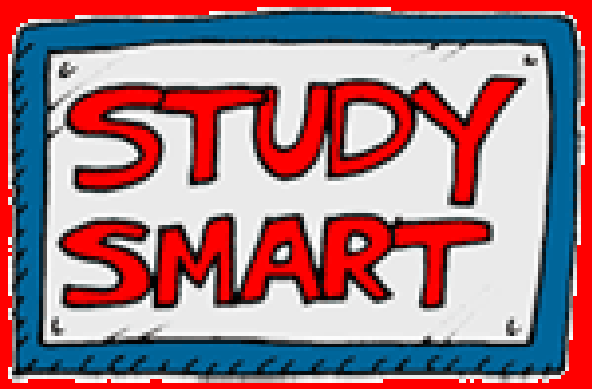
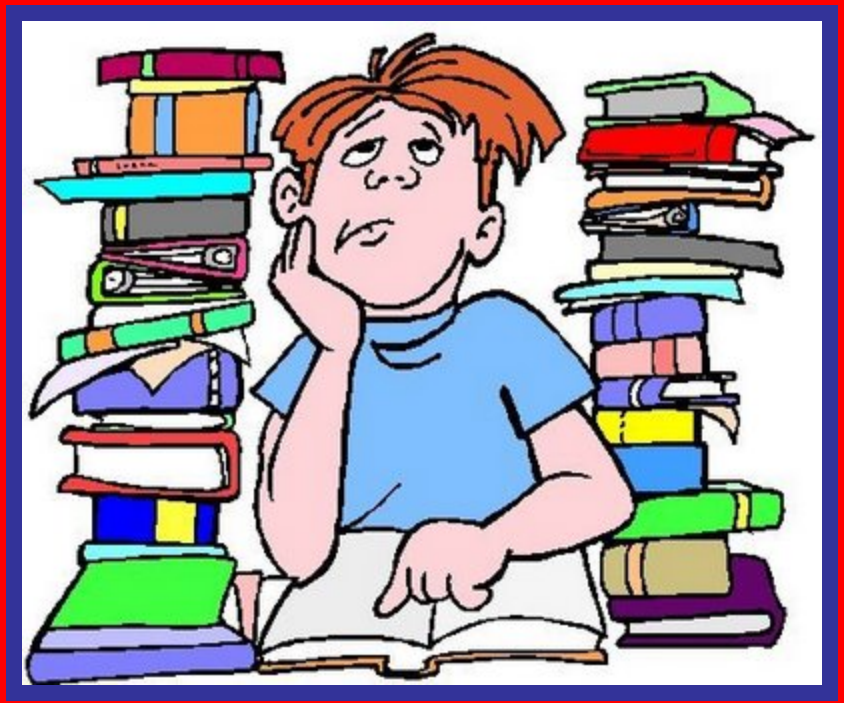
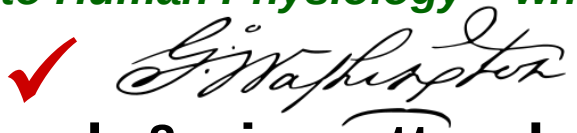
Midterm Review Slides





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

Bl 121 Lecture 1



I. ***Announcements***: Please check & sign attendance roster. Not on list? See Pat during a break or after class. *Lab 1 Histology* tomorrow in 130 HUE: 12 n & 1 pm sections.

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

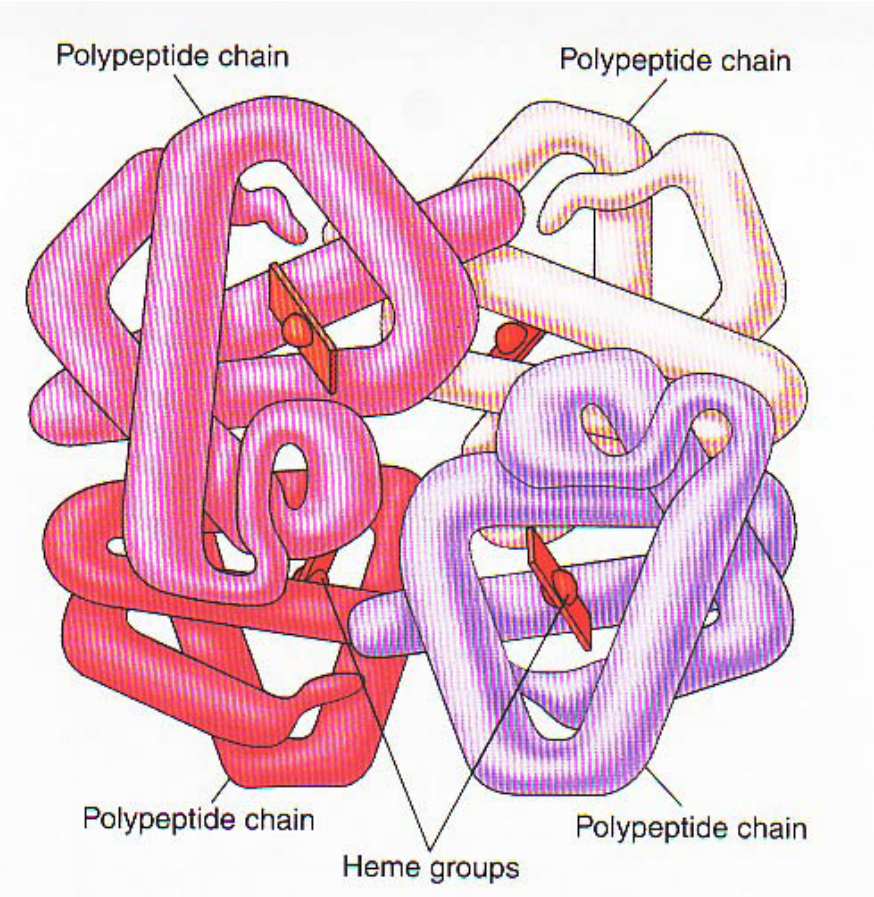
III. ***Human Physiology*** LS ch 1, DC Module 1
   - A. What? cf: Anatomy LS p 1
   - B. Where?Body Levels of Organization LS pp1-6, DC pp1-5
   - C. How? Different Study Approaches LS p 1
   - D. Why? Security+Decision-Making Power LS p xxi, DC p v

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

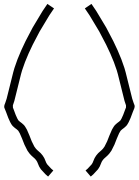
Structure* begets *function!
Structure* gives rise to *function!
***Structure & function* are inseparable!**



Preoperative Diagnoses: R Knee

Degenerative Joint Disease (DJD) = arthritis

Varus malalignment = bow-leg



William Sterett, MD
Ben Hogan, PAC
Vail Summit Orthopedics

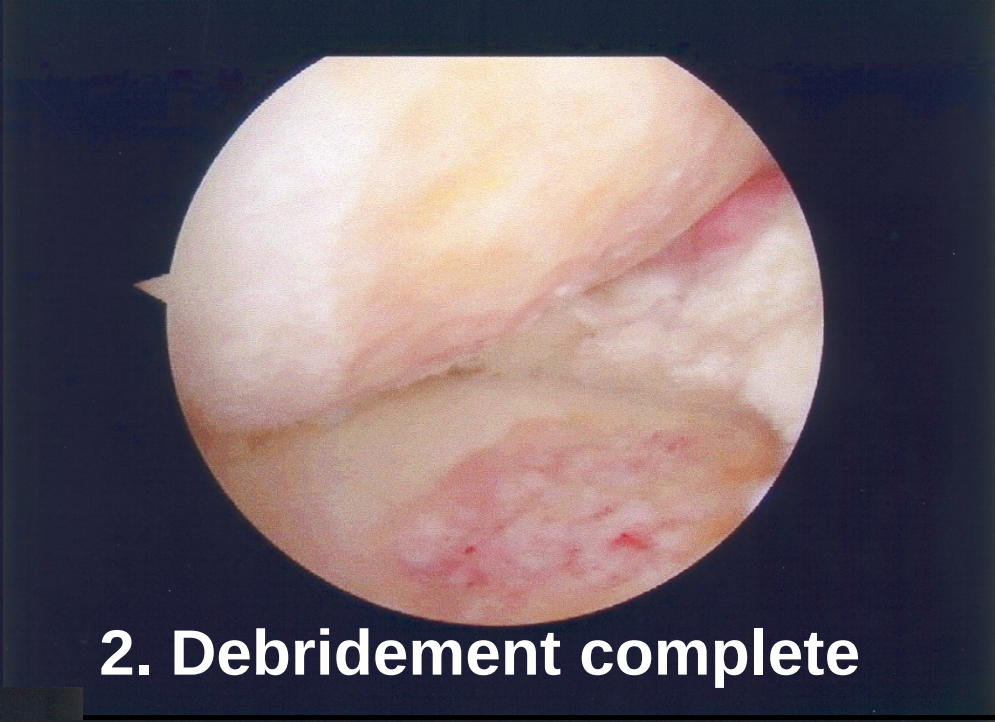
Procedures:

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

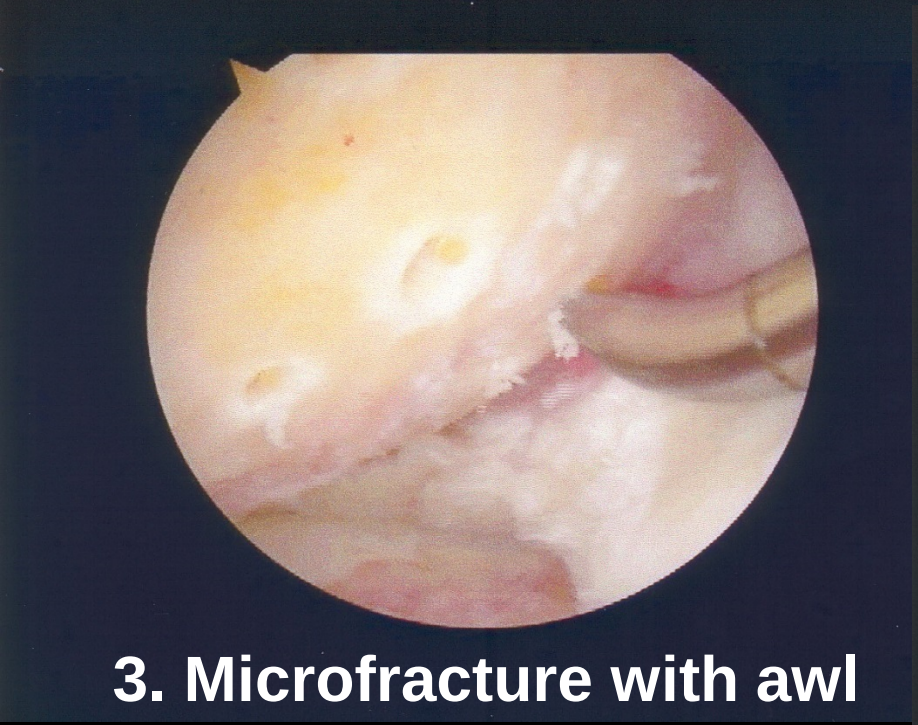
Blocks/Medications:

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

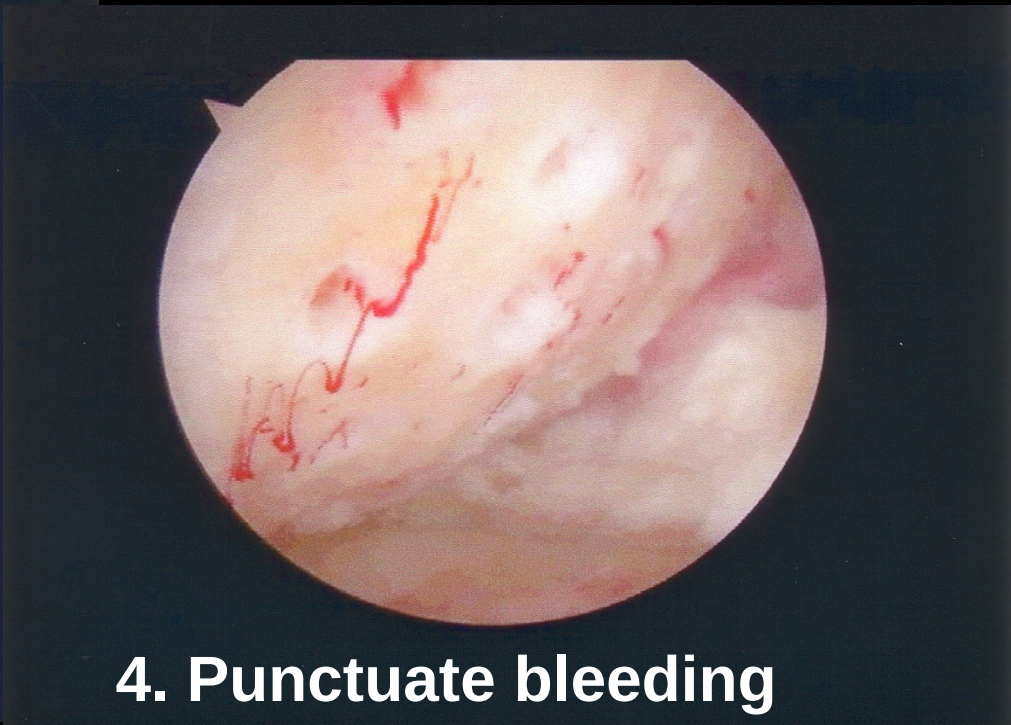
1. Arthroscopy clean-up



2. Debridement complete



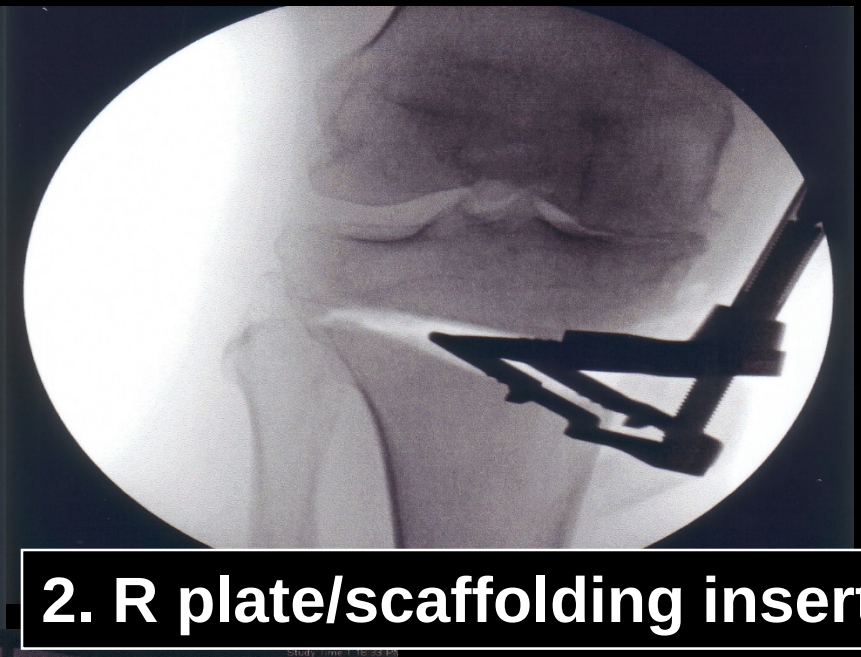
3. Microfracture with awl



4. Punctuate bleeding

High-Tibial Osteotomy (HTO) to Realign the Joint

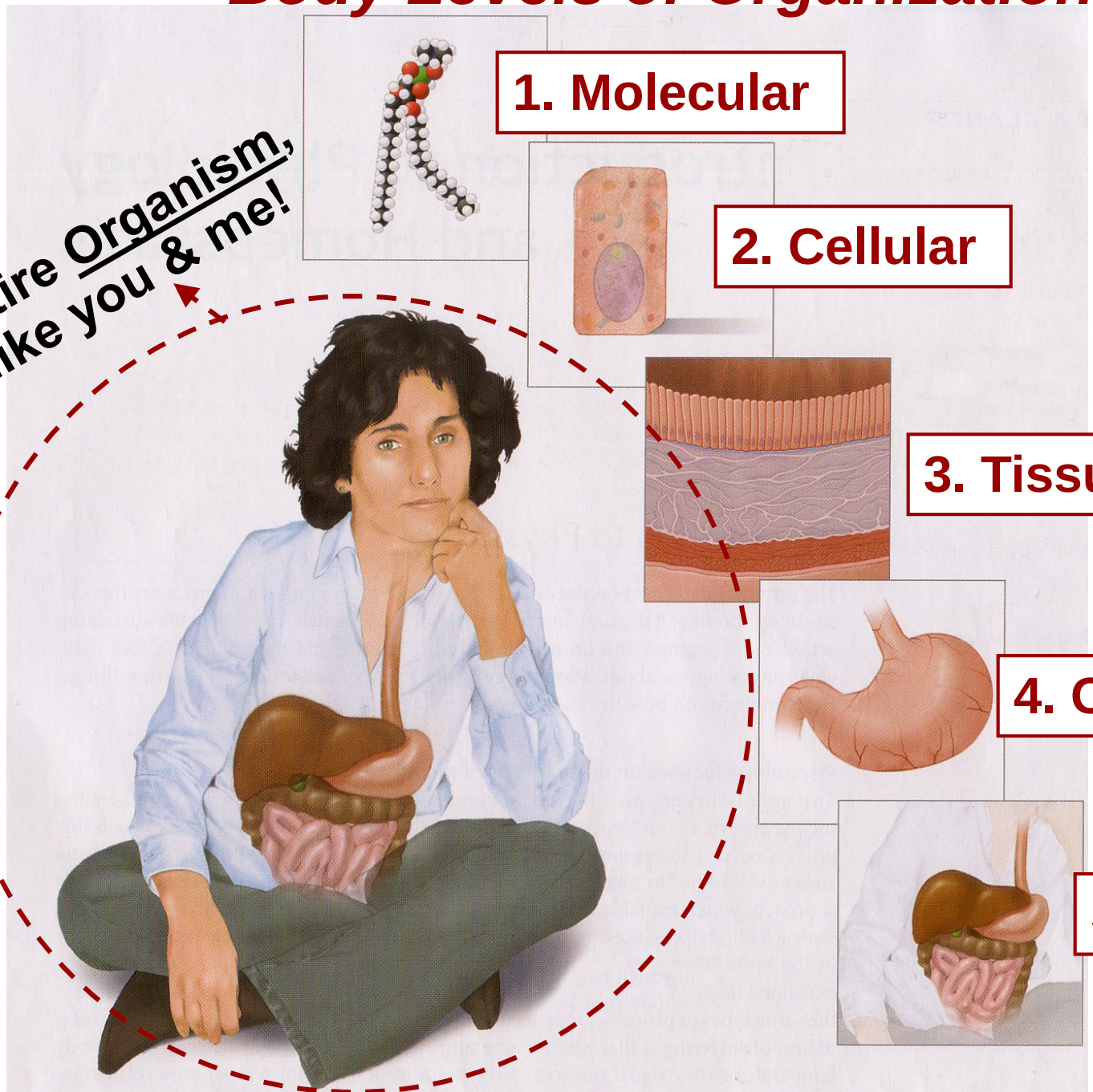
1. Oscillating saw cut



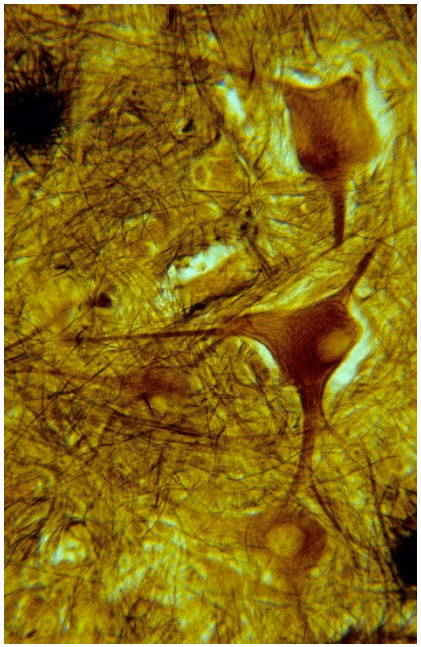
2. R plate/scaffolding insert

3. Align, stabilize w/screws & pack defect

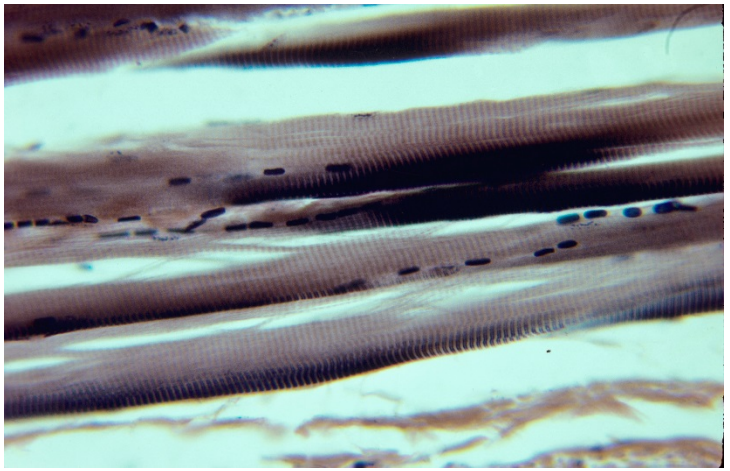
Body Levels of Organization



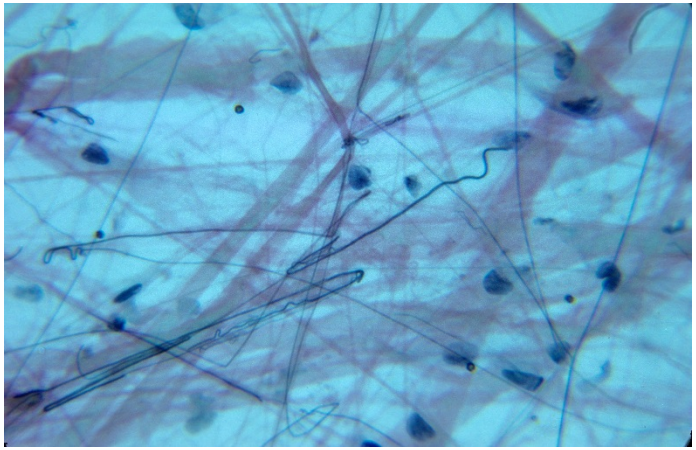
LS fig 1-1 p 2



Nerve conducts



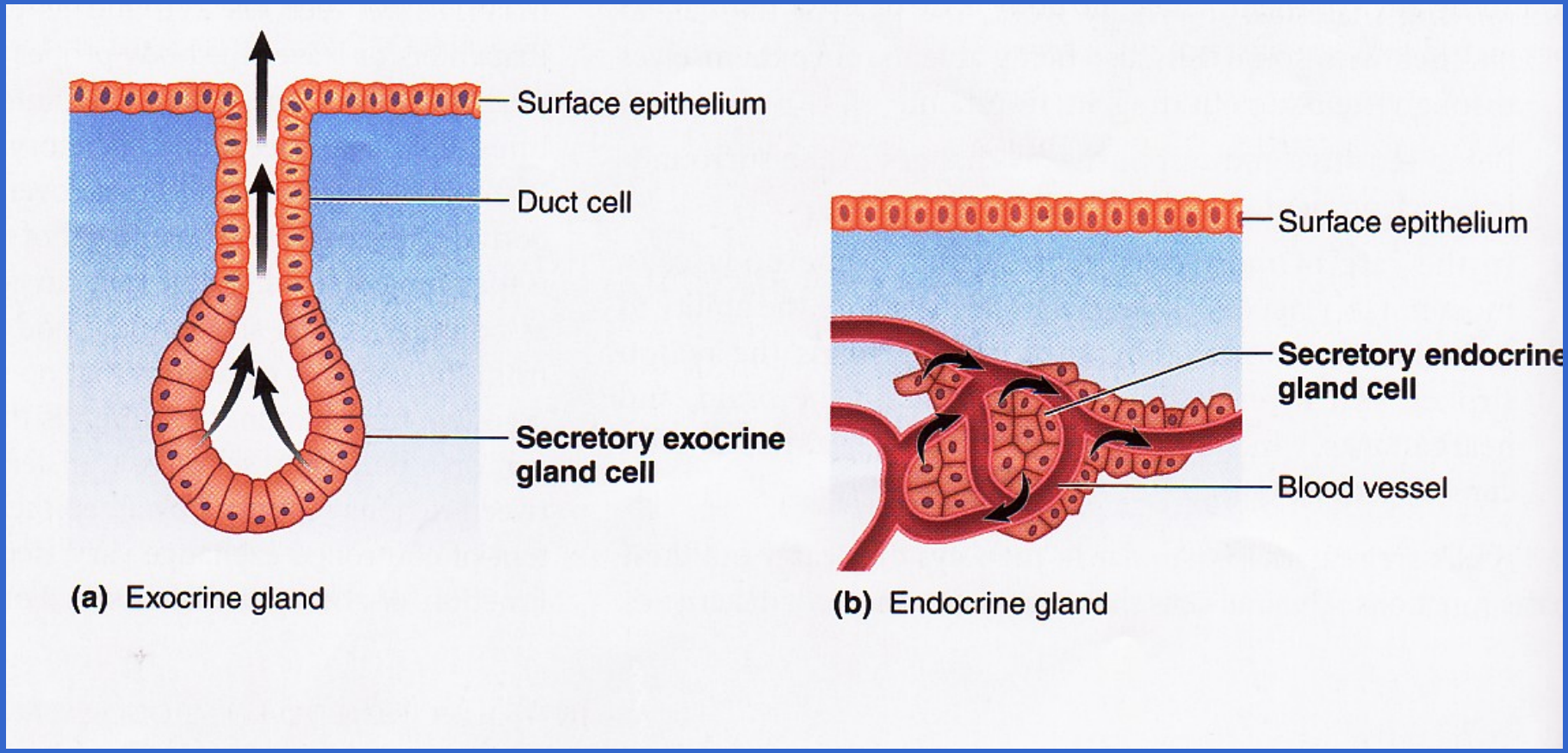
Muscle contracts



Connective connects!!

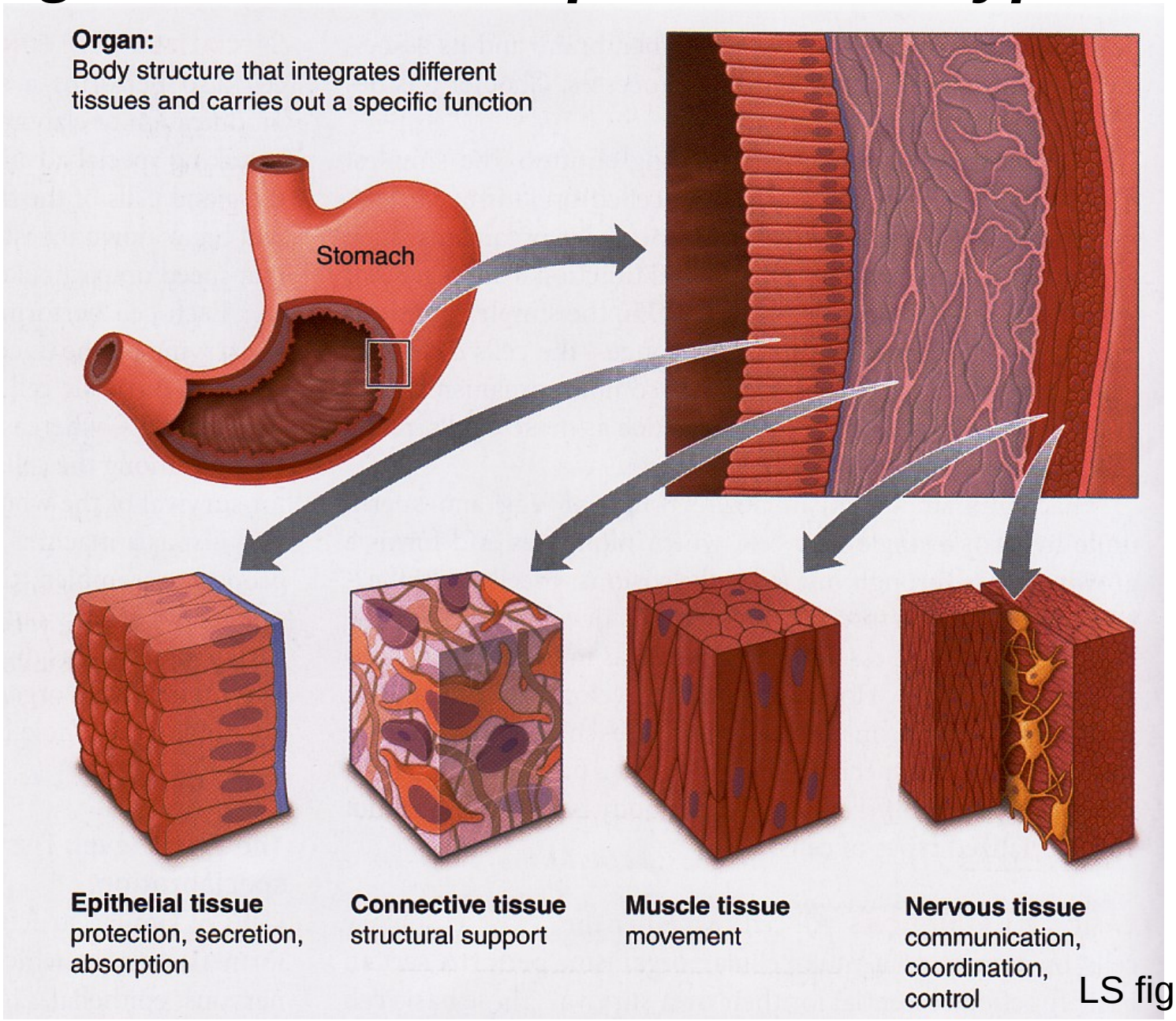
Epithelial covers

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



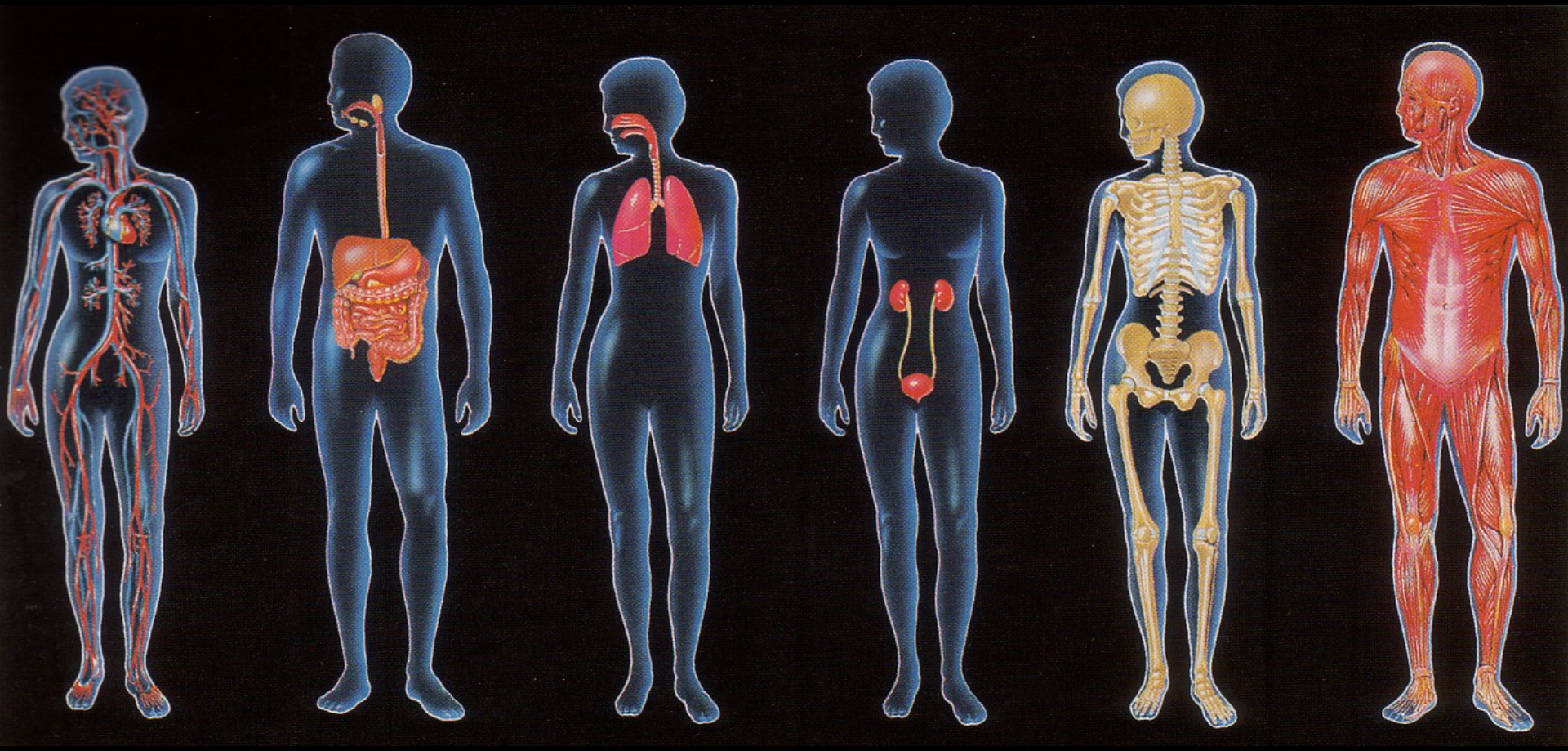
LS fig 1-3 p 4

Organs are made up ≥ 2 tissue types



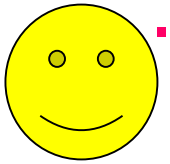
LS fig 1-2 p 4

Which body systems?



LS fig 1-4 p 6

BI 121 Lecture 2



...Histology exploratory fun!!
Thanks for signing in!

I. ***Announcements*** Lab today 12 n & 1 pm. Q last time?

II. ***Connections*** Extracellular fluid (ECF) & Homeostasis

A. ECF: Plasma *vs.* Interstitium?

B. Dr Evonuk Balances LS pp 5 - 15

C. ***Physiology in the News*** Are we like watermelons?

D. Simplified Model DO Norris *cf*: fig 1- 8 LS

E. Negative feedback? Positive feedback? LS pp 14 - 15

F. Balances & *e.g.* H_2O, T°C, BP Dr Evonuk + LS pp 8 - 10

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

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

B. Basic survival skills ch 1 p 3

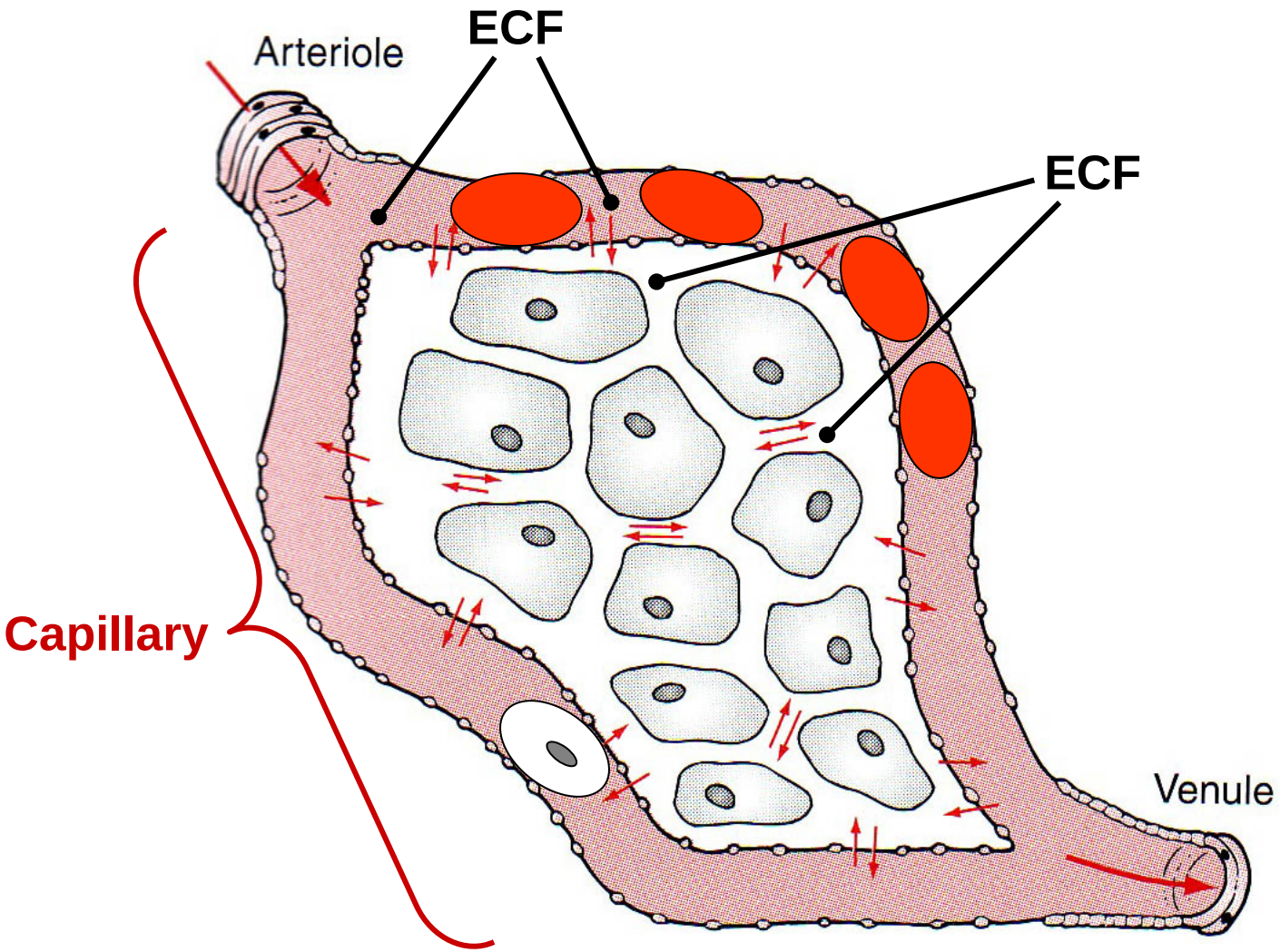
C. Organelles ≡ Membranous, cytoplasmic specialty shops!

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

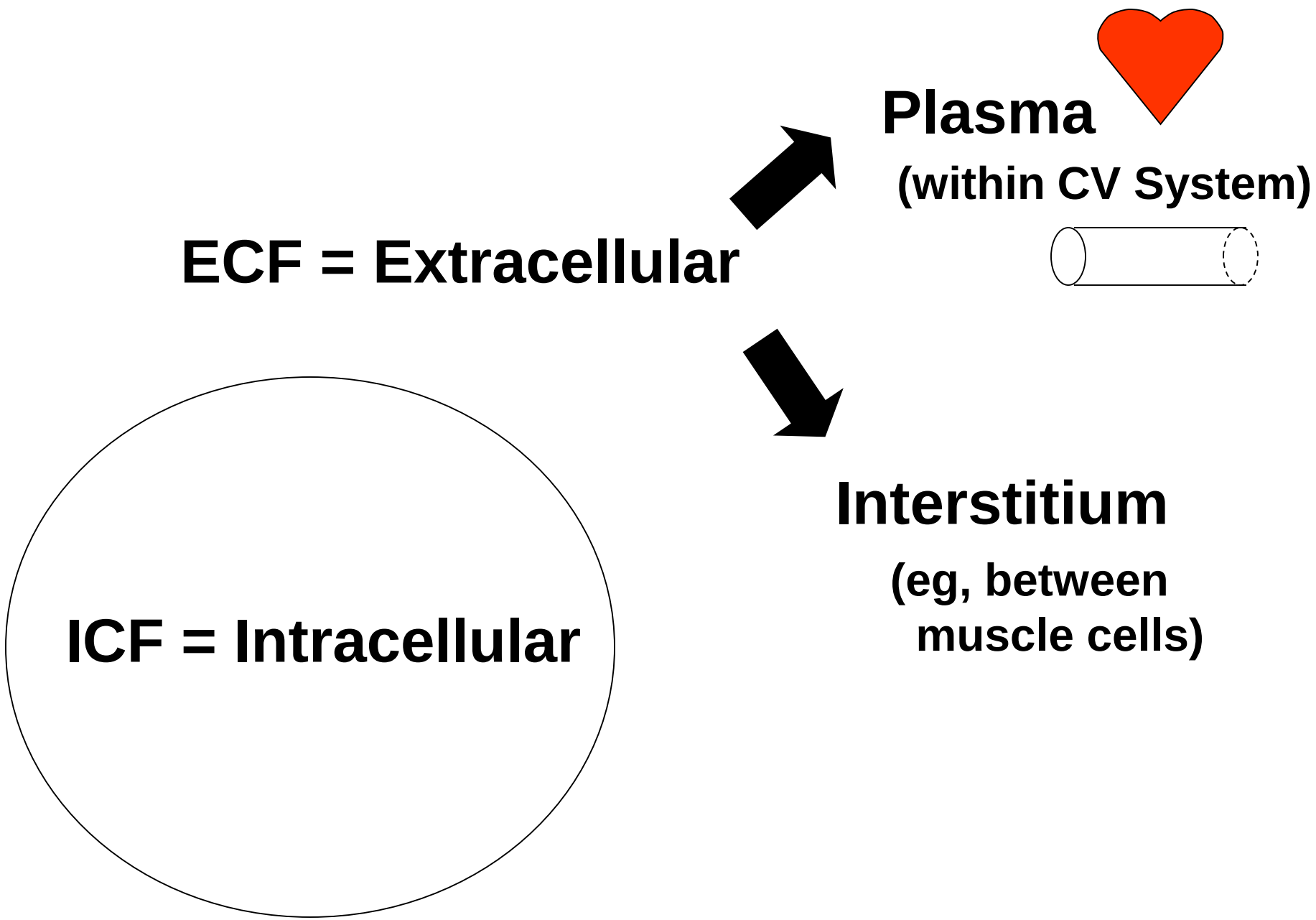
E. What about vaults? LS 2006, p 32 + *Science News*

Where is extracellular fluid?



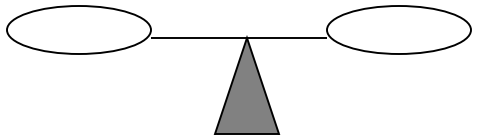
As long as <u>between/outside</u> cells, ECF everywhere?

G&H 2011


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

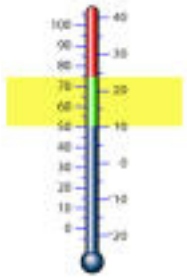
Metabolic

ANA- CATA-



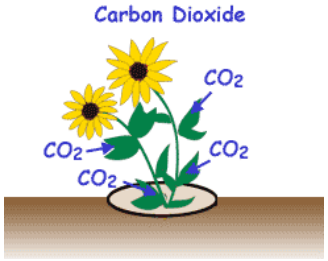
H_2O

T°C



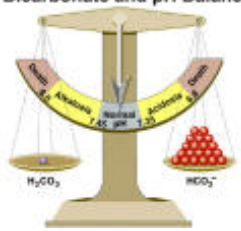
Dr. Evonuk's 6 Balances

O_2/CO_2



$Ion^{+/-}$

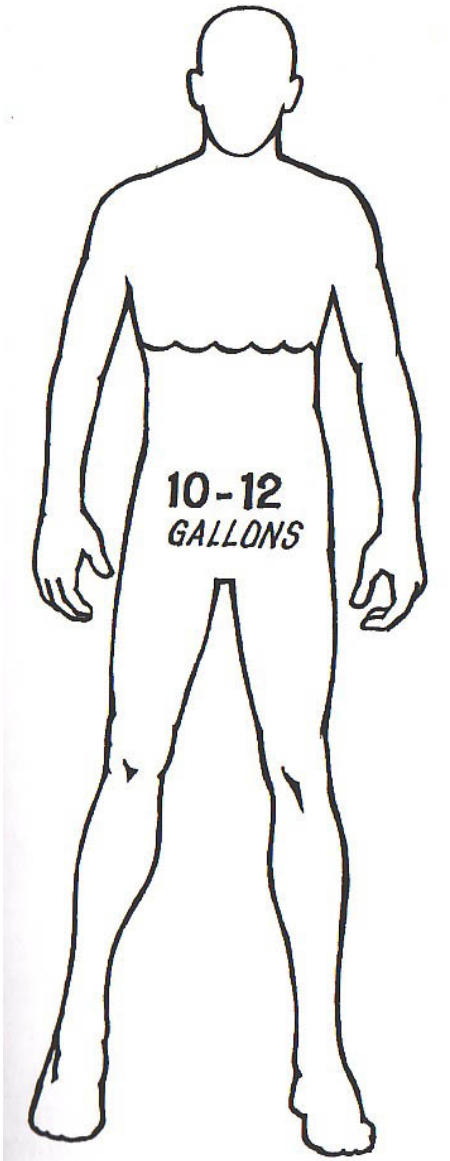
pH



Drink about 1 L per 1000 calories energy expenditure!!

Human ~ 2/3 H_2O

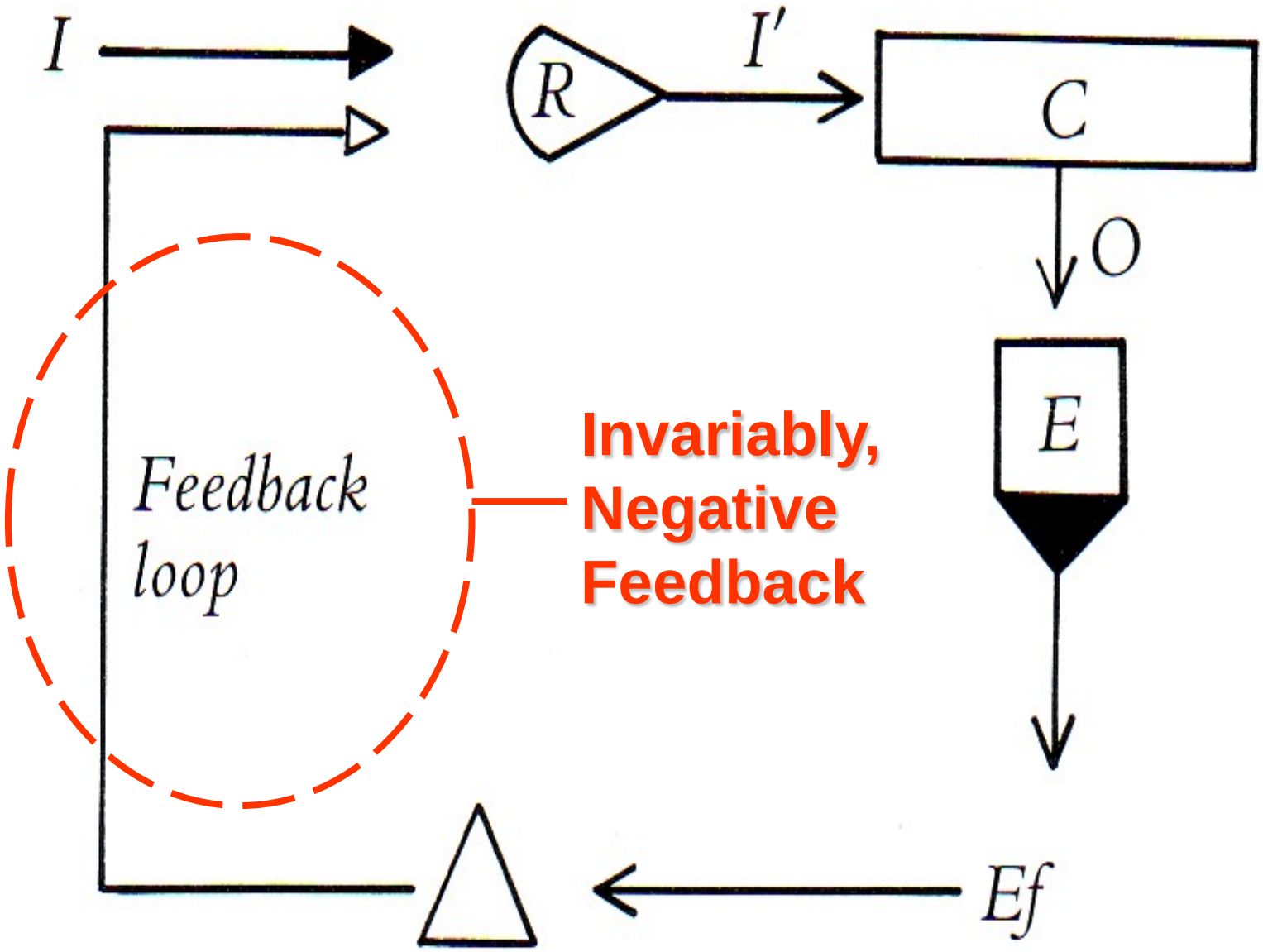
~ 60 – 70 %



150 lb /68 kg

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

= ~40 – 48 kg H_2O


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

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

Selected +FB eg:

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

70% H_2O
= 49L

eg

ICF =
35L

+

ECF = 14L

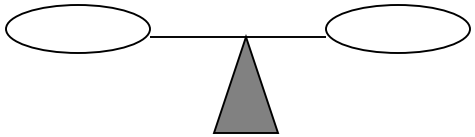
[Interstitium = 11L
Plasma = 3L]

H_2O

INPUT

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

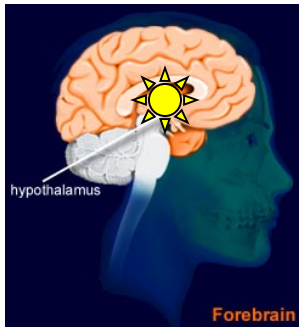
BALANCE!



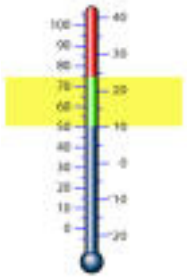
OUTPUT

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

Controller = Hypothalamus with Set Point



T°C



T°C

Lethal

42°C

Protein Denaturation

True Diurnal Variation

110°F

Set Point

37°C

98.6°F

35°C

Mild Hypothermia

Profound Hypothermia

33°C

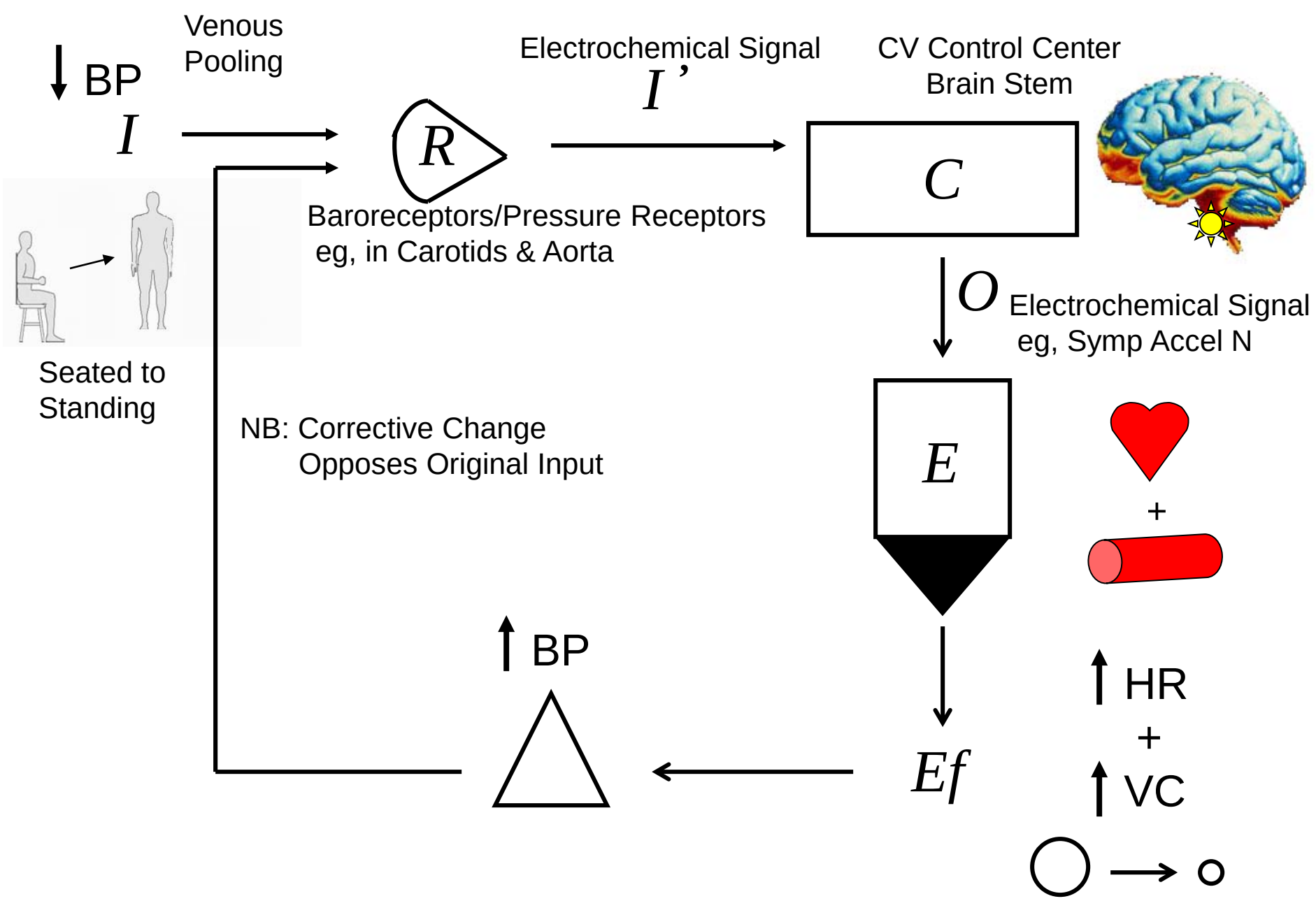
< 30°C

Lethal

29°C

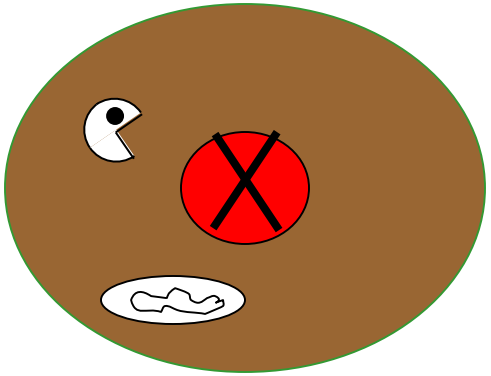
0600 1400 0600 1400

Time of Day


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

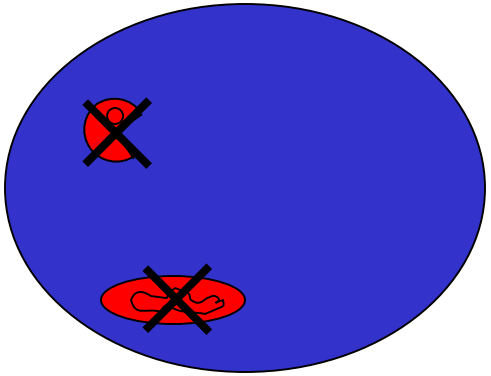
Cytoplasm = Cell - Nucleus

[Extract nucleus; includes organelles]

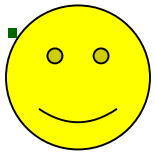


Cytosol = Cytoplasm - Organelles

[Extract organelles; complex gel-liquid]



BI 121 Lecture 3 **Anatomy & Physiology Lab tomorrow!...**



I. ***Announcements*** **Q from lecture or lab?**

II. ***Cell Physiology Connections*** **LS ch 2**

- **A. Exocytosis vs. Endocytosis fig 2-5 a & b, p 25**
- **B. Organelles ≡ ICF specialty shops (continued) ...**
  3. Lysosomes 4. Peroxisomes 5. Mitochondria pp 20-34, fig 2-5 thru 2-8, pp 20-7, tab 2-1 p 36
- **C. *Physiol News* Moms eggs execute Dad's mitochondria?**
- **D. What about vaults? LS 2006, p 32 + *Science News***

III. ***Anaerobic vs Aerobic Metabolism Summary*** **LS ch 2 pp 26-33**

- **A. Key differences fig 2-15 + vpl**
- **B. Selected details: Glycolysis, CAC, ETC, fig 2-9 thru 2-12**

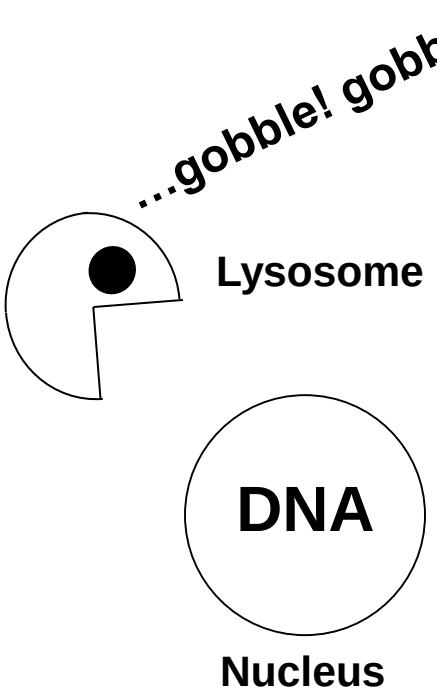
IV. ***Introduction to Genetics*** **LS 2012 ch 2 p 20-1 + Appendix C**

- **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**

Why Compartments? Advantage?

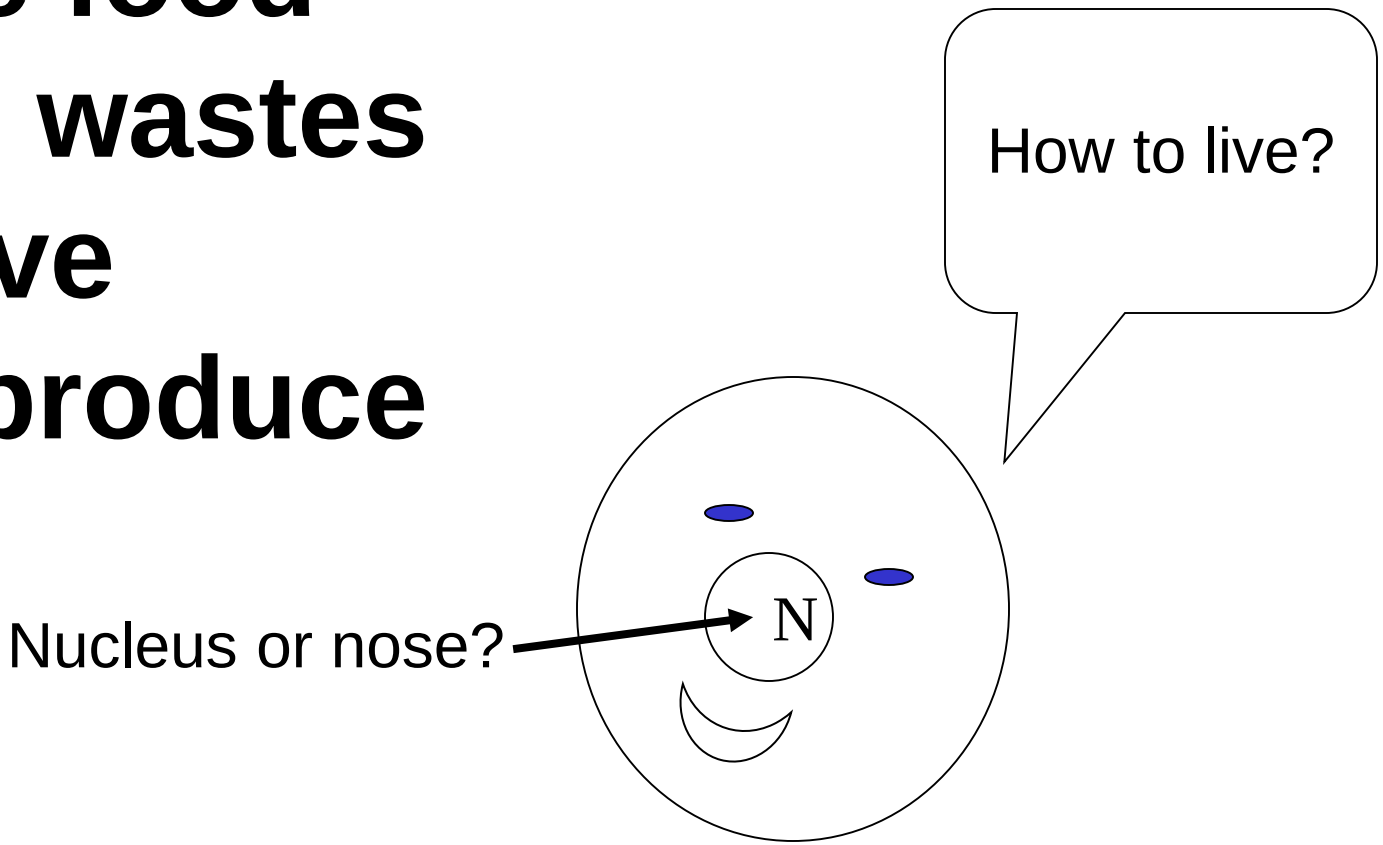
<u>*Incompatible*</u> reactions can take place

<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!

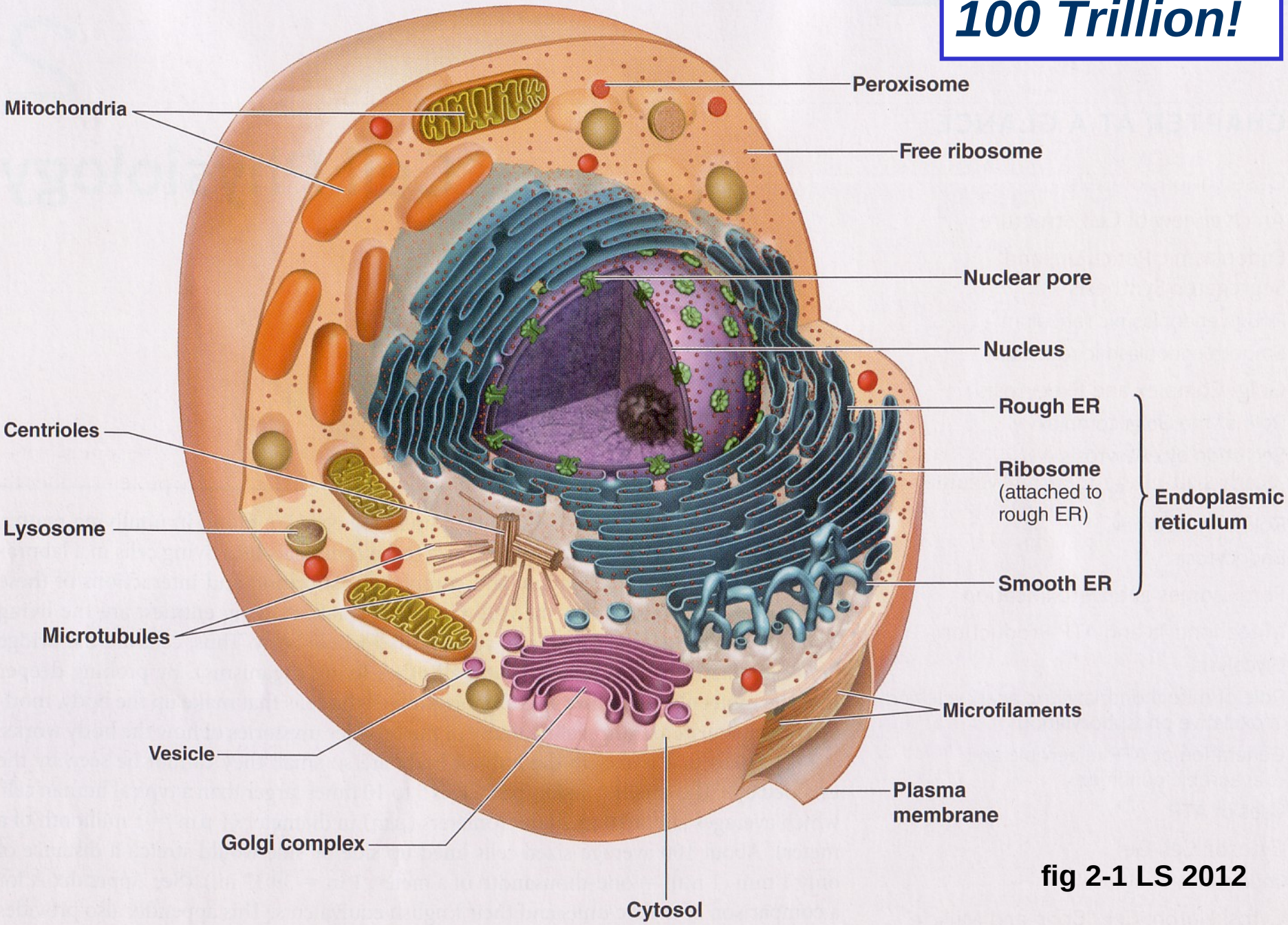
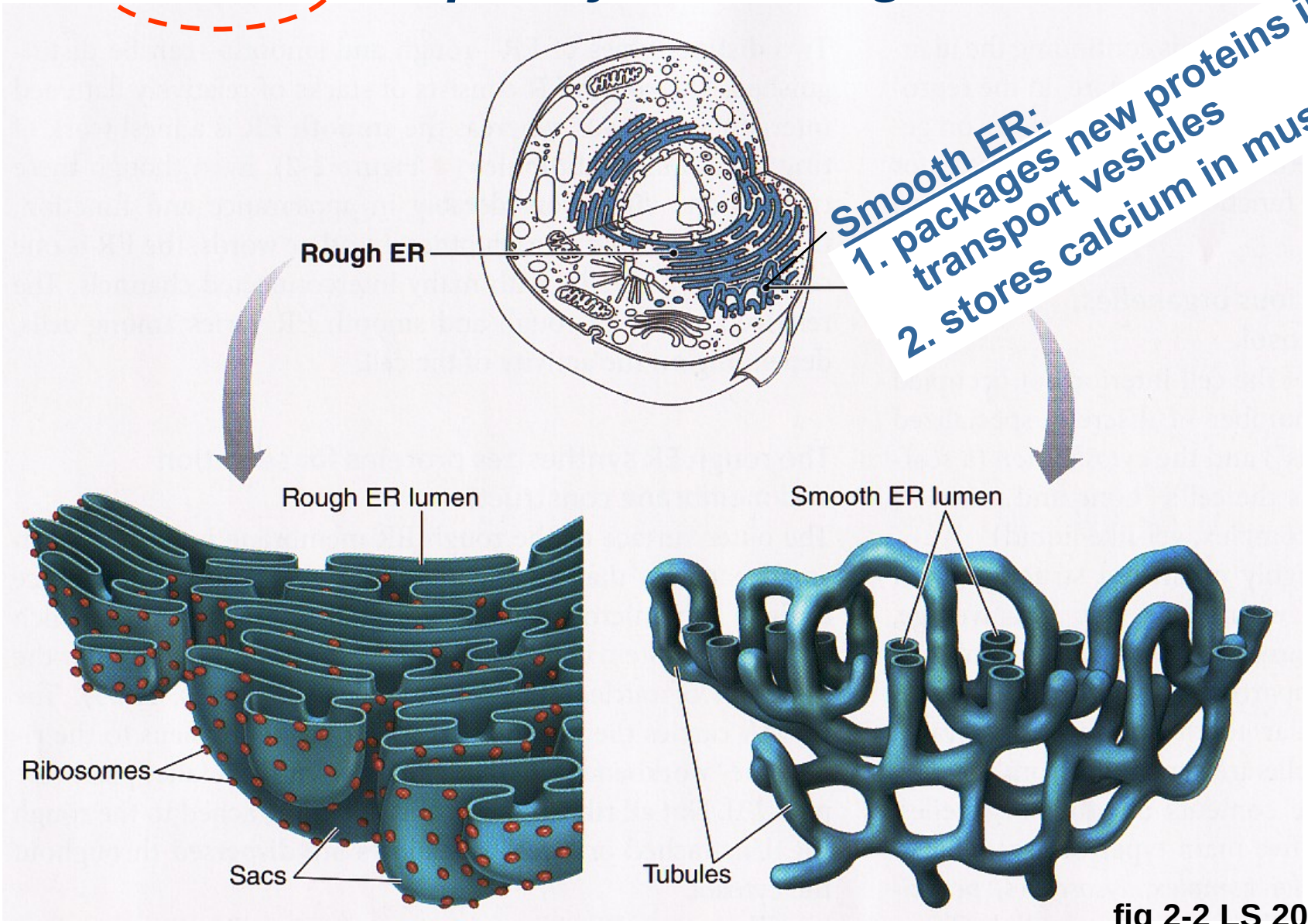


fig 2-1 LS 2012

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

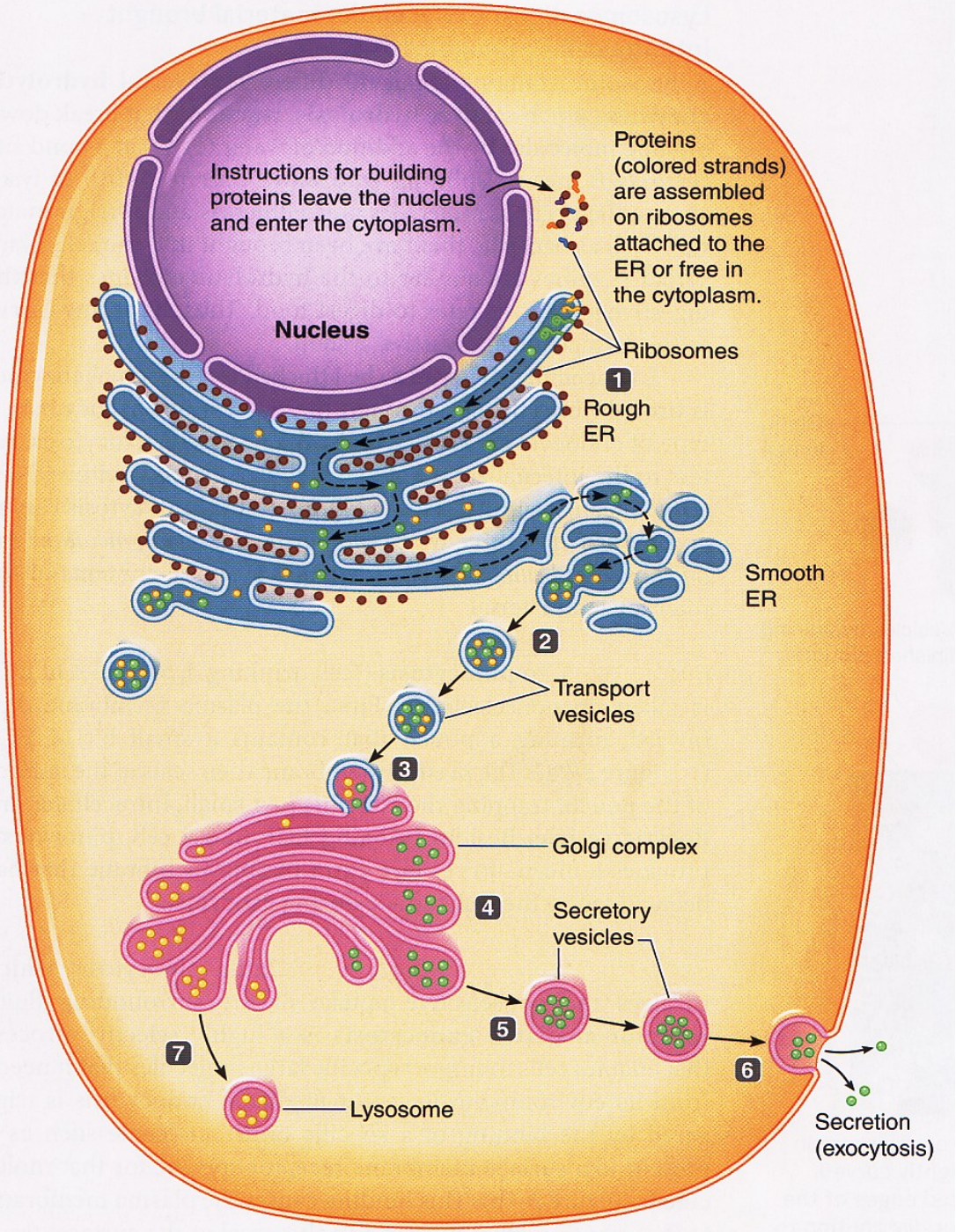


fig 2-3 LS 2012

Lysosomes vs. *Peroxisomes*

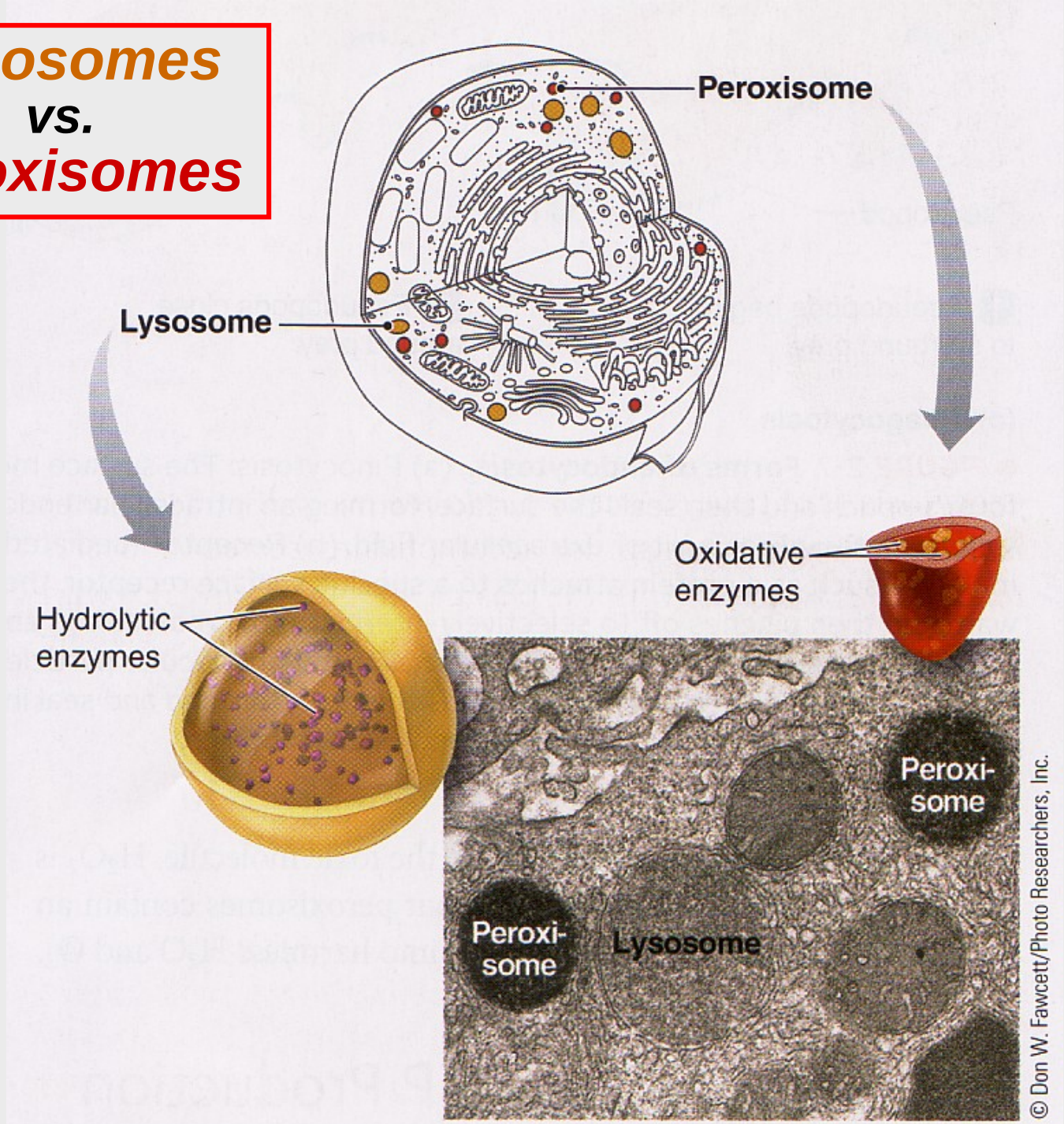
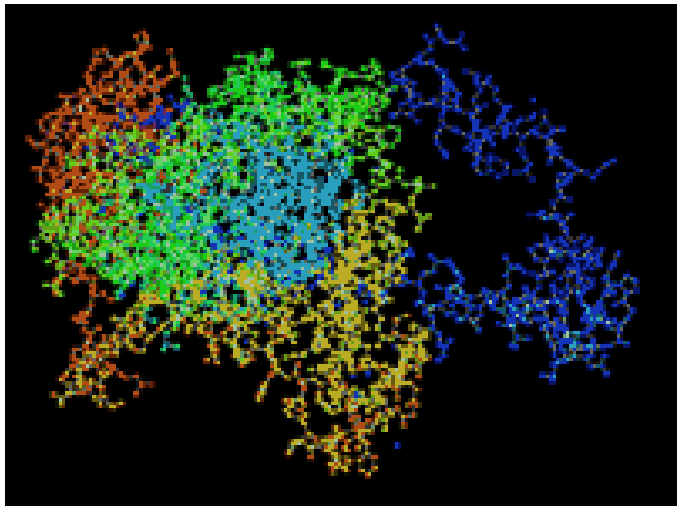


fig 2-6 LS 2012

Catalase Enzyme Reaction in Peroxisomes Neutralize Toxin at Production Site!



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

Mitochondria: Energy Organelles

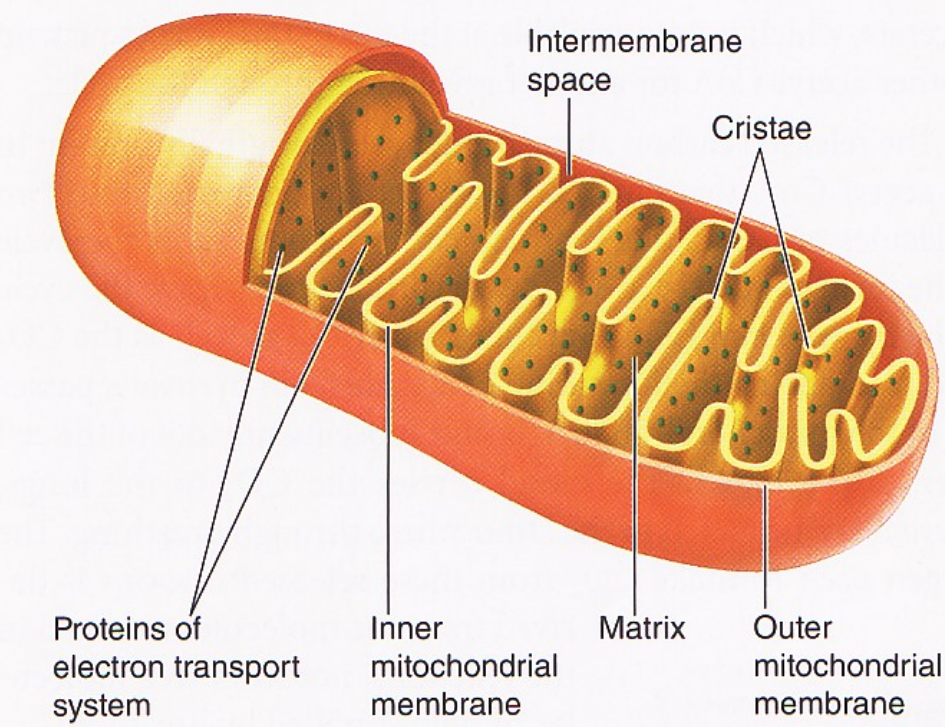


fig 2-8 LS 2012

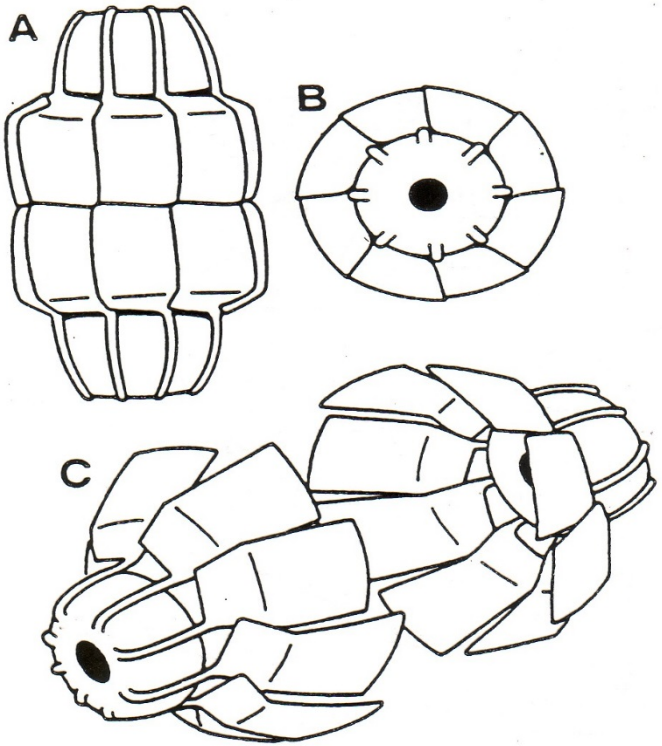
Mom's eggs execute Dad's mitochondria

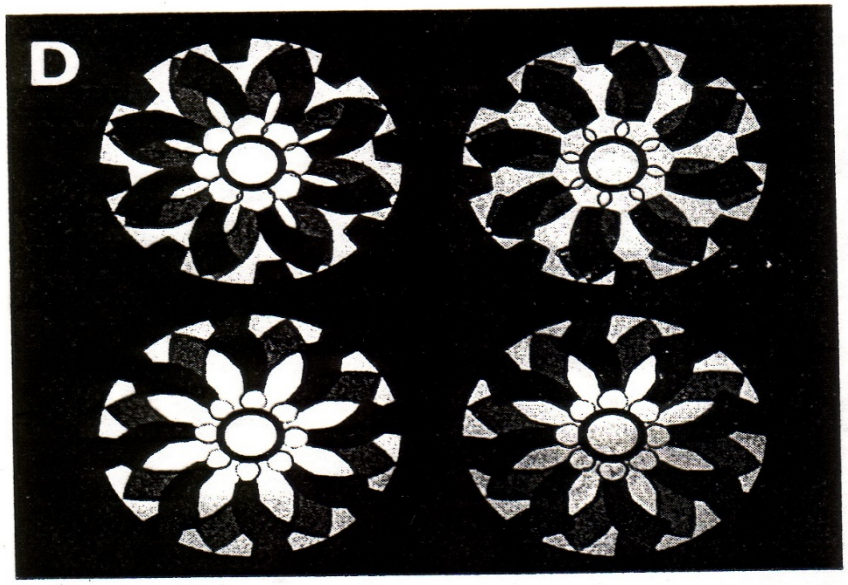
In "Hamlet," Rosencrantz and Guildenstern deliver a letter to the rulers of England that carries the ill-fated duo's own death sentence. Perhaps Shakespeare knew a bit about reproductive biology.

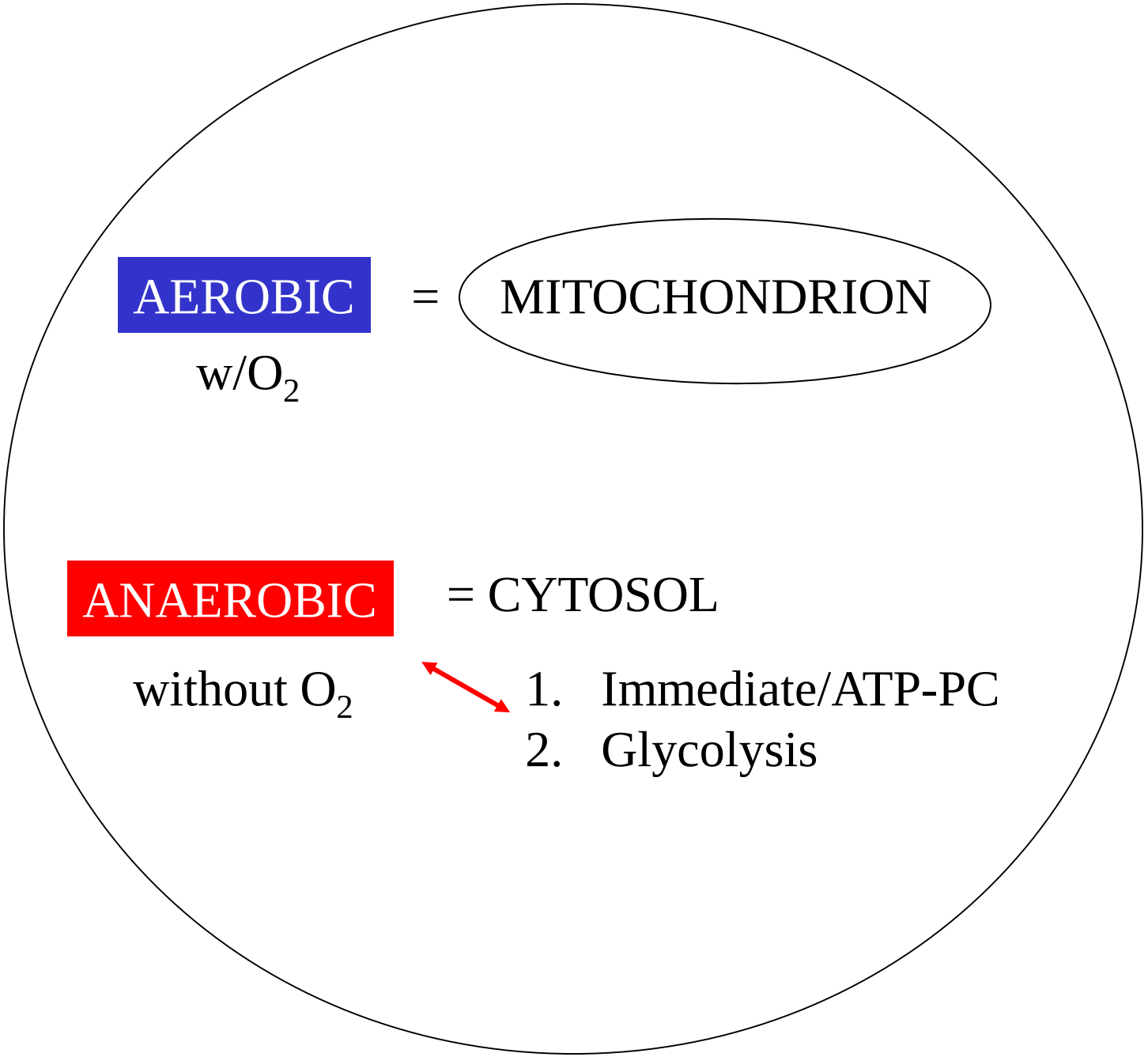
Scientists have now found that during a sperm's creation, its mitochondria—energy-producing units that power all cells—acquire molecular tags that mark them for destruction once the sperm fertilizes an egg. This death sentence, a protein called ubiquitin, may explain why mammals inherit the DNA within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


A
B
C


D

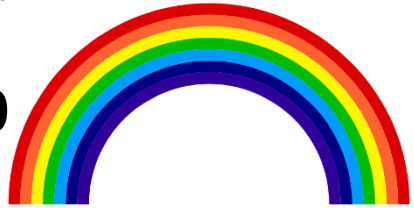

AEROBIC
=
MITOCHONDRION
w/O2
ANAEROBIC
= CYTOSOL
without O2
1. Immediate/ATP-PC
2. Glycolysis

Anatomy & Physiology Lab today!...

BI 121 Lecture 4

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

II. ***Introduction to Genetics*** **LS 2012 ch 2 p 20-1 + Appendix C**
- A. How does information flow in the cell? fig C-6
- B. How does DNA differ from RNA? pp A-20 thru A-22
- C. Genetic code? pp A-22, A-23
- D. How & where are proteins made? fig C-7, C-9
- E. Class skit: Making proteins @ ribosomes!



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: 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. *Nutrition Quackery, Balanced Approach* Kleiner, Monaco+

4 oz → 3 oz

Deck of Cards

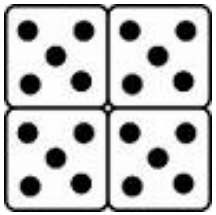
or

≡ 1 c

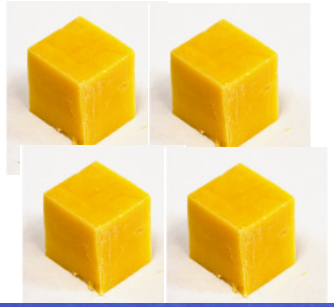
≡

raw → cooked

≡ 1/3 c

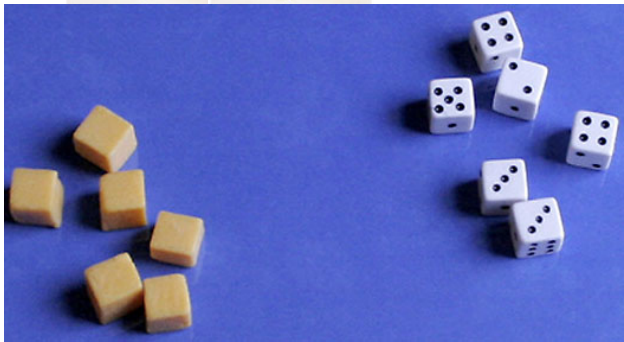


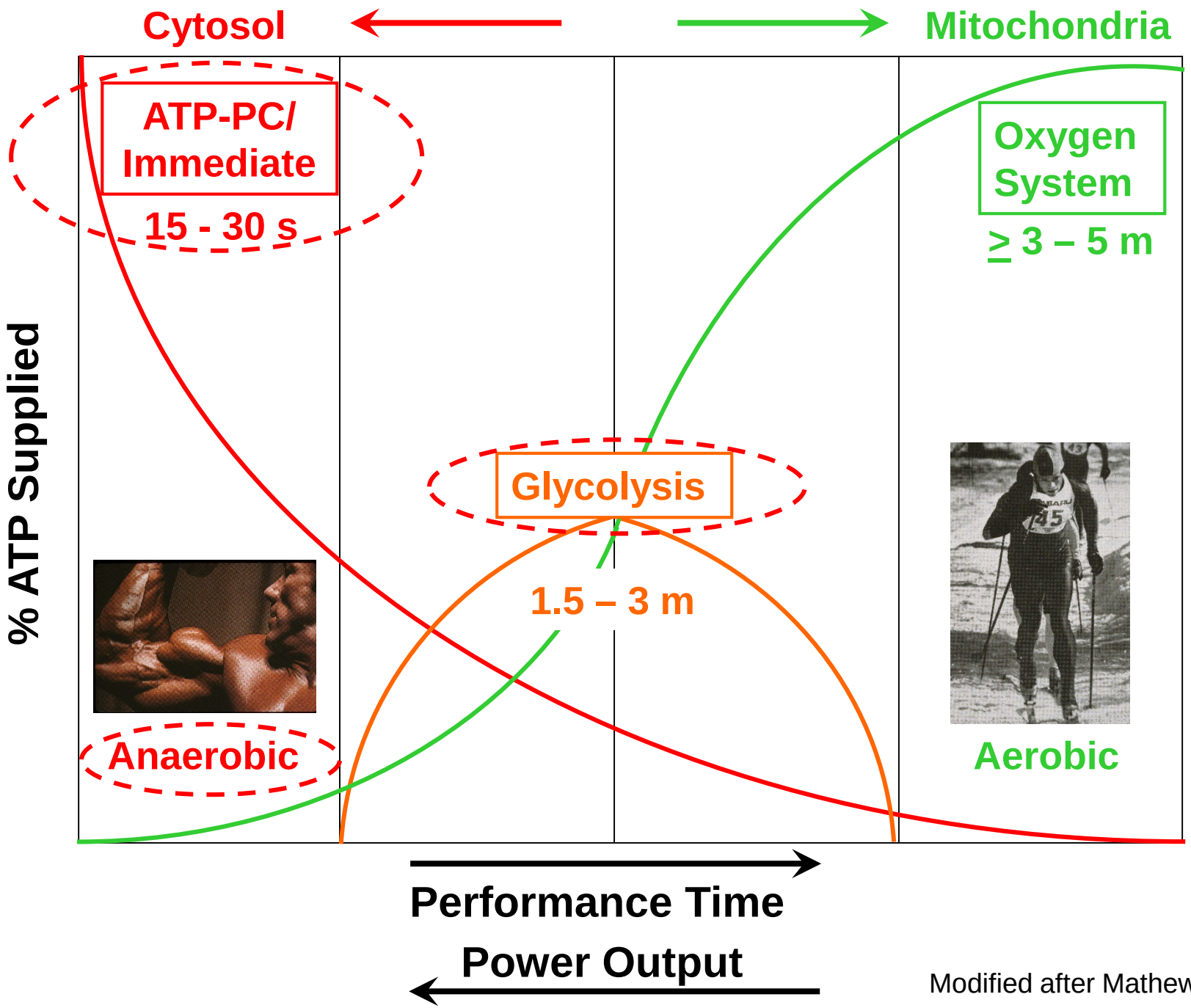
≡ 1 oz



≡ ¼ c

≡ 1.5 oz

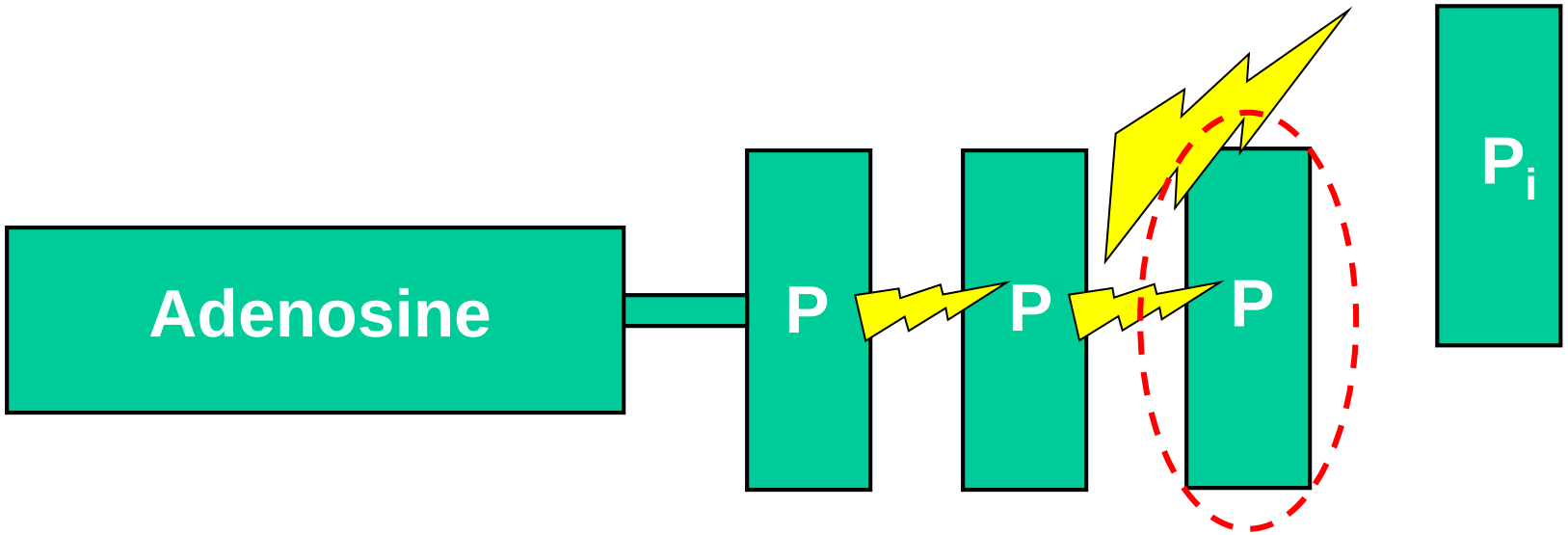




Modified after Mathews & Fox

Cleave One High Energy Phosphate Bond To Do Work!!

7 – 10
KiloCalories/KCal

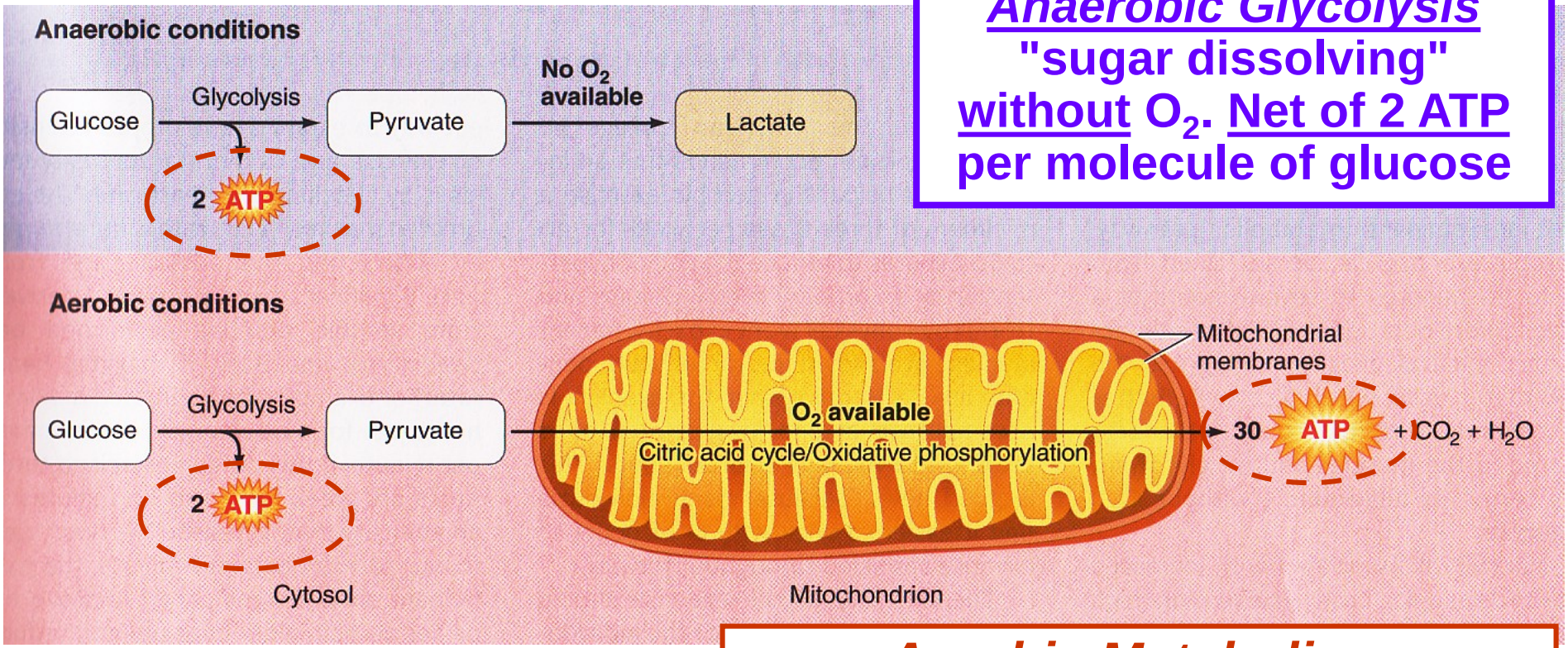


1. *Synthesis of Macromolecules*
2. *Membrane Transport*
3. *Mechanical Work*

Make big things from little things!

Move things! Microscopic! ⟷ Move things! Macroscopic!

Anaerobic vs. Aerobic Metabolism



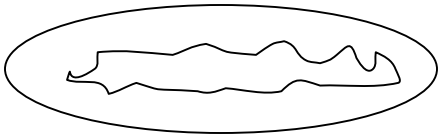
Anaerobic Glycolysis
"sugar dissolving" without O_2. Net of 2 ATP per molecule of glucose

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

ANAEROBIC

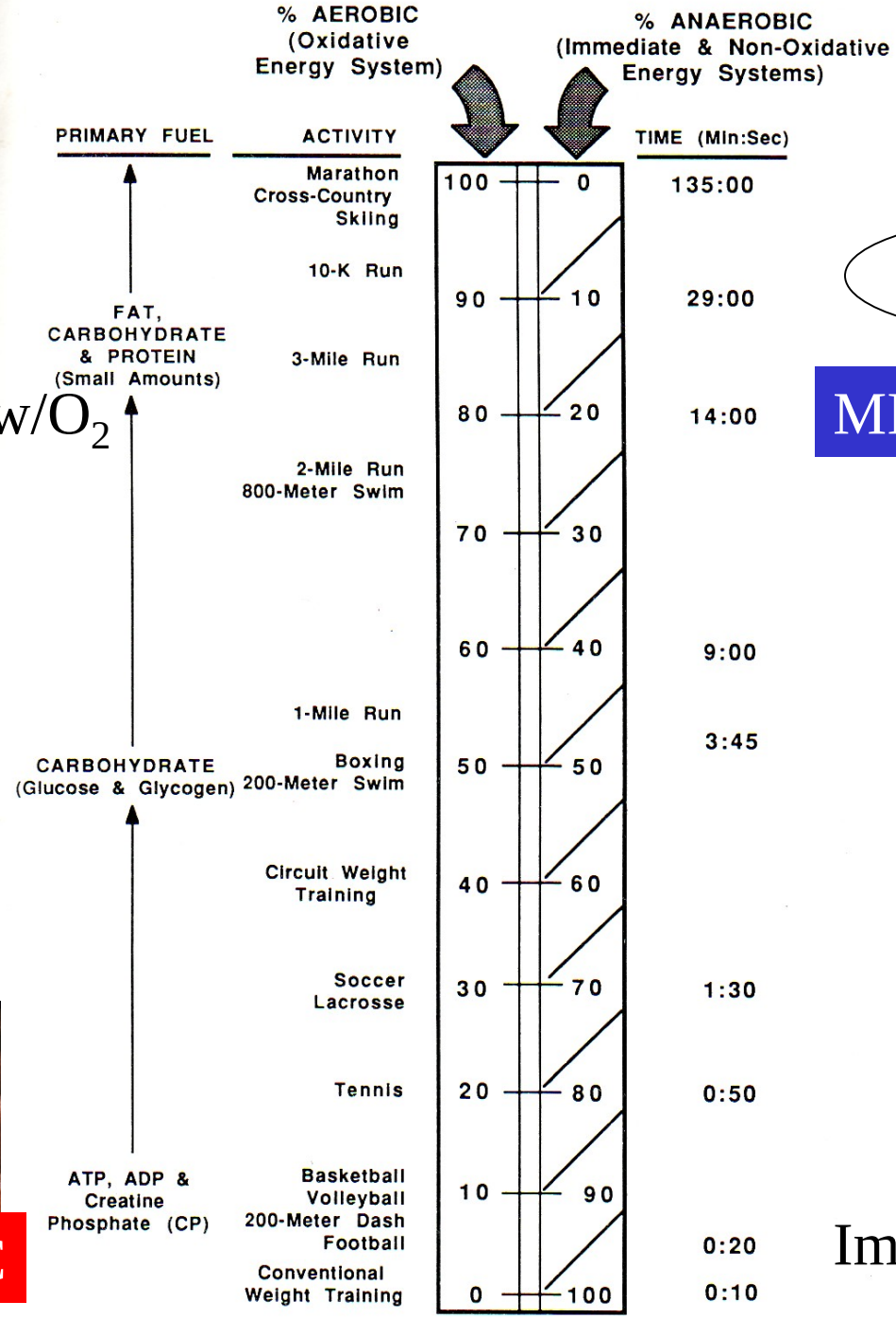


MITOCHONDRIA

CYTOSOL

Glycolysis

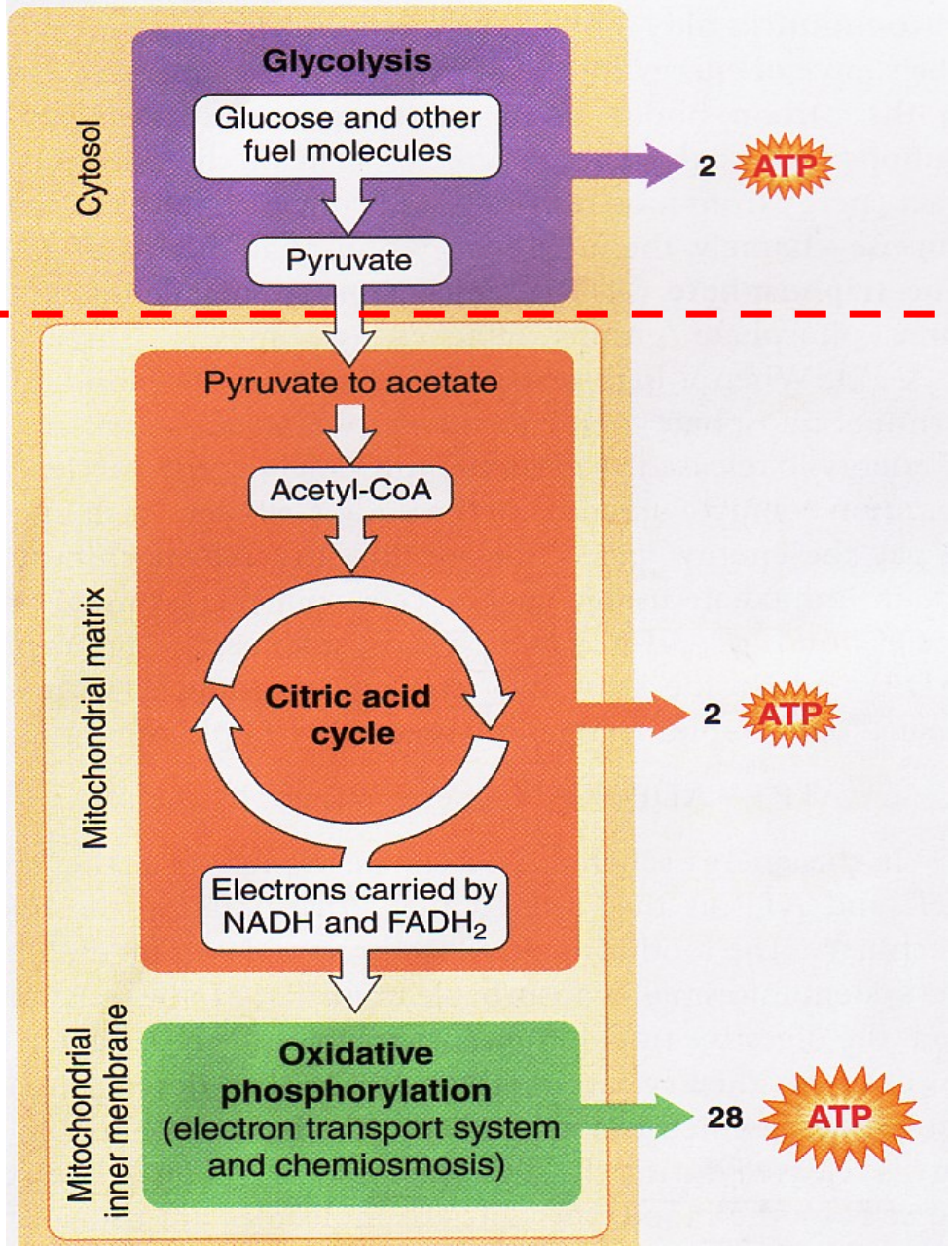
Immediate/ATP-PC



Stages of Cellular Metabolism/Respiration

Anaerobic
Glycolysis
Cytosol

Aerobic
Metabolism
Mitochondria

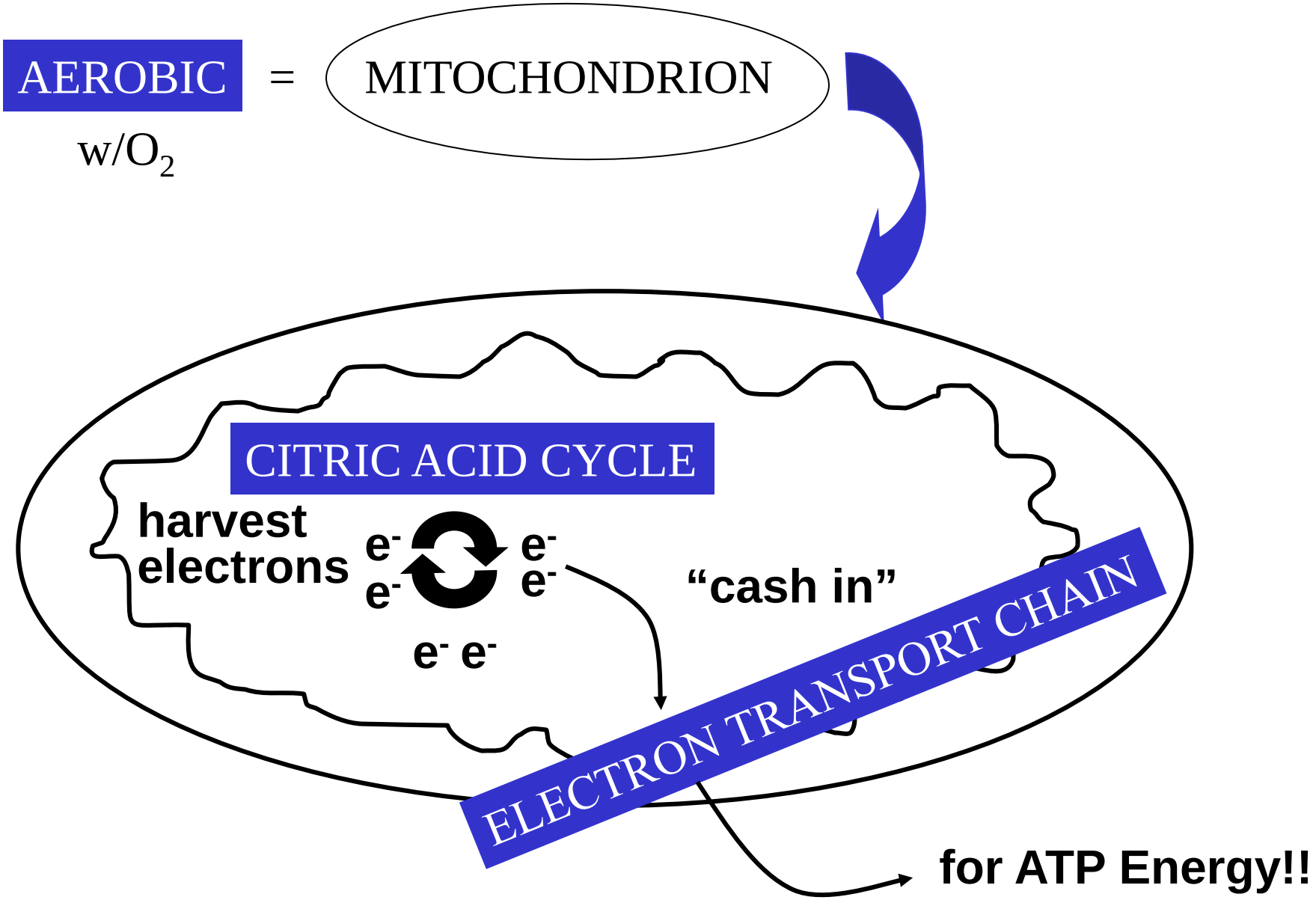


Matrix

Inner Membrane

fig 2-9 LS 2012

Goals of Aerobic Metabolism



BI 121 Lecture 5

Yes, more fun!...

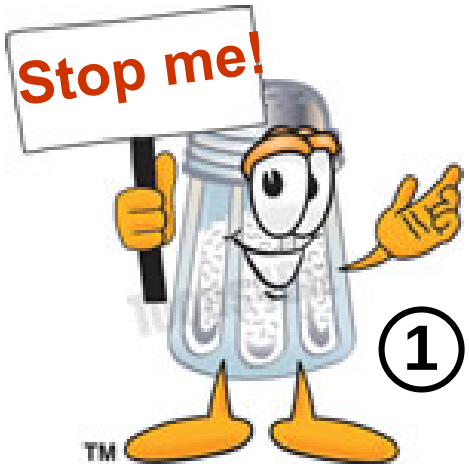
I. *Announcements* Lab 3 tomorrow Nutritional Analyses. Thanks for recording dietary data on LM p 3-7 & exploring *https://www.supertracker.usda.gov/*. Sample MT Questions.

II. *Nutritional Physiology in the News*
UCB Wellness Letter, June 2011, Salt–beyond hypertension
Gain weight by drinking your calories?
UCB Wellness Letter, November 2014, Coconuts are on a roll?

III. *Nutrition Primer* (continued) DC Module 2, Sizer & Whitney (S&W) Science Library
A. What's the best path to losing weight? What about fasting? Zuti & Golding 1976; Sacks *AHA NPAM Council* 2009; AMDR? Adjusted Macronutrient Distribution Range!
B. *Nutrition Quackery, Balanced Approach* Kleiner, Monaco+

IV. *Digestion* LS 2012 ch 15, pp 437-9, DC Module 3 pp 17-23
A. Steps of digestion Dr. Evonuk + LS pp 437- 9; DC p 23
B. Hydrolysis: the central linking theme! LS p 438, Fox 2009
C. What's missing? LS fig 15-1 p 438
D. GI-Donut analogy? Dr. Lorraine Brilla WWU
E. Gut secretions: What? Where? Why? LS p 438, 440-1
F. Organ-by-organ review LS tab 15-1 pp 440-1 + DC fig 3-1

More Reasons to Shake the Salt Habit



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

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

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

④ GI cancer risk, inflammation?

UCB Wellness Letter Jun 2011 p 5

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

≡

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

Better choices!

Many claims with little scientific, peer-reviewed, research support

http://www.doctoroz.com/videos/surprising-health-benefits-coconut-oil

Coconut Oil Health Benefits

- Improves or Reverses Alzheimer's Disease
- Improves Type 2 AND Type 1 Diabetes
- Improves or Heals Many Skin Diseases
  - Fungal Infections
  - Acne
  - Eczema
  - Keratosis Polaris
  - Psoriasis
  - Rosacea
- Provides Peak Performance Energy
  - Drug-free Energy
  - Longer Endurance
- Kills Candida Fungus
- Helps with Hypothroidism
  - Increases Metabolism
  - Raises Body Temperature
- Conditions and Strengthens Hair
  - Penetrates Roots
  - Kills Lice
  - Improves Dandruff
- Kills many Bacteria AND Viruses
- Promotes Weight Loss
  - Preserves Muscle Mass
  - Promotes Ketosis

Find all the research at: CoconutOil.com

Coconut Oil Nutritional Wonder?

Claims?

http://coconutoil.com/about-us/

Review articles, last 5 yr (1) on health benefits?

http://www.ncbi.nlm.nih.gov/pubmed/?term=coconut+oil+health+benefits

Other articles?

http://www.ncbi.nlm.nih.gov/pubmed/10948851

http://www.ncbi.nlm.nih.gov/pubmed/22260106

The bottom line?

http://www.cspinet.org/nah/articles/coconut-oil.html

http://www.health.harvard.edu/newsletters/Harvard_Health_Letter/2011/May/coconut-oil

http://health.clevelandclinic.org/2012/05/heart-healthy-cooking-oils-101/

http://en.wikipedia.org/wiki/Smoke_point

Coconuts are on a roll?

1. ***Blood Cholesterol &*** ❤ ***Health?*** **Lauric acid, 1^0 saturated fat may ↑ HDL good > LDL bad cholesterol, but depends on fat replaced. Neutral effect? Still don't really know!**

2. ***Weight Loss?*** **Medium change fatty acids metabolized uniquely. Few human studies on body weight have had inconsistent results. Like all edible oils, high in kcal (120/Tbsp) so counterproductive.**

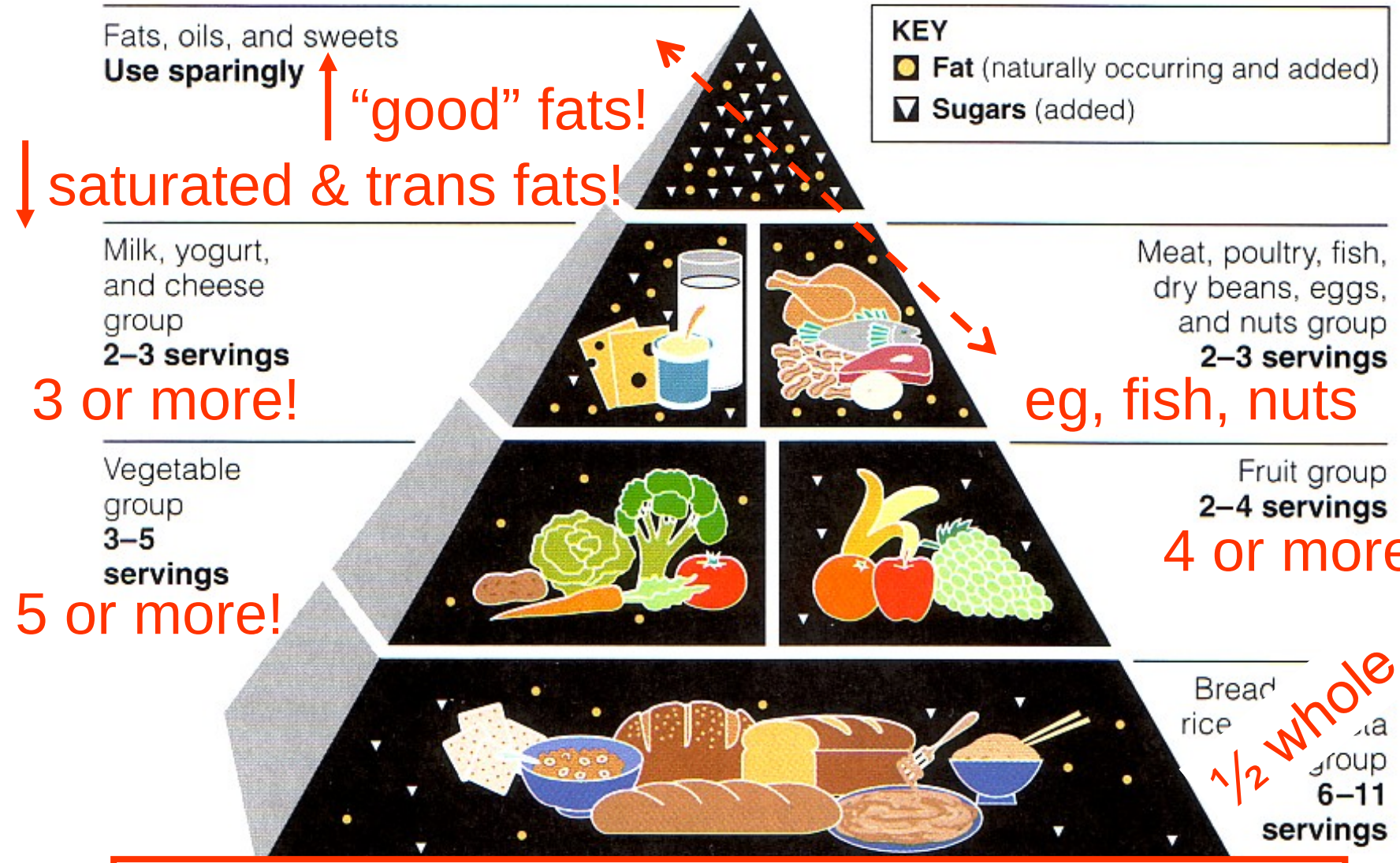
UCB Wellness Letter **Nov 2014 p 1 & 5**

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*

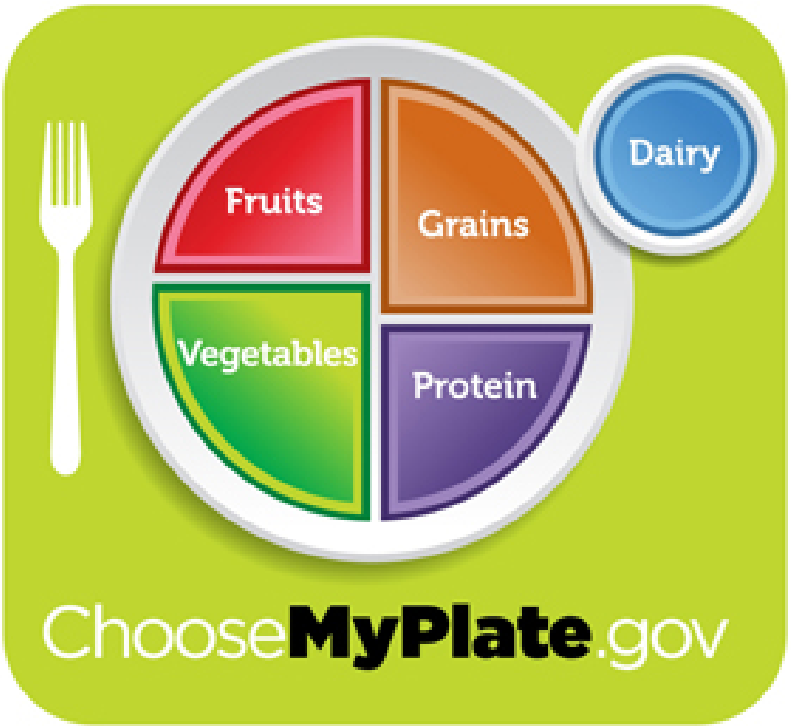
US Modifications to 1992 Food Pyramid 2005



Regular Physical Activity: Exercise! Exercise!!

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)

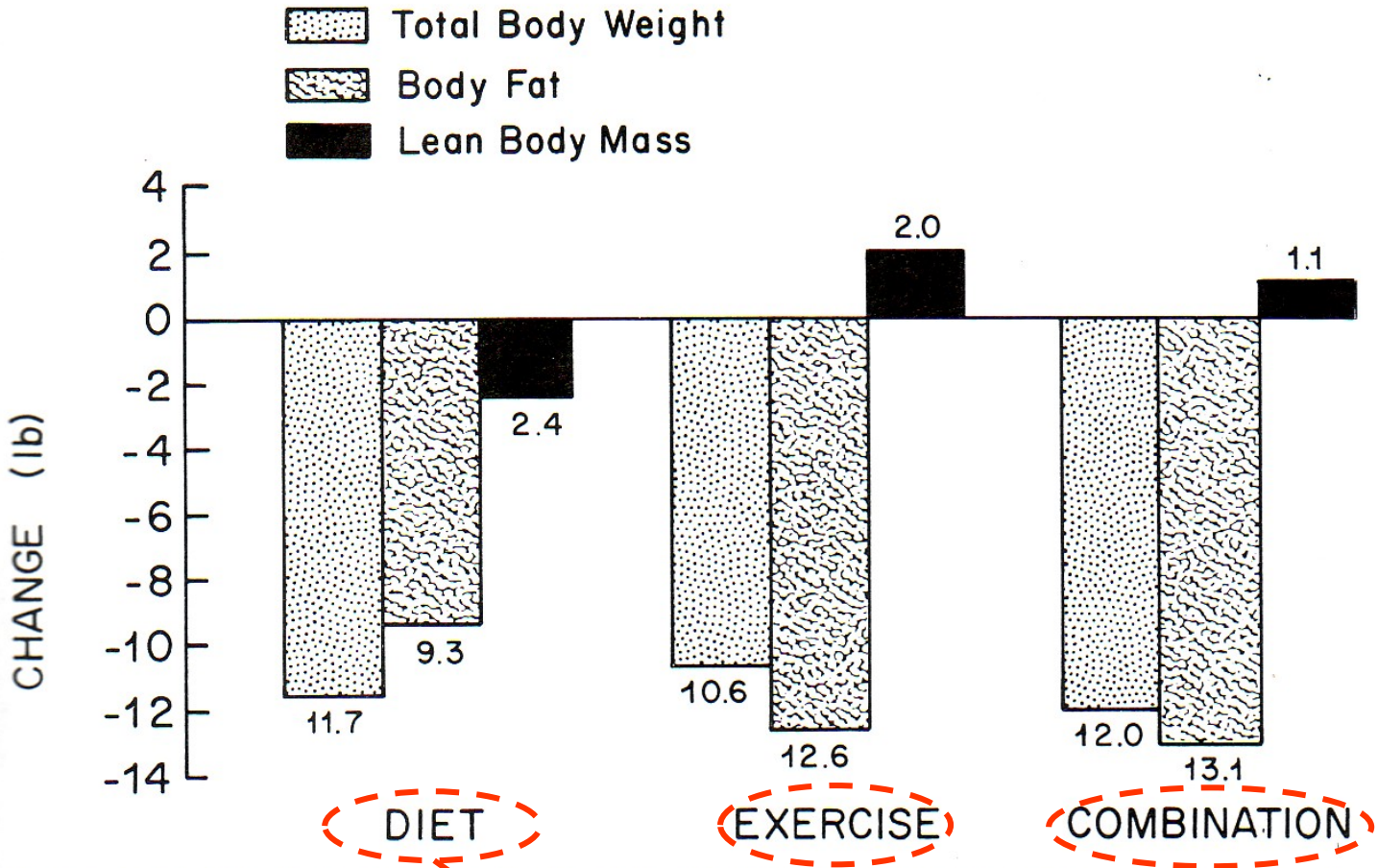
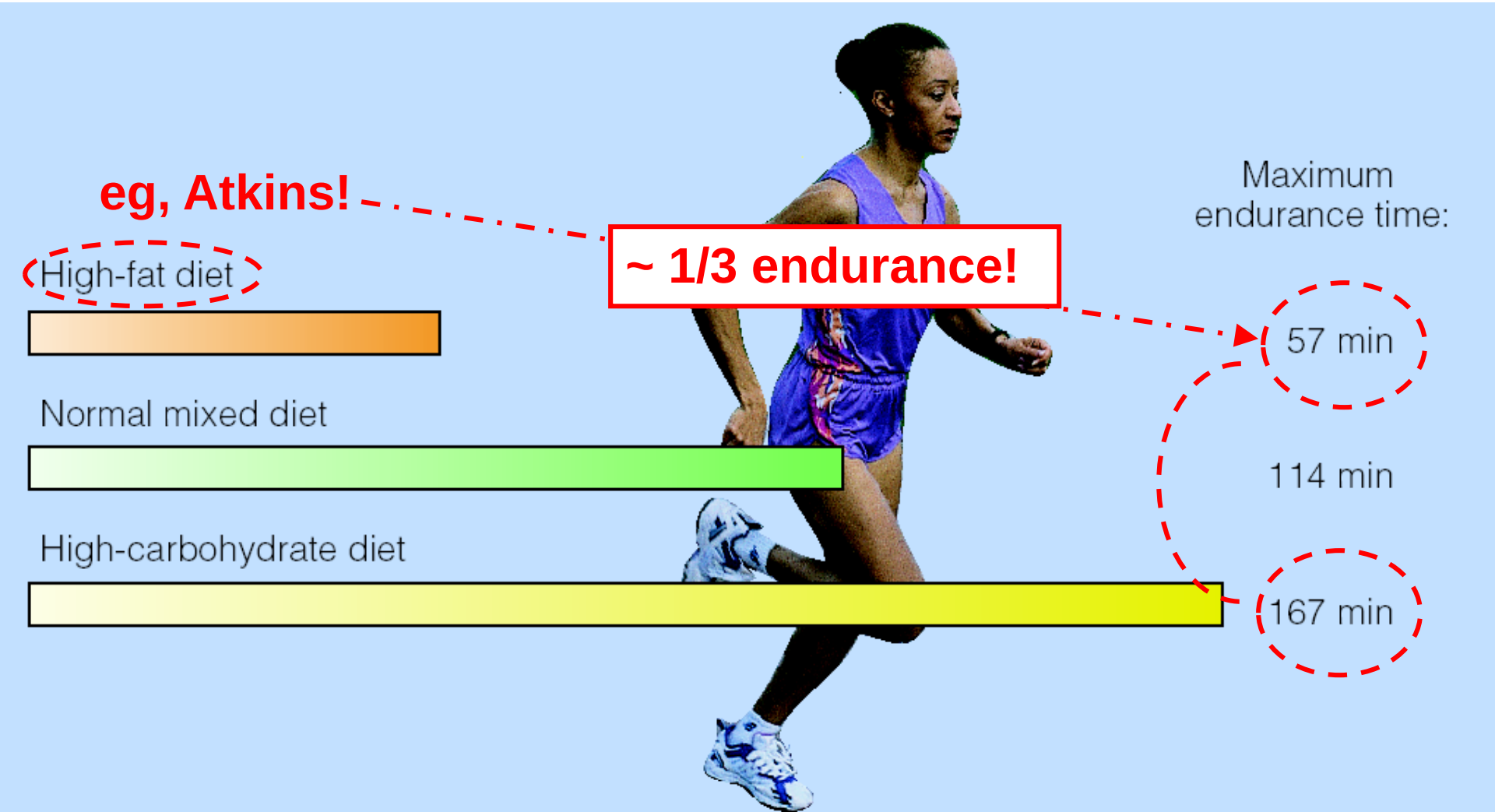


Figure 4–9. Changes in body weight, body fat, and lean body weight for diet, exercise, and combination groups. (From Zuti W. B., and Golding, L. A.: Comparing diet and exercise as weight reduction tools. **Phys. Sportsmed.** 4:49–53, 1976.)

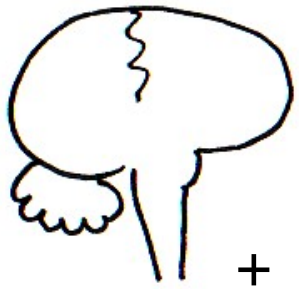
***NB*: Each group 500 kcal deficit/day, 16 weeks**

Dietary Composition & Physical Endurance



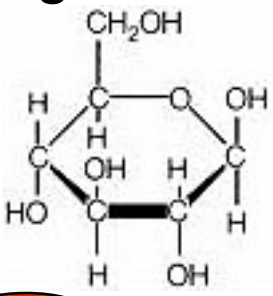
cns

2



+

glucose



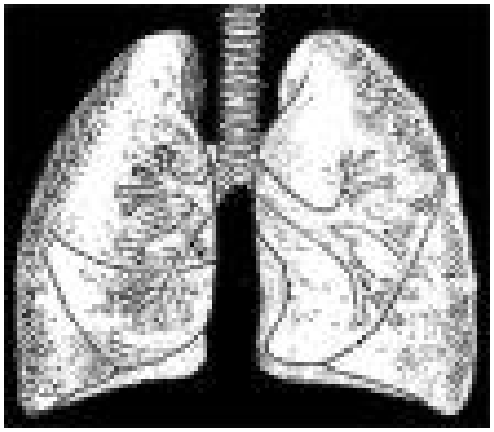
rbcs

3

Negative Effects of Low Carbohydrate

1

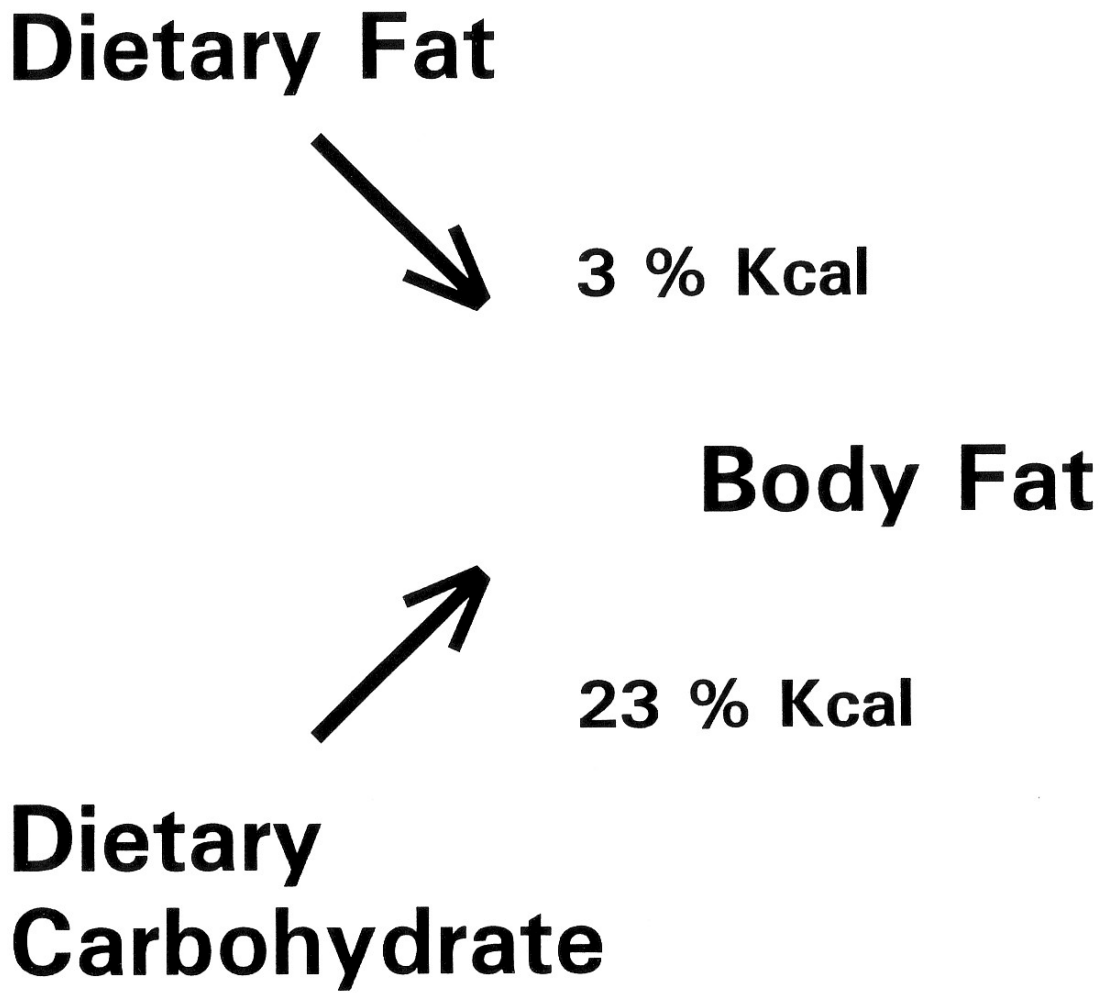
4



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

+ gall stones, ↓ thermoregulation...

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

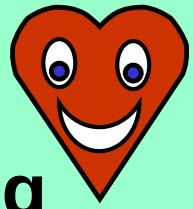
76.7% { **26 lb Water**

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)!

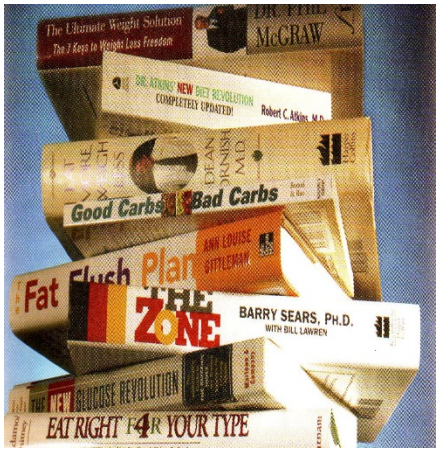
Energy Nutrient	*% Total Calories*
Carbohydrate	**45-65%**
Fat	**20-35%**
Protein	**10-35%**

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

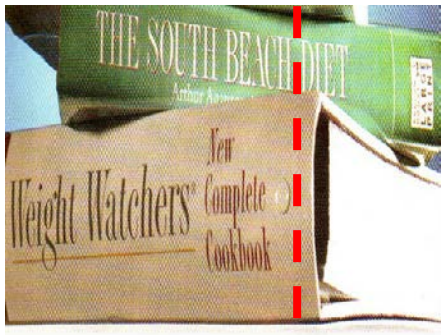
1. **Treatment based on unproven theory calling for non-toxic, painless therapy.**
2. **Author's/purveyor's credentials aren't recognized in scientific community.**
3. **No reports in scientific, peer-reviewed literature but rather mass media used for marketing.**
4. **Purveyors claim medical establishment 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.**

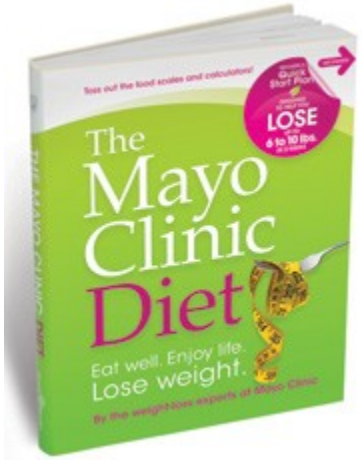
NOT PEER-REVIEWED =

TRADE BOOKS

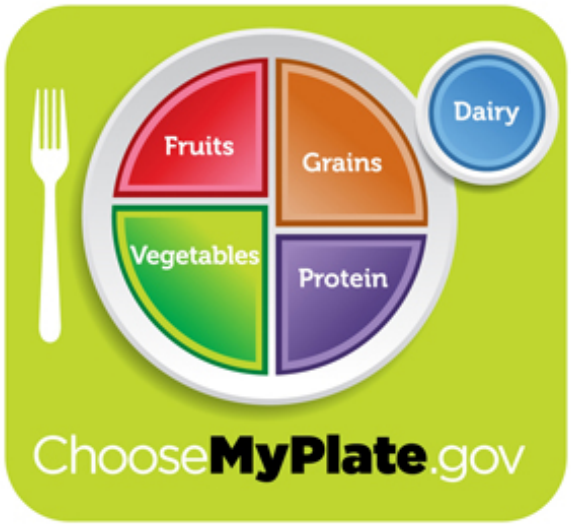


PEER-REVIEWED = TEXTS → RESEARCH





AHA + DASH + MAYO CLINIC



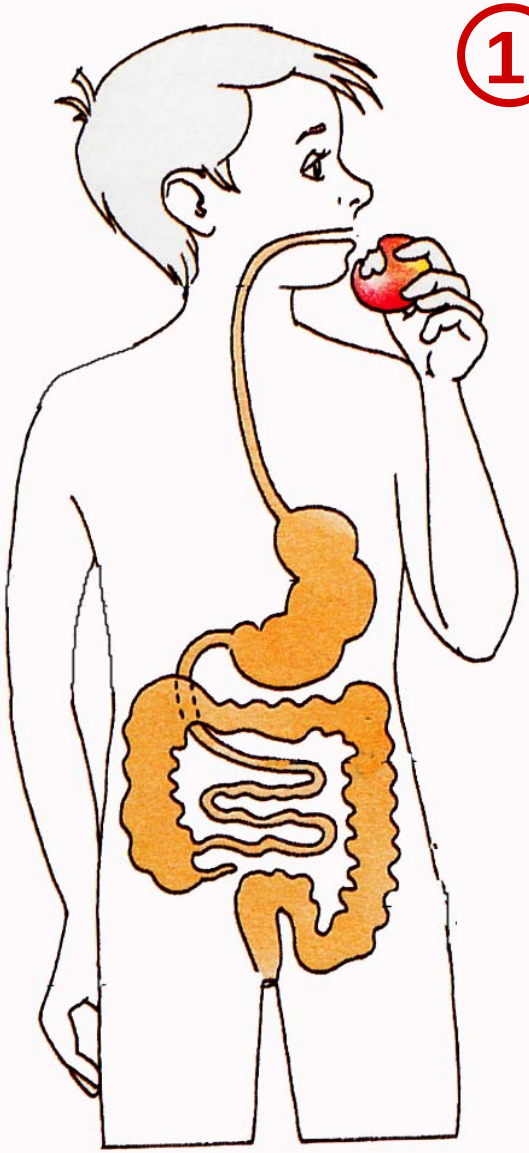
LOWER CARBOHYDRATE

LOWER FAT

ELIMINATE CALORIES or FOOD GROUPS ENCOURAGE FASTING

ADEQUACY BALANCE CONSISTENCY & MODERATION

Digestion Steps

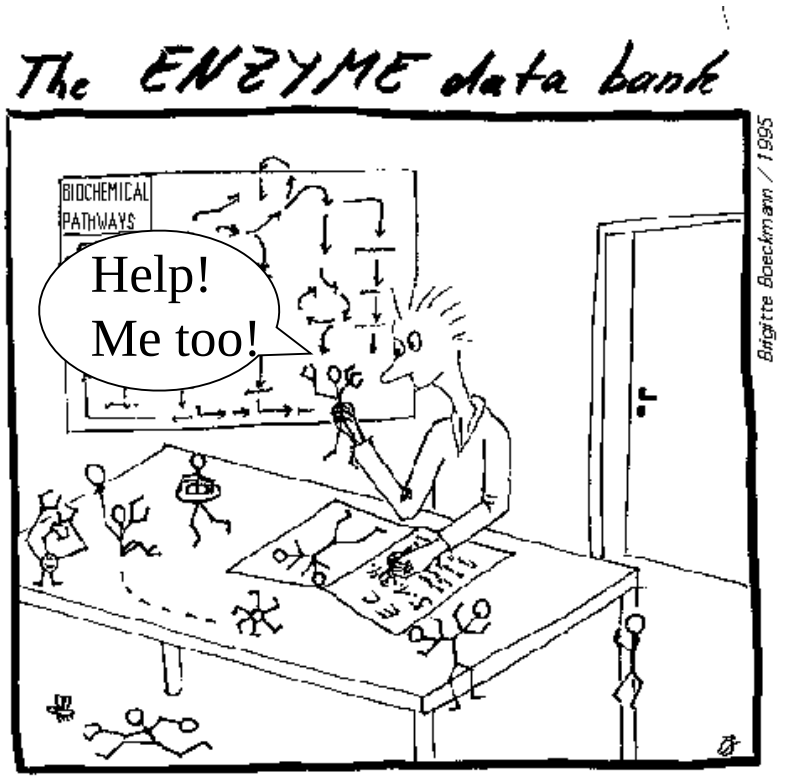


1. Ingestion
2. Mechanical Digestion
3. Chemical Digestion
4. Peristalsis
5. Absorption
6. Storage
7. Defecation

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

Hydrolysis of Energy Nutrients

+

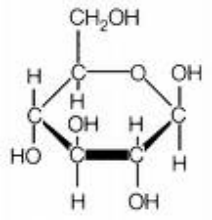


H_2O + Enzyme

Polymer to Monomer (Many to One)

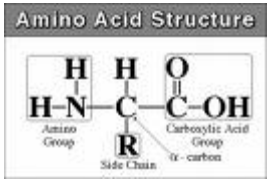
…Central-linking theme!!

Carbohydrate

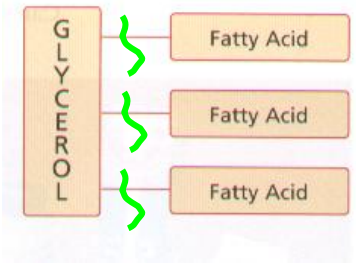


Glucose

Protein
+
Fat

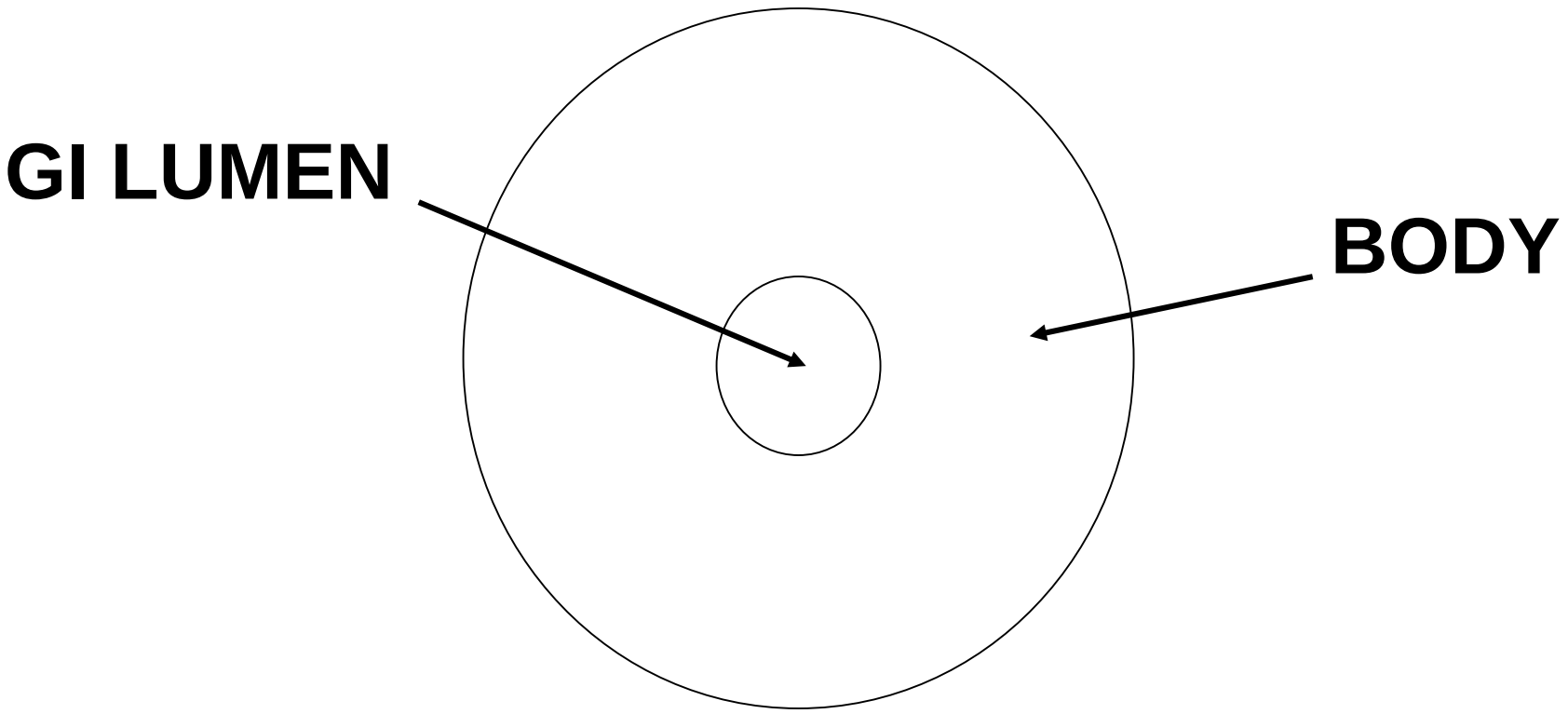


Amino Acids



Fatty Acids
+
Glycerol

GI-DONUT ANALOGY



Gut Secretions

Secretion	***Release Site***
1. Mucus	**into GI Lumen**
2. Enzymes	**into GI Lumen**
3. H_2O, acids, bases+	**into GI Lumen**
4. Hormones	**into Blood**

1. Mouth

Ingestion entry way
salivary gland secretion
mucus + enzymes
enzymatic digestion: carbohydrate
mastication = chewing
deglutition = swallowing

2. Esophagus

Rapid transit
peristalsis
secretion mucus

3. Stomach

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

4. Liver-Gall Bladder

Emulsification =
detergent action of bile
+ secretion

5. Pancreas

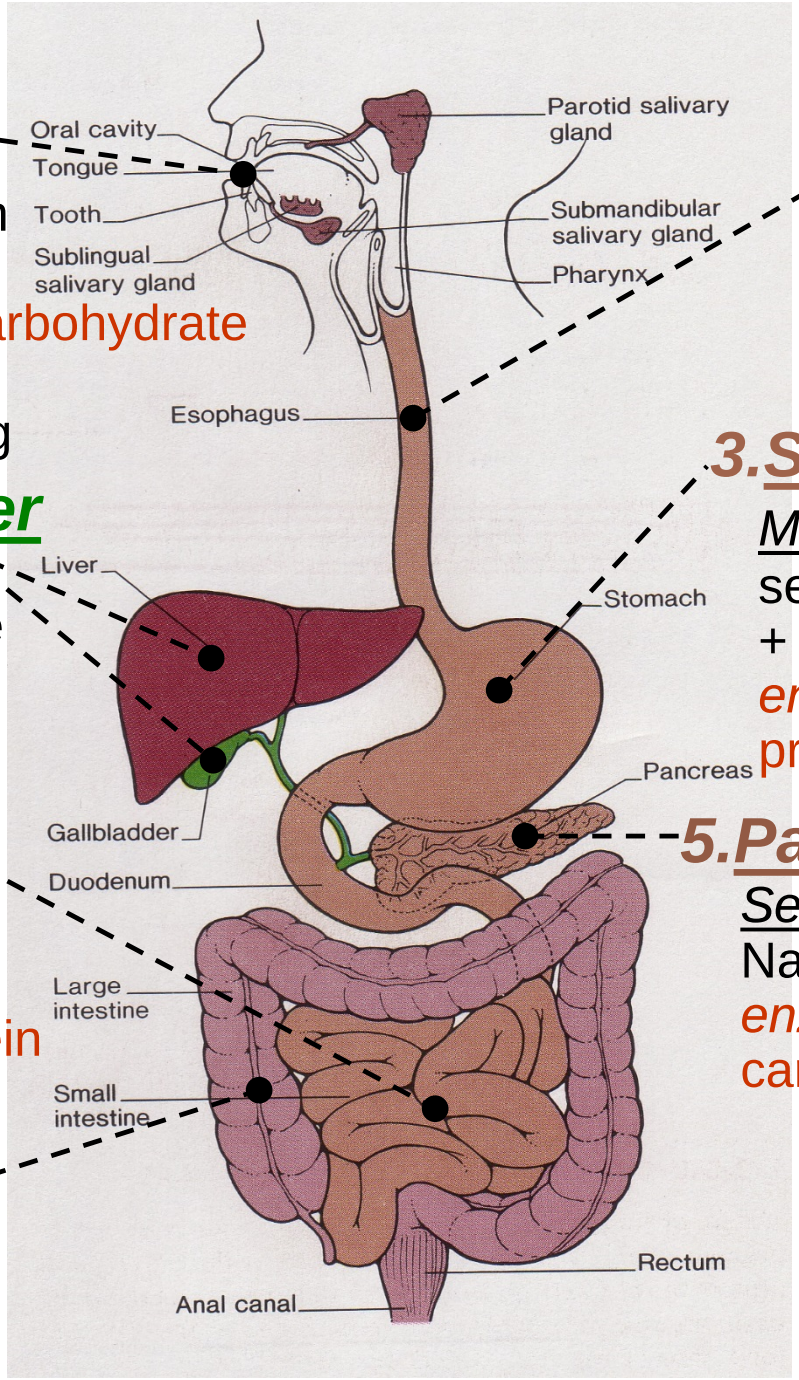
Secretion mucus +
$NaHCO_3$ + enzymes
enzymatic digestion:
carbohydrate, fat, protein

6. Small Intestine

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

7. Large Intestine

Dehydration
secretion + absorption
storage + peristalsis



Common Control Mechanisms

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

Hey – I'll be ready because I book it!!

BI 121 Lecture 6 + Q + ½ Midterm Review

I. ***Announcements*** **Next session Q? ~½ review, then Midterm.**
Fun Lab 3 Nutrition today! Sample Suisse Calculation? Q?

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

III. ***Digestion Connections*** **LS ch 15, DC Module pp 17-23**
- **A. Histology of the gut LS fig 15-2, 15-3 p 442-3**
- **B. Stomach protein digestion + zymogens? LS fig 15-7, 15-9**
- **C. Accessory organs: Pancreas & Liver + Recycling! LS pp 457-63**
- **D. Small intestine? Ulcers? LS fig 15-20,15-22 pp 467-8**
  http://www.cdc.gov/ulcer **Beyond the Basics LS p 456**
- **E. Summary of chemical digestion LS tab 15-5 p 466**
- **F. Large intestine? LS fig 15-24 pp 472-4**

IV. ***Midterm Review*** **Discussion + Q?**

How Do I Calculate the % of Total Calories from Carbohydrate, Fat & Protein?

Carbohydrate 46 g x 4 kcal/g = 184 kcal

% Carbohydrate = 184/567 = 0.326 ≡ ~33%

Fat 39 g x 9 kcal/g = 351 kcal

% Fat = 351/567 = 0.619 ≡ ~ 62%

Protein 8 g x 4 kcal/g = 32 kcal

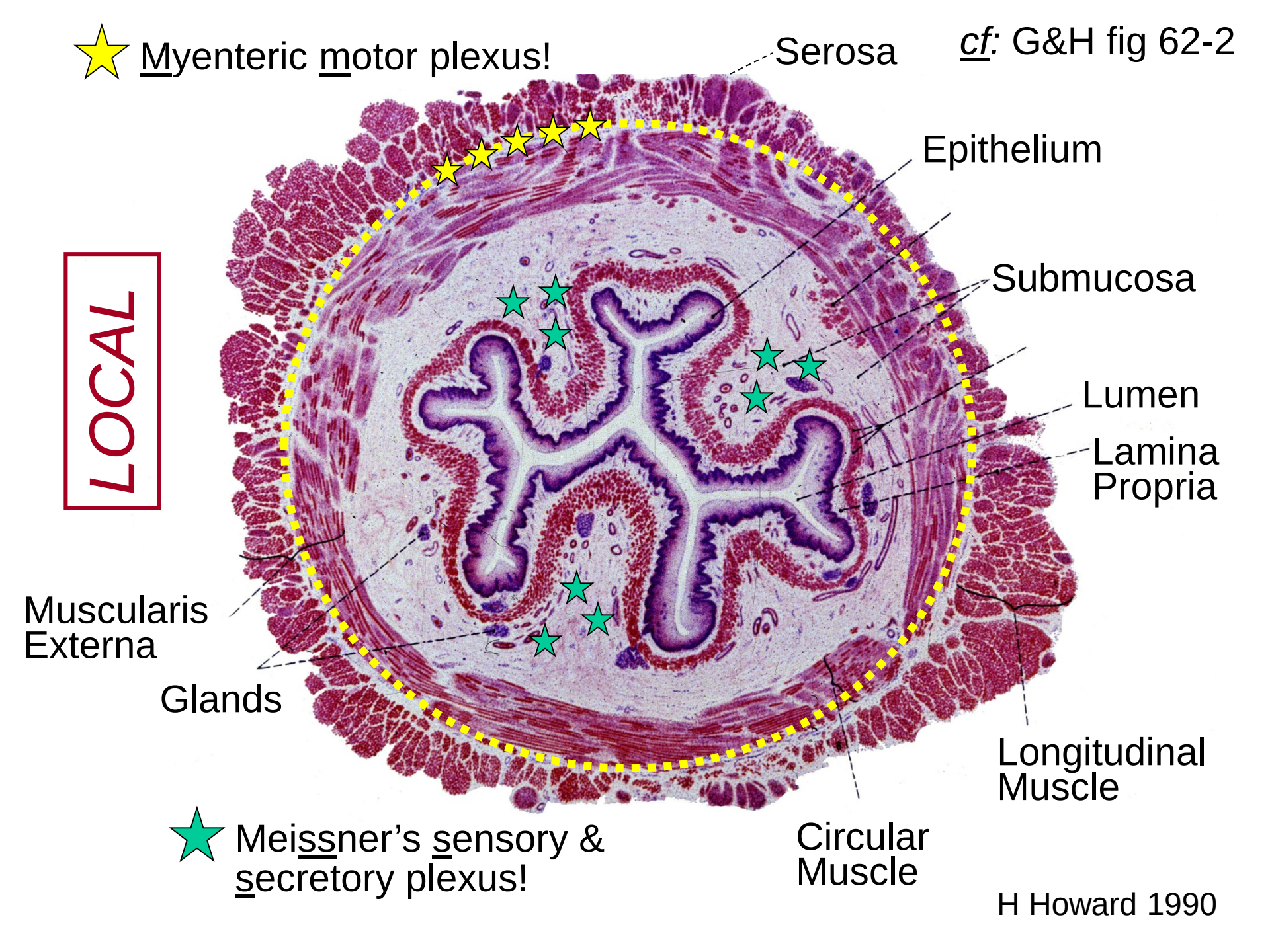
% Protein = 32/567 = 0.056 ≡ ~ 6%

∑ = 567 kcal

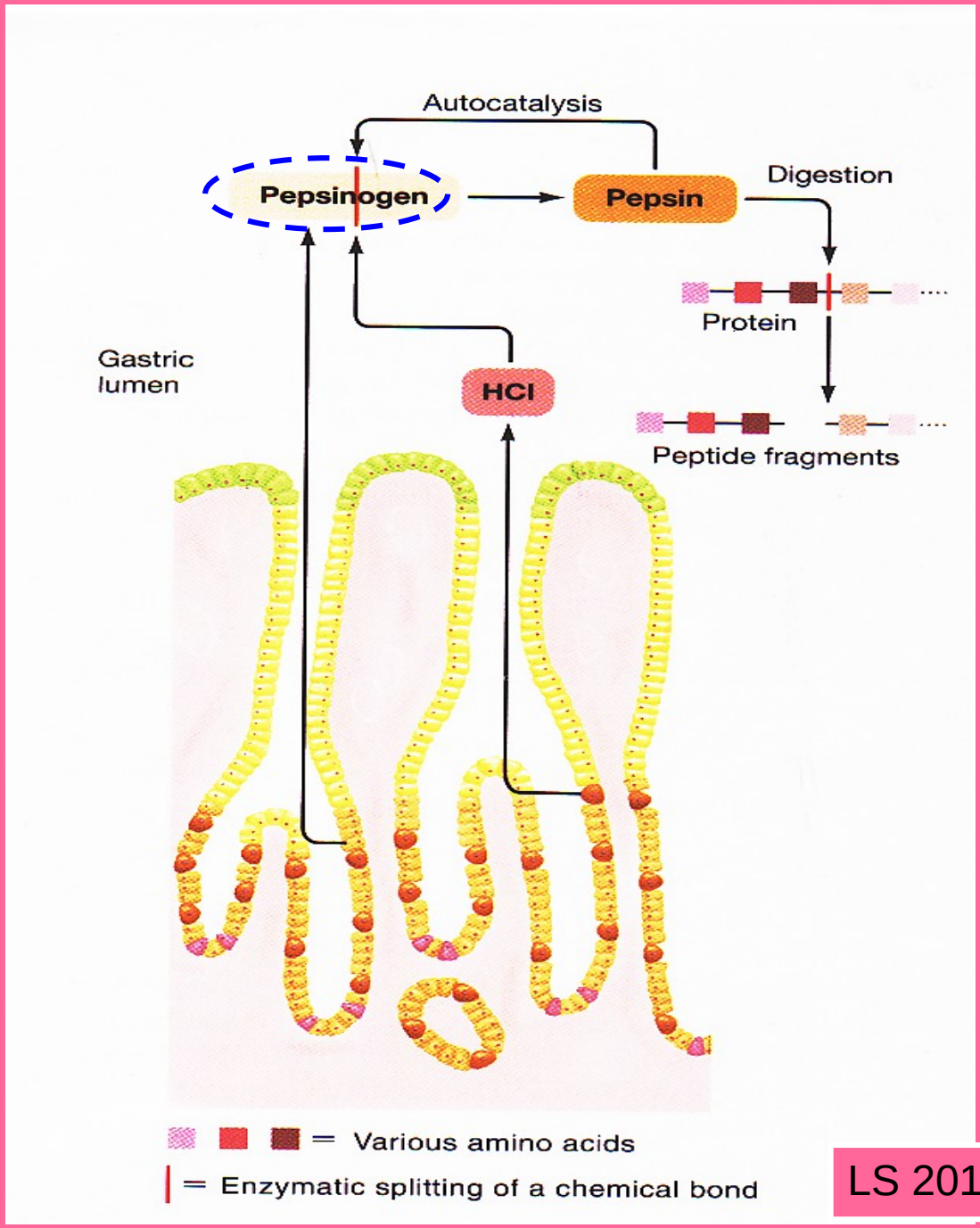
American Institute for Cancer Research (AICR) Healthy Grilling Quiz Summary

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. Cook small portions/kebabs.**

AICR Newsletter, Summer 2006

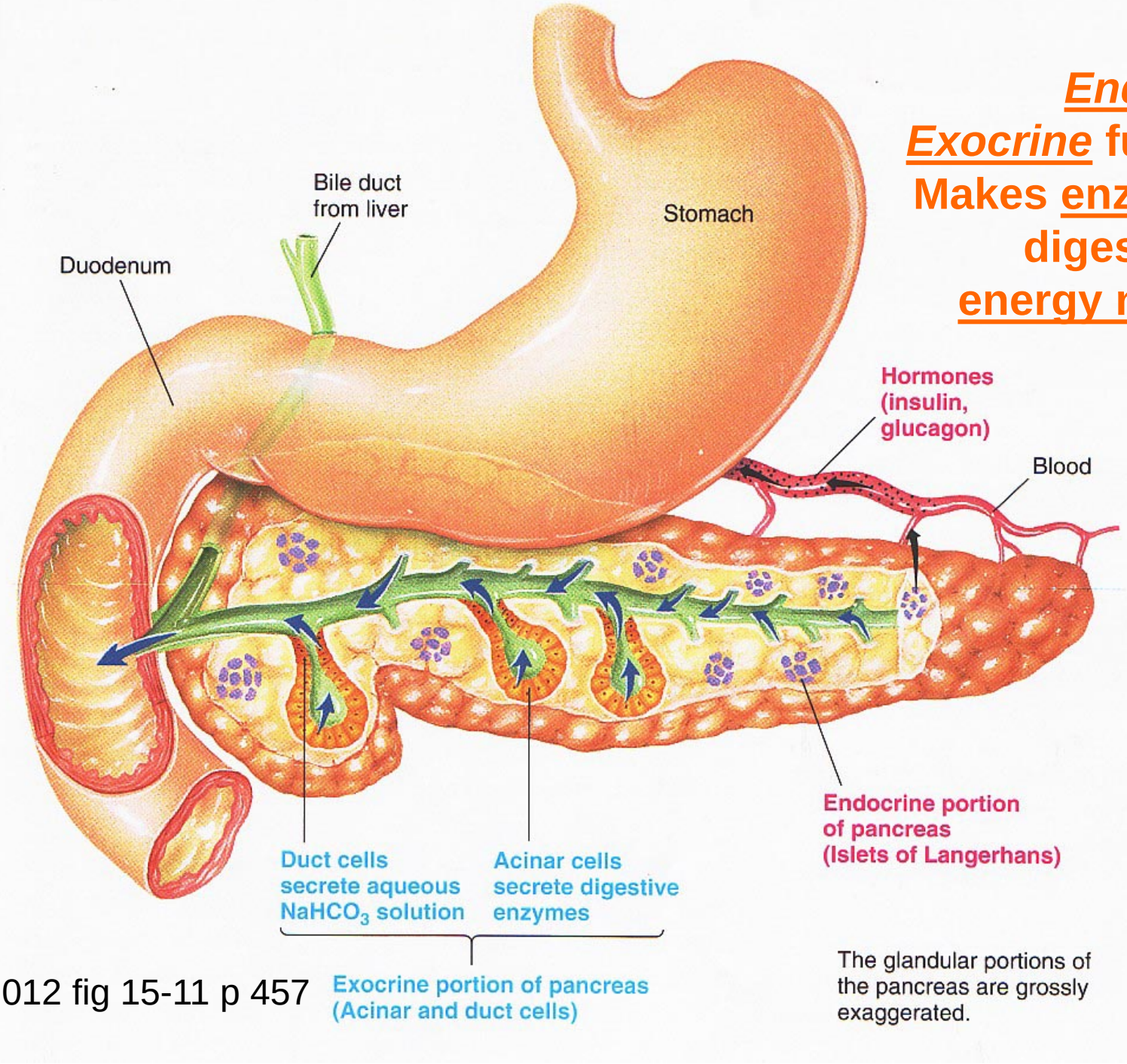

Myenteric motor plexus!
Serosa
cf: G&H fig 62-2
Epithelium
LOCAL
Submucosa
Lumen
Lamina Propria
Muscularis Externa
Glands
Longitudinal Muscle
Meissner's sensory & secretory plexus!
Circular Muscle
H Howard 1990

Zymogen= an inactive precursor

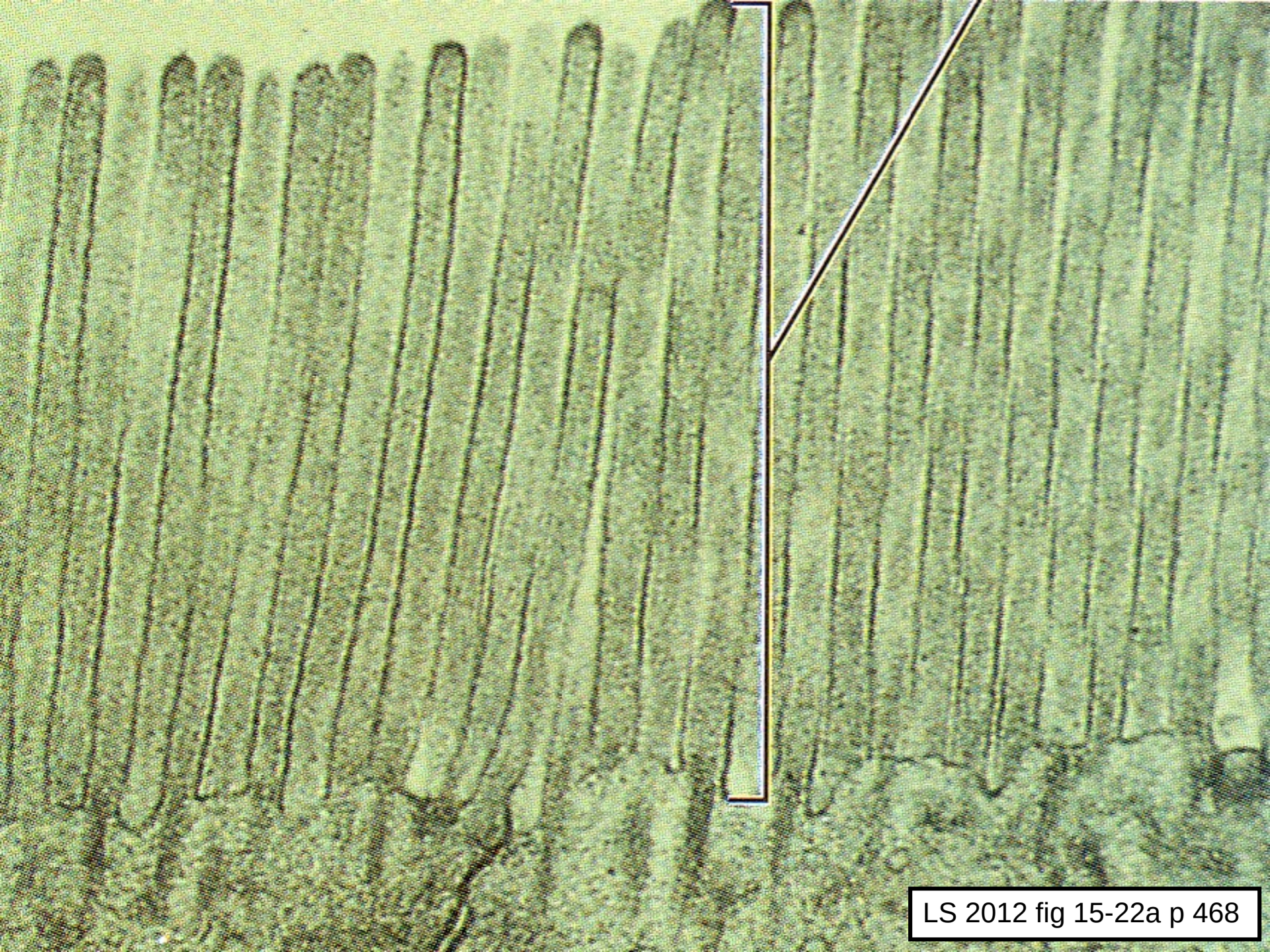


LS 2012 fig 15-9 p 452

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



LS 2012 fig 15-11 p 457



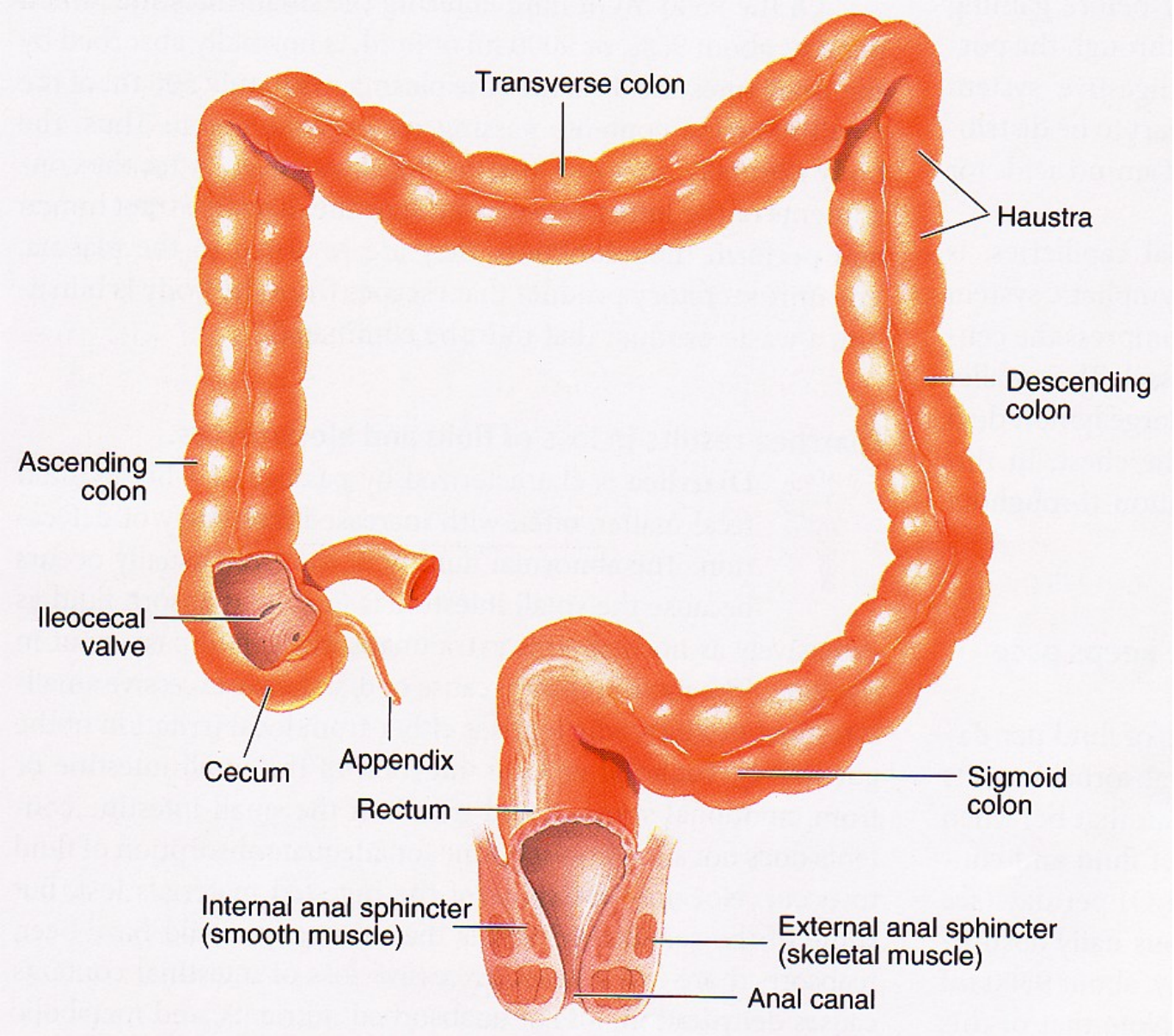
LS 2012 fig 15-22a p 468

http://www.cdc.gov/ulcer/

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.

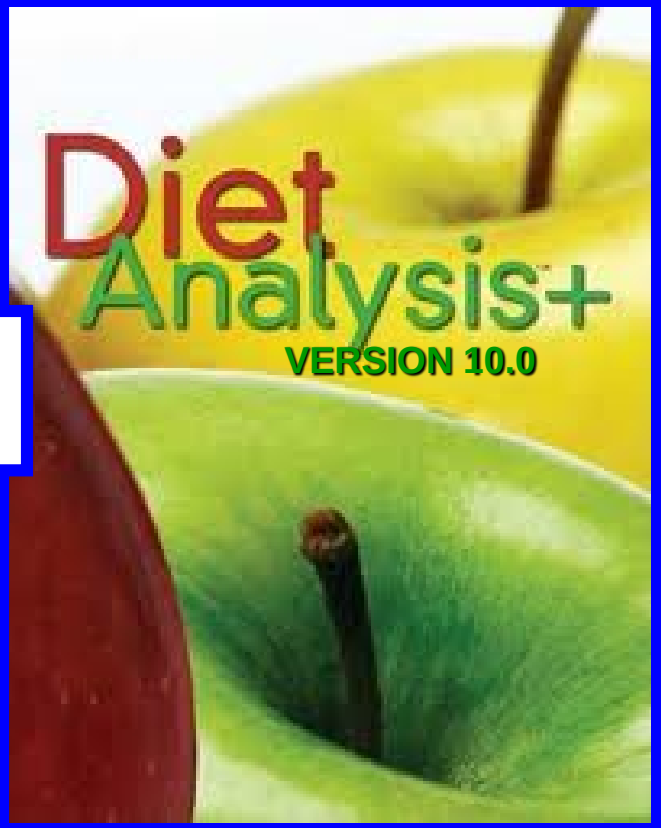
Large Intestine Structure & Function



LS 2012 fig 15-24 p 472

Lab 3: Nutritional Analyses via 2 Programs

+



https://www.supertracker.usda.gov/