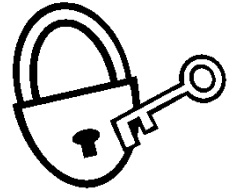


BI 121 Lecture 4



Structure-function = fun!



I. Announcements Anatomy & Physiology Lab today!

Motivation to Study! Remember to complete p 3-7 dietary record in LM < Lab 3 next wk! Estimating serving sizes. Q?

II. Cell Physiology... Lysosomes, Peroxisomes, Mitochondria

III. Anaerobic vs Aerobic Metabolism Metabolism

LS ch 2 pp 26-33, fig 2-15, 2-9, 2-10, 2-11, 2-12 +...

A. Anaerobic: Cytosol ATP-PC immediate vs. Glycolysis

B. Aerobic: Mitochondria citric acid cycle, electron transport

IV. Introduction to Genetics LS pp 20-1 + Appendix C

A. What's a gene? Where? p A-18, fig C-2, C-3

B. Why are genes important? p A-18

C. What's DNA & what does it look like? pp A-18 thru A-20

D. How does information flow in the cell? fig C-6

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

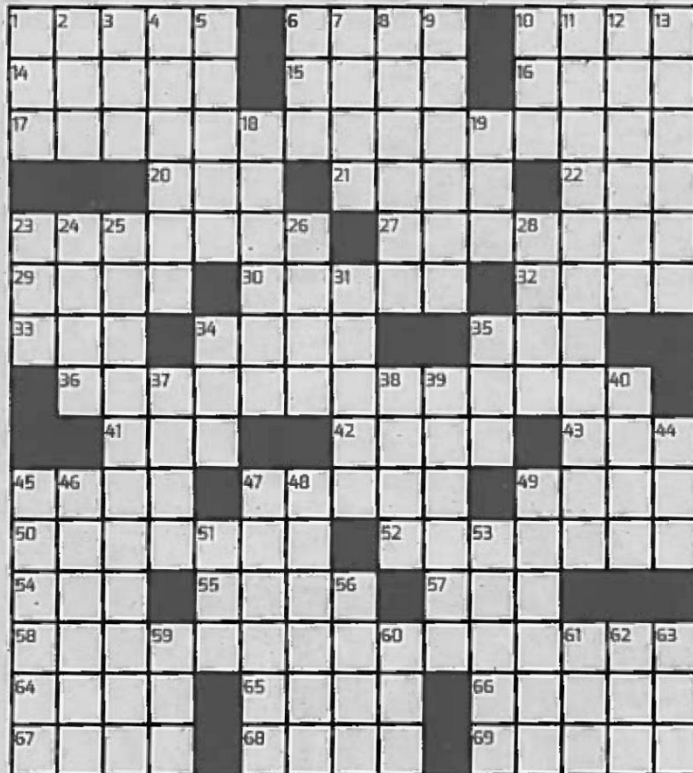
F. Genetic code? pp A-22, A-23

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

Biology can help you with all phases of your life! In fact, it is the science of life!

55 One-in-a-million
57 Messenger ____
58 Answer to the algebra problem

FUN & GAMES: CROSSWORD



ACROSS

- 1 Goose egg
- 6 "Major" beast
- 10 Porter's regretful Miss
- 14 From Basra, say
- 15 Time to stuff stockings
- 16 [sigh]
- 17 Start of an algebra problem
- 20 Toby filler
- 21 To ____ (perfectly)
- 22 Heating option
- 23 Least fresh
- 27 Throw one's support behind
- 29 "____ nerve!"
- 30 Poet with a "fanatic's heart"
- 32 Passage preventers, often
- 33 Québec assent
- 34 Jettison
- 35 Outgoing flight stat
- 36 The rest of the algebra problem
- 41 Kitty
- 42 "L'____ c'est moi"
- 43 Alternative to Yahoo!

- 45 It has feathers and flies
- 47 Black Sabbath's genre
- 49 Benchmarks: Abbr.
- 50 Think tank types
- 52 Like stir-fry
- 54 Meditation sounds
- 55 One-in-a-million
- 57 Messenger ____
- 58 Answer to the algebra problem
- 64 Steaming
- 65 Causes of some celebrity clashes
- 66 Link with
- 67 Fictional Flanders and Devine
- 68 Kind of day for a competitive cyclist
- 69 Historic English county

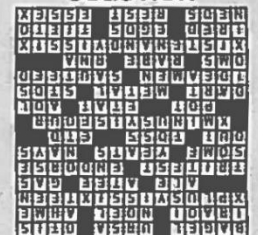
DOWN

- 1 Beiderbecke of jazz
- 2 Dadaist Jean
- 3 Guy's mate
- 4 Regard as identical
- 5 Fine cotton thread
- 6 Prefix with -form
- 7 Parks in front of a bus?

- 8 Sonnet part
- 9 Xenophobes' fear
- 10 Muesli morsel
- 11 Mrs. Robinson's movie
- 12 "Fine with me"
- 13 Classic quintet
- 18 Response to "Who, me?"
- 19 Marked, in a way
- 23 Menu general
- 24 Gumbo thickener
- 25 "Wow!"
- 26 Actress Harper of "No Country for Old Men"
- 28 Savvy about
- 31 Until now
- 34 Cause of a boom and bust?
- 35 Young newt
- 37 Smidge
- 38 "Take ____ a sign"
- 39 Subject of a cap, in sports
- 40 Didn't go by foot
- 44 "Dropped" drug
- 45 Compound in Agent Orange
- 46 Venerate
- 47 More Scroogelike
- 48 Tee off
- 49 Equilibrium
- 51 "Battlefield fare: Abbr.

- 53 Pull together
- 56 Slaughter in baseball
- 59 Some highlight reel features, for short
- 60 Summer hrs.
- 61 Parisian's possessive
- 62 Ore suffix
- 63 Affectionate sign-off

SOLUTION



4 oz → 3 oz



Deck of Cards



or



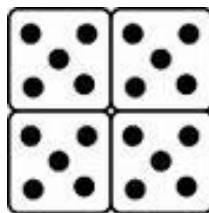
≡ 1 c

≡

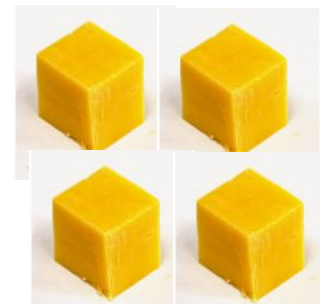
raw → cooked



≡ 1/3 c



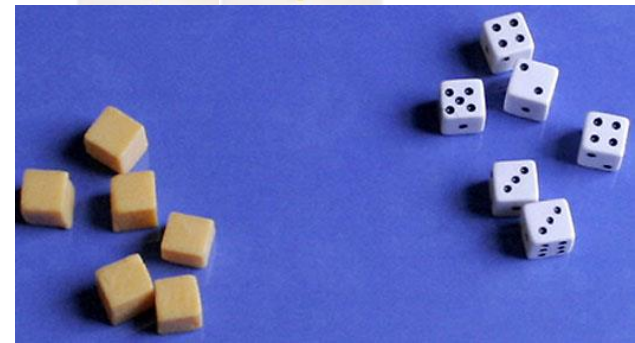
≡ 1 oz



≡ 1/4 c



≡ 1.5 oz



Cell type, size, number?

Estimating numbers is always a challenge!

300×10^{12} ? 10^{15} ?

30×10^{12} ? , 100×10^{12} ?

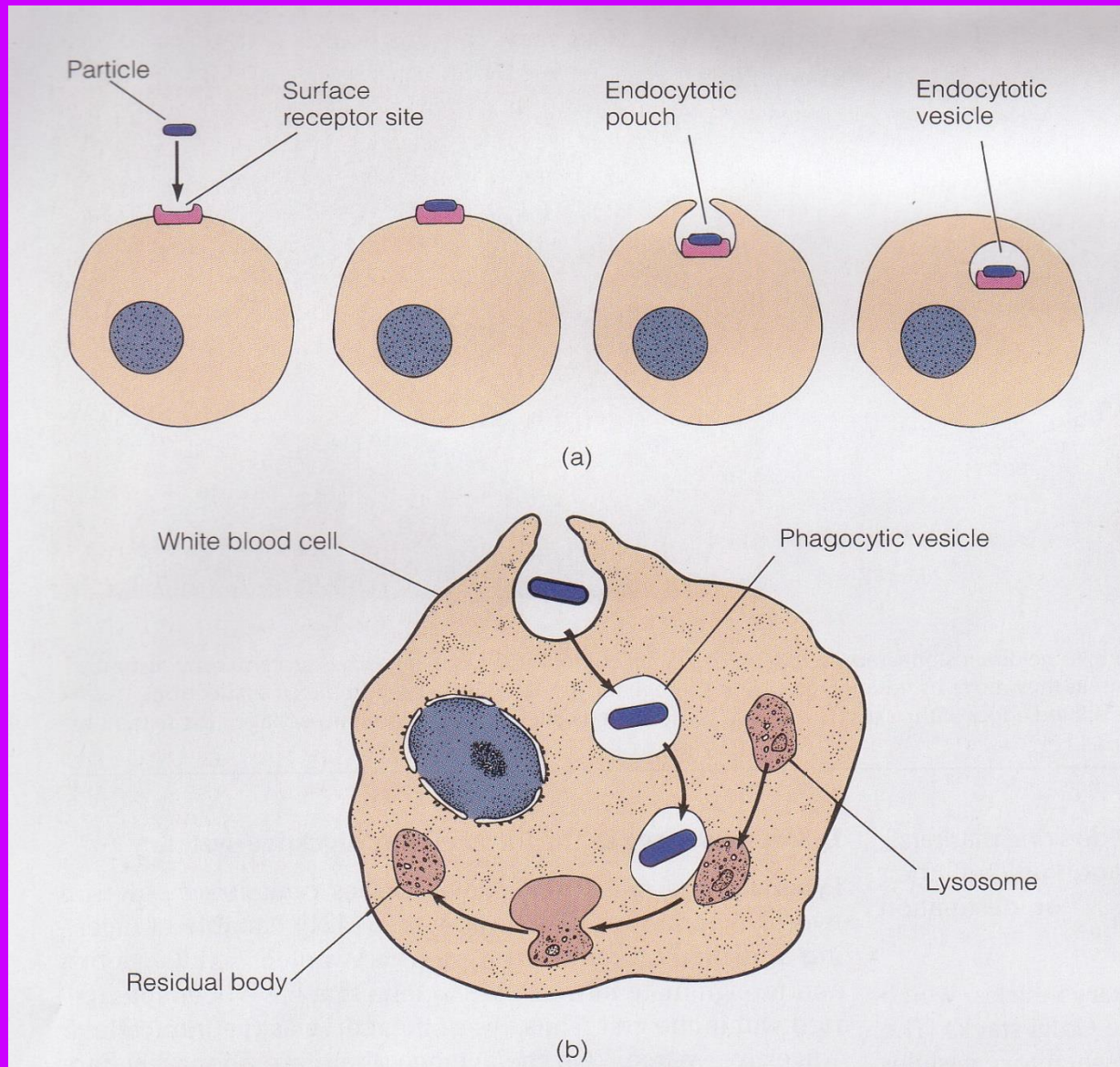
10^9 ? 10^{12} ?

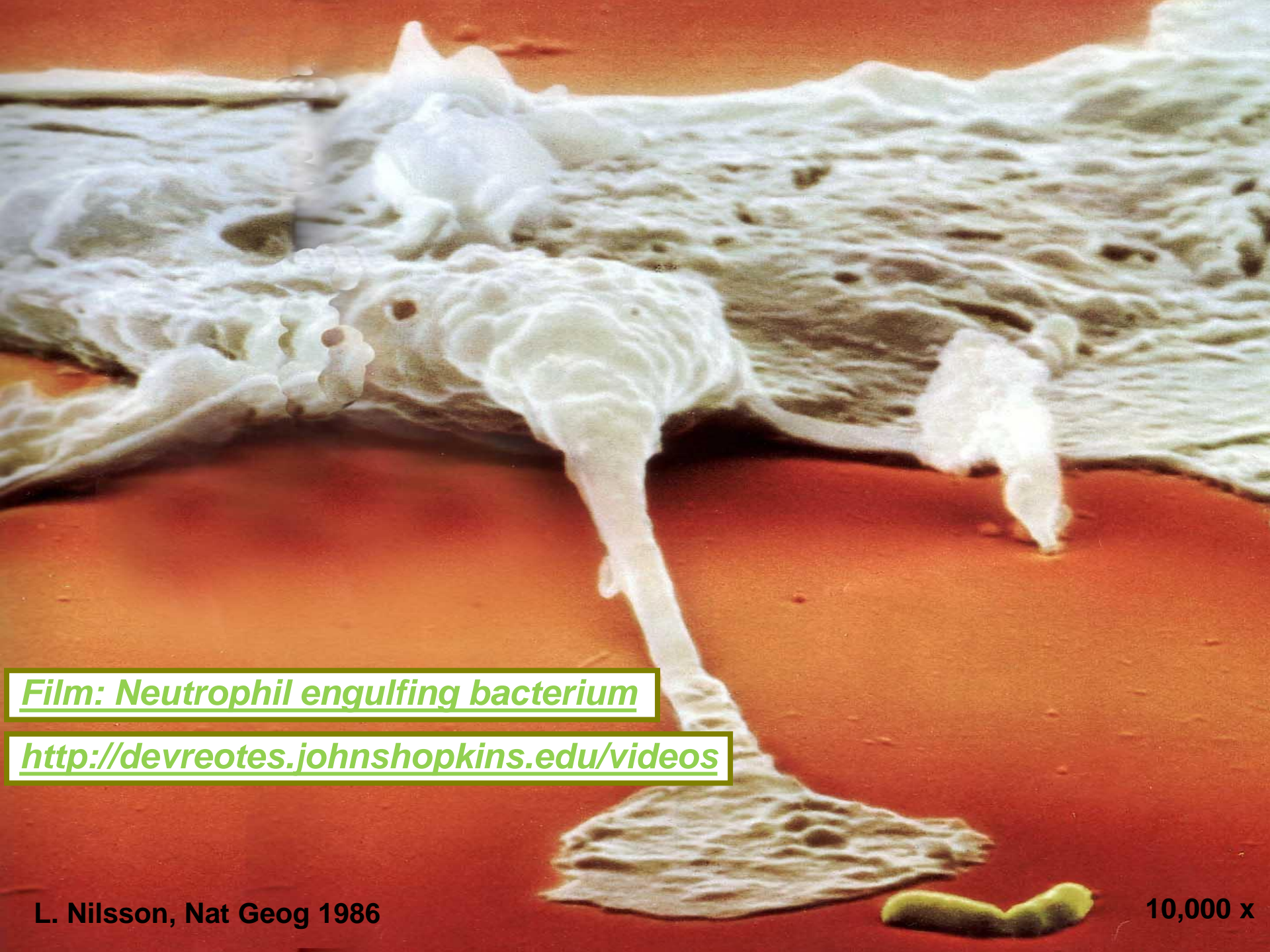
10^3 ✓



Scientists don't know everything!

Phagocytosis: Cell Eating!

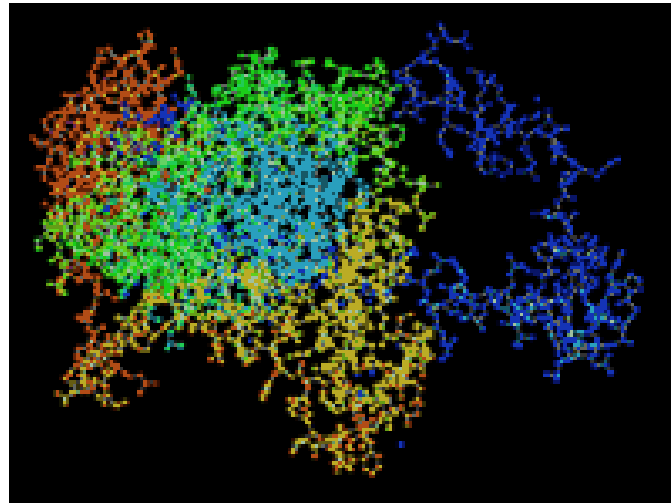


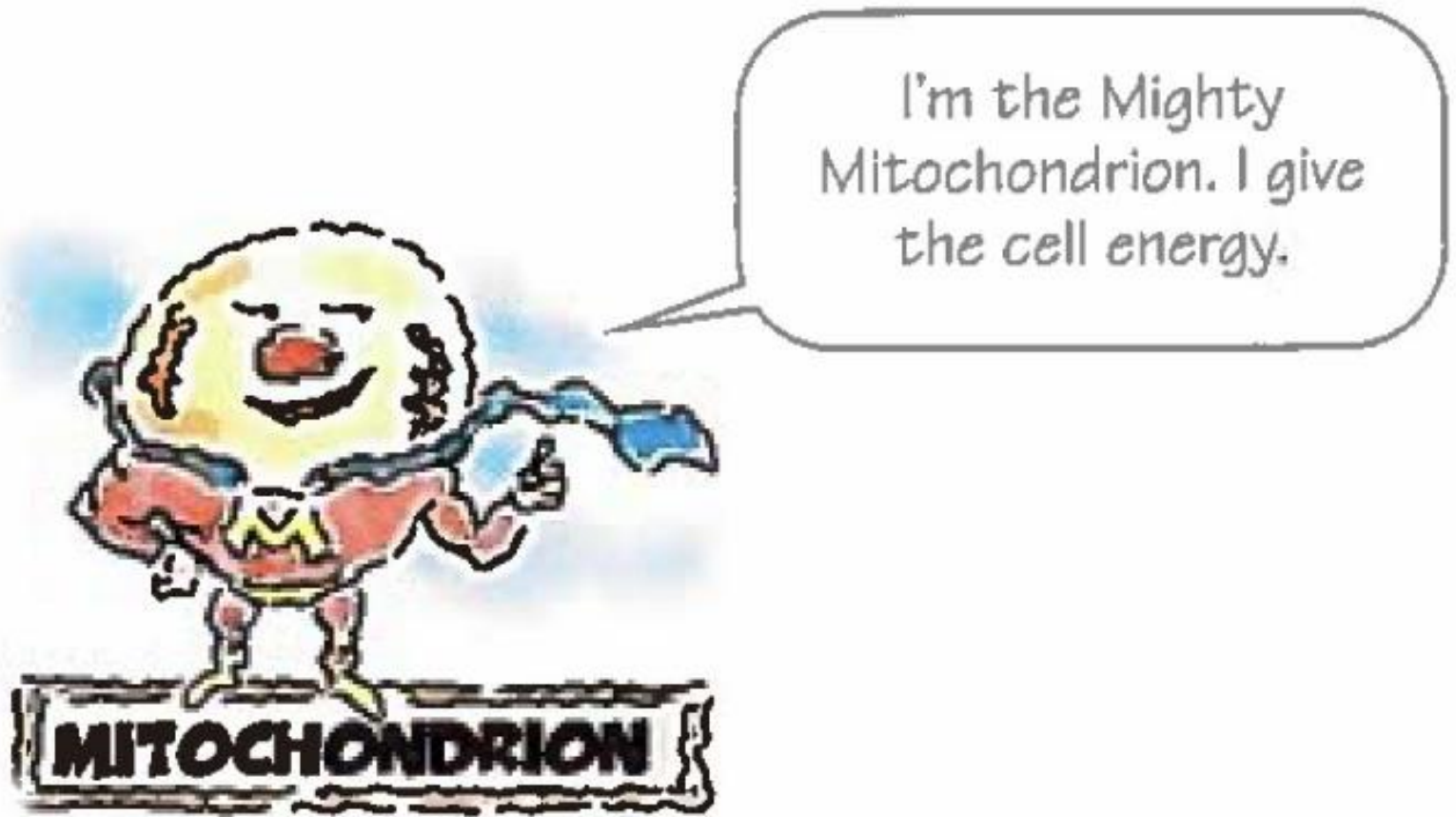


Film: Neutrophil engulfing bacterium

<http://devreotes.johnshopkins.edu/videos>

Catalase Enzyme Reaction in Peroxisomes Neutralize Toxin at Production Site!





SOURCE: Bot Roda, Illustrator. *Anatomy & Physiology made Incredibly Visual!*
Wolters Kluwer Health, Lippincott Williams & Wilkins, 2009.

Mitochondria: Energy Organelles

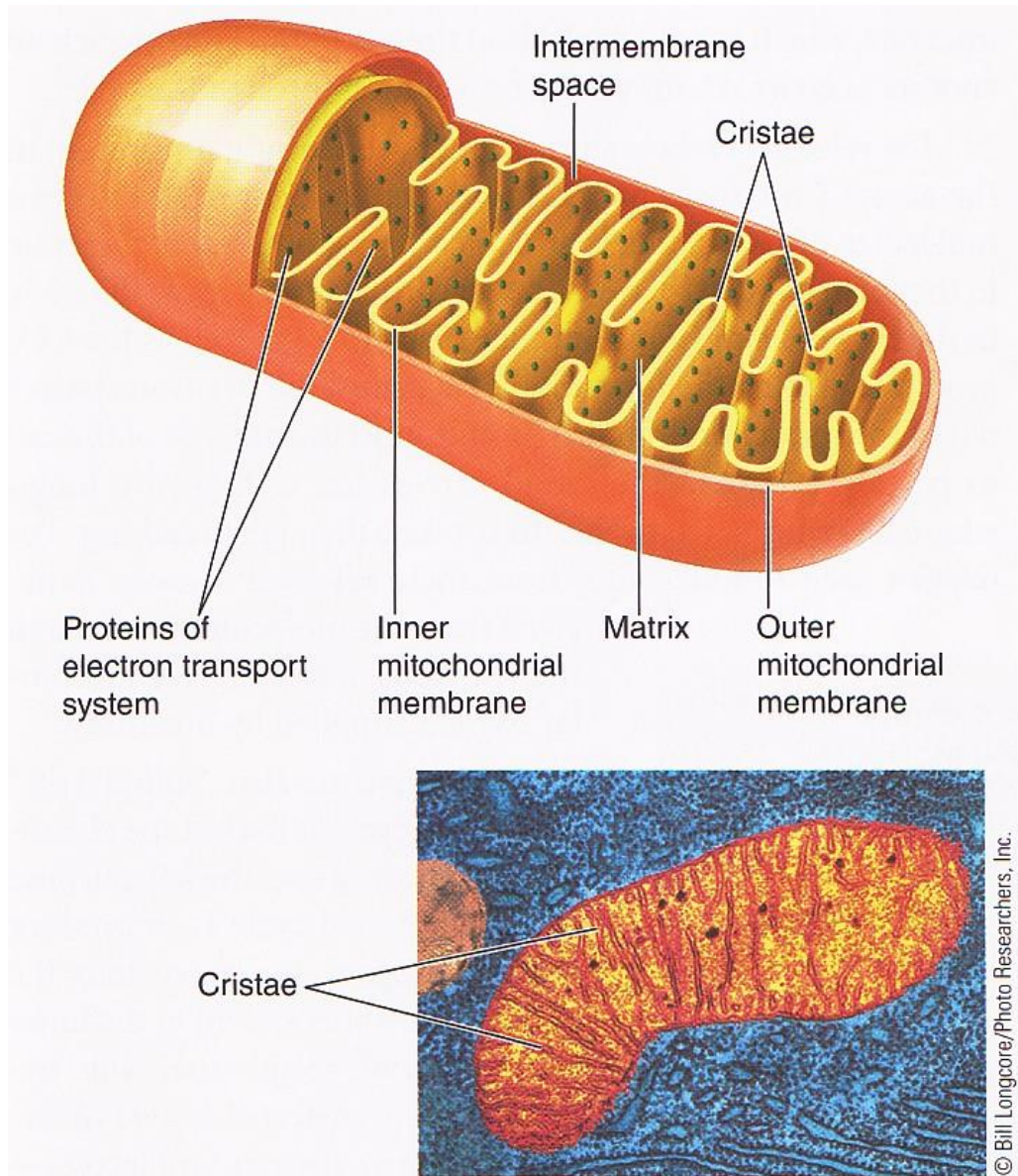
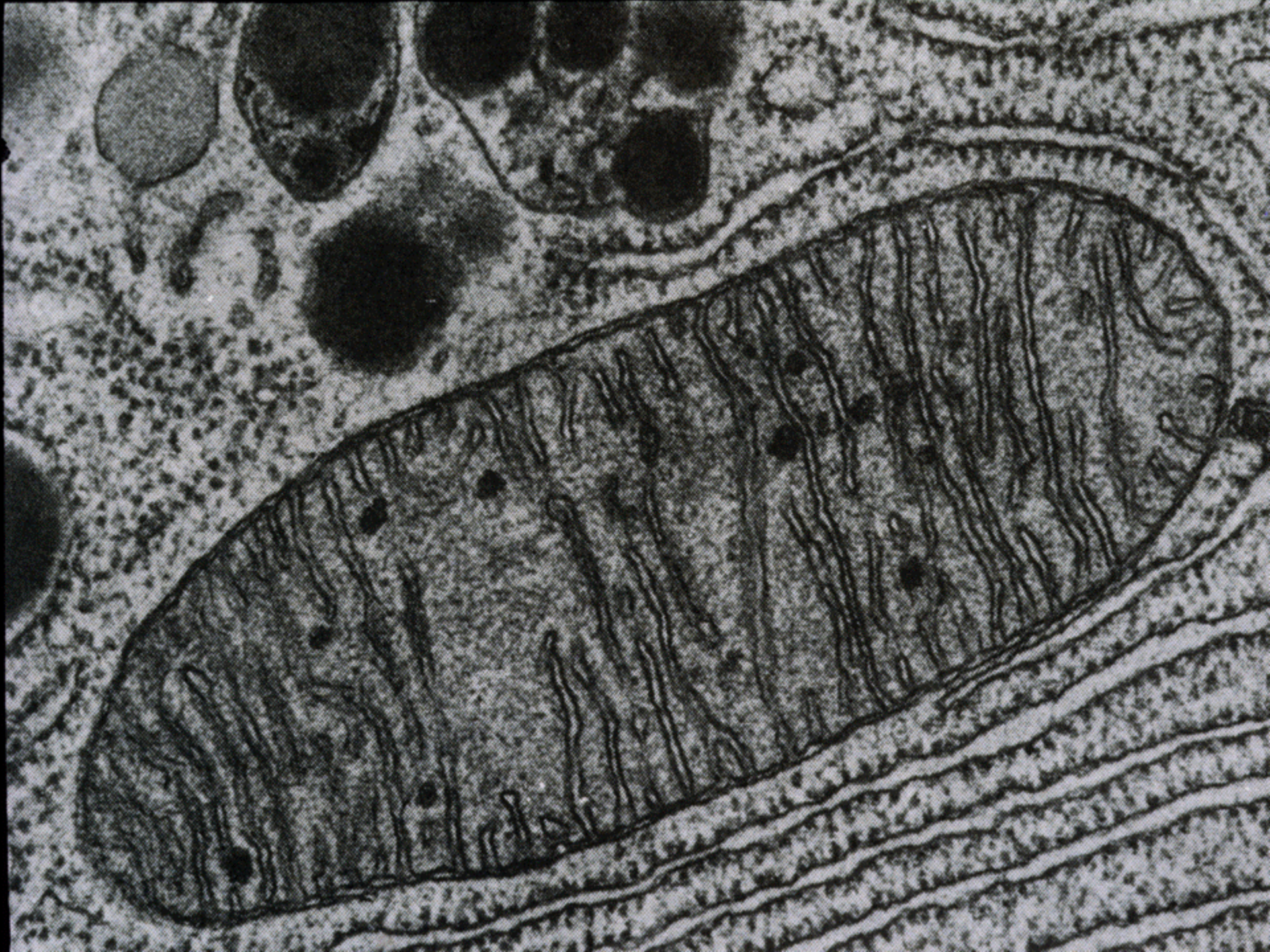
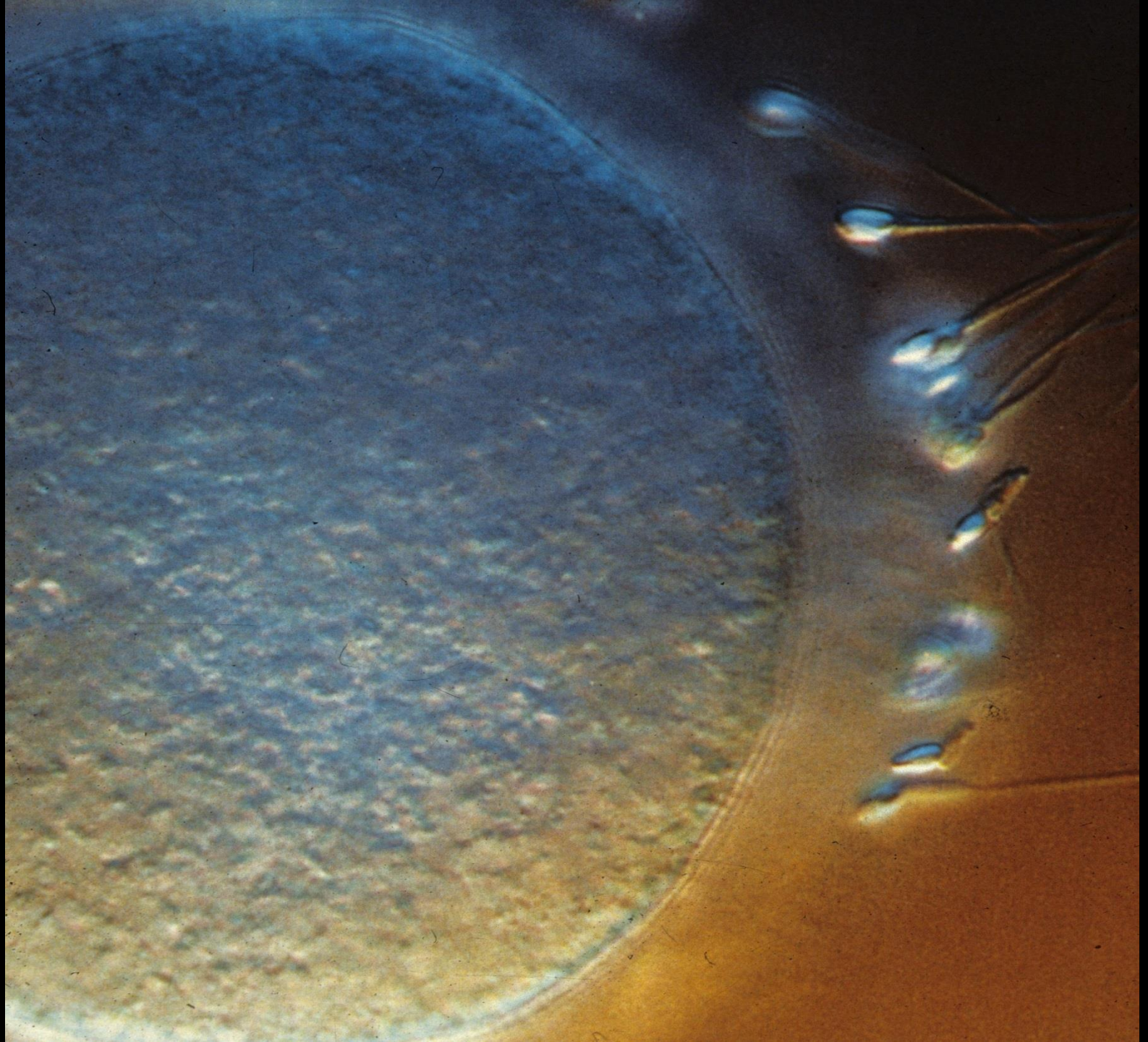


fig 2-8 LS 2012





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.



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

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

AEROBIC

w/O₂

=

MITOCHONDRION

ANAEROBIC

without O₂

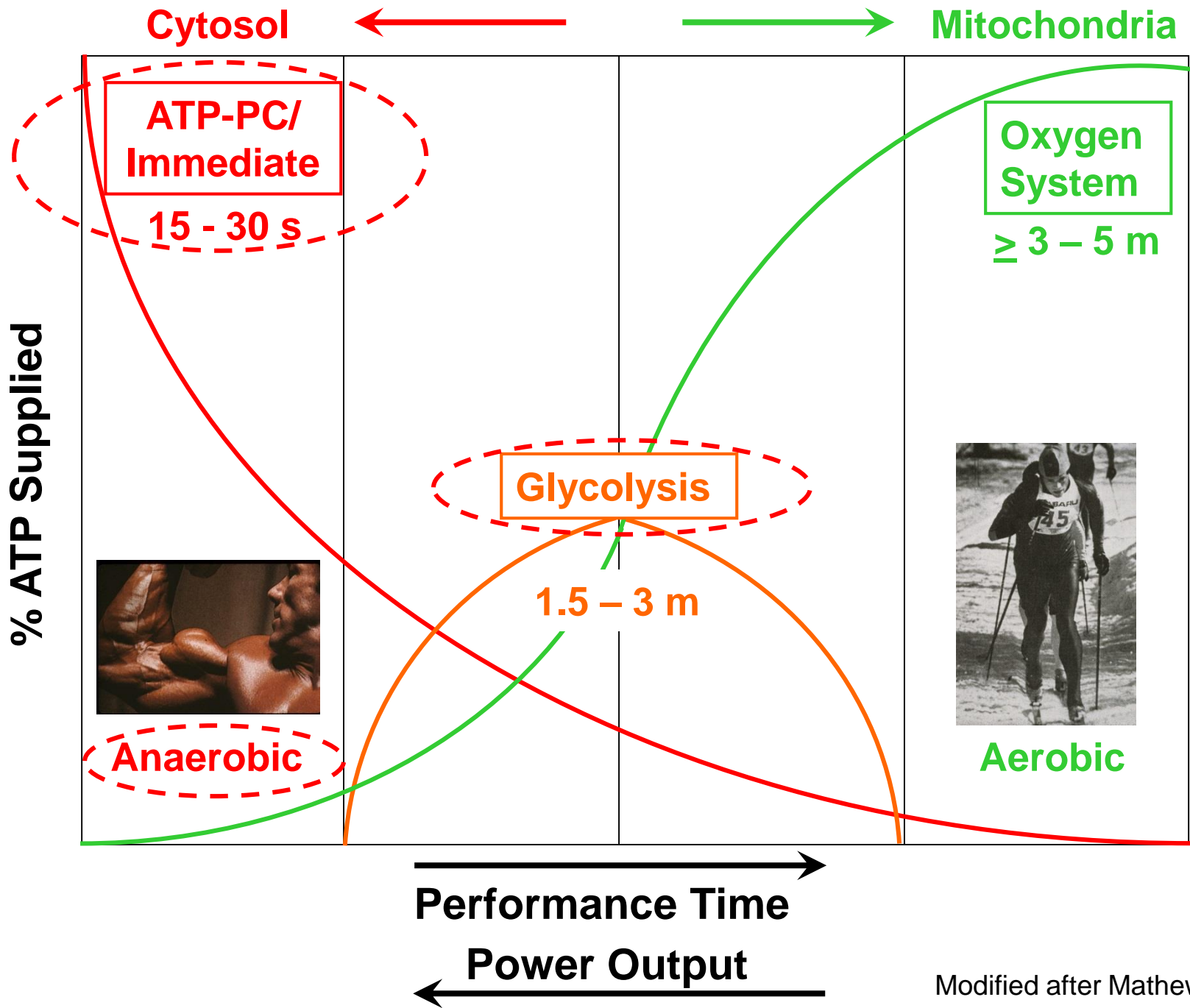
= CYTOSOL



1. Immediate/ATP-PC
2. Glycolysis

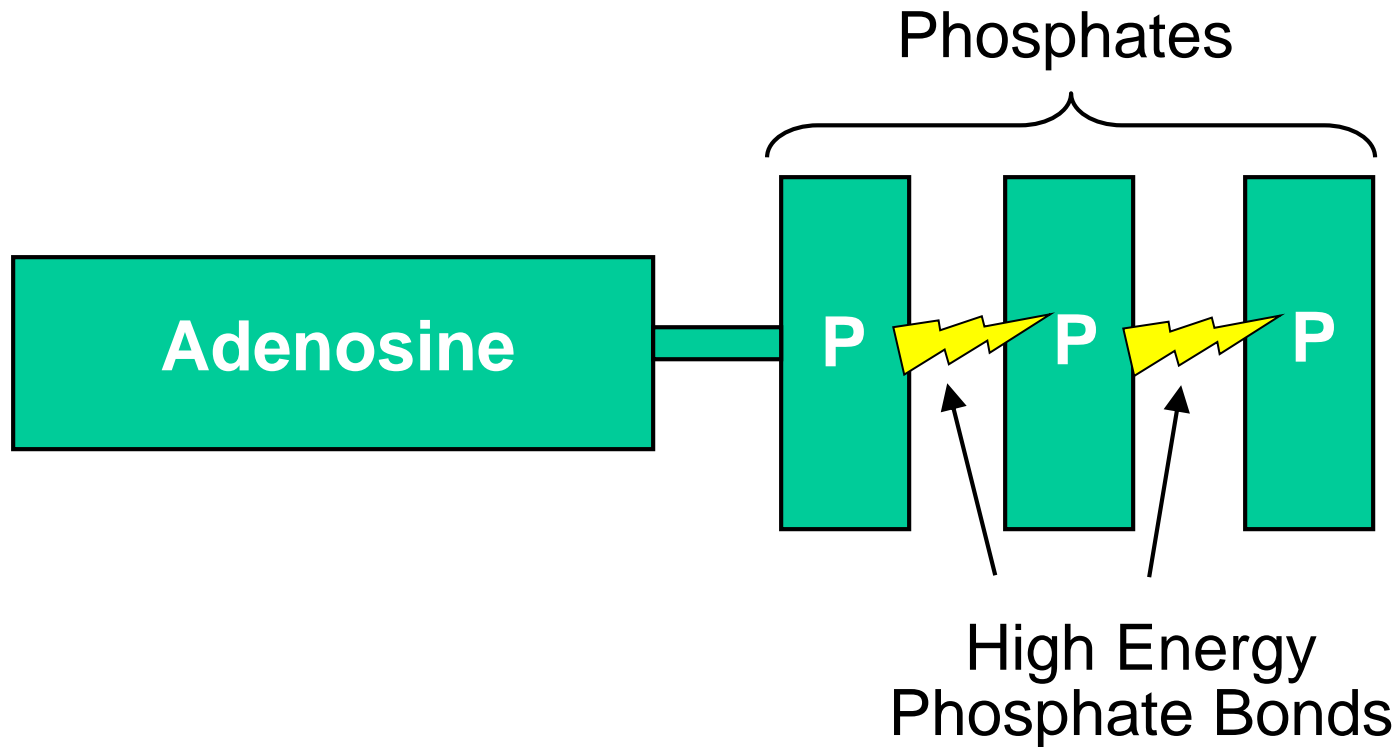


<https://jissn.biomedcentral.com/articles/10.1186/s12970-017-0173-z>
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3407788/>

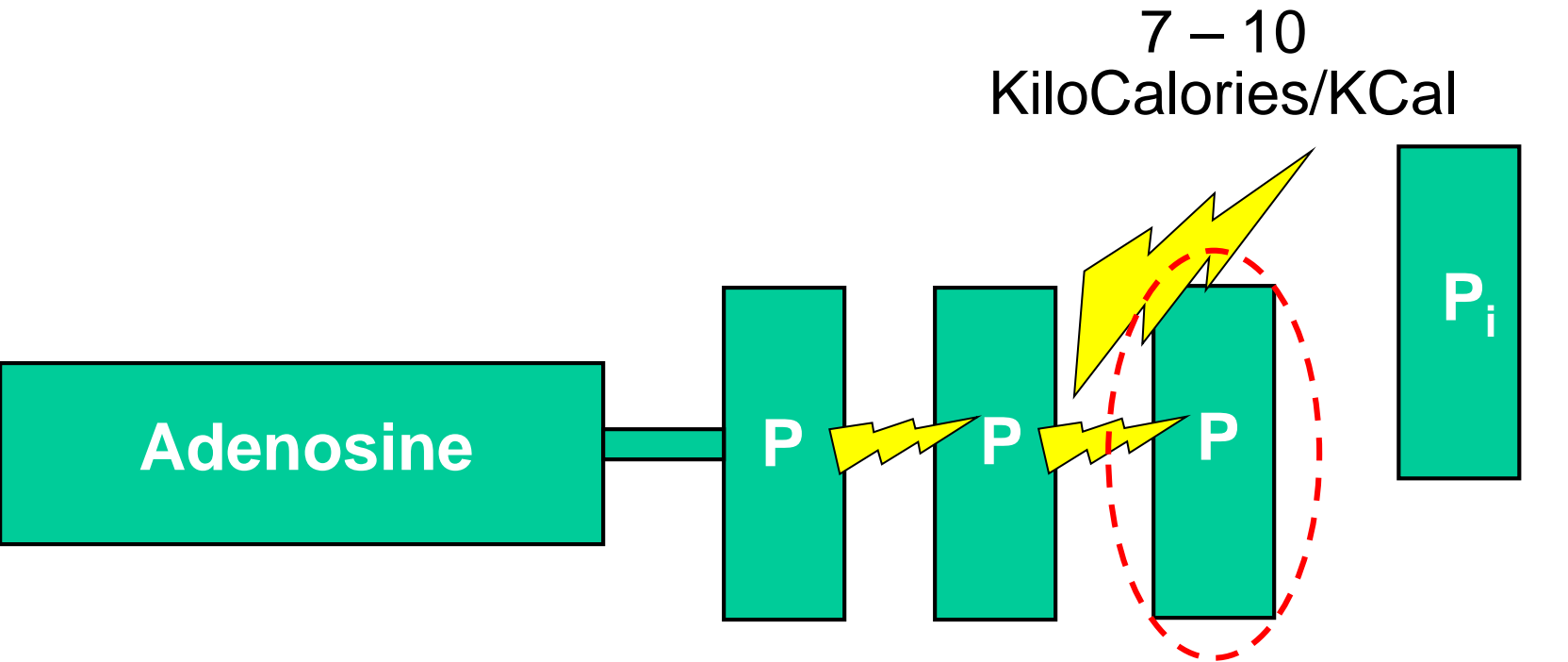


Modified after Mathews & Fox

ATP = Adenosine Tri Phosphate
*The Common Energy Currency
or the Cash Cells Understand!!*



Cleave One High Energy Phosphate Bond To Do Work!!



① *Synthesis of Macromolecules*

Make big things from little things!

② *Membrane Transport*

Move things!
Microscopic!

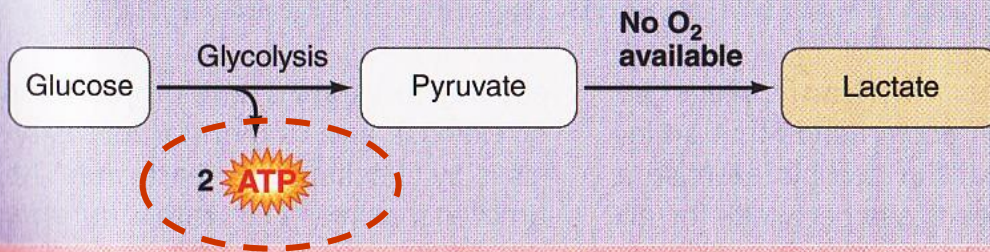
③ *Mechanical Work*

Move things!
Macroscopic!



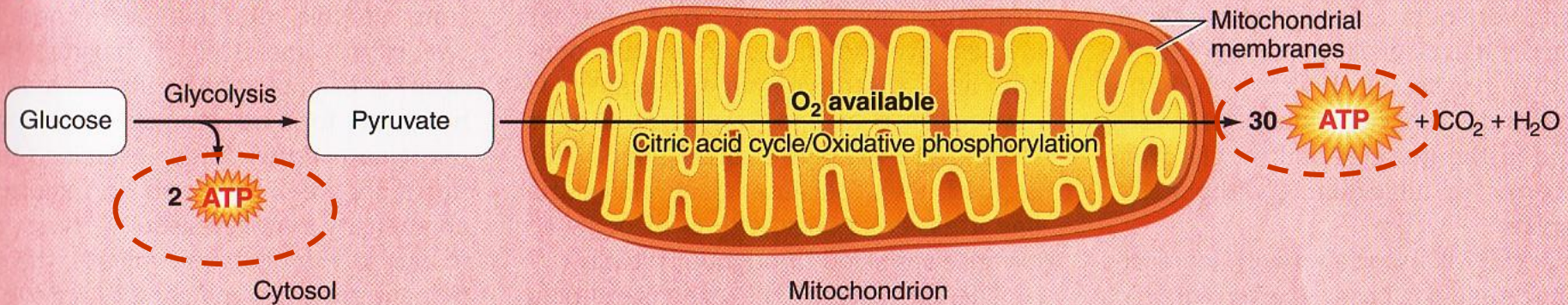
Anaerobic vs. Aerobic Metabolism

Anaerobic conditions



Anaerobic Glycolysis
"sugar dissolving"
without O₂. Net of 2 ATP
per molecule of glucose

Aerobic conditions

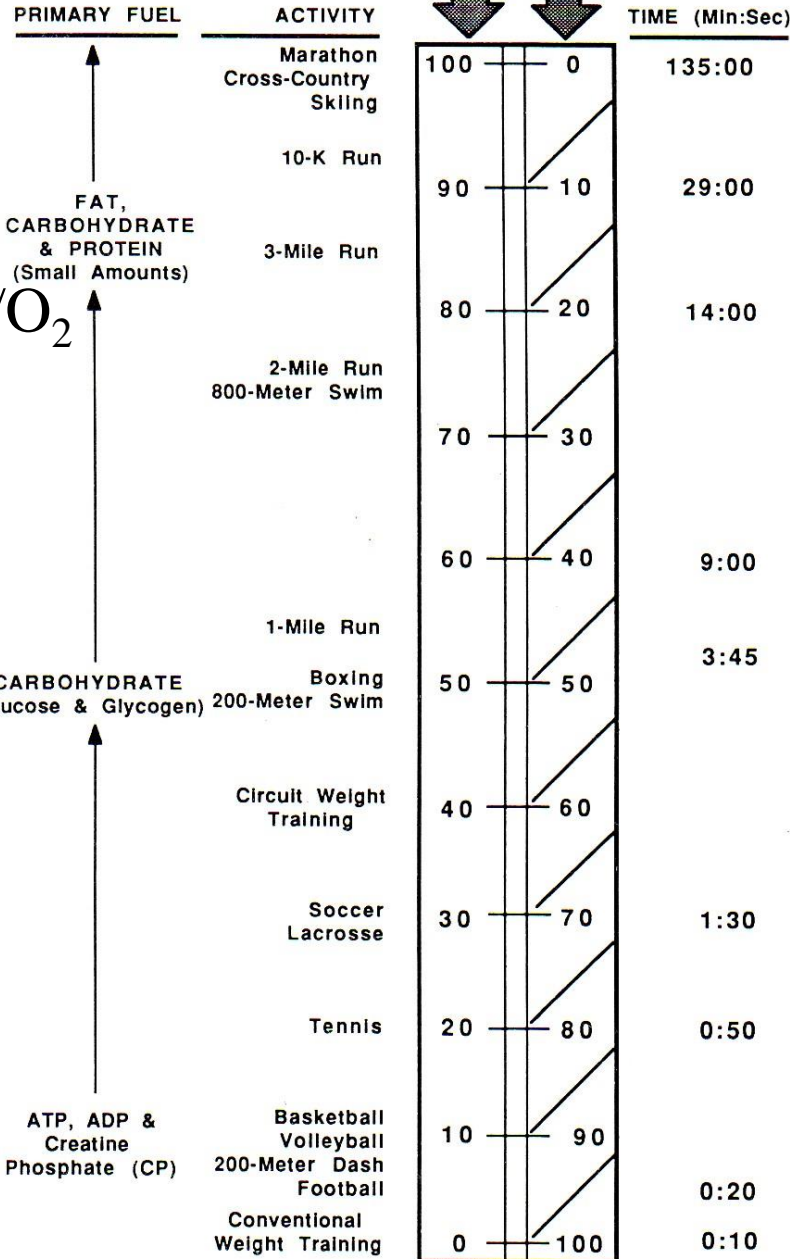


Aerobic Metabolism
+mitochondrial processing of
glucose with O₂. Net of 32 ATP
per molecule of glucose



AEROBIC

w/O₂



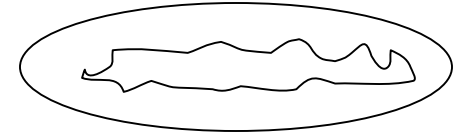
FAT,
CARBOHYDRATE
& PROTEIN
(Small Amounts)

CARBOHYDRATE
(Glucose & Glycogen)

ATP, ADP &
Creatine
Phosphate (CP)



ANAEROBIC



MITOCHONDRIA

CYTOSOL

Glycolysis



Immediate/ATP-PC

Stages of Cellular Metabolism/Respiration

**Anaerobic
Glycolysis
Cytosol**

**Aerobic
Metabolism
Mitochondria**

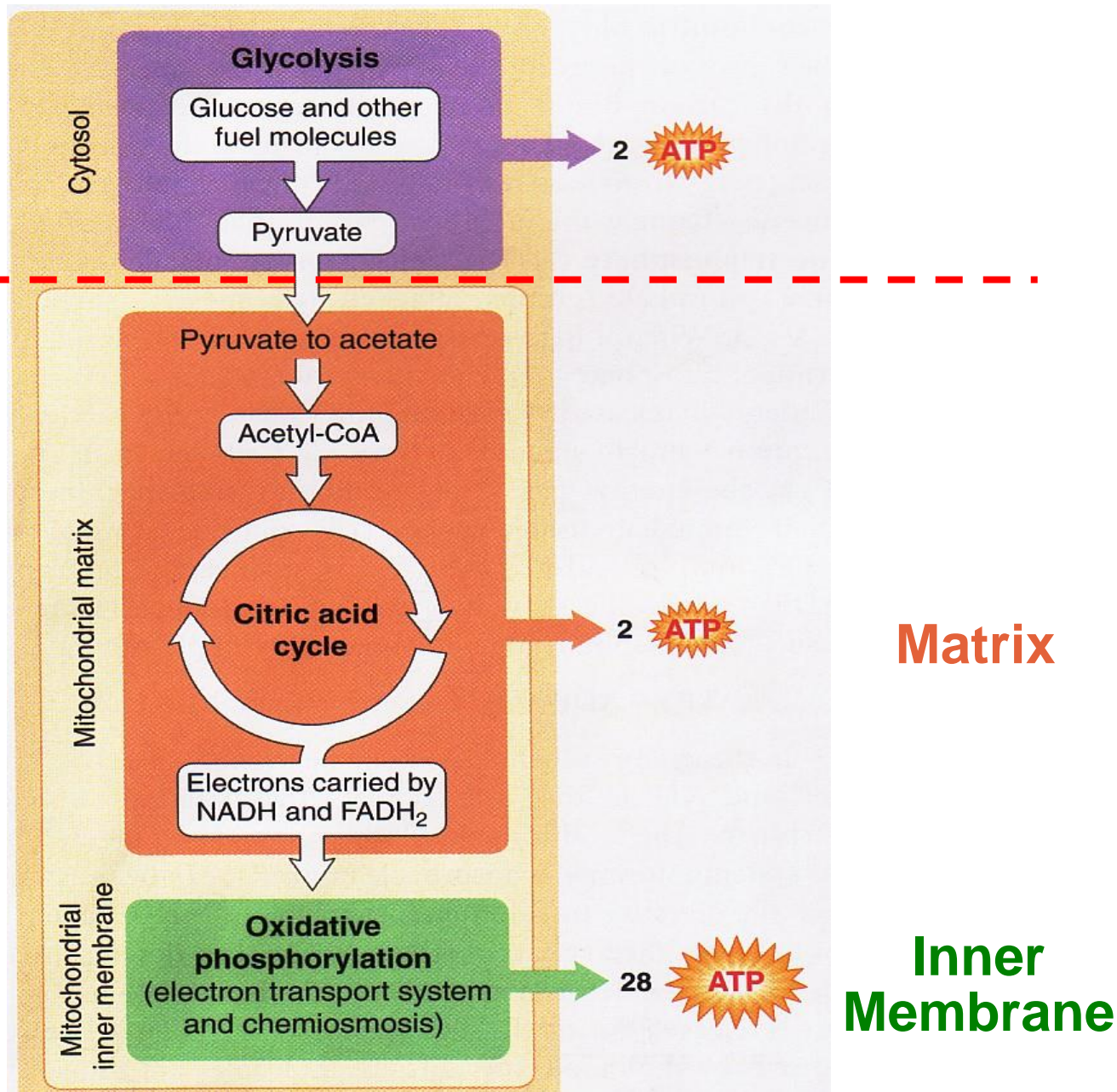


fig 2-9 LS 2012

Cashing in electrons at the Electron Transport Chain (ETC) produces an abundance of ATP energy molecules!

Cytosol

Outer mitochondrial membrane

MitoSciences®

Rod Capaldi
U of O Biology



Inner
...

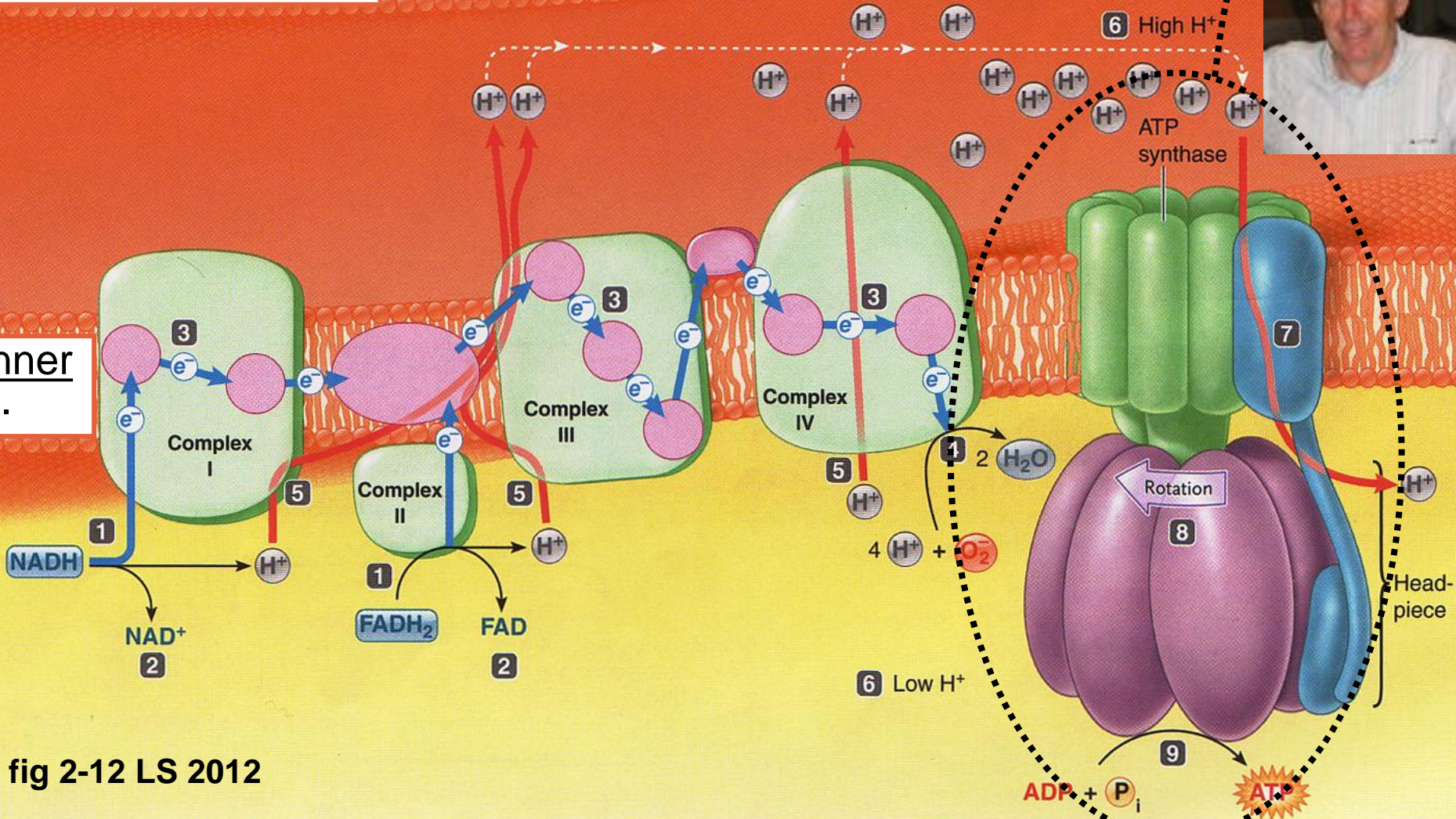


fig 2-12 LS 2012

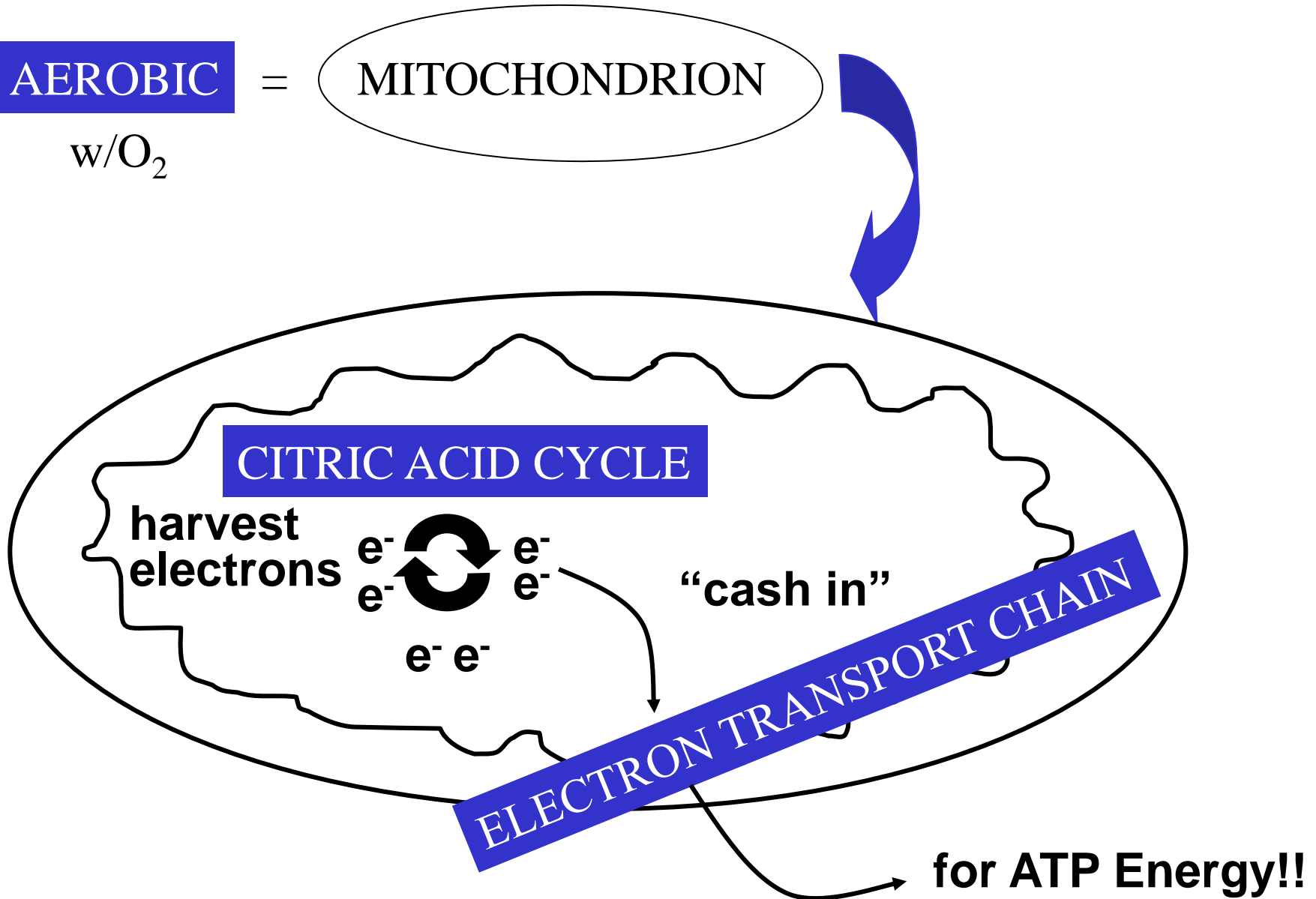
Goals of Aerobic Metabolism

AEROBIC

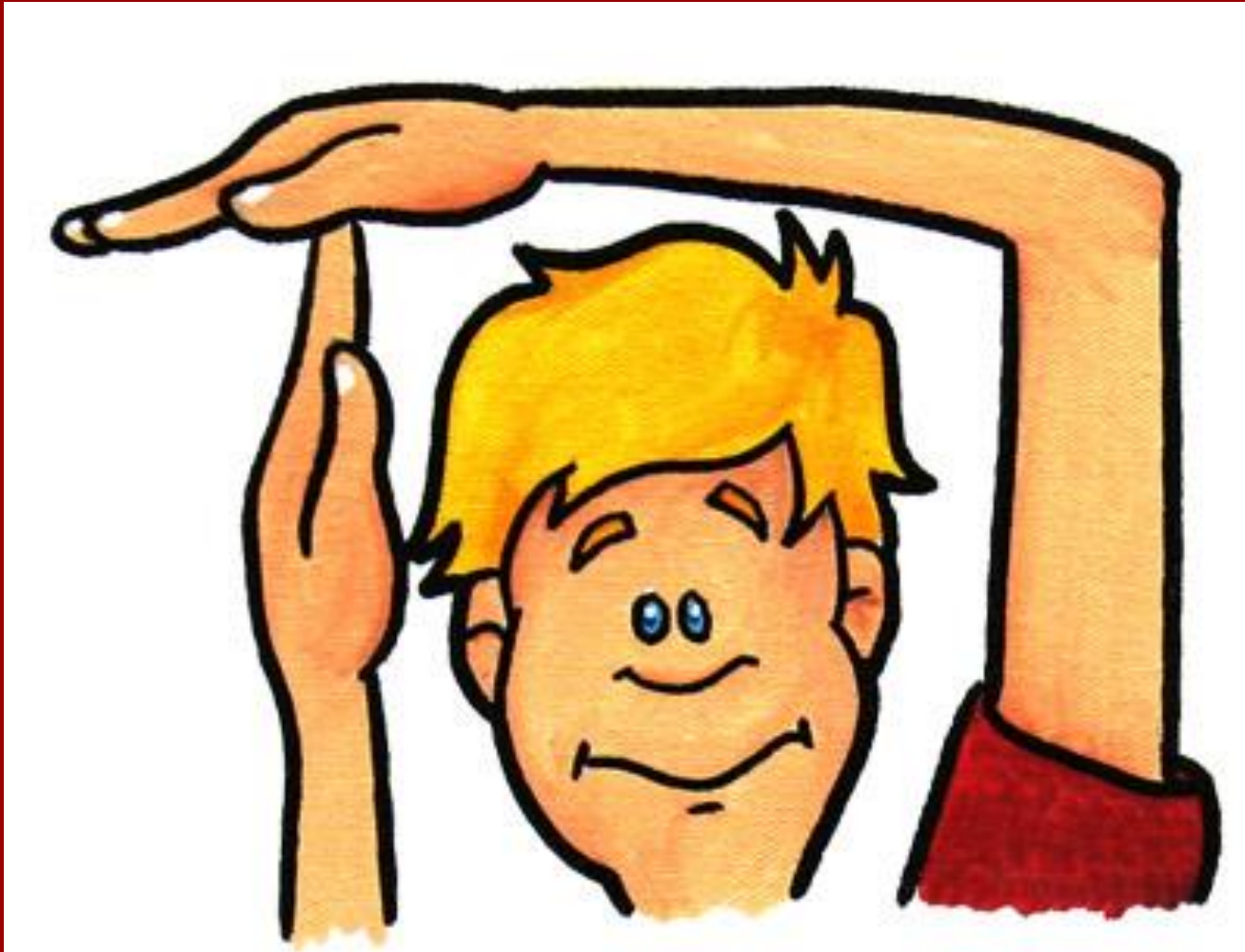
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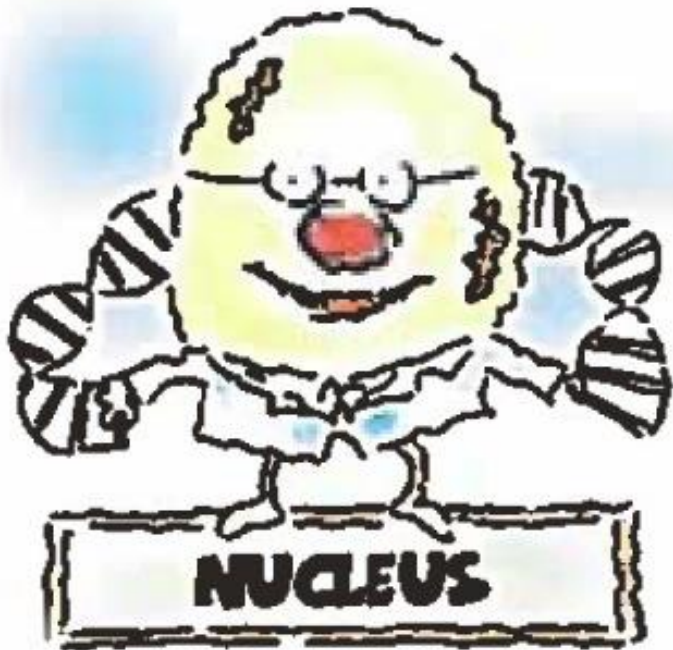
MITOCHONDRION

w/O₂



Time-out for questions!





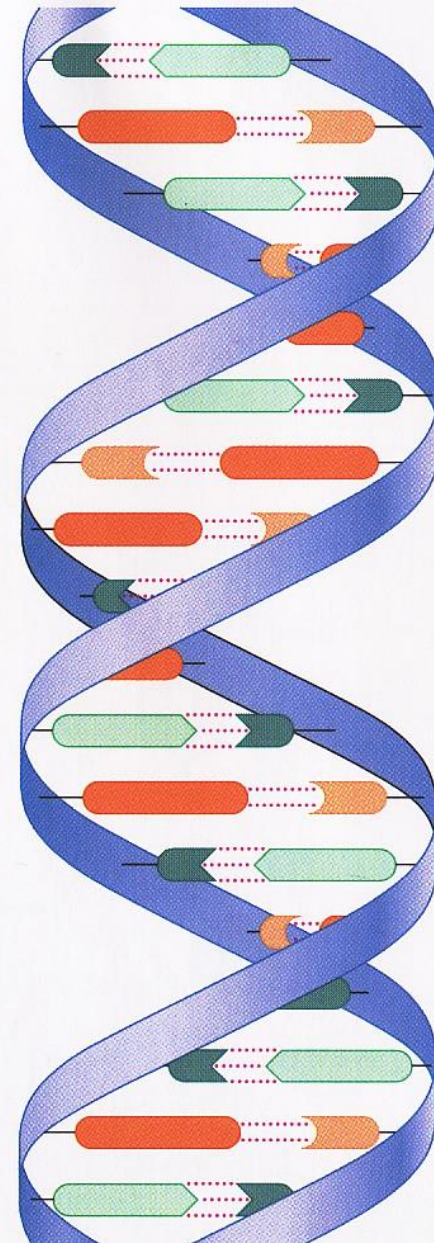
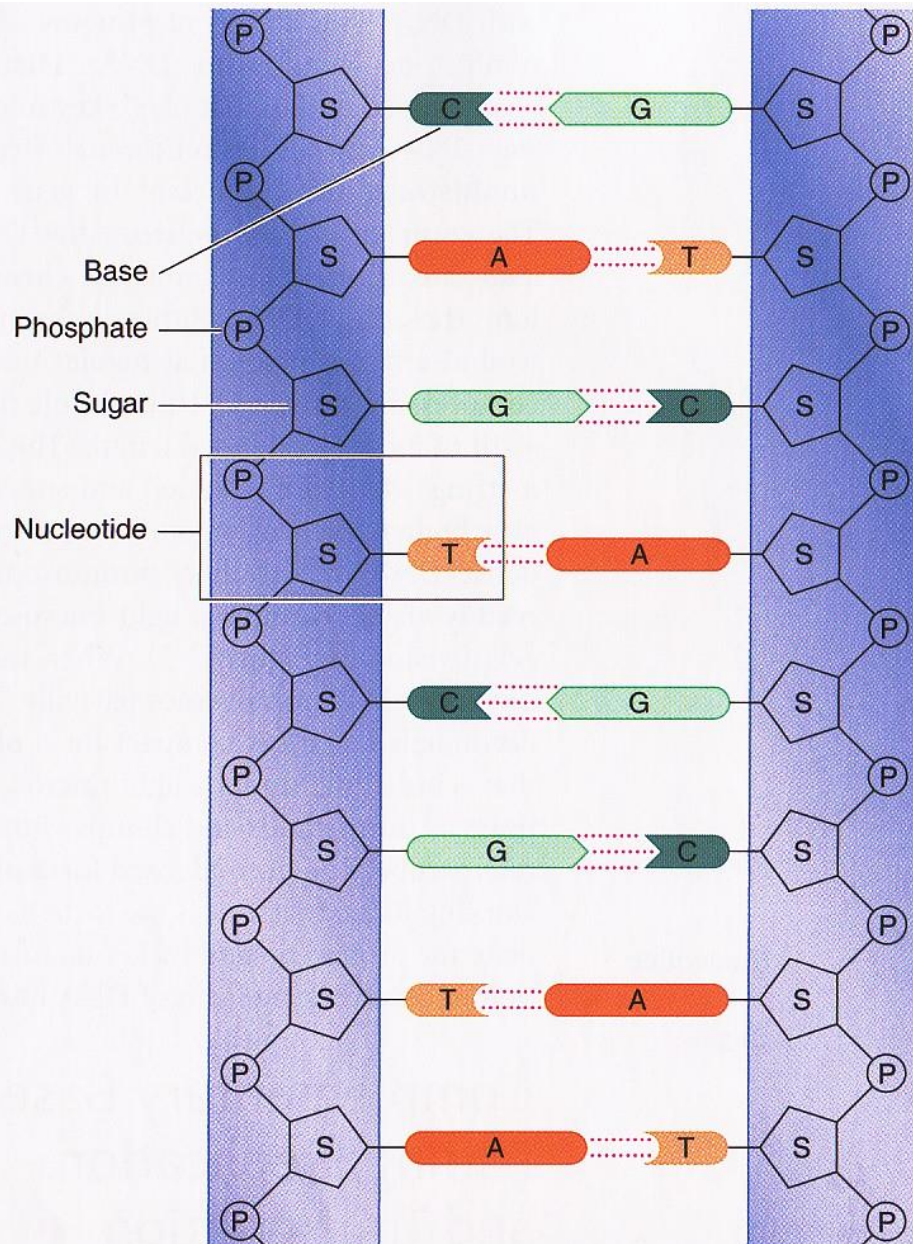
I'm the brain, or control center, of the cell. I carry most of the genetic material, so if you have red hair, it's probably because of me!

SOURCE: Bot Roda, Illustrator. *Anatomy & Physiology made Incredibly Visual!* Wolters Kluwer Health, Lippincott Williams & Wilkins, 2009.

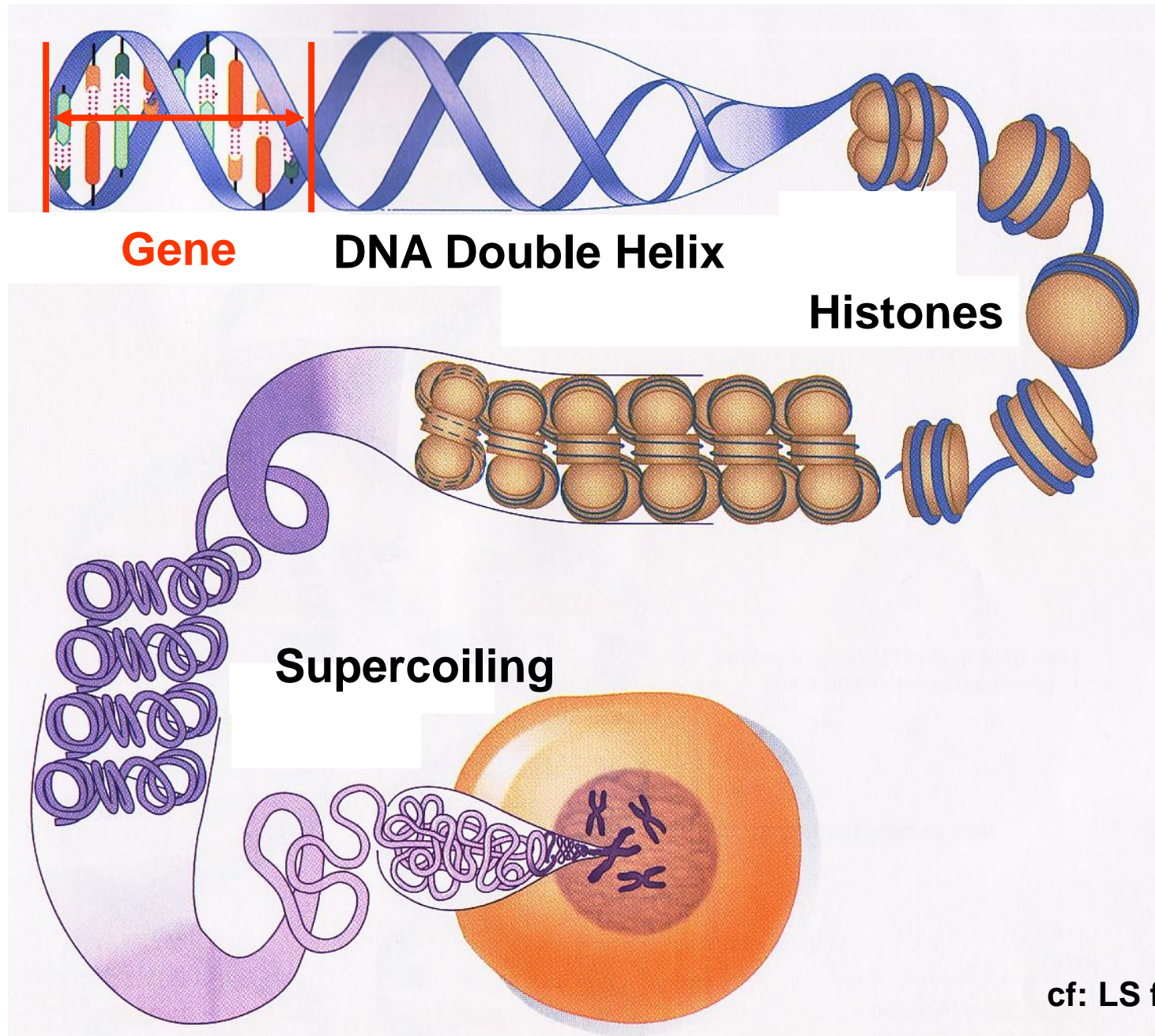
What are DNA's major functions? Heredity + Day-to-Day Cell Function



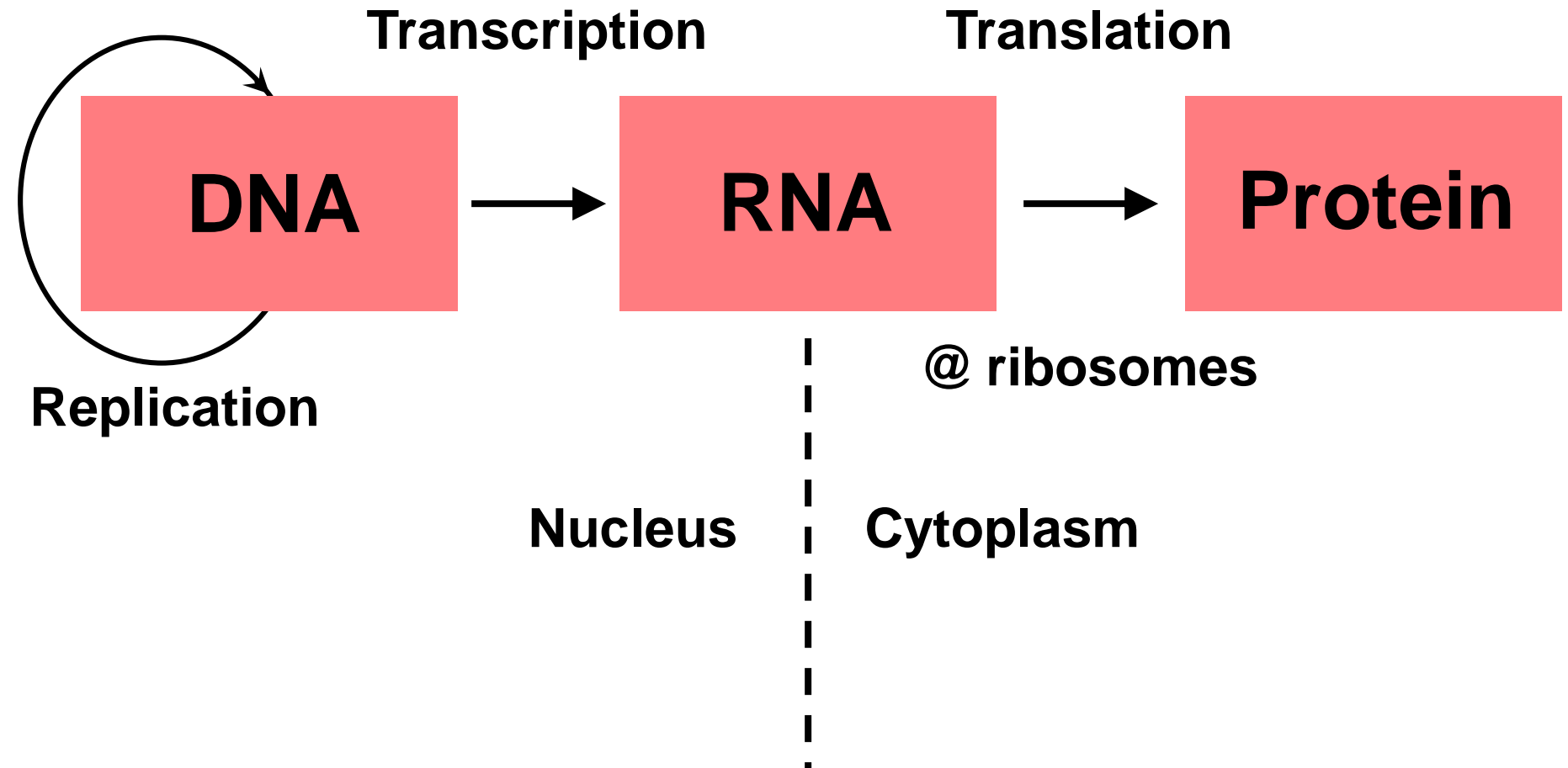
What does DNA look like? Double-helix!!



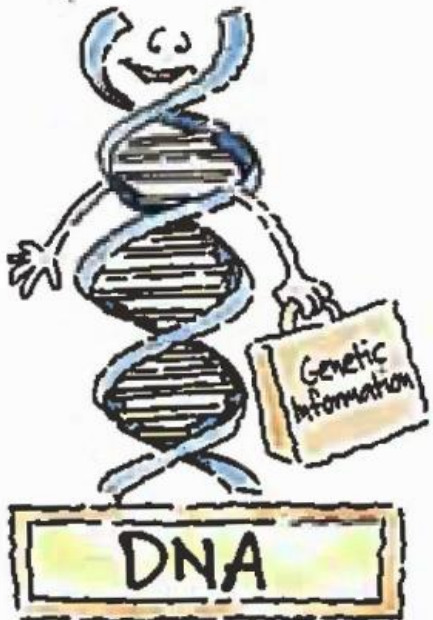
Gene = *Stretch of DNA that codes for a protein*



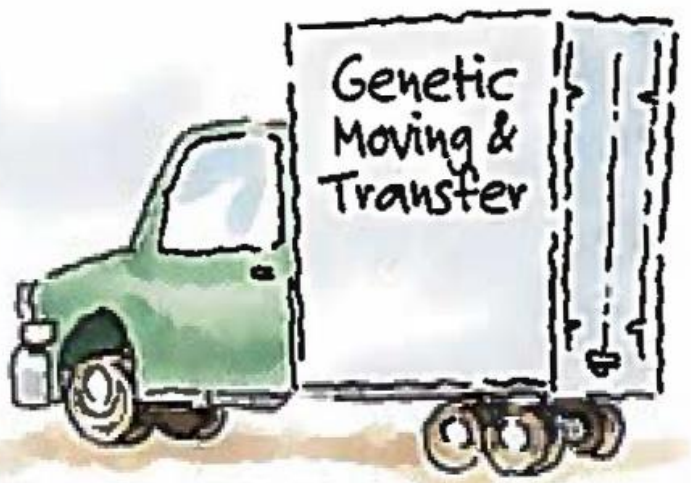
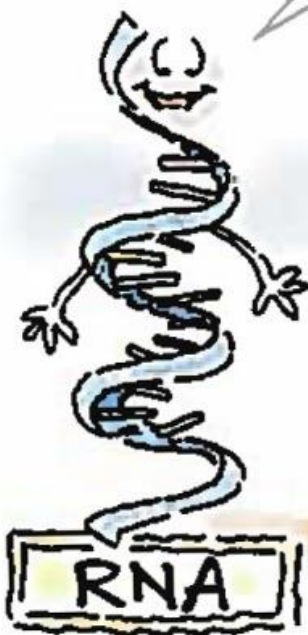
What does DNA do, day-to-day?



I carry the genetic information that provides the blueprint for protein synthesis.



I transfer genetic information to the ribosomes, where protein synthesis occurs.



SOURCE: Bot Roda, Illustrator. *Anatomy & Physiology made Incredibly Visual!* Wolters Kluwer Health, Lippincott Williams & Wilkins, 2009.

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^o 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

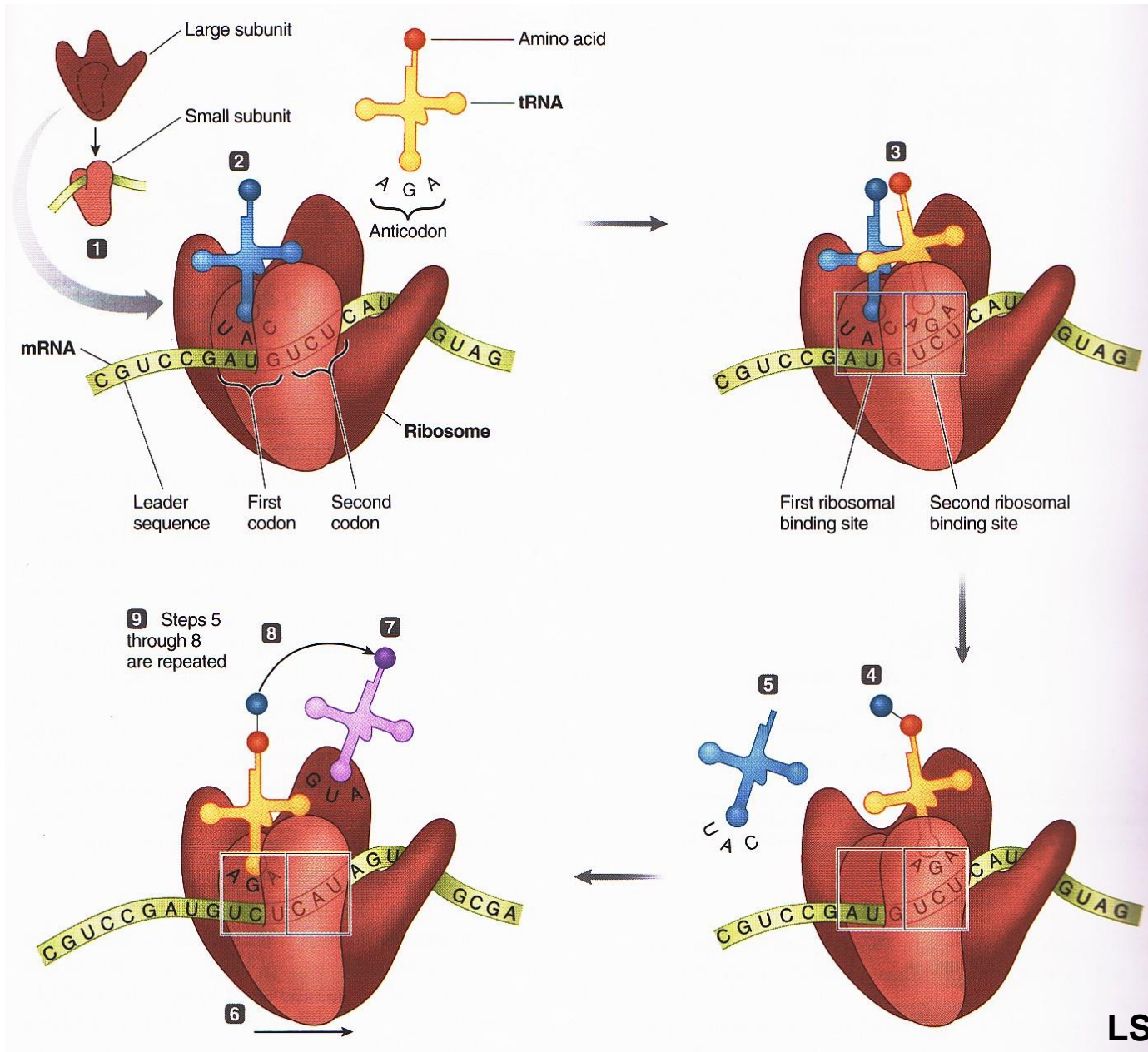
TAC

AUG

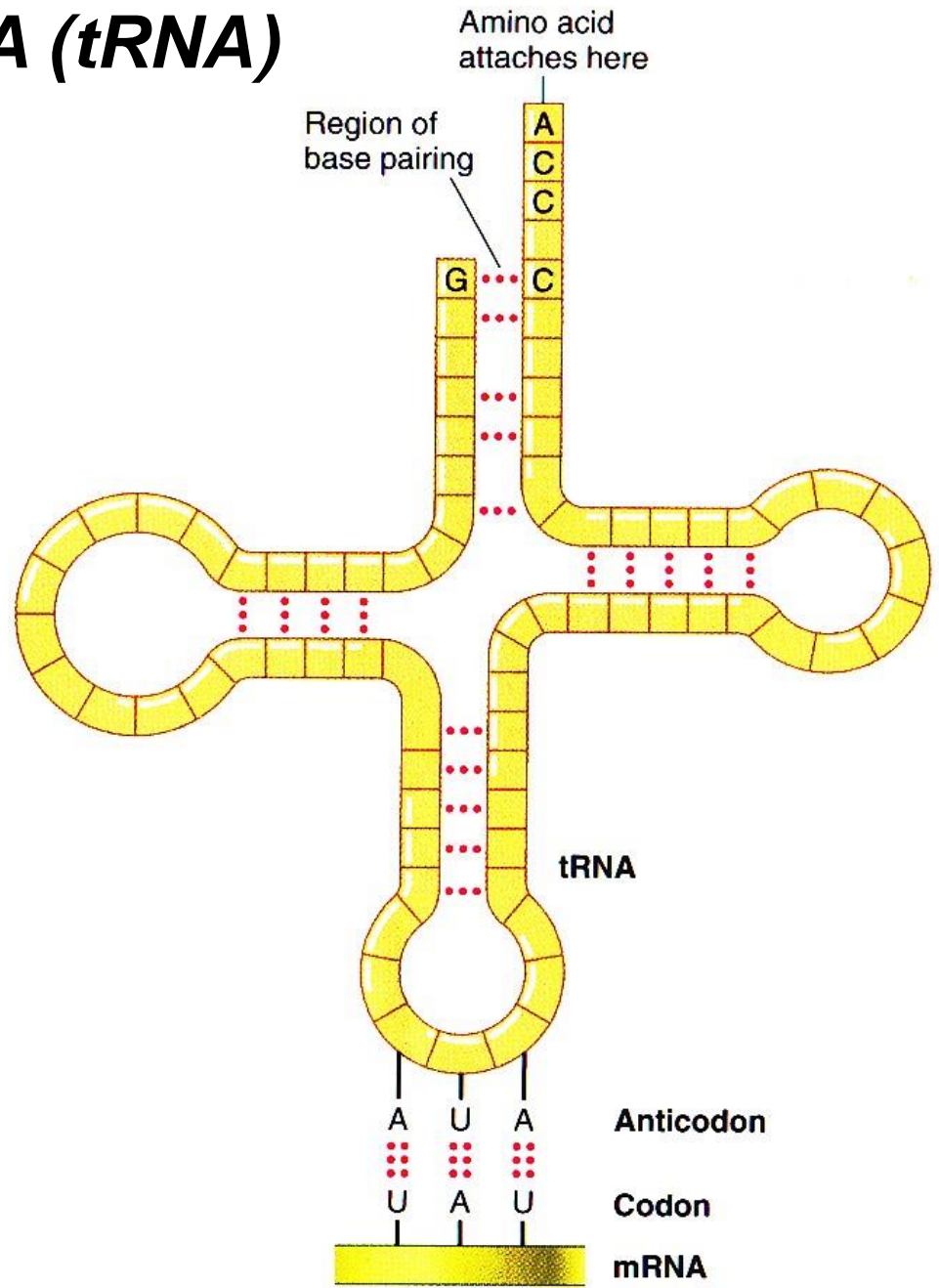
UAC

		Second base of codon				
		U	C	A	G	
First base of codon	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } Ser UCC } UCA } UCG }	UAU } Tyr UAC } UAA } Stop UAG } Stop	UGU } Cys UGC } UGA } Stop UGG } Trp	U C A G
	C	CUU } Leu CUC } CUA } CUG }	CCU } Pro CCC } CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } Arg CGC } CGA } CGG }	U C A G
	A	AUU } Ile AUC } AUA } AUG } Met Start	ACU } Thr ACC } ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	U C A G
	G	GUU } Val GUC } GUA } GUG }	GCU } Ala GCC } GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } Gly GGC } GGA } GGG }	U C A G

Translation? Ribosomes Make Proteins

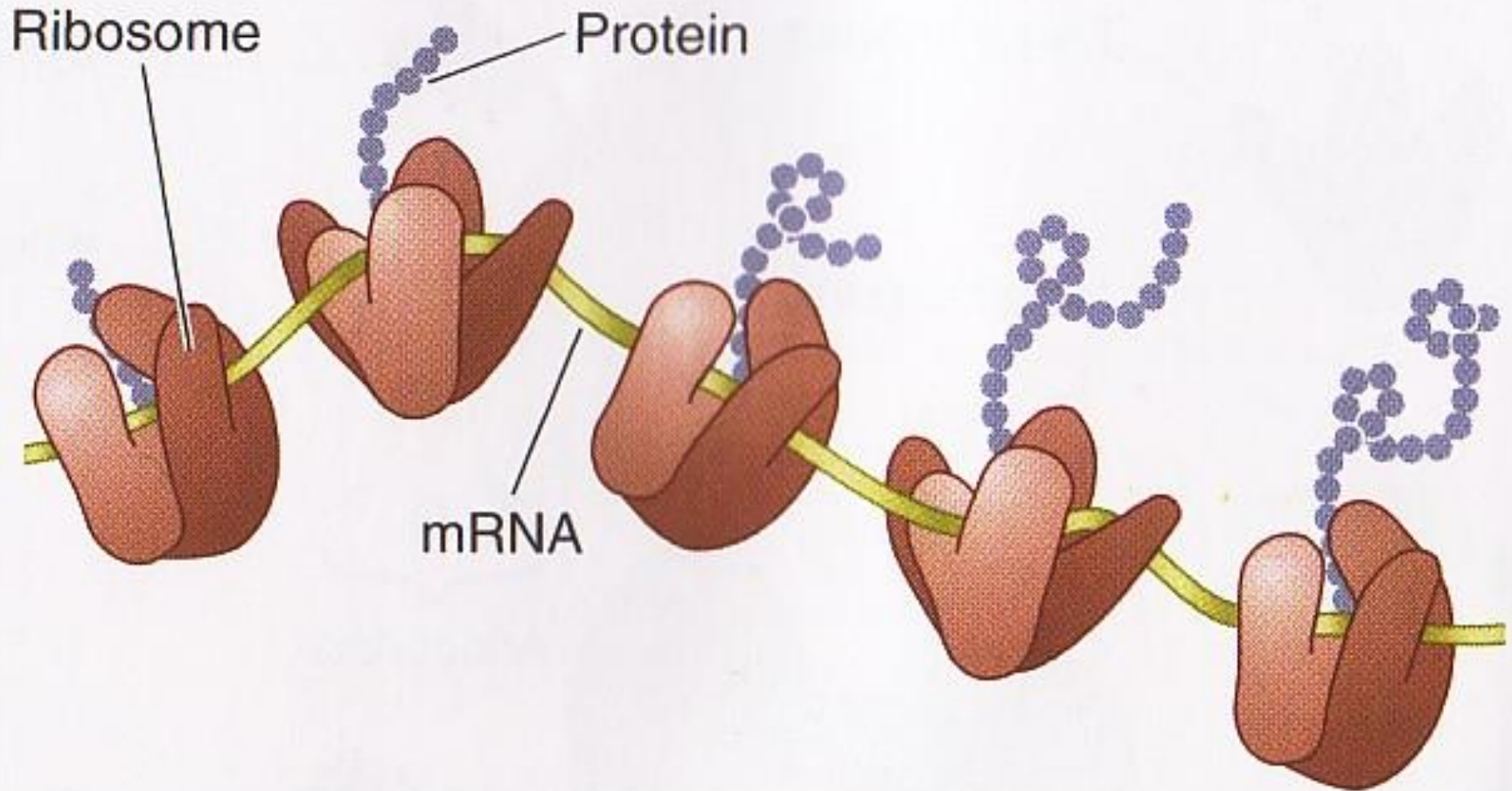


Transfer RNA (tRNA)



LS fig C-8

A Polyribosome. Which Way is Synthesis?



Class Skit on Translation!



A *protein* synthesizing factory, where *translation* takes place!

What's a ribosome?



You rock, baby!



Questions + Discussion

