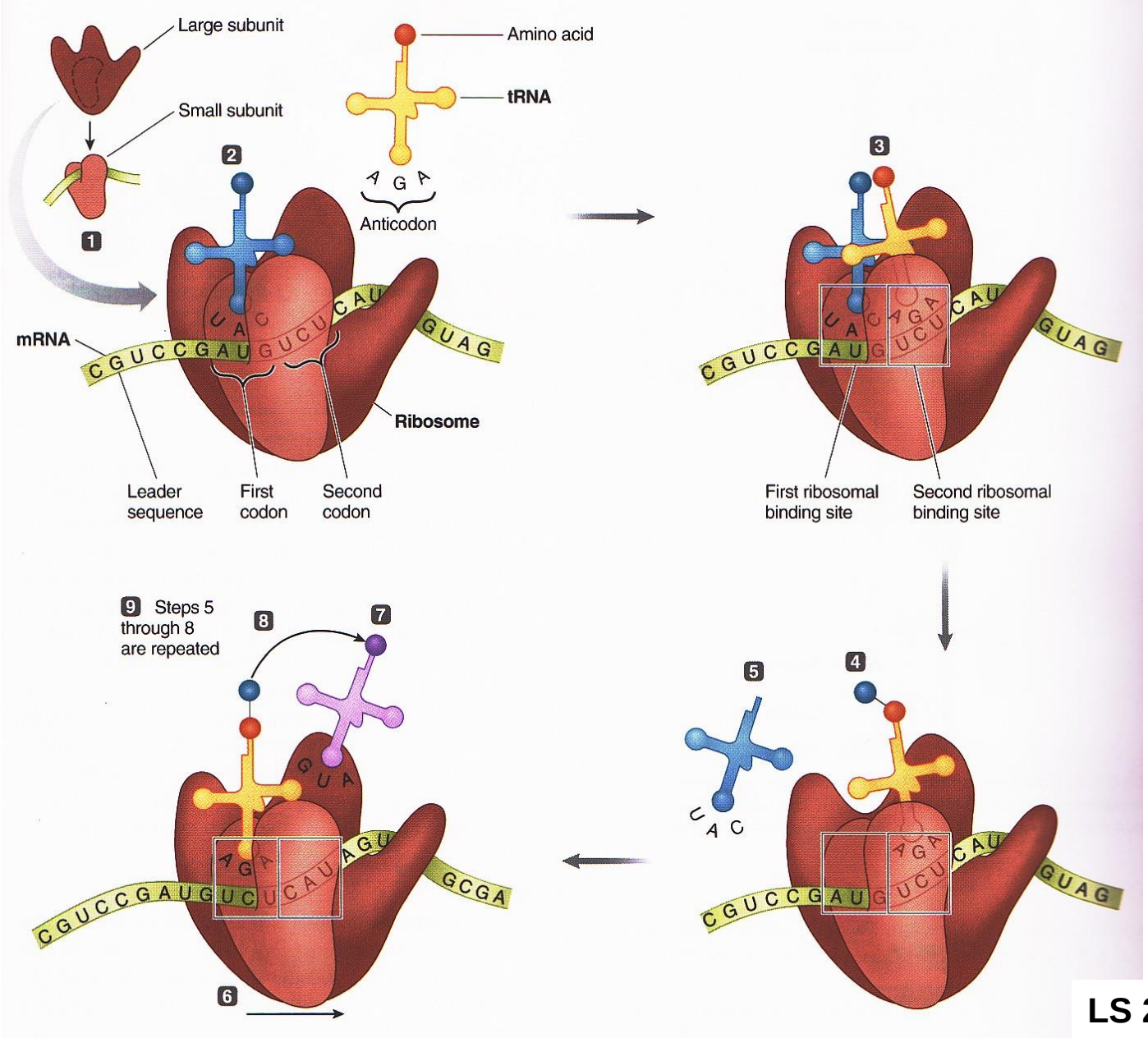
1. Double-stranded
2. Deoxyribose (without oxygen)
3. A, T, C, G
   Thymine
4. Self-replicative (can copy itself)
5. Nucleus (+mitochondria)

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

Bl 121 Lecture 5

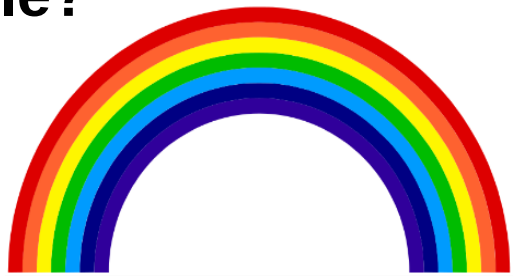
Nutrition Lab 3 tomorrow!
Exam I this Wednesday, July 3rd!!...

I. Announcements **Data + Flashdrive for Nutrition Lab! Q?**

II. Sample Exam Q + Q about Exam?

III. Nutrition Primer **DC Module 2, 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: HHS-USDA, AICR, Eat the *Rainbow*!**
C. ***Blue Zones?*** **Habits of longest lived people?**
D. **Okinawan Longevity Diet?**
E. **Pondering Paleo? Marlene Zuk, U Minn**
F. **Animals vs. Plants? Protein, WHO, Meat?**
G. **TMAO, Neu5GC and Inflammation?**
H. **Carbohydrate Confusion. Why Plants & Whole Grains?**
I. **Exercise, Carbohydrates & Fats**
J. **How Optimal % Body Fat US Wt Registry, Zuti & Golding**



IV. GI (Gut) Structure & Function **DC Module 3, LS 2012 ch 15**

A. **Gut Doughnut Analogy + Secretions L Brilla WWU**
B. **Digestion Steps Dr. Evonuk + LS pp 437- 439; DC p 23**
C. **Hydrolysis + Polymer → Monomer: Central Themes! LS p 438, SI Fox 2009 + …**

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,…**

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 <u>always</u>, 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.

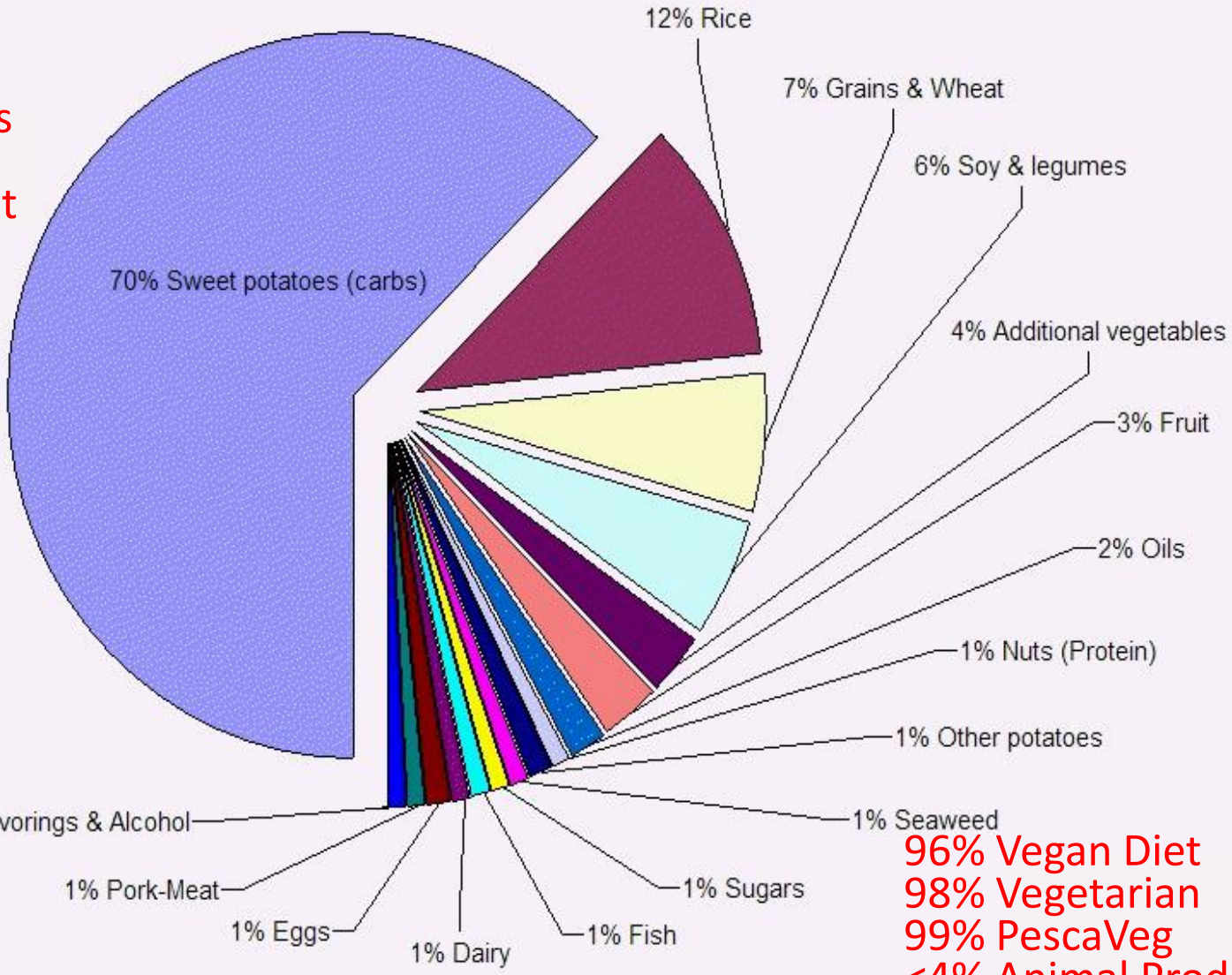
M Poulain & Coworkers. *Experimental Gerontology*, Sep 2004

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

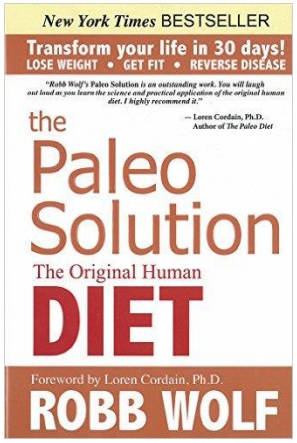
96% Vegan Diet
98% Vegetarian
99% PescaVeg
<4% Animal Prod
<1% Fish
<1% Meat-Pork

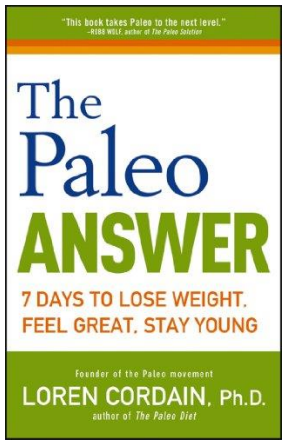
SCIENTIFIC STUDY: "The Diet of the World's Longest-Lived People and Its Potential Impact on Morbidity and Life Span"
JOURNAL: Annals of the Academy of Sciences - Volume 1114: 434–455 (2007).

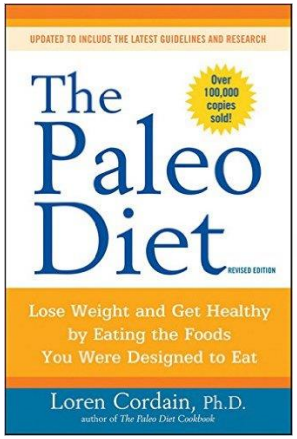
Note: These are the Actual Food Measurements of the Centenarians, not the diet of All island Okinawans or the ones who died, but the ones who lived.

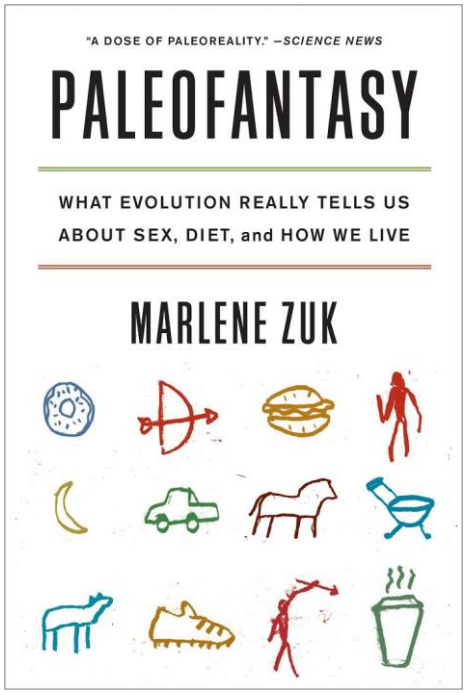
Pondering Paleo?

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!

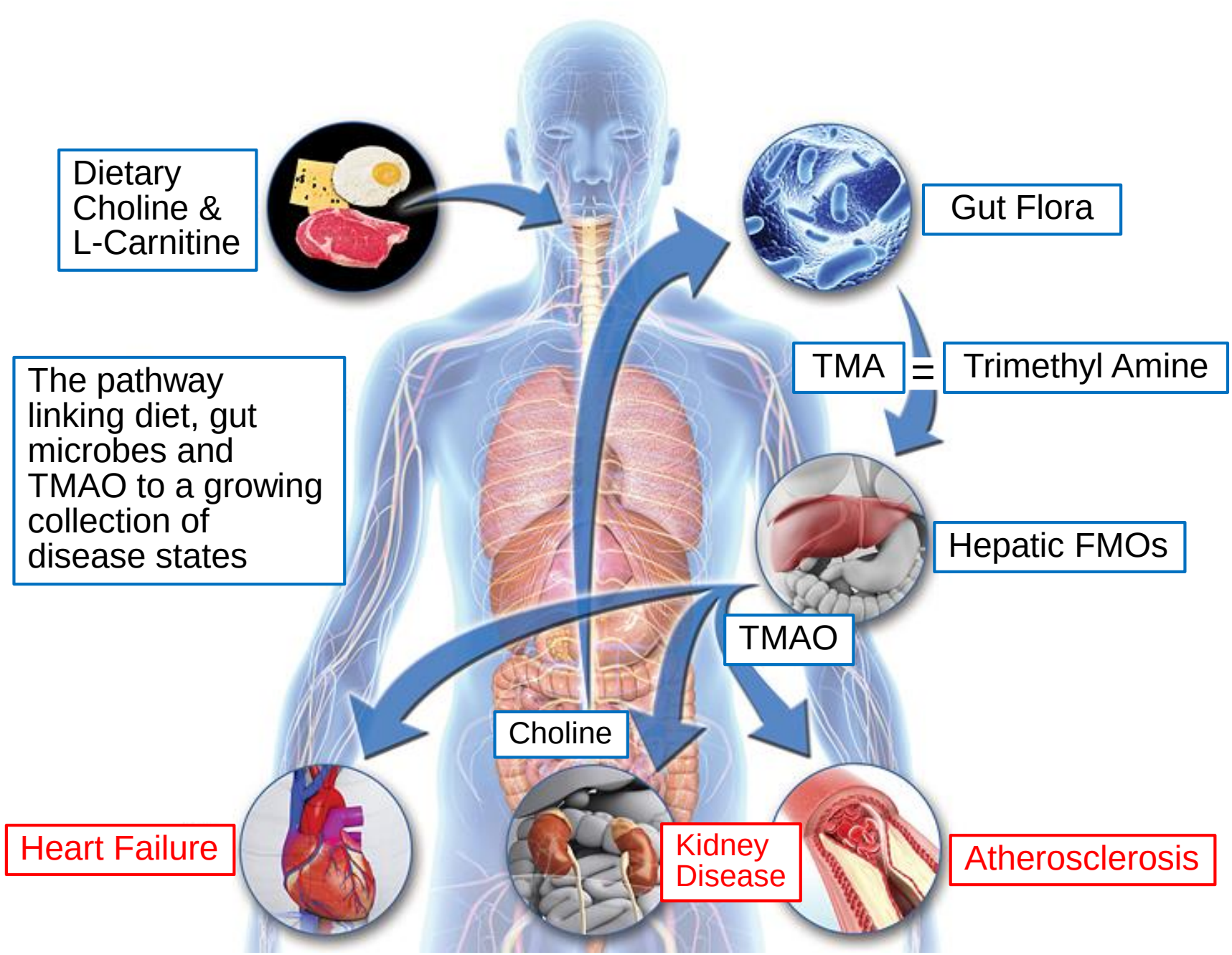
Average US woman gets 35% > RDA!
Average US man 65% >RDA!

Red Meat, Processed Meat & Cancer Incidence

Total cancer mortality & cancers of:

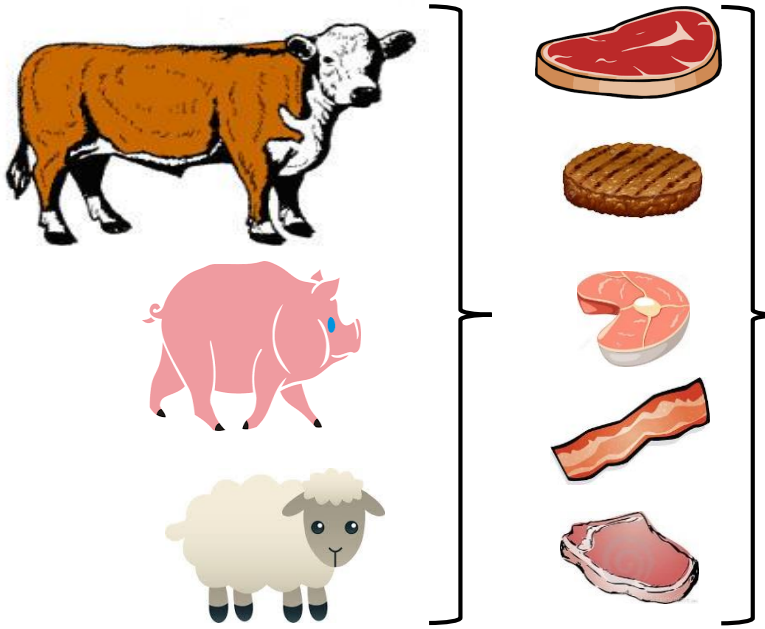
Colon & rectum
Esophagus
Liver
Pancreas
Kidney
Prostate
Lung
Breast

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

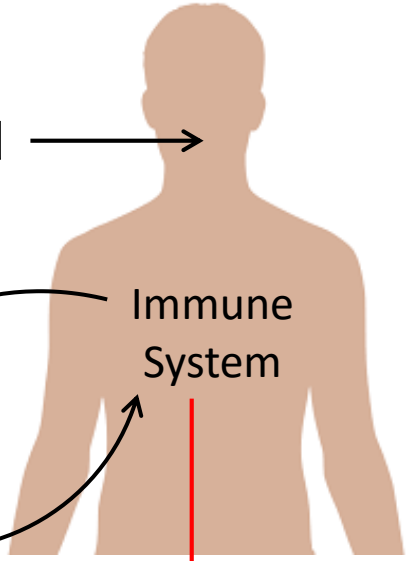


http://www.nejm.org/doi/full/10.1056/NEJMoa1109400#t=article

Red Meat-Derived Glycan Promotes Inflammation & Disease



N-Glycolylneuramic acid
(Neu5GC)

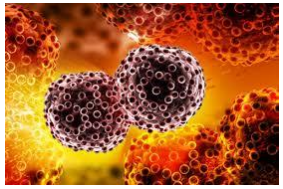


Ab to Neu5GC
Neu5GC Ab

Xeno Auto-Antigen!
Anti-Neu5GC Ab

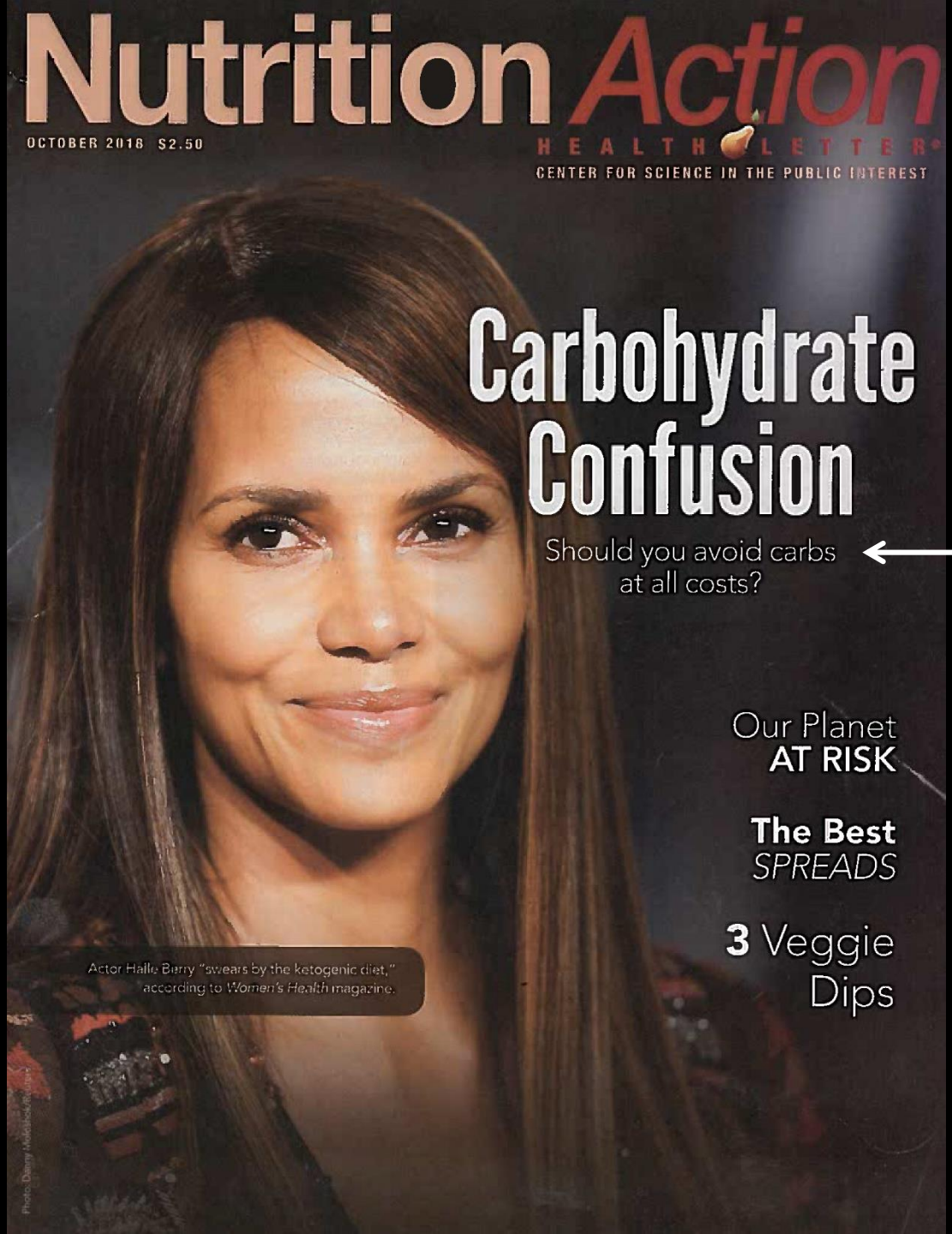
Atherosclerosis

Cancer

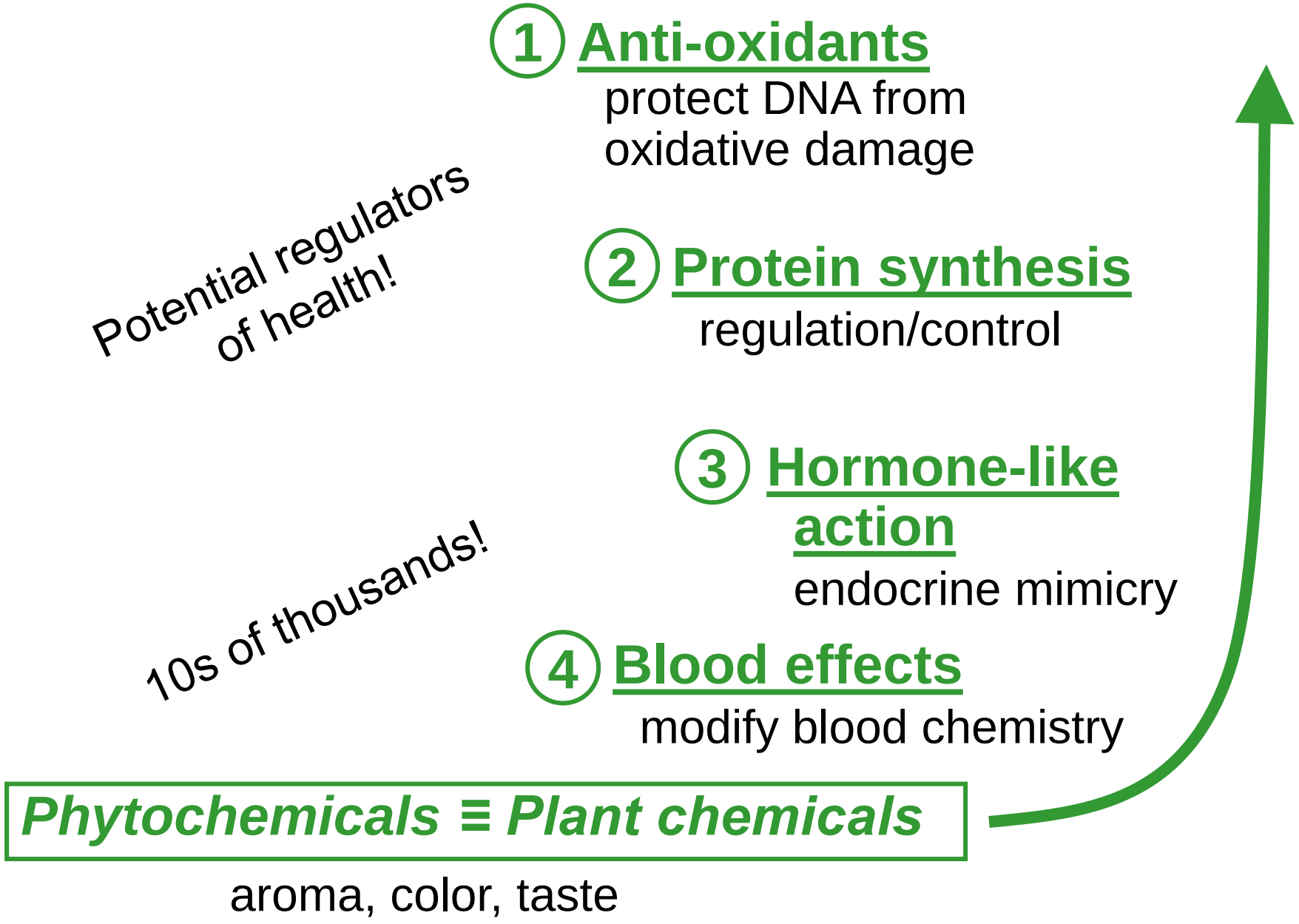


Chronic Inflammation
Amyloid-A +
Acute Phase Proteins
IL-6

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



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


1 Anti-oxidants
protect DNA from oxidative damage
Potential regulators of health!
2 Protein synthesis
regulation/control
3 Hormone-like action
endocrine mimicry
10s of thousands!
4 Blood effects
modify blood chemistry
Phytochemicals ≡ Plant chemicals
aroma, color, taste

Why Eat Whole Grains?

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

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

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

B-vitamins thiamin, niacin, riboflavin ↑ energy metabolism

Folate ↑ red blood cells, ↓ neural tube defects

Iron ↑ O_2 carrying, ↓ iron-deficiency anemia in women

Magnesium ↑ bone building & muscle energy release

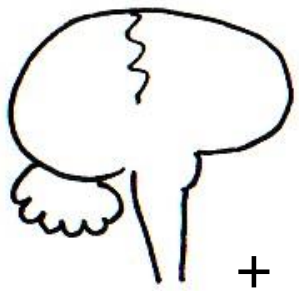
Selenium an anti-oxidant, protects body cells & ensures a healthy immune system…

https://www.choosemyplate.gov/grains-nutrients-health

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

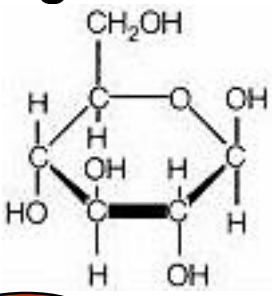
cns

2



+

glucose



rbcs

3

Negative Effects of Low Carbohydrate

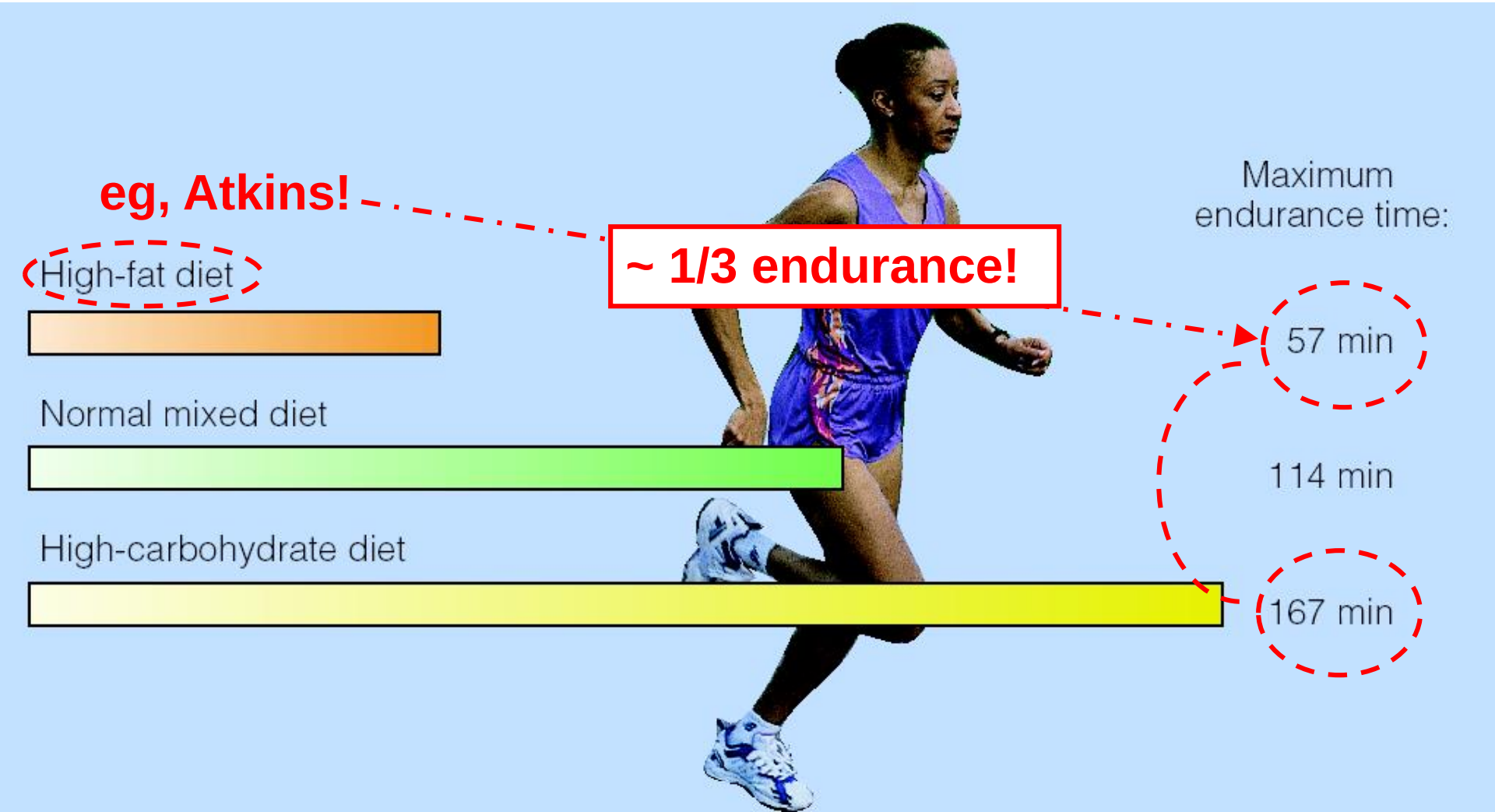
1

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...

Dietary Composition & Physical Endurance



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

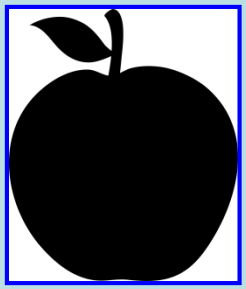
> ¾ **26 lb Water**

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

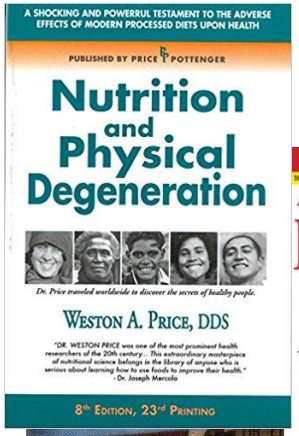
- Eight of 10 ate breakfast daily which may help better manage calories during the day
- Self-monitor, weigh themselves ≥ 1x/wk & many still keep food dairies

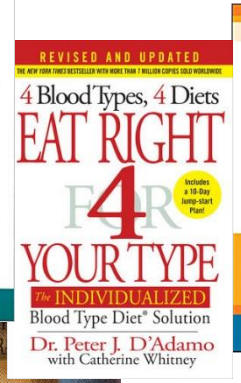
- Much planned physical activity, 60-90 min/d, 1^0 walking + looked for other ways to be active

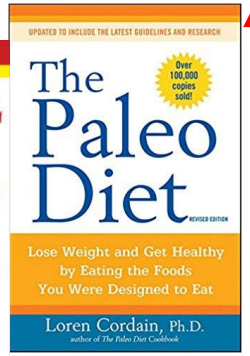
http://www.nwcr.ws/Research/published%20research.htm

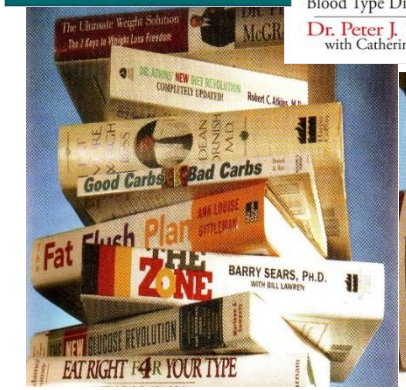
UC Berkeley Wellness Engagement Calendar, September 2013

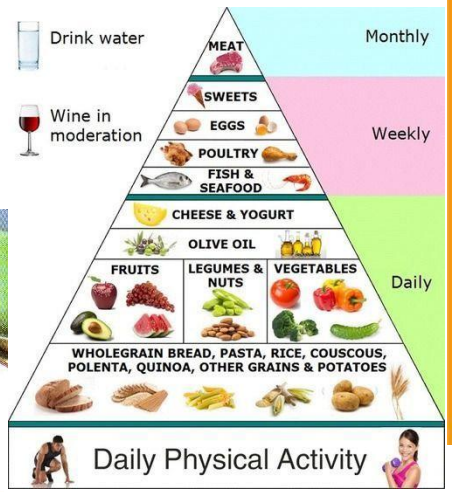
Which Diets are Best?



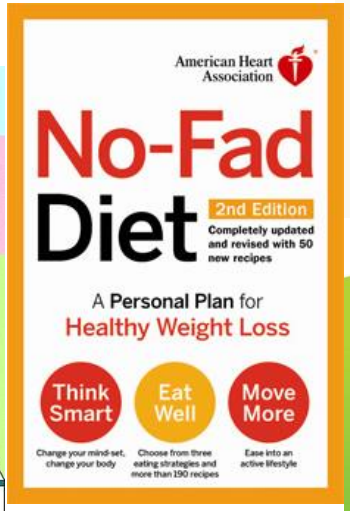


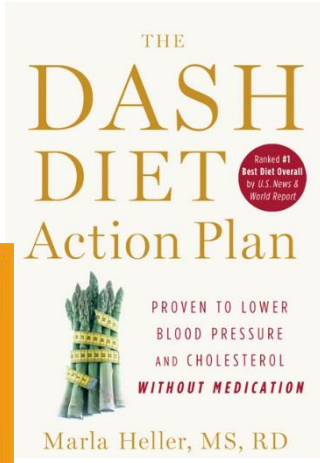


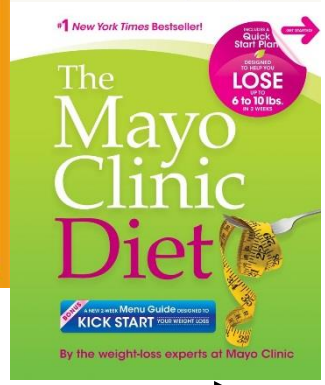




Mediterranean Diet







Not Plant-based
Lower Carbohydrate

Plant-based
Lower Fat

Not Peer-Reviewed =
Trade Book
→ Opinion

Peer-Reviewed =
Text Books
→ Research

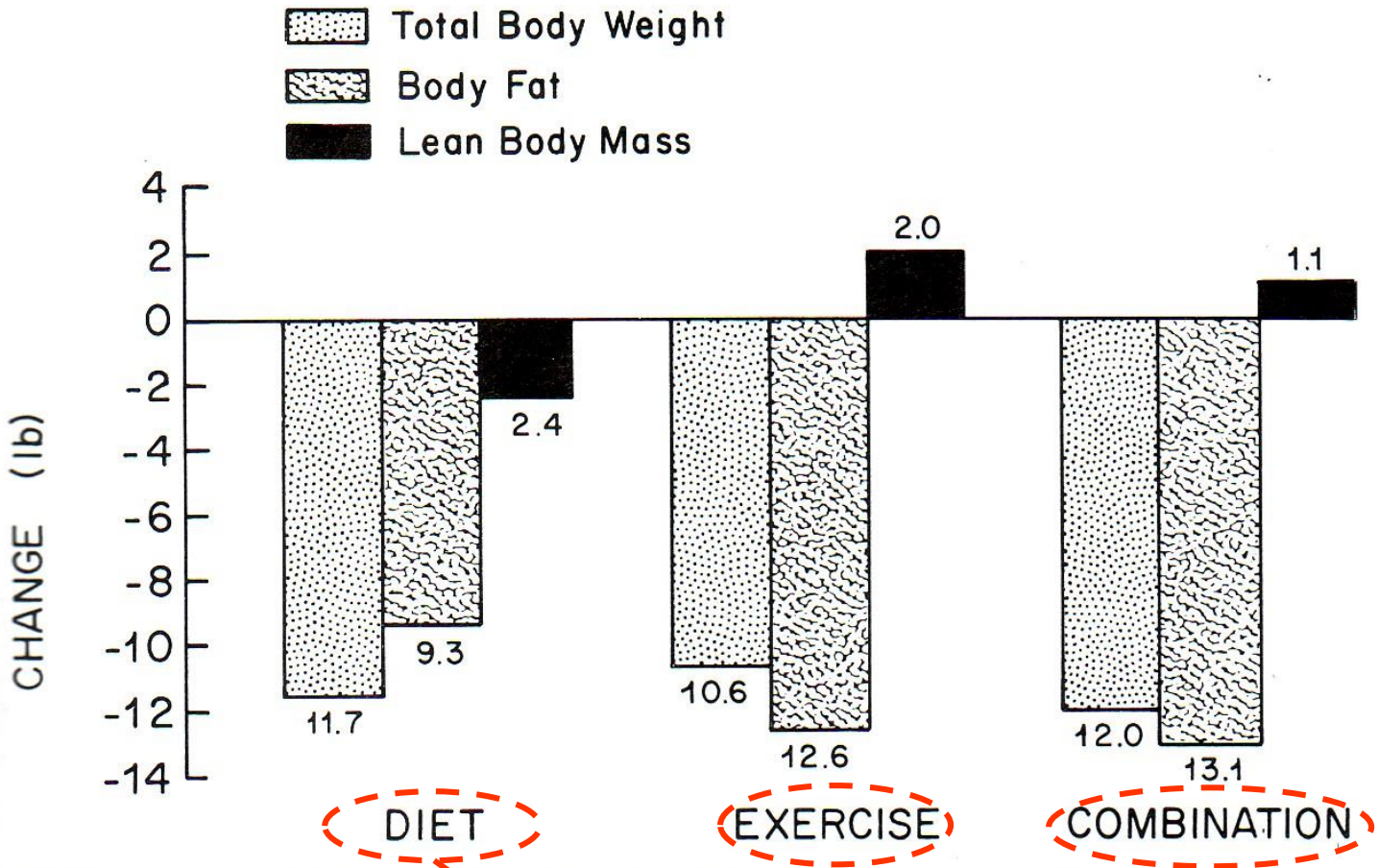
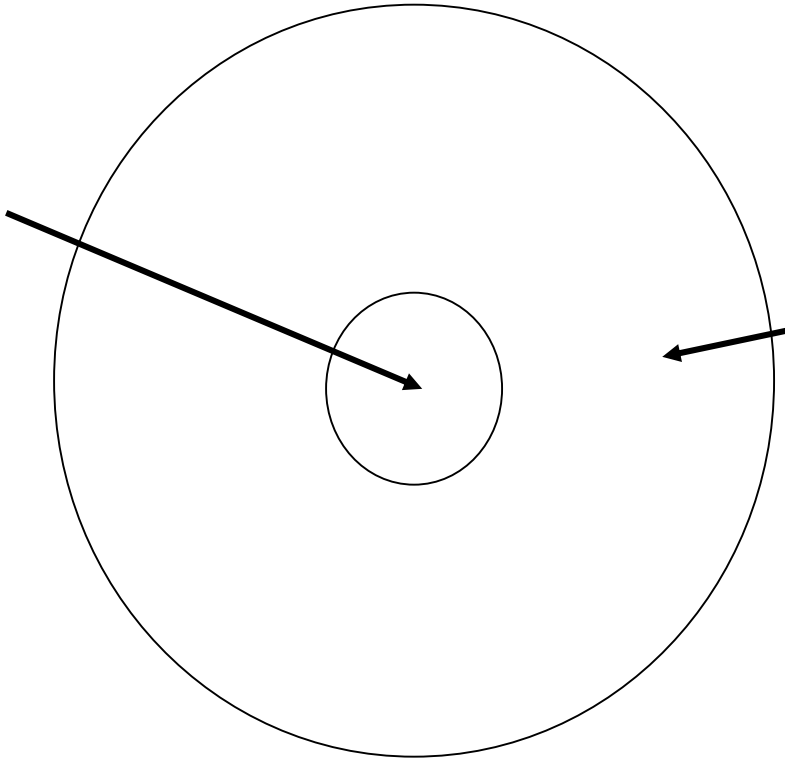


Figure 4–9. Changes in body weight, body fat, and lean body weight for diet, exercise, and combination groups. (From Zuti W. B., and Golding, L. A.: Comparing diet and exercise as weight reduction tools. **Phys. Sportsmed.** 4:49–53, 1976.)

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

GI-Doughnut Analogy

GI Lumen

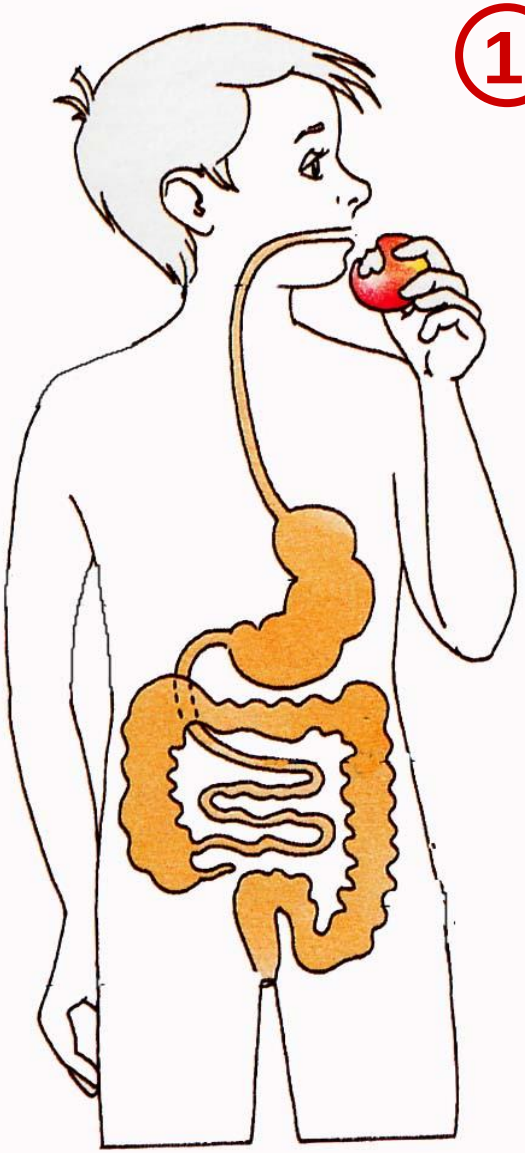


Body

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**

Digestion Steps

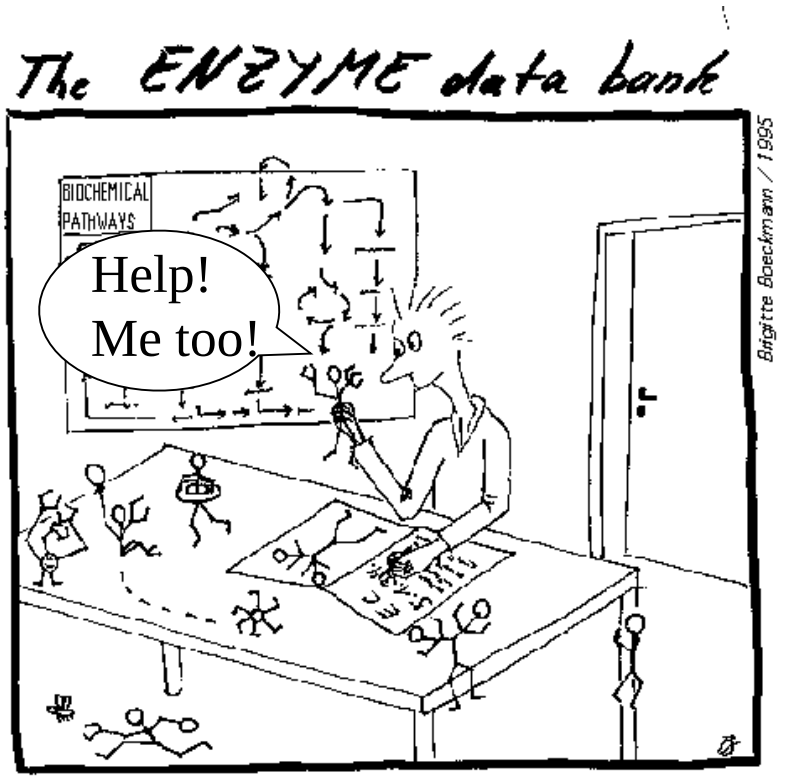


1. Ingestion
2. Mechanical Digestion
3. Chemical Digestion
4. Peristalsis
5. Absorption
6. Storage
7. Defecation

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

Hydrolysis of Energy Nutrients

+

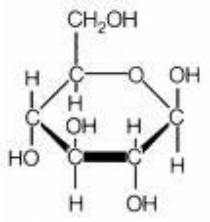


H_2O + Enzyme

Polymer to Monomer (Many to One)

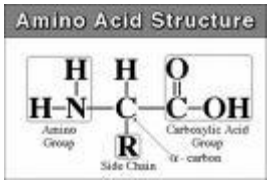
…Central-linking theme!!

Carbohydrate

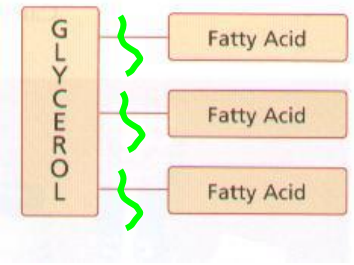


Glucose

Protein
+
Fat



Amino Acids



Fatty Acids
+
Glycerol

Bl 121 Lecture 6

I. ***Announcements*** **Next session Q? ~½ review, then Exam I.**

II. ***Nutrition News*** **Be a whiz at healthy grilling! *AICR American Institute for Cancer Research,* Grilling Quiz!**

III. ***GI Connections*** **LS ch 15, DC Module pp 17-23**

- **A. Gut control mechanisms**
- **B. Histology of the gut LS fig 15-2, 15-3 p 442-3**
- **C. Organ-by-organ review**
- **D. Stomach protein digestion + zymogens? LS fig 15-7, 15-9**
- **E. Accessory organs: Pancreas & Liver + Recycling! LS 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. Summary of chemical digestion LS tab 15-5 p 466**
- **H. Large intestine? LS fig 15-24 pp 472-4**

American Institute for Cancer Research (AICR) Healthy Grilling Quiz Summary

1. **Marinade, marinade, marinade! By doing so, you can decrease carcinogens formed during grilling by ≤ 96%!**
2. **Cover the grill with aluminum foil, turn gas down or wait for low-burning embers, cook to the side.**
3. **Best choices for grilling include vegetables and fruits (no HCAs + enzymes to inactivate HCAs!), and lean meats (*e.g.*, fish & skinless chicken↓ PAHs).**
4. **Flip meat every minute to reduce charring & remove charred portions prior to eating.**
5. **To limit cancer risk, eat no more than 3 oz grilled red meat in a day! Cook small portions/kebabs.**

AICR Newsletter, Summer 2006

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

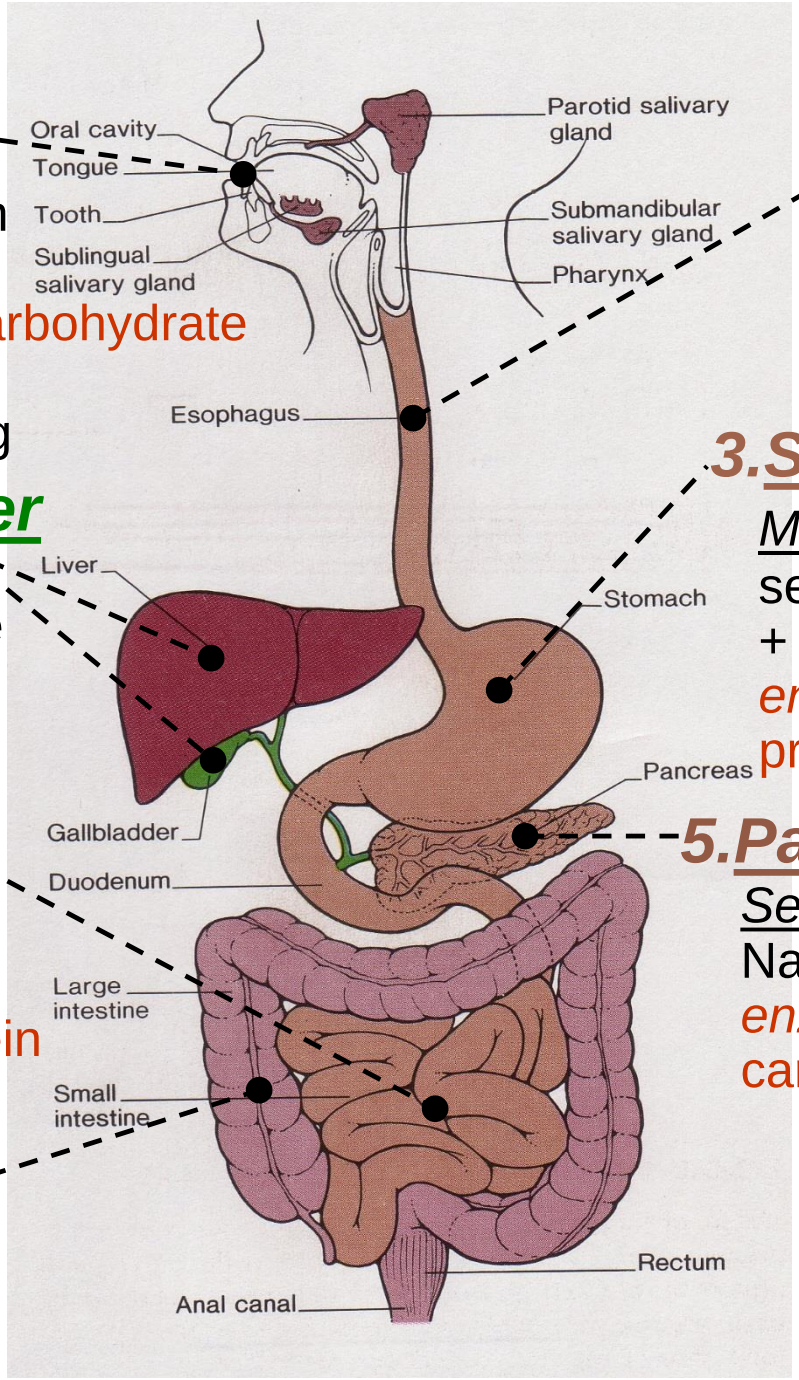
Secretion mucus +
$NaHCO_3$ + enzymes
enzymatic digestion:
carbohydrate, fat, protein

6. Small Intestine

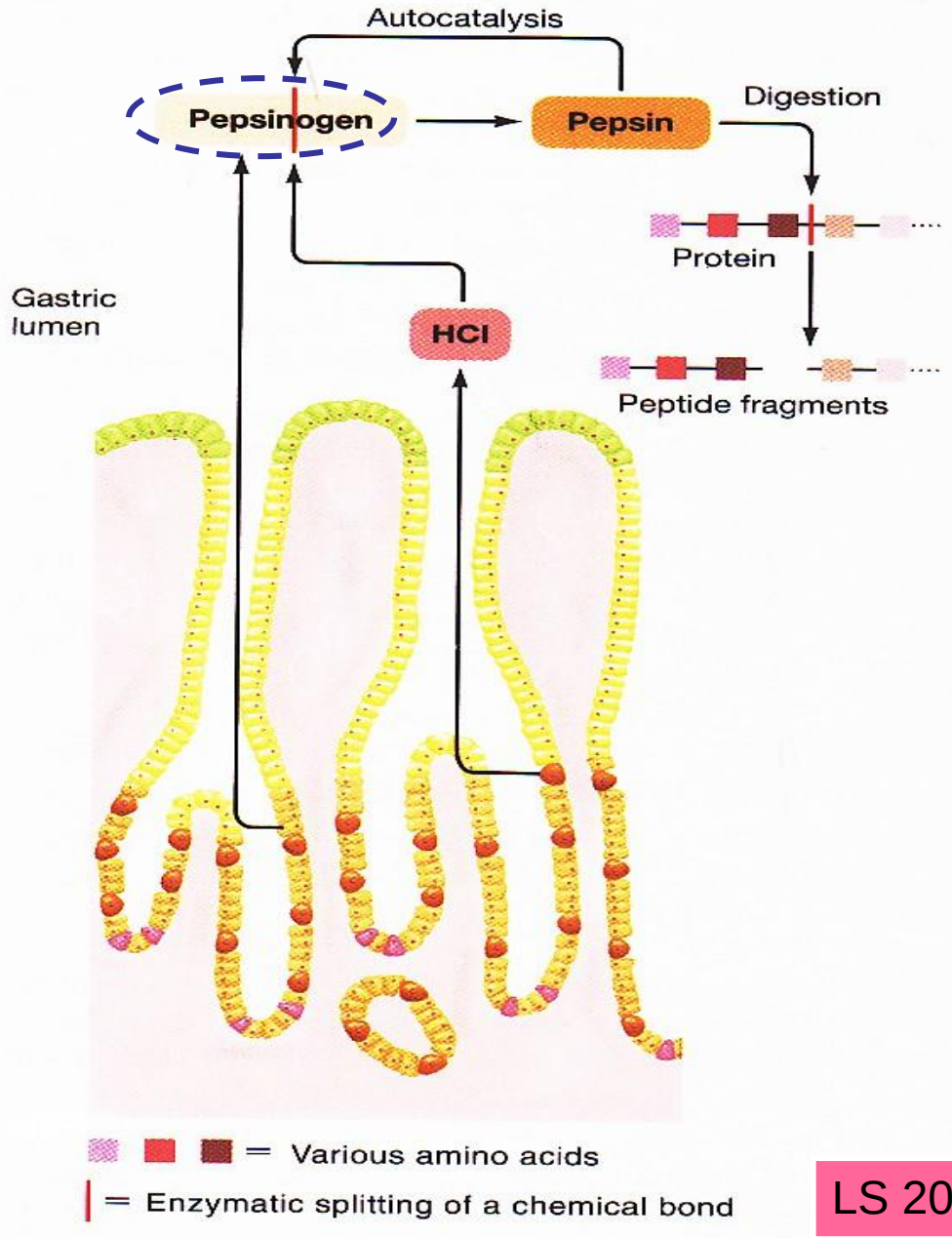
Absorption
Secretion mucus
+ enzymes
enzymatic digestion:
carbohydrate, fat, protein
Peristalsis

7. Large Intestine

Dehydration
secretion + absorption
storage + peristalsis

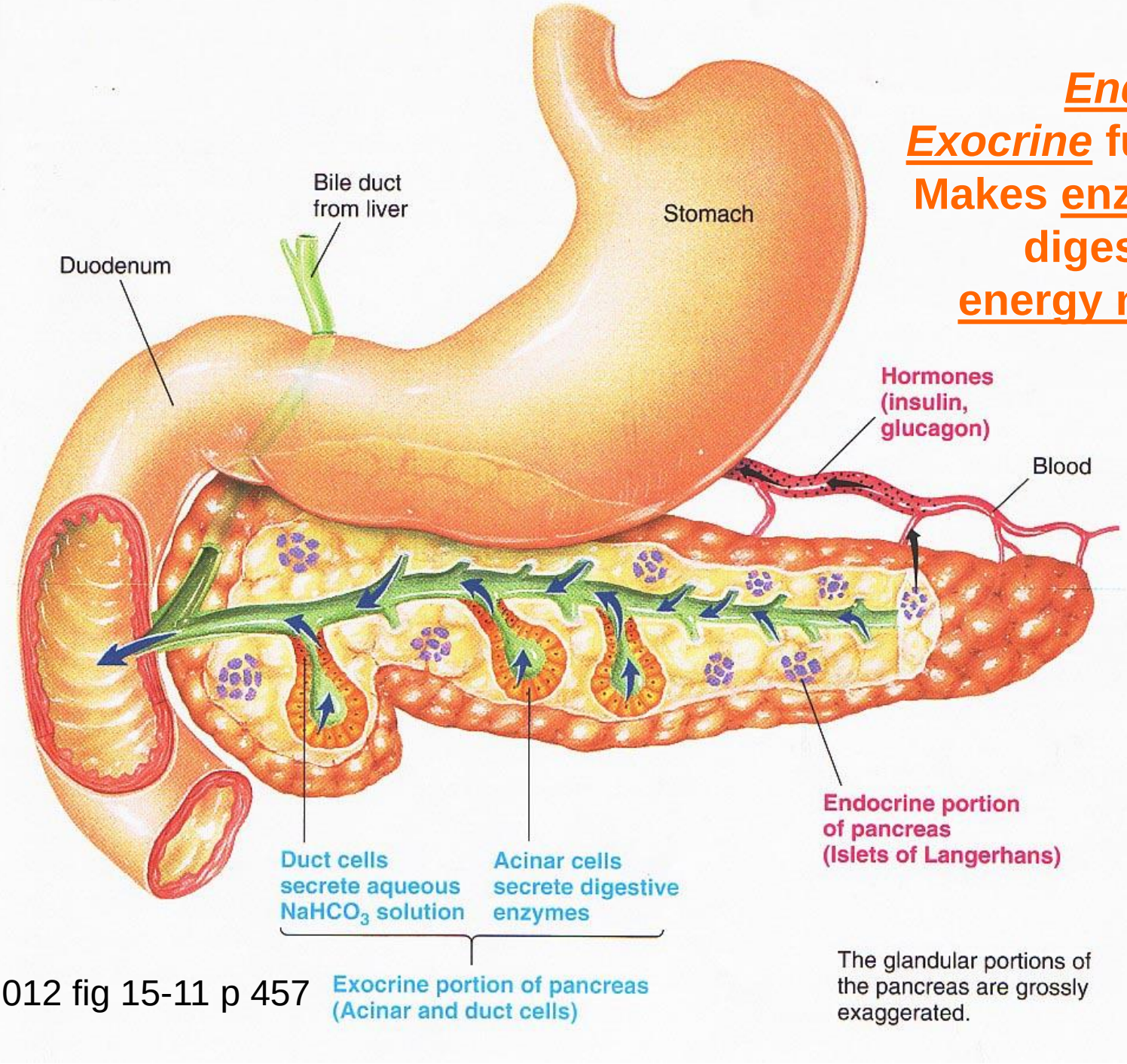


Zymogen= an inactive precursor



LS 2012 fig 15-9 p 452

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



LS 2012 fig 15-11 p 457

Ulcer Facts

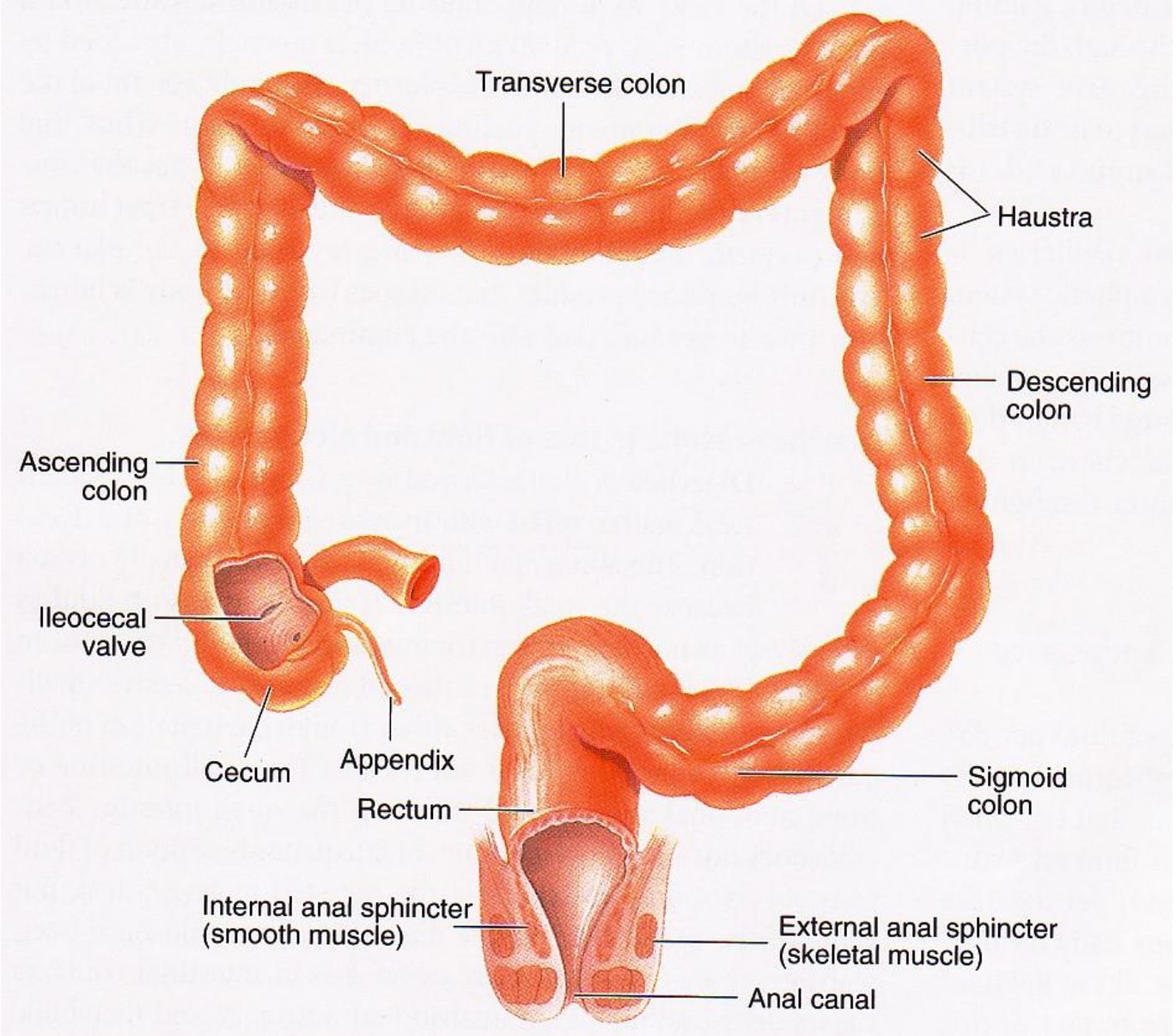
- Most ulcers are caused by an infection, not spicy food, acid or stress.
- The most common ulcer symptom is burning pain in the stomach.
- Your doctor can test you for *H. pylori* infection.
- Antibiotics are the new cure for ulcers.
- Eliminating *H. pylori* infections with antibiotics means that your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

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

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

LS 2012 p 446

Large Intestine Structure & Function



LS 2012 fig 15-24 p 472