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

BI 121 Lecture 2

I. ***Announcements*** Lab 1 Histology today!130 HUE. Fun!
Please record your diet on p 3-7 LM & analyze it by Friday with https://www.supertracker.usda.gov/ Estimating quantities. Q?

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

4 oz → 3 oz

or

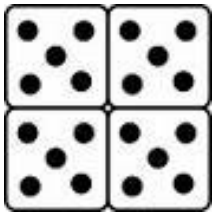
≡ 1 c

raw → cooked

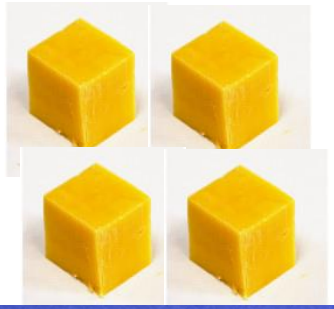
Deck of Cards

≡

≡ 1/3 c



≡ 1 oz

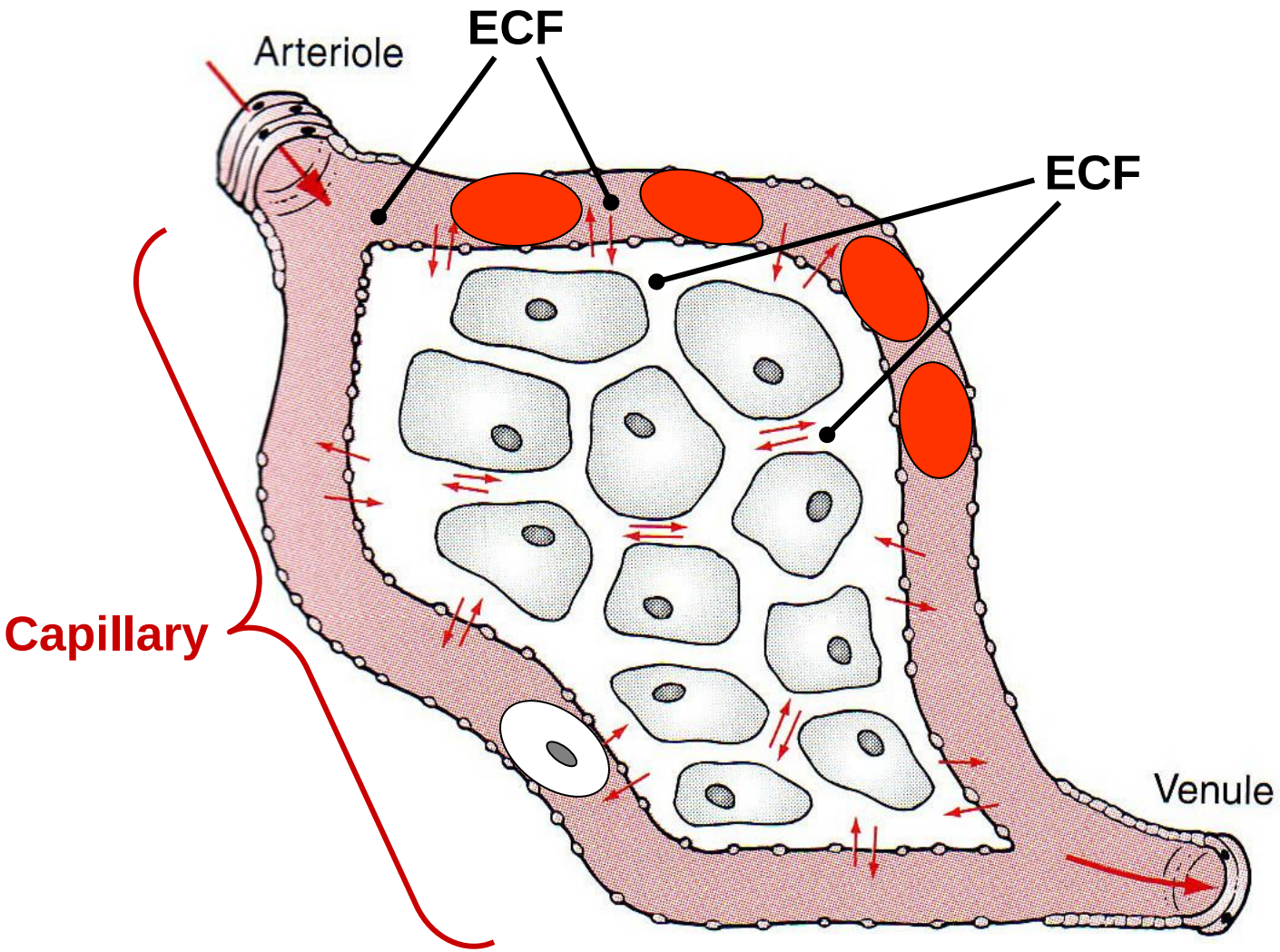


≡ ¼ c

≡ 1.5 oz

Active Learning
Group Work

Where is extracellular fluid?



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

G&H 2011

ECF = Extracellular

Plasma

(within CV System)

Interstitium

(eg, between muscle cells)

ICF = Intracellular

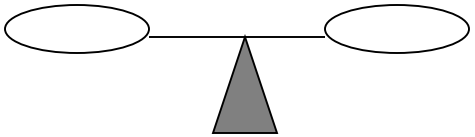
https://www.youtube.com/watch?v=B658Yn3INYc

Homeostasis
or
Homeokinesis?

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

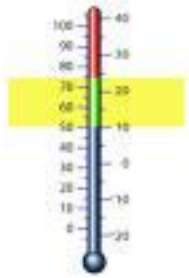
Metabolic

ANA- CATA-



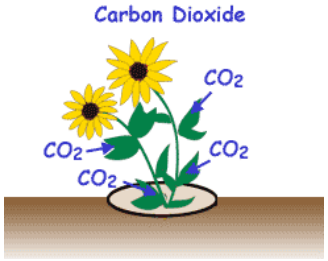
H_2O

T°C



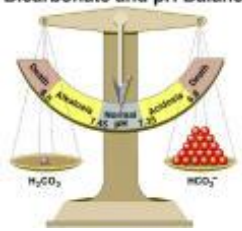
Dr. Evonuk's 6 Balances

O_2/CO_2



$Ion^{+/-}$

pH

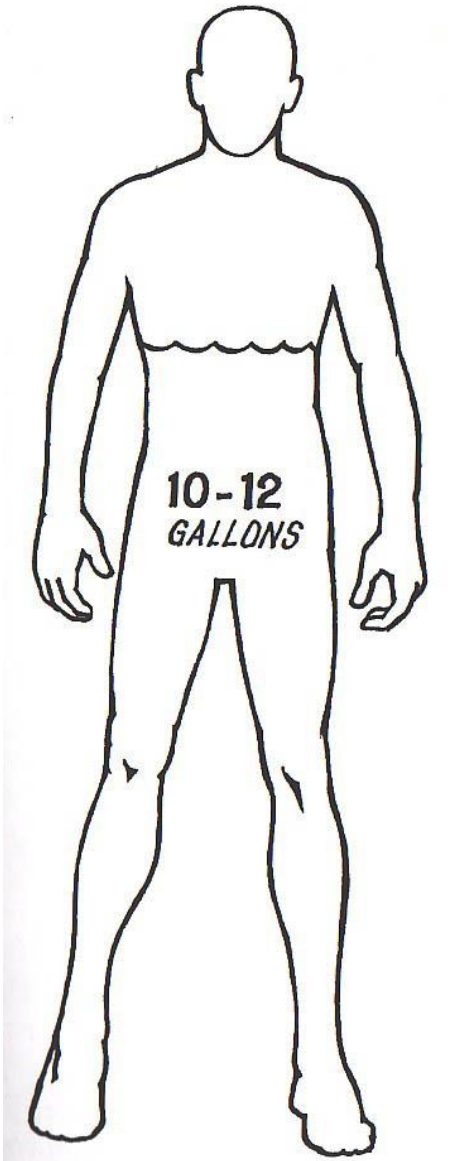


No, we're not watermelons, but H_2O is definitely critical!!

Drink about 1 L per 1000 calories energy expenditure!!

Human ~ 2/3 H_2O

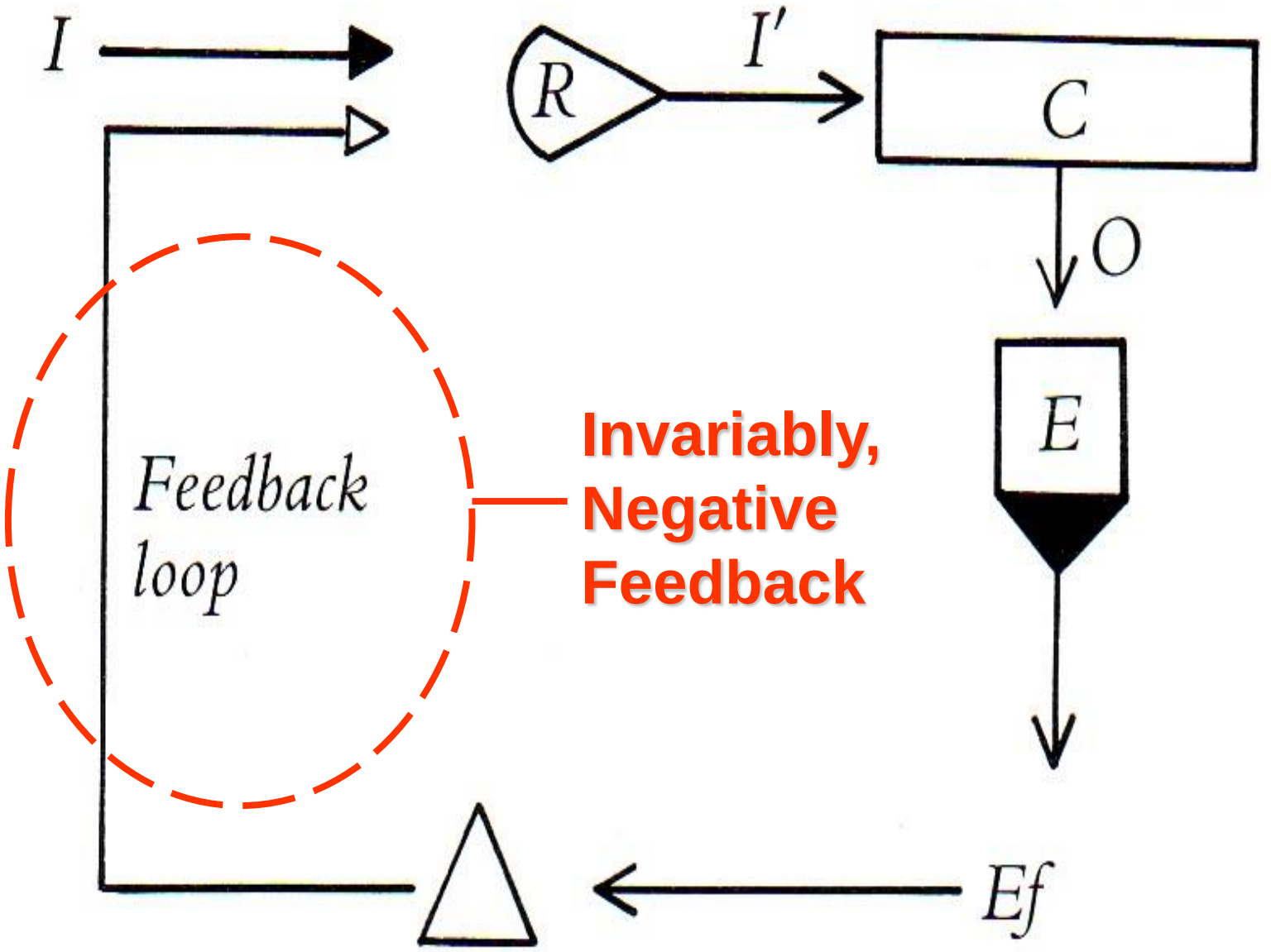
~ 60 – 70 %



150 lb /68 kg

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

= ~40 – 48 kg H_2O

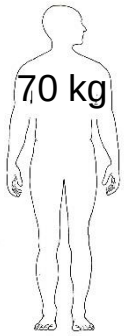

I
R
I′
C
O
E
Feedback loop
Invariably, Negative Feedback
Ef

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

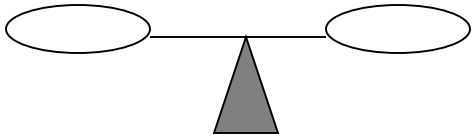
Interstitium = 11L
Plasma = 3L

H_2O

INPUT

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

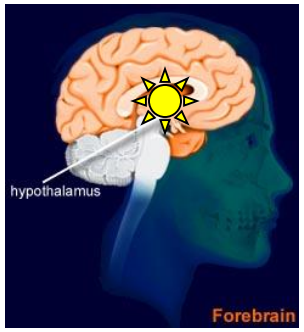
BALANCE!



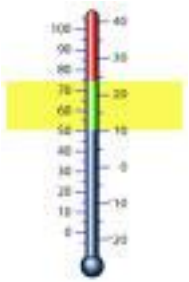
OUTPUT

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

Controller = Hypothalamus with Set Point



ToC



ToC

Lethal

42oC

Protein Denaturation

110oF

Set Point

37oC

98.6oF

35oC

Mild Hypothermia

Profound Hypothermia

33oC

< 30oC

Lethal

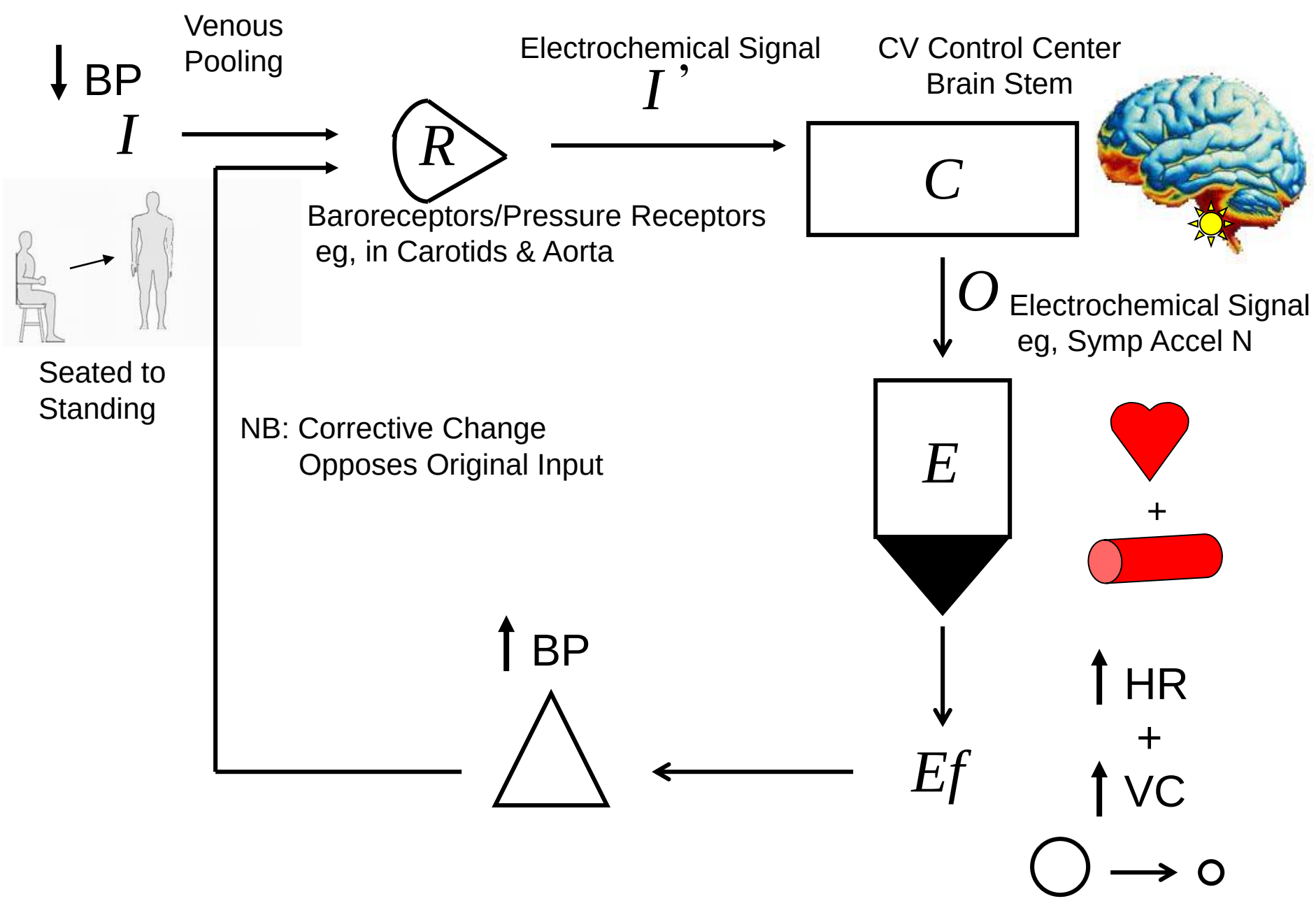
29oC

0600 1400 0600 1400

Time of Day

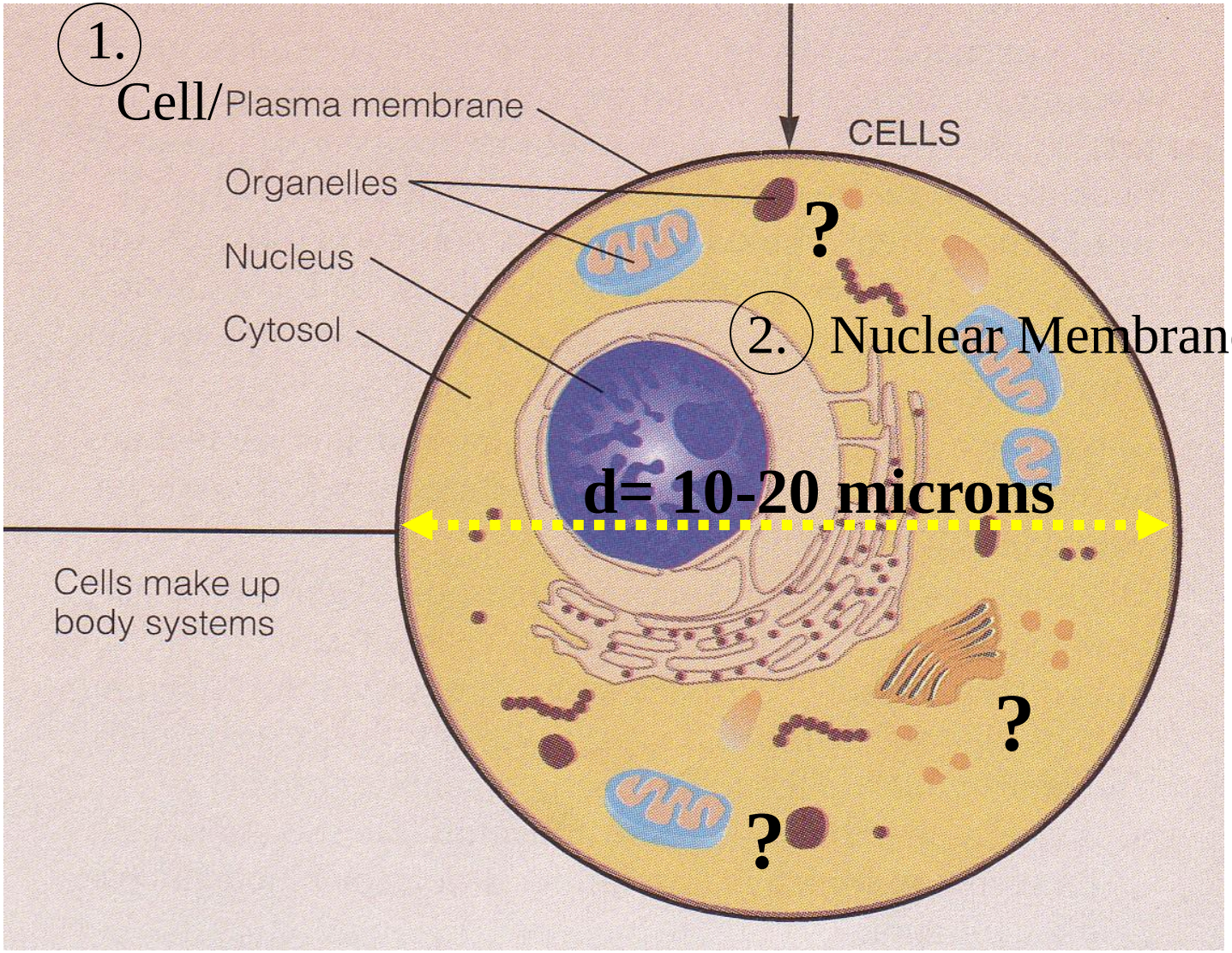
True Diurnal Variation

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

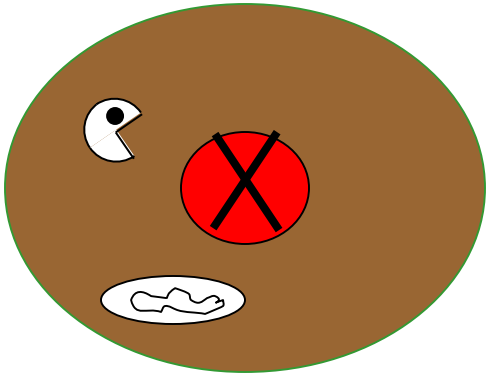
Class Discussion + Break!

HOW BIG? 100 CELLS LENGTHWISE = 1 mm!!



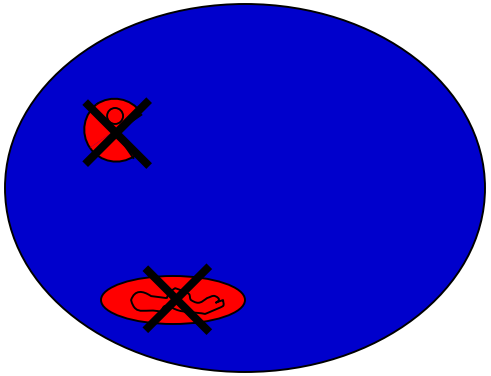
Cytoplasm = Cell - Nucleus

[Extract nucleus; includes organelles]



Cytosol = Cytoplasm - Organelles

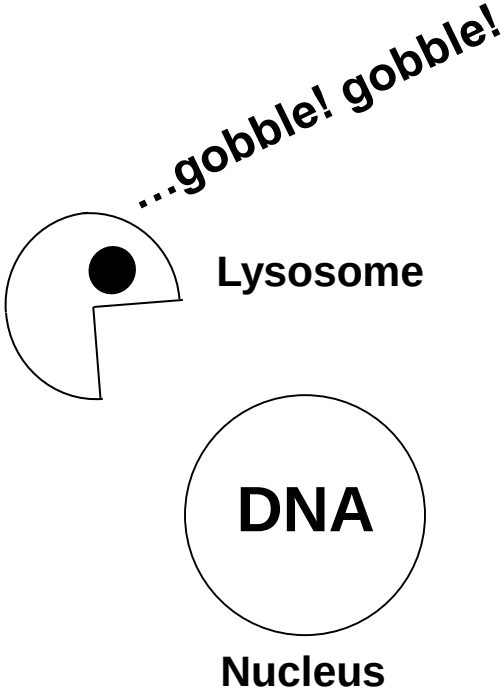
[Extract organelles; complex gel-liquid]



Why Compartments? Advantage?

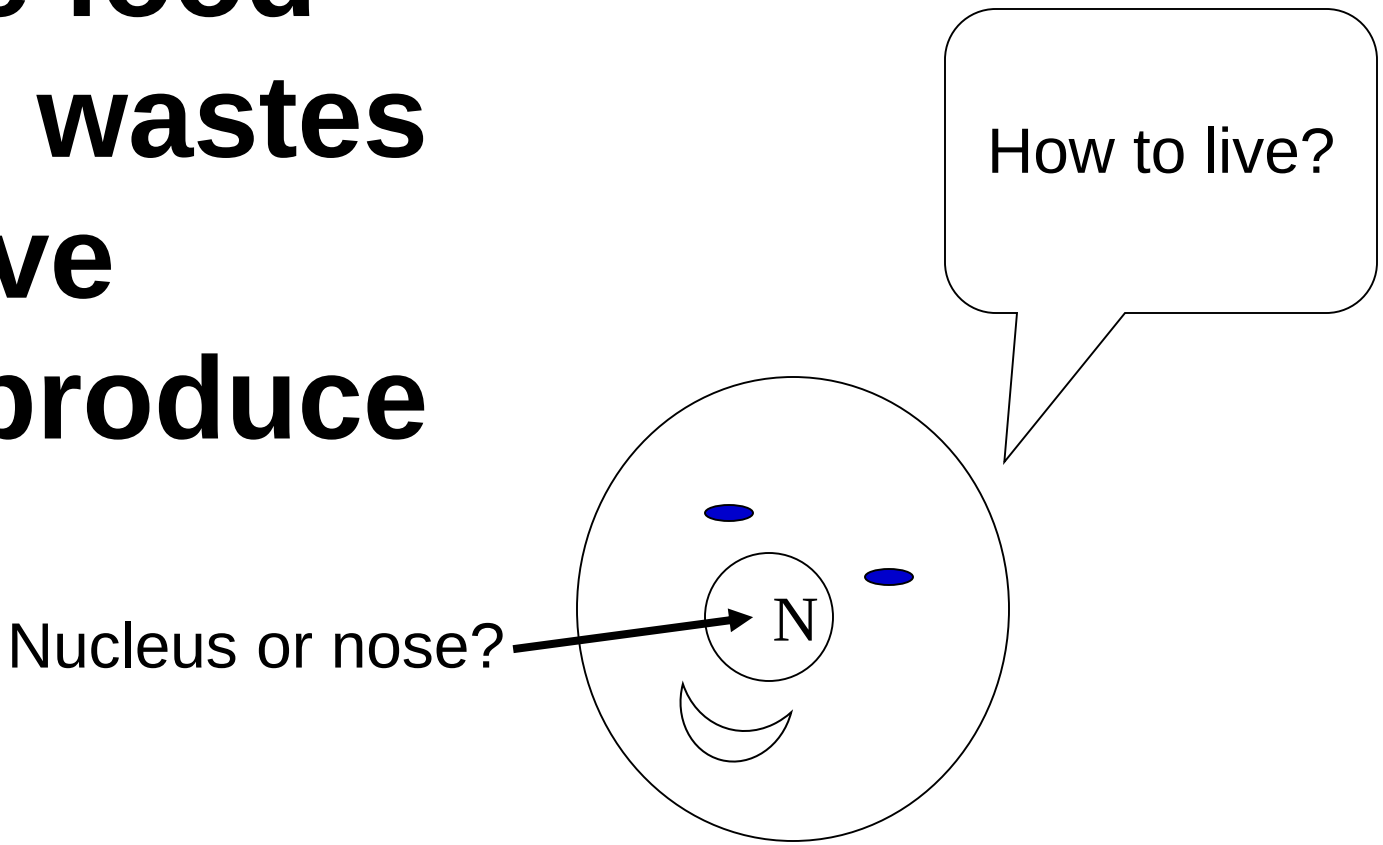
<u>*Incompatible*</u> reactions can take place

<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!

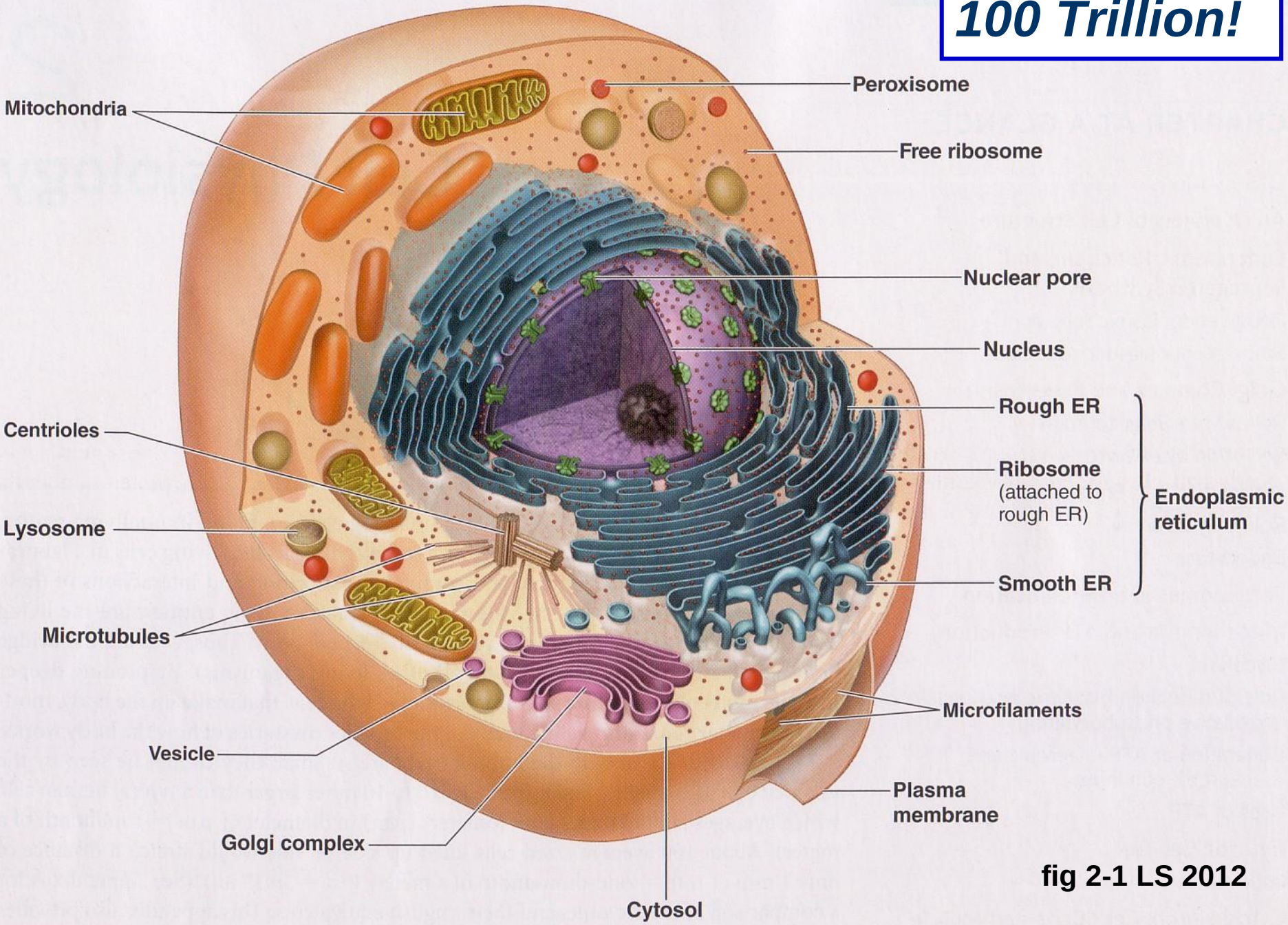
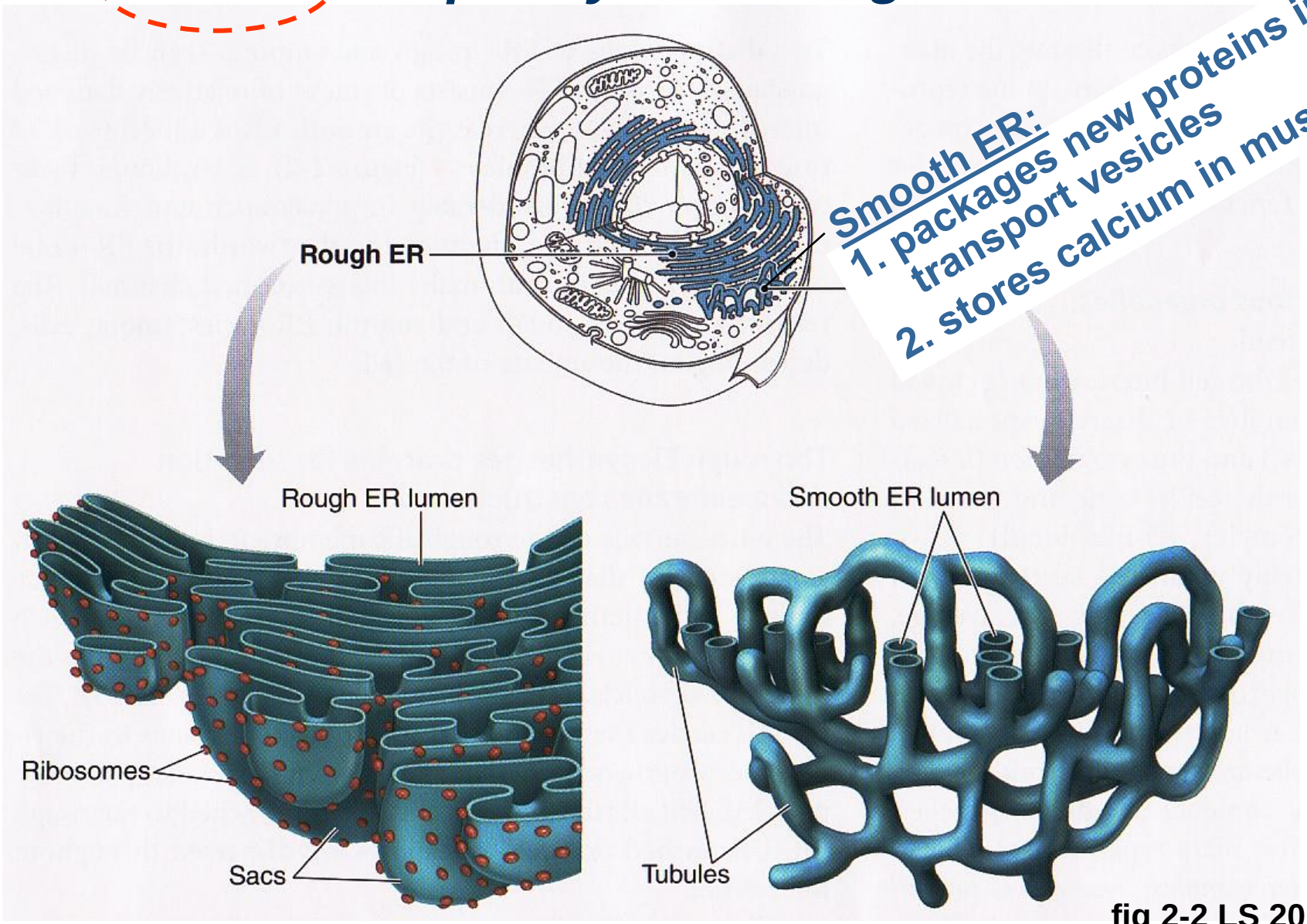


fig 2-1 LS 2012

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

Electron Micrographs of Rough vs. Smooth ER

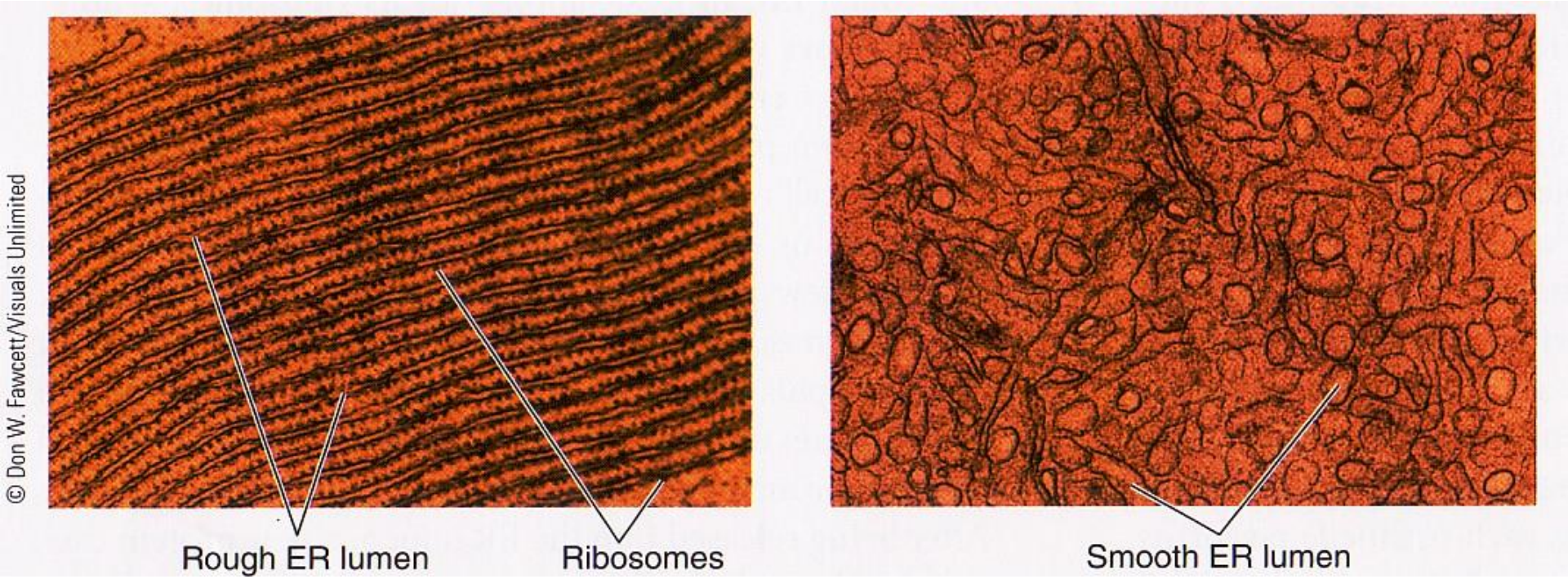


fig 2-2 LS 2012

Secretion of Proteins Produced by ER

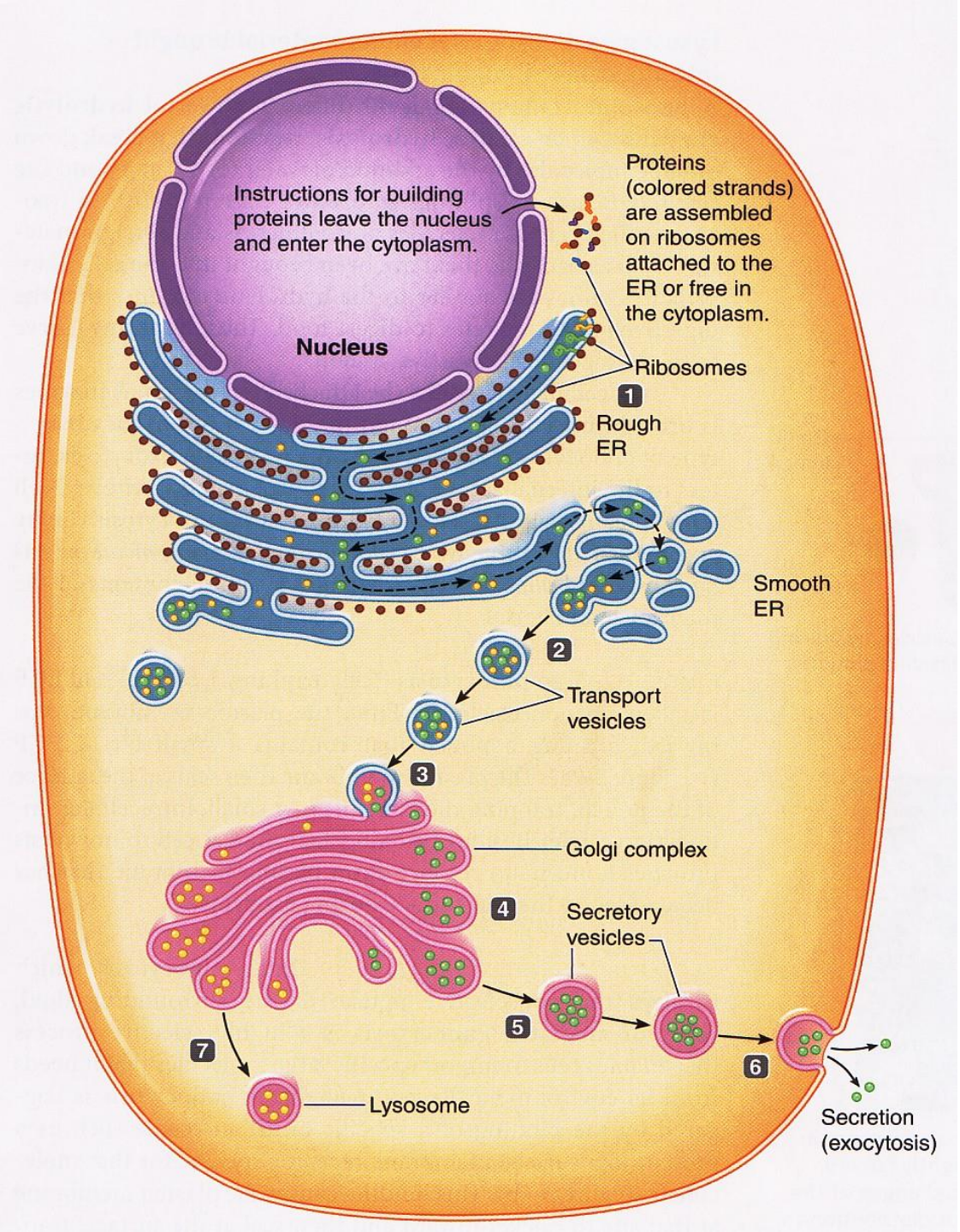


fig 2-3 LS 2012

Golgi Complex: Final Processing, Packaging & Distribution

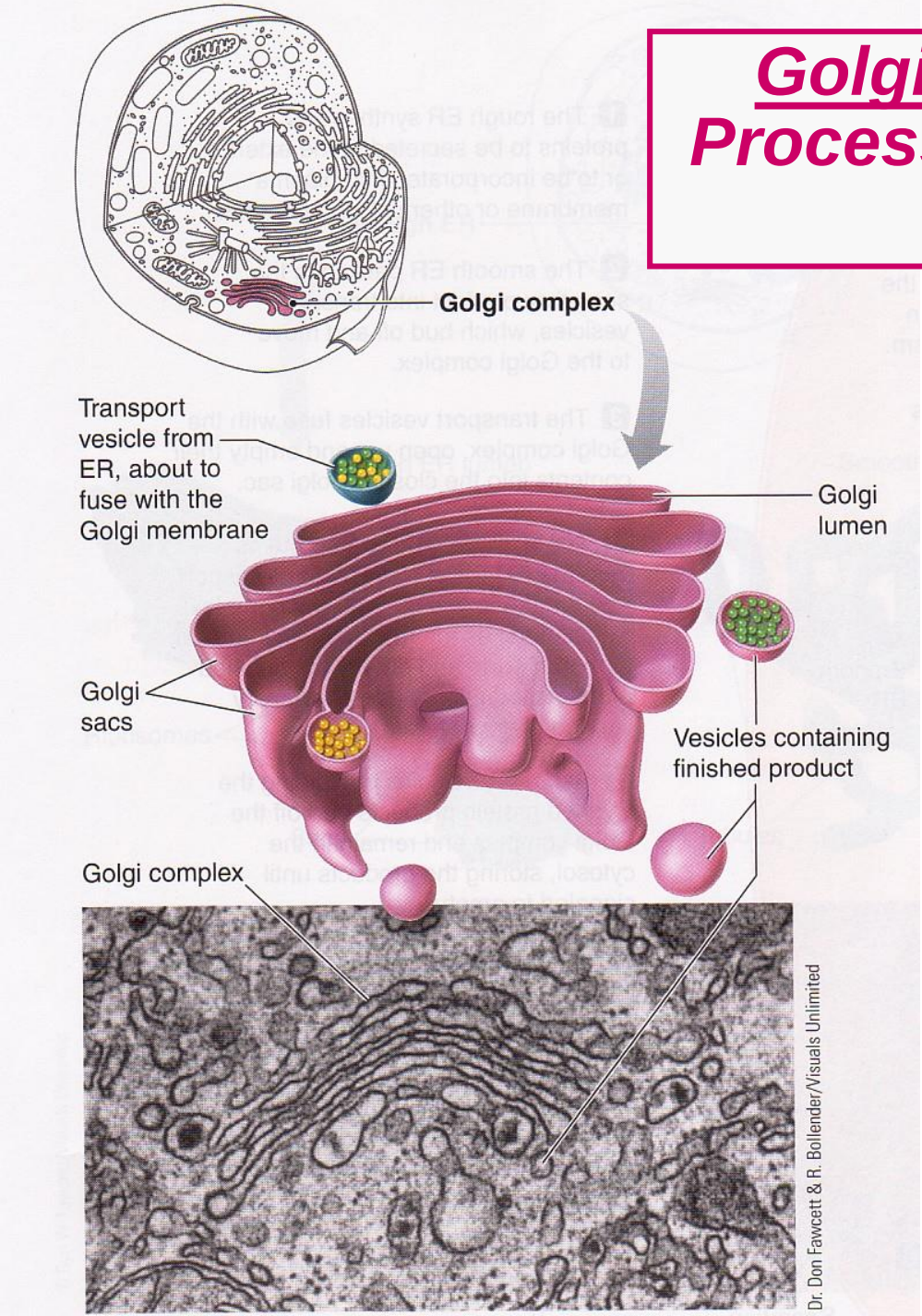
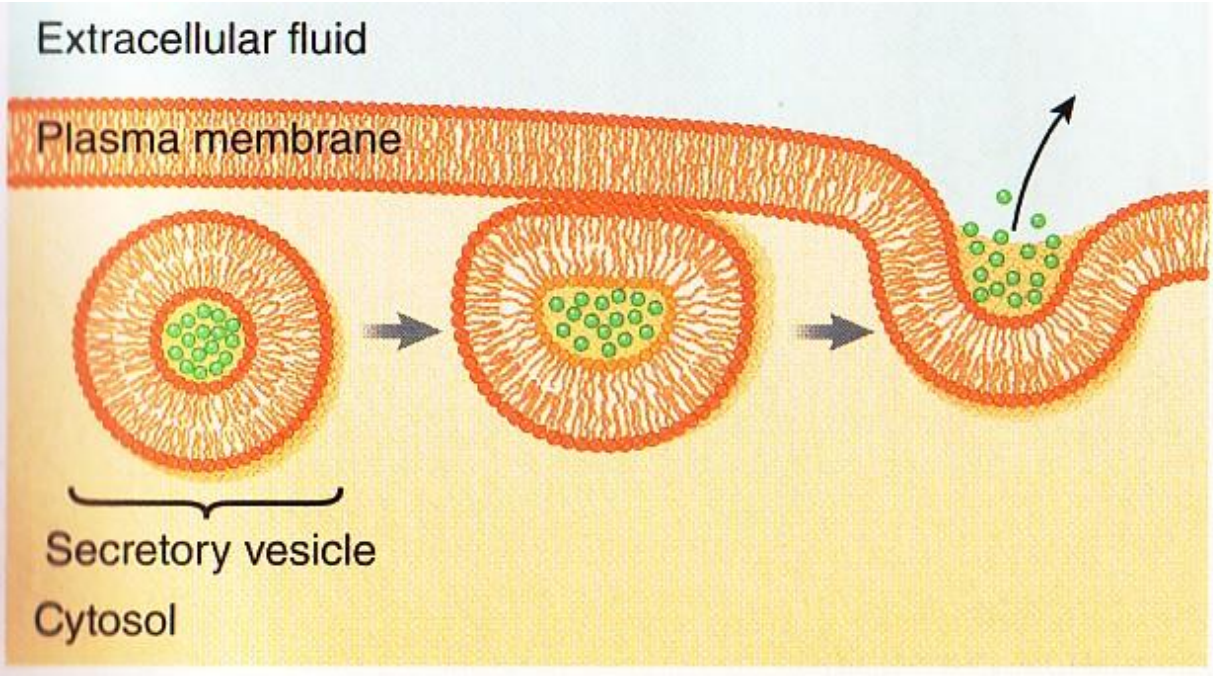


fig 2-4 LS 2012

Exocytosis: Primary Means of Secretion



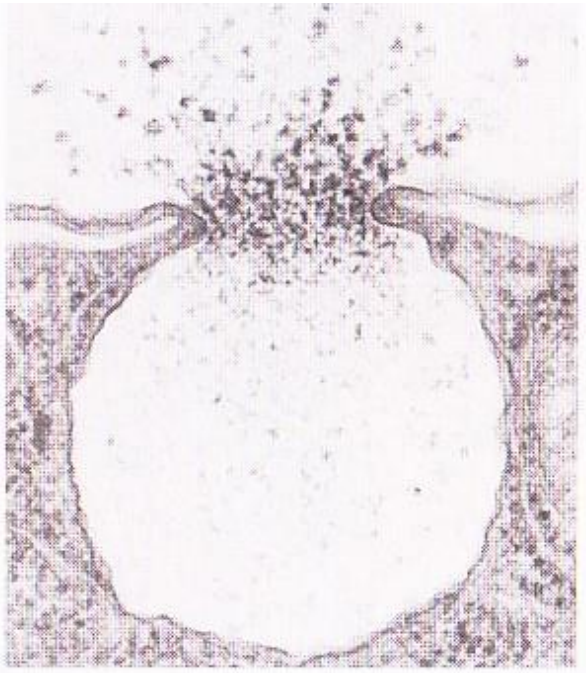
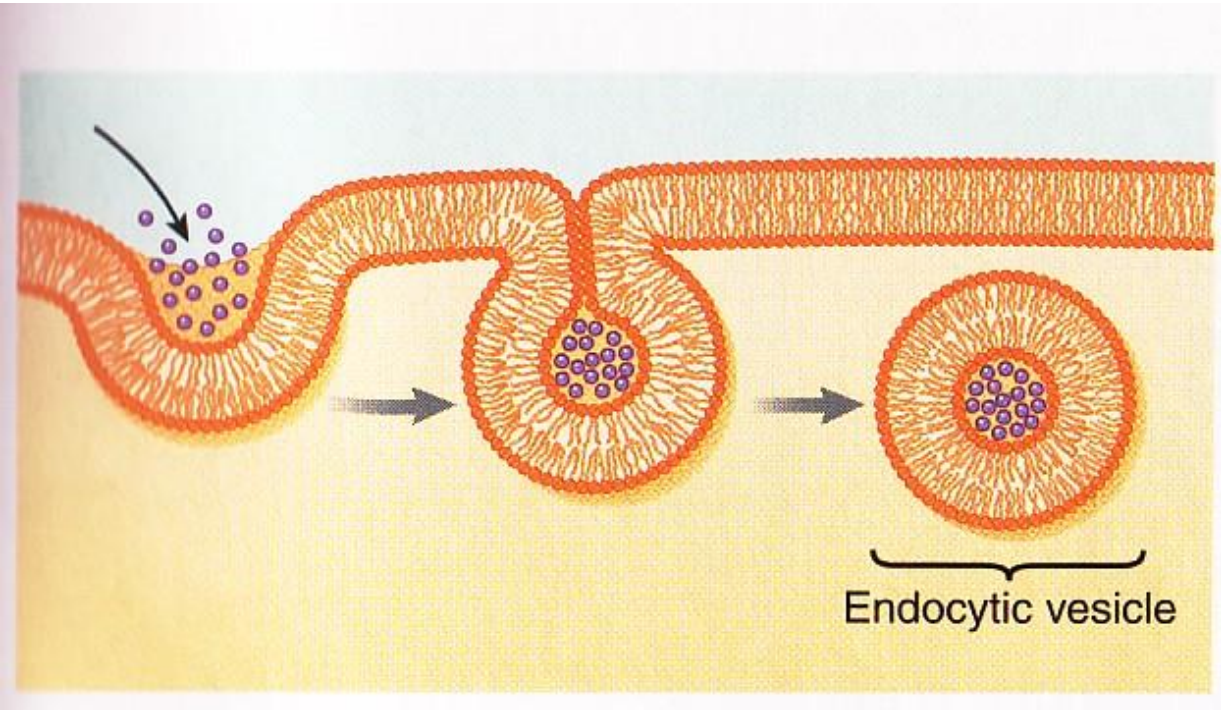


fig 2-5a LS 2012

Endocytosis: Primary Means of Ingestion



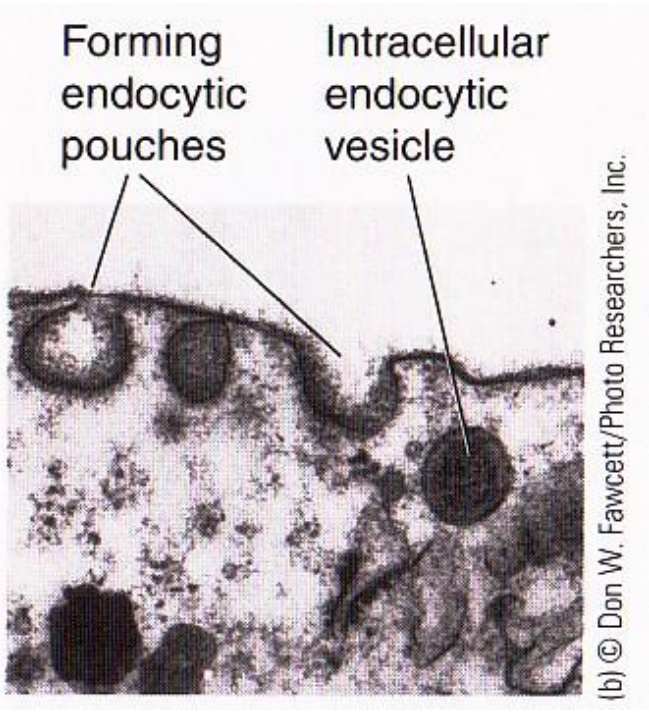


fig 2-5b LS 2012

Lysosomes *vs.* *Peroxisomes*

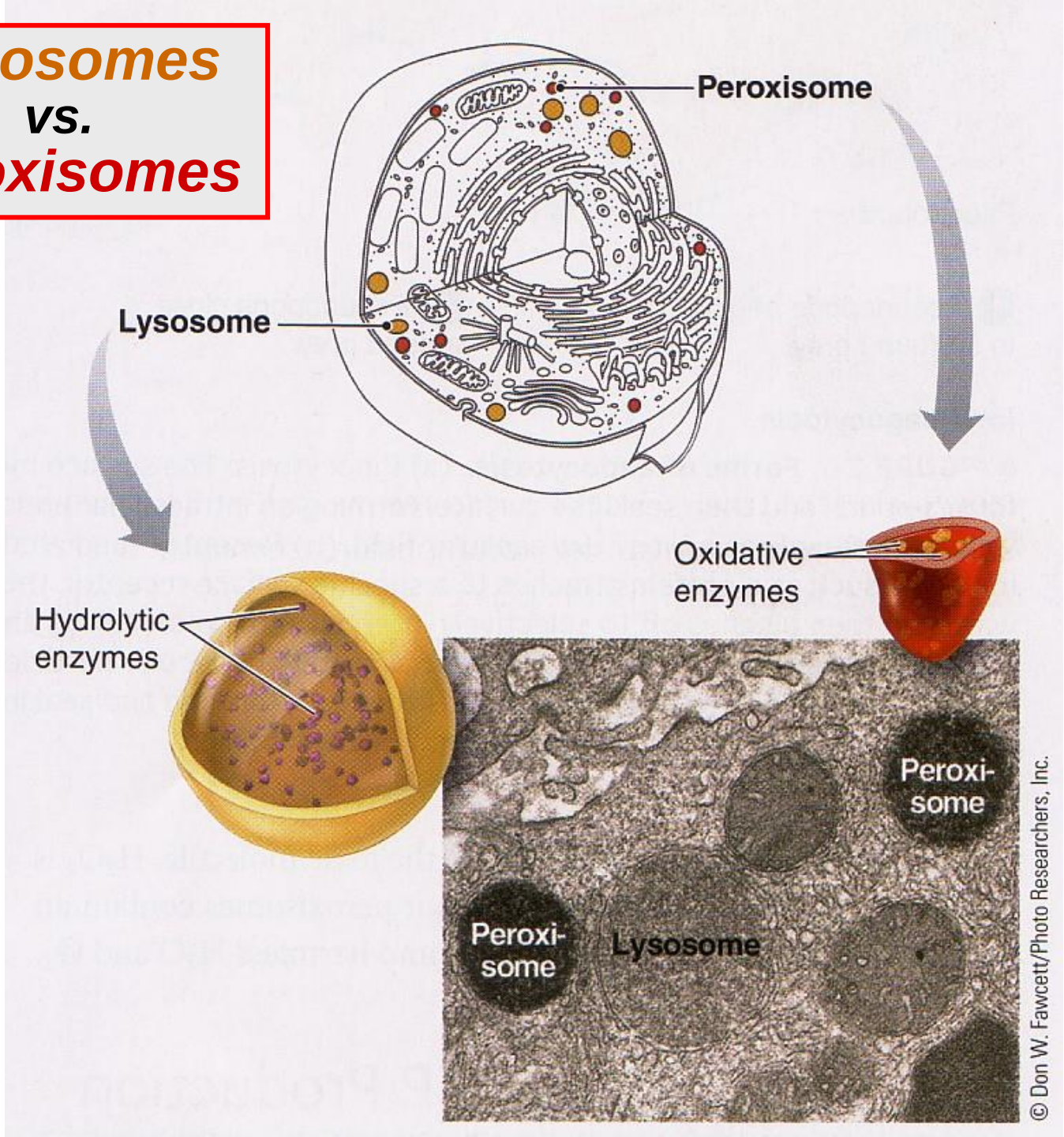


fig 2-6 LS 2012

Phagocytosis: Cell Eating!

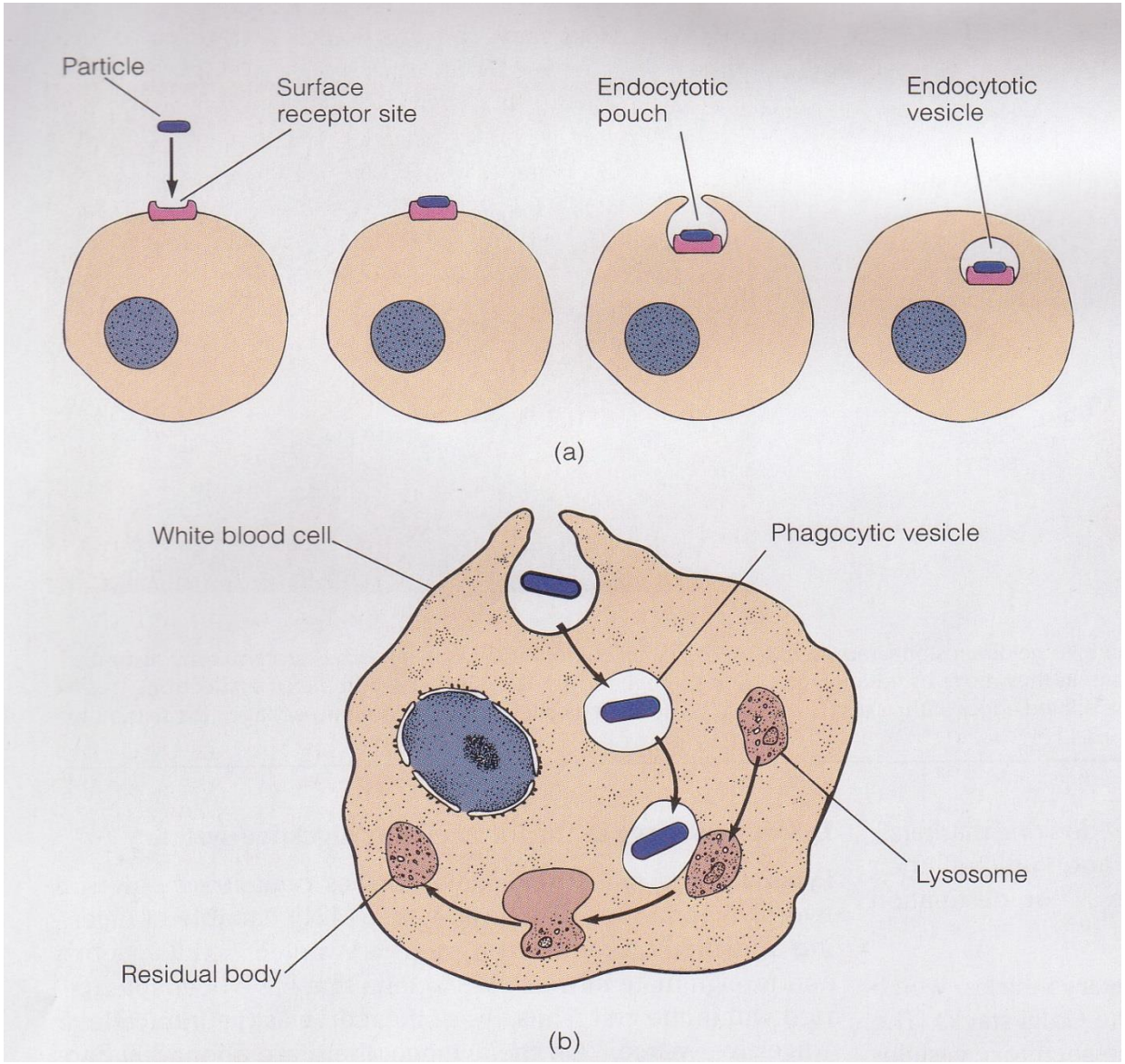
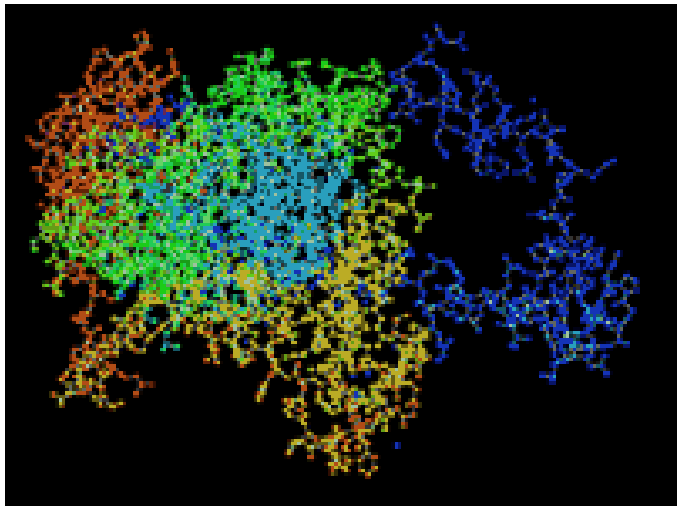


fig 2-7 LS 2006


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

Catalase Enzyme Reaction in Peroxisomes Neutralize Toxin at Production Site!



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

Mitochondria: Energy Organelles

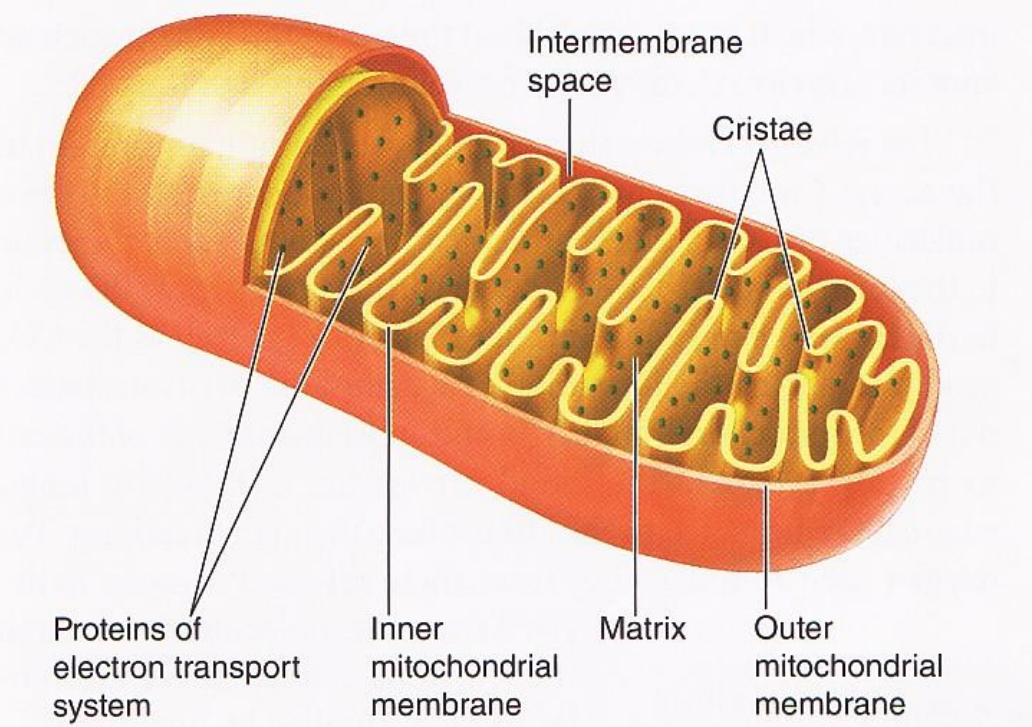


fig 2-8 LS 2012