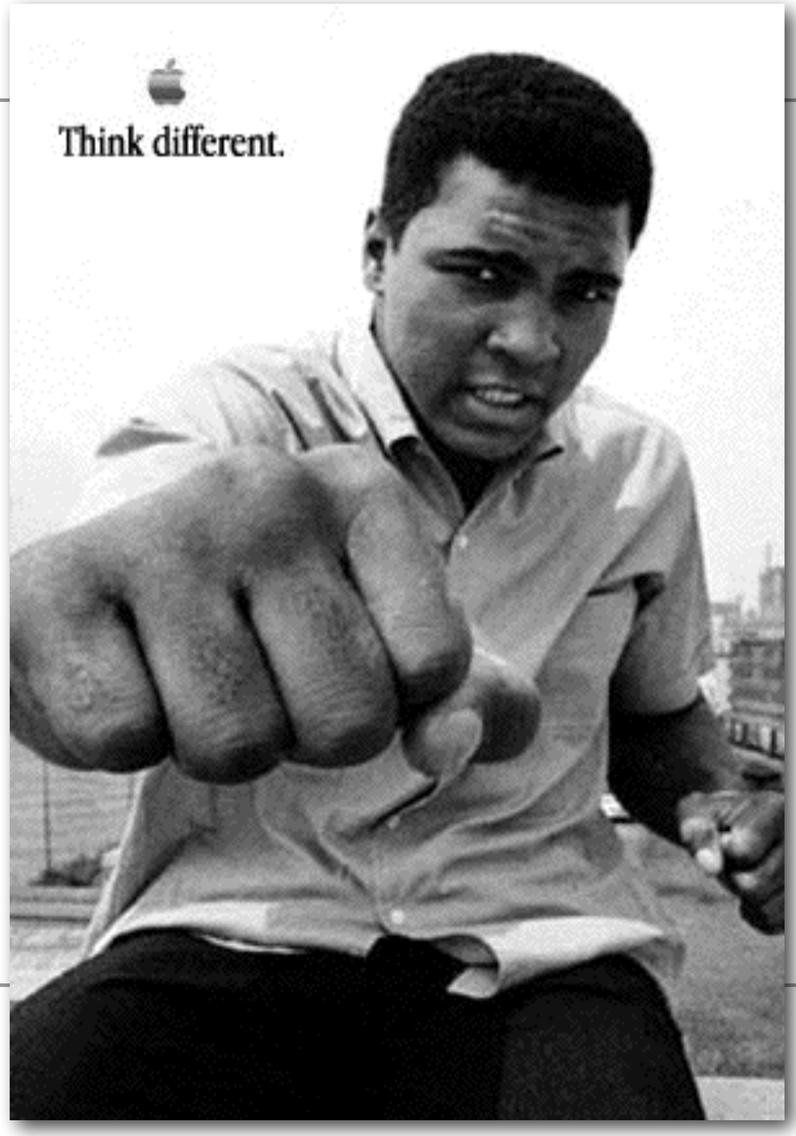
LB145-Fall *2023*



1. **Pick up** Name Folder

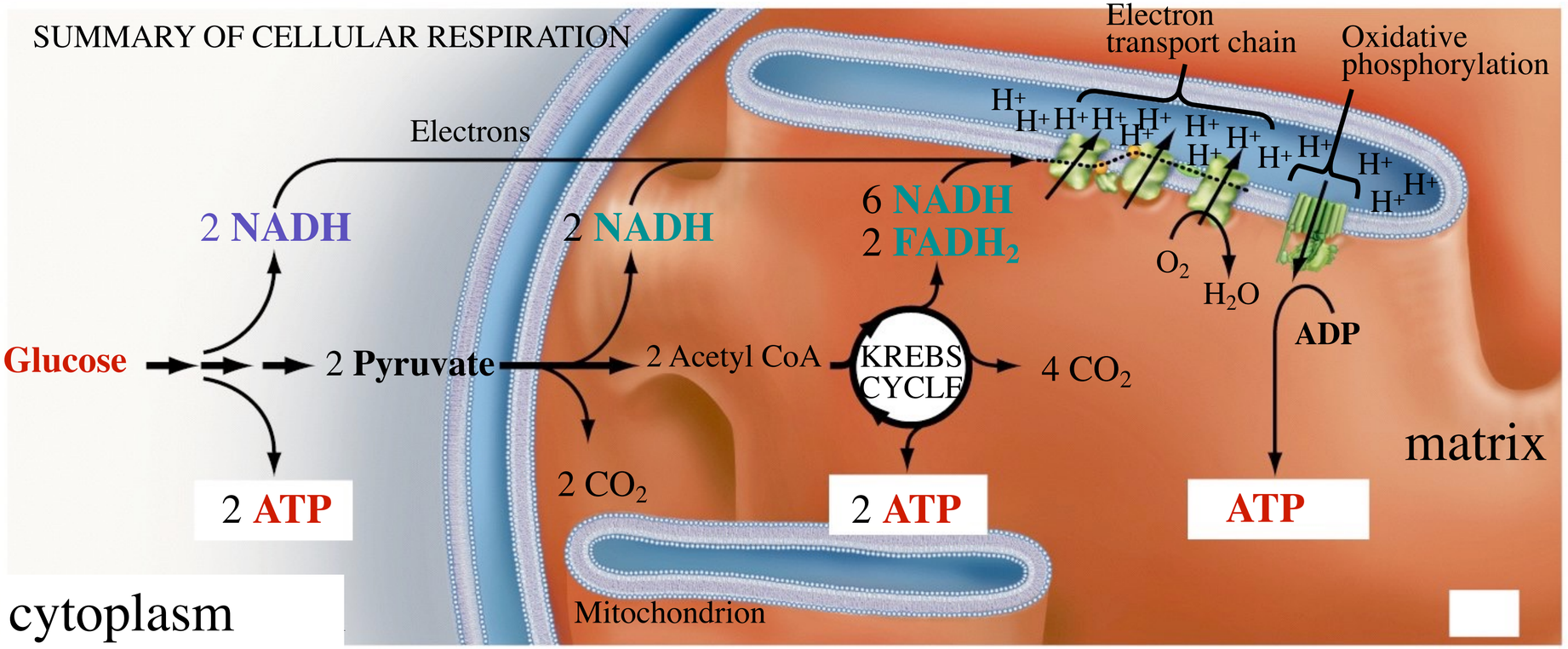
- Pick up name folder and set it up at seat.

2. **Sit** with your group.

- laptops on outer perimeter (avoid distracting)

3. **Clicker** Attendance

- Launch your Top Hat, and get ready to click.


SUMMARY OF CELLULAR RESPIRATION
Electron transport chain
Oxidative phosphorylation
Electrons
2 NADH
2 NADH
6 NADH
2 FADH2
Glucose
2 Pyruvate
2 Acetyl CoA
KREBS CYCLE
4 CO2
O2
H2O
ADP
matrix
2 CO2
2 ATP
2 ATP
ATP
cytoplasm
Mitochondrion

Chemiosmosis: Uncouplers

Some drugs known as uncouplers facilitate diffusion of protons across the mitochondrial inner membrane. When such a drug is added, what will happen to ATP synthesis and oxygen consumption?

a) Both ATP synthesis and oxygen consumption will decrease.

b) ATP synthesis will decrease; oxygen consumption will increase.

c) ATP synthesis will increase; oxygen consumption will decrease.

d) Both ATP synthesis and oxygen consumption will increase.

e) ATP synthesis will decrease; oxygen consumption will stay the same.

Electron Transport Chain and Respiration

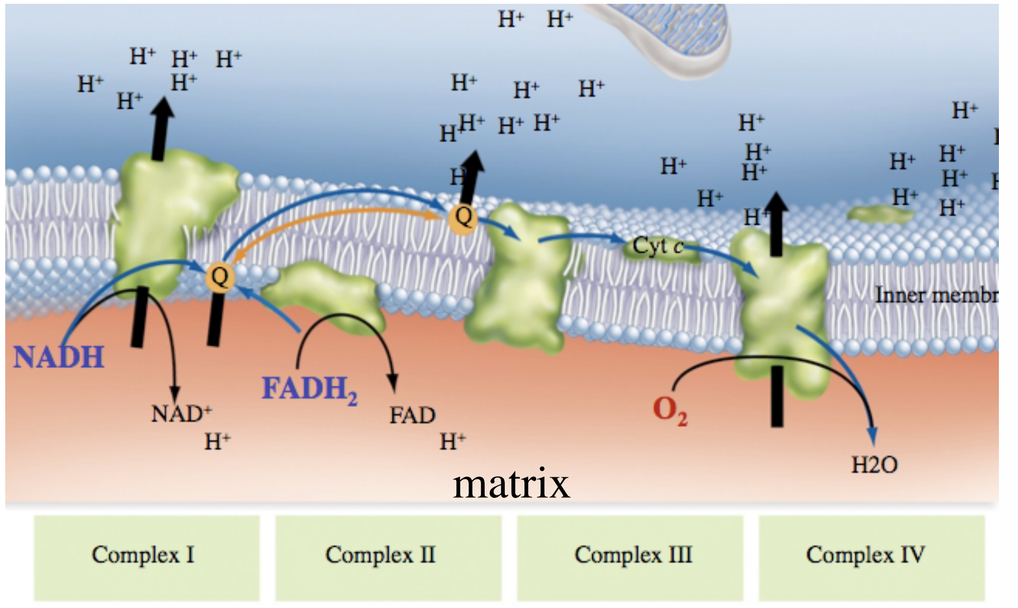
Rotenone inhibits Complex I (NADH-Q Reductase). When Complex I is completely inhibited, cells will

a) neither consume oxygen nor make ATP.

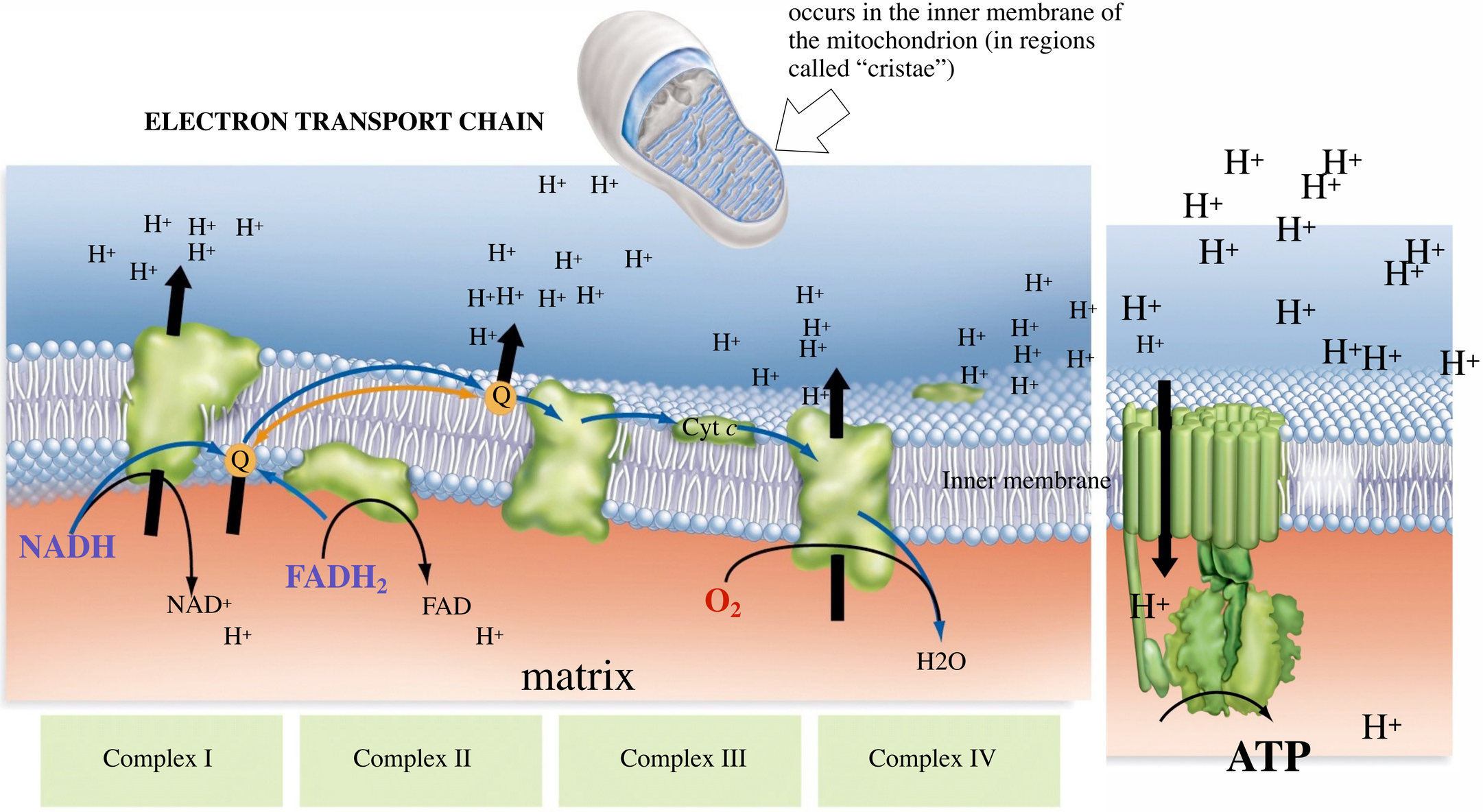
b) not consume oxygen and will make ATP through glycolysis and fermentation.

c) not consume oxygen and will make ATP only through substrate-level phosphorylation.

d) consume less oxygen but still make some ATP through both glycolysis and respiration.

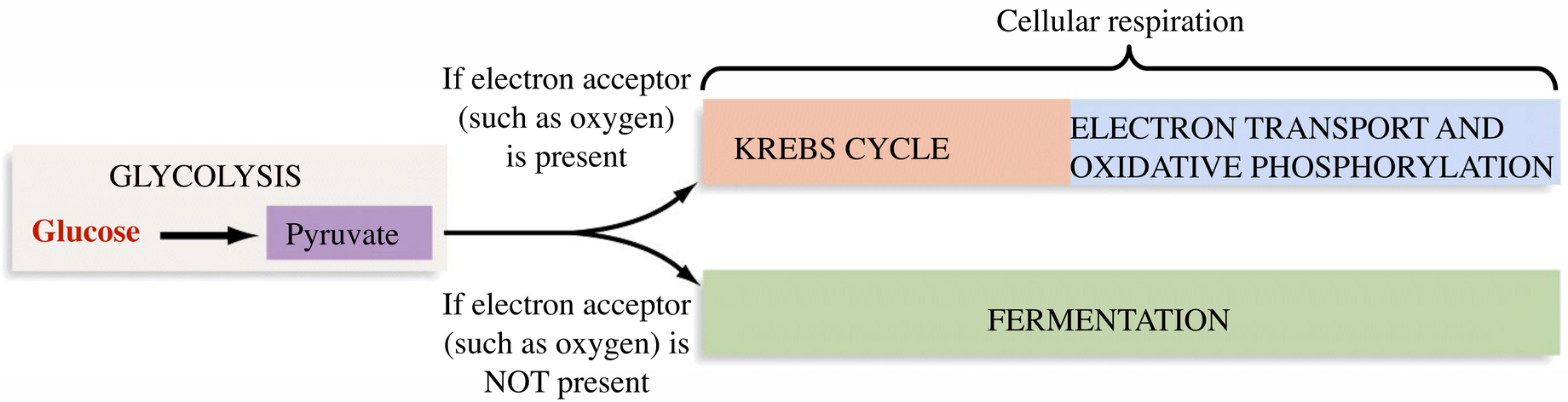


The electron transport chain occurs in the inner membrane of the mitochondrion (in regions called “cristae”)

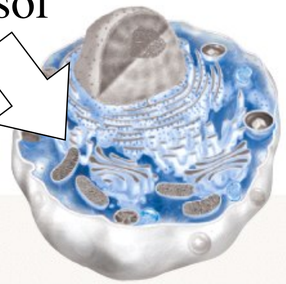


What would help YOUR learning?

a. Discuss the topic of Rotational Catalysis
b. Review Metabolism and Electron Transport Chain
c. Explain how Glycolysis is like eating Pizza!
d. Talk about Fermentation as an option in some cells
e. Discuss Krebs Cycle and the path inside the mitochondria like the events in the Biovisions movie
f. Explain how I can get paid in the summer to work by the beach in Malibu CA at a REU.

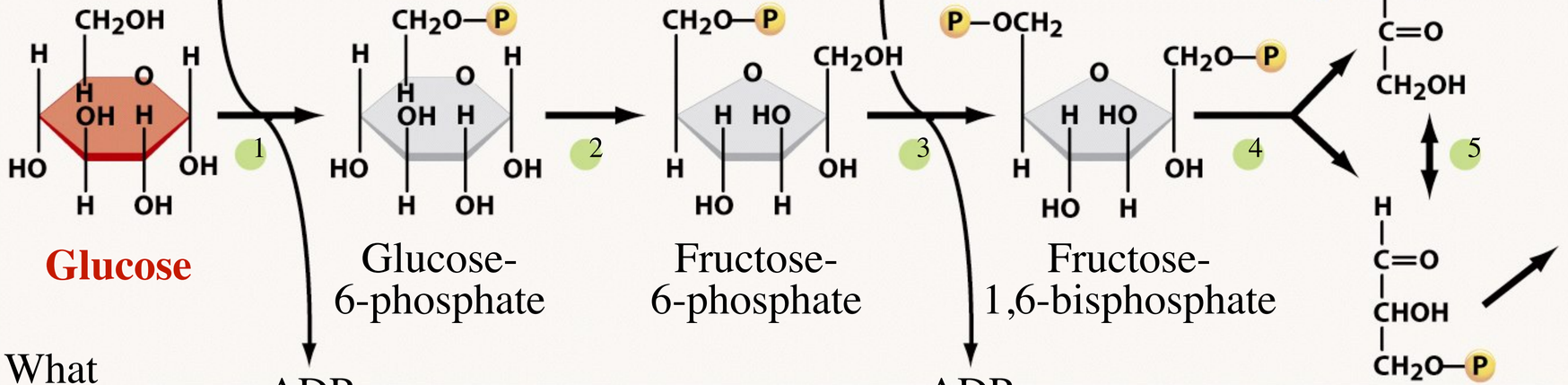

Cellular respiration
If electron acceptor (such as oxygen) is present
GLYCOLYSIS
Glucose
Pyruvate
KREBS CYCLE
ELECTRON TRANSPORT AND OXIDATIVE PHOSPHORYLATION
If electron acceptor (such as oxygen) is NOT present
FERMENTATION

All 10 reactions of glycolysis occur in cytosol



GLYCOLYSIS

What goes in: ATP



What comes out: ADP ADP

Glycolysis begins with an energy-investment phase of 2 ATP

PIP

- Think of the beginning of “Glyco-lysis” as eating a pizza

Think Glucose = Pizza

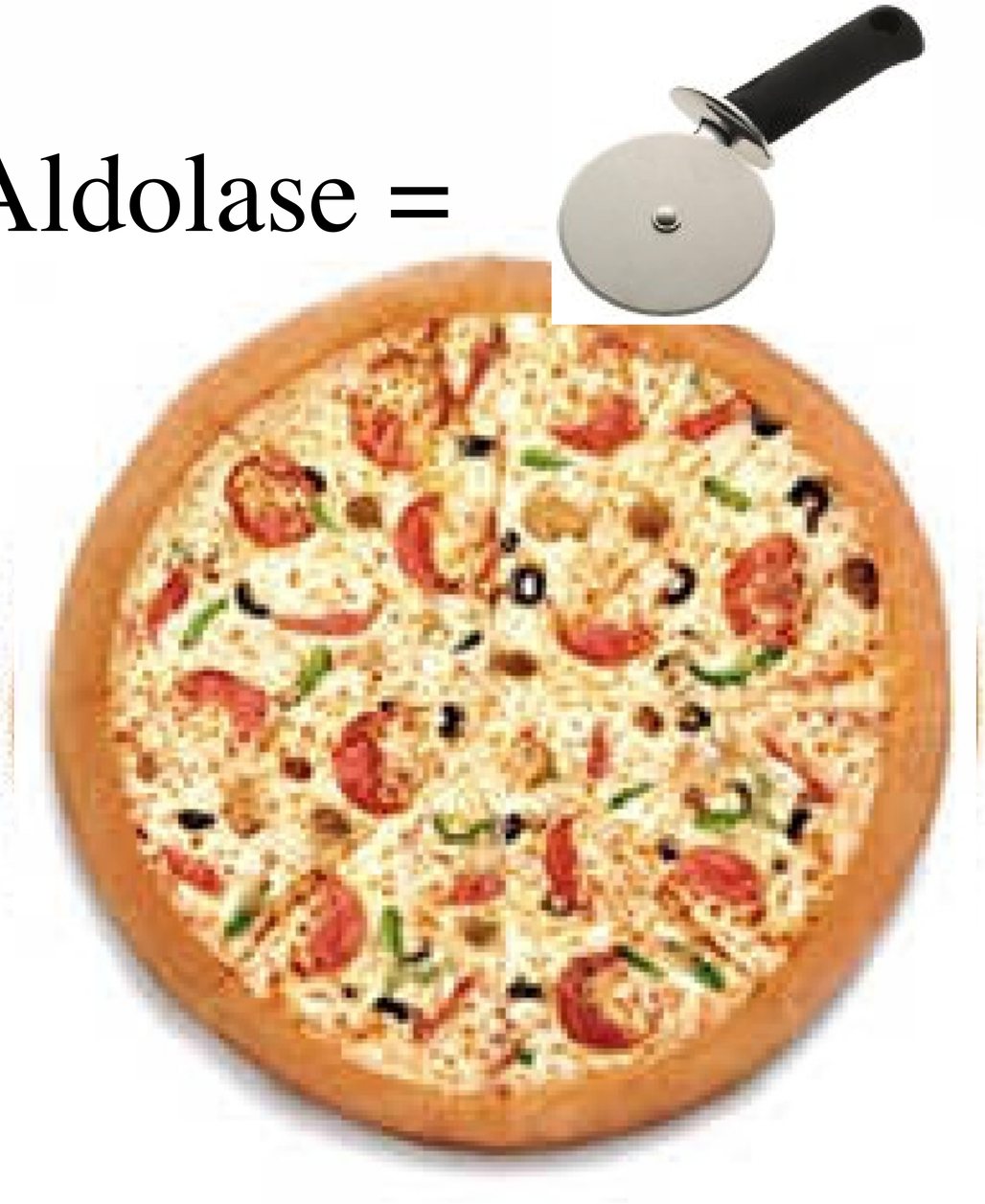
The common ‘hexo-pyranose’ form of Pizza

Meet **PIP**

(**P**hosphorylate-**I**somerize-**P**hosphorylate)

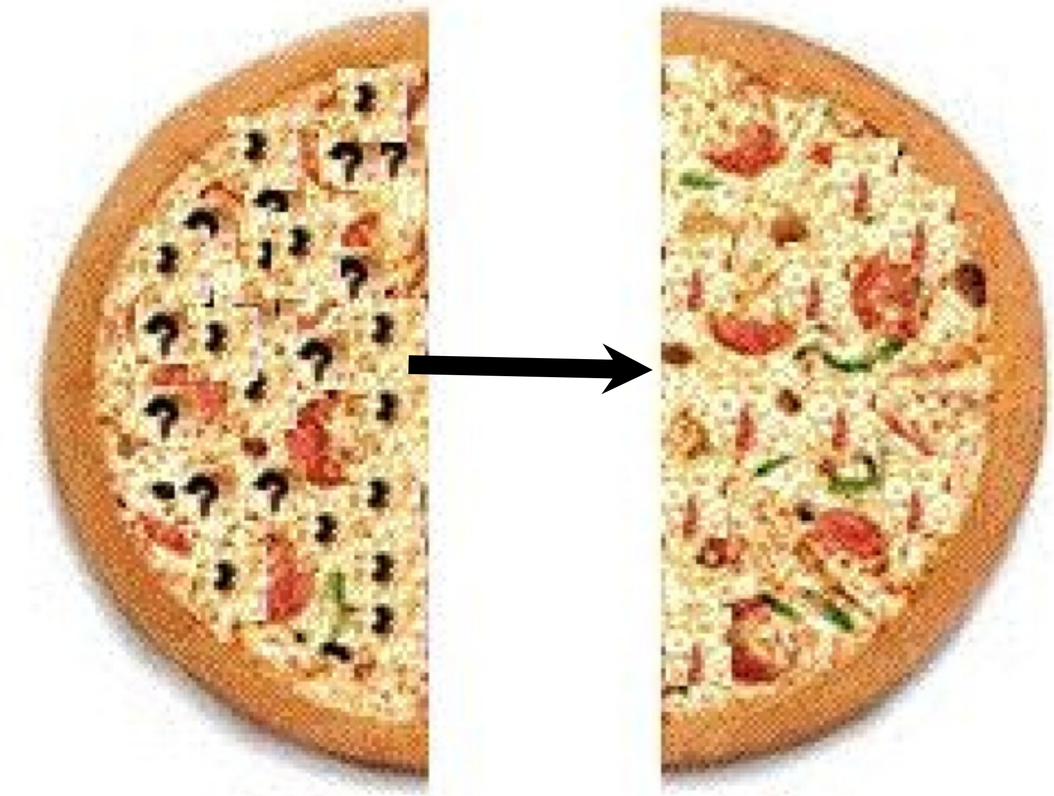
- Is that *really* the best way to hold on to your pizza?

Aldolase =



Fructose 1-6 Bisphosphate -> DHAP (ick) and G-3-P (tasty!)

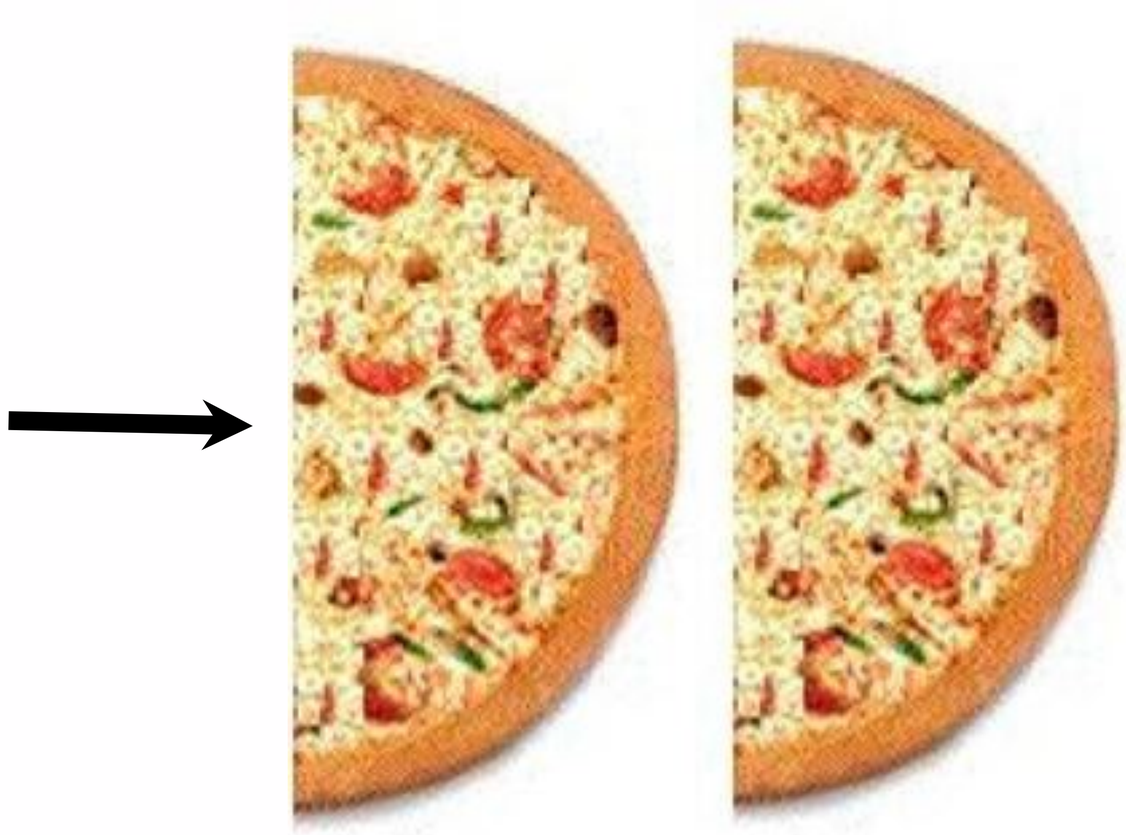
Isomerase ->



DHAP (ick)

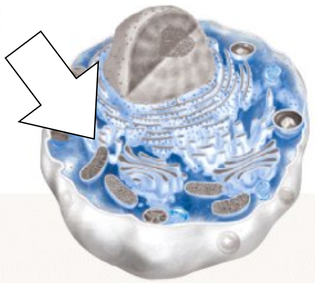
G-3-P (tasty!)

Isomerase ->

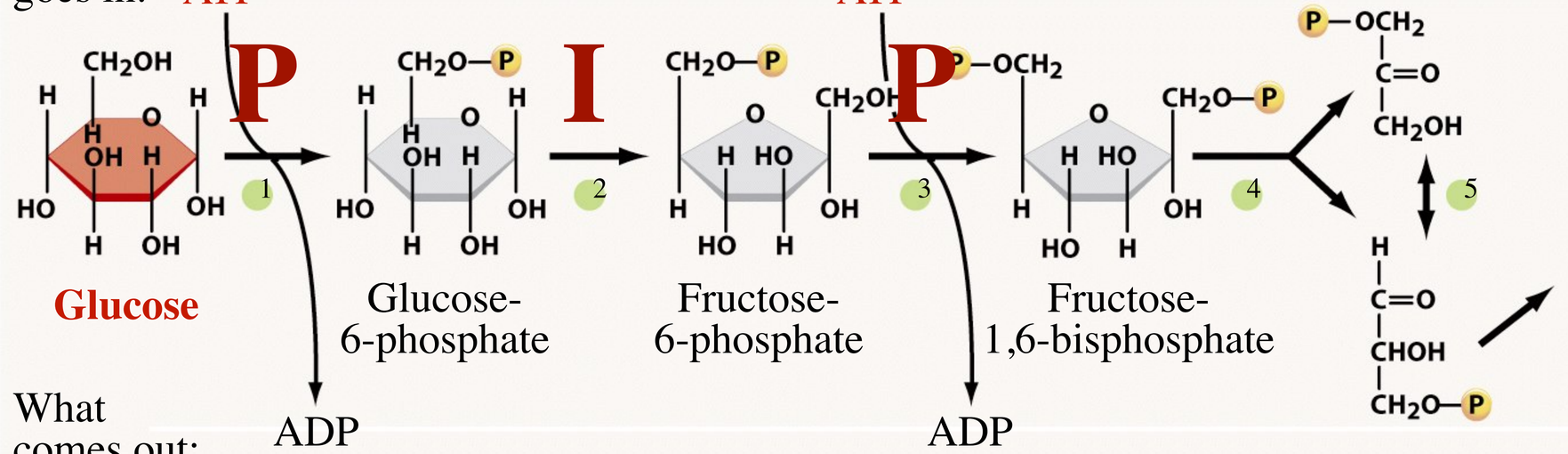


G-3-P (tasty!) G-3-P (tasty!)

GLYCOLYSIS Energy-investment phase



What goes in: ATP ATP



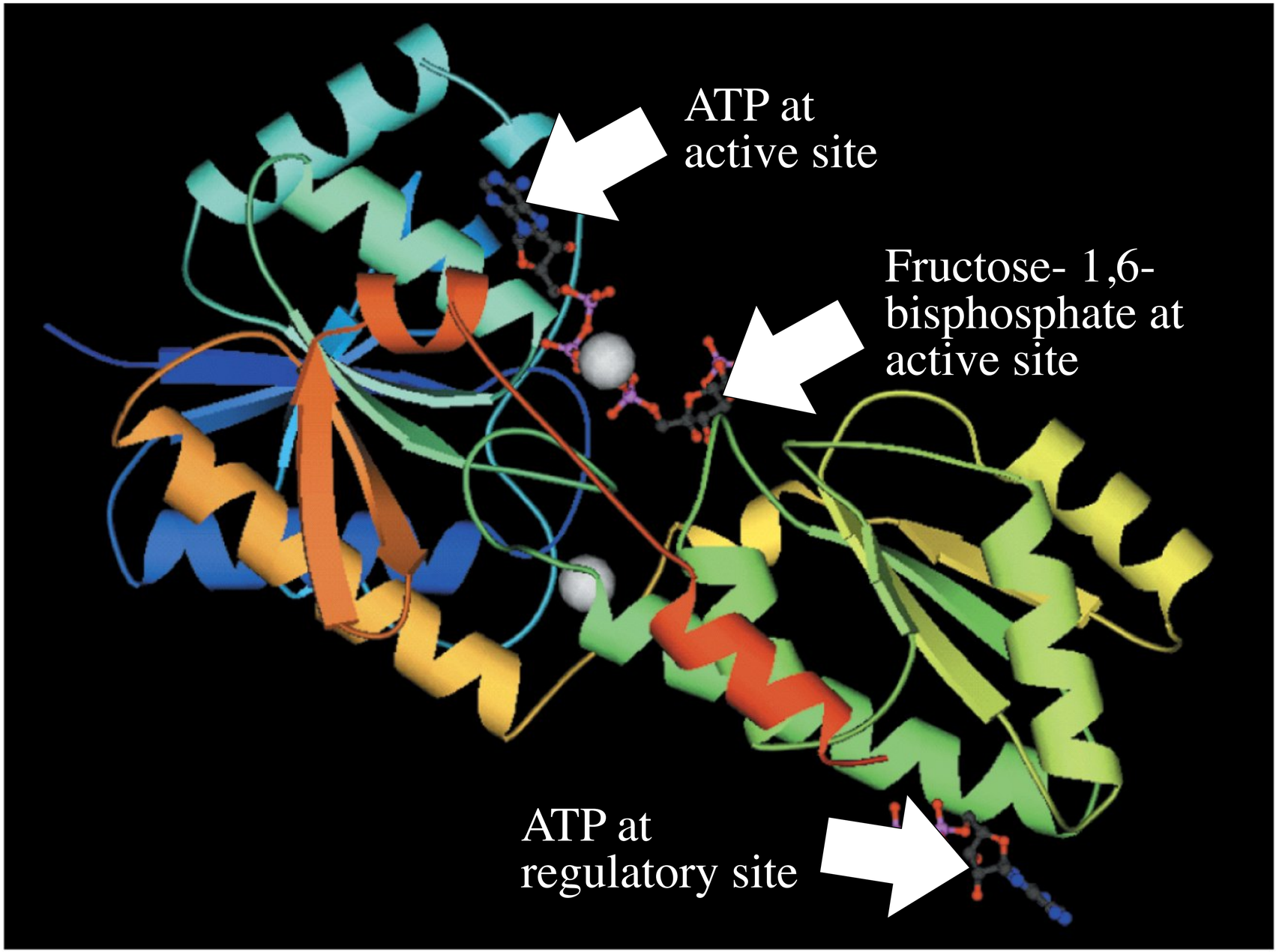
What comes out:

Hexokinase (capture) **phosphoglucoisomerase** **PFK***

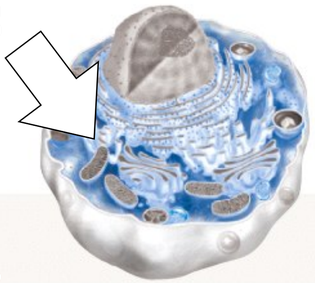
??????

[ATP] high

PFK is highly regulated



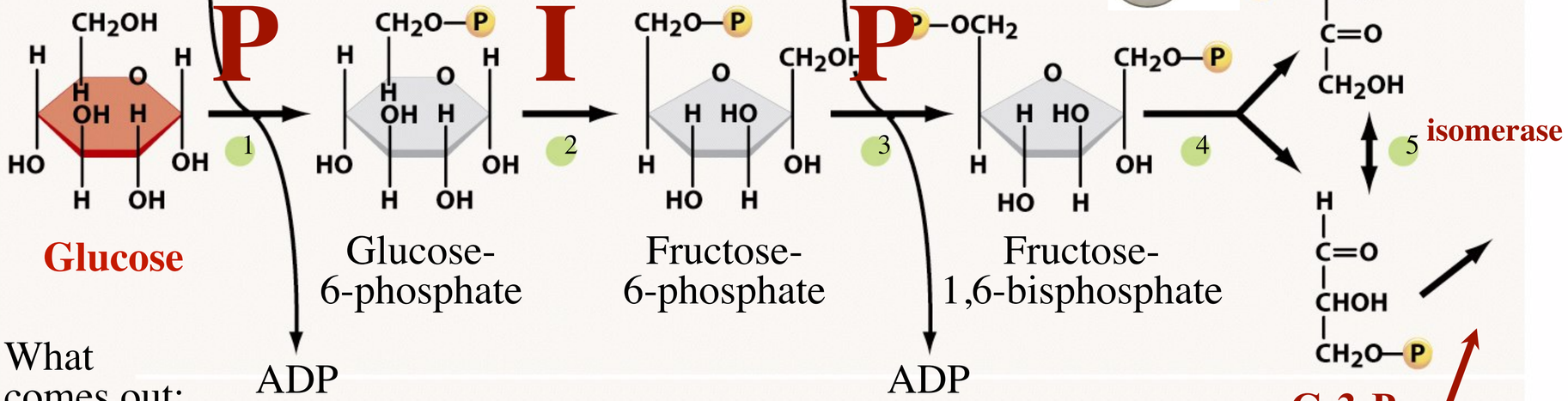
GLYCOLYSIS Energy-investment phase



aldolase

What goes in: ATP ATP

DHAP

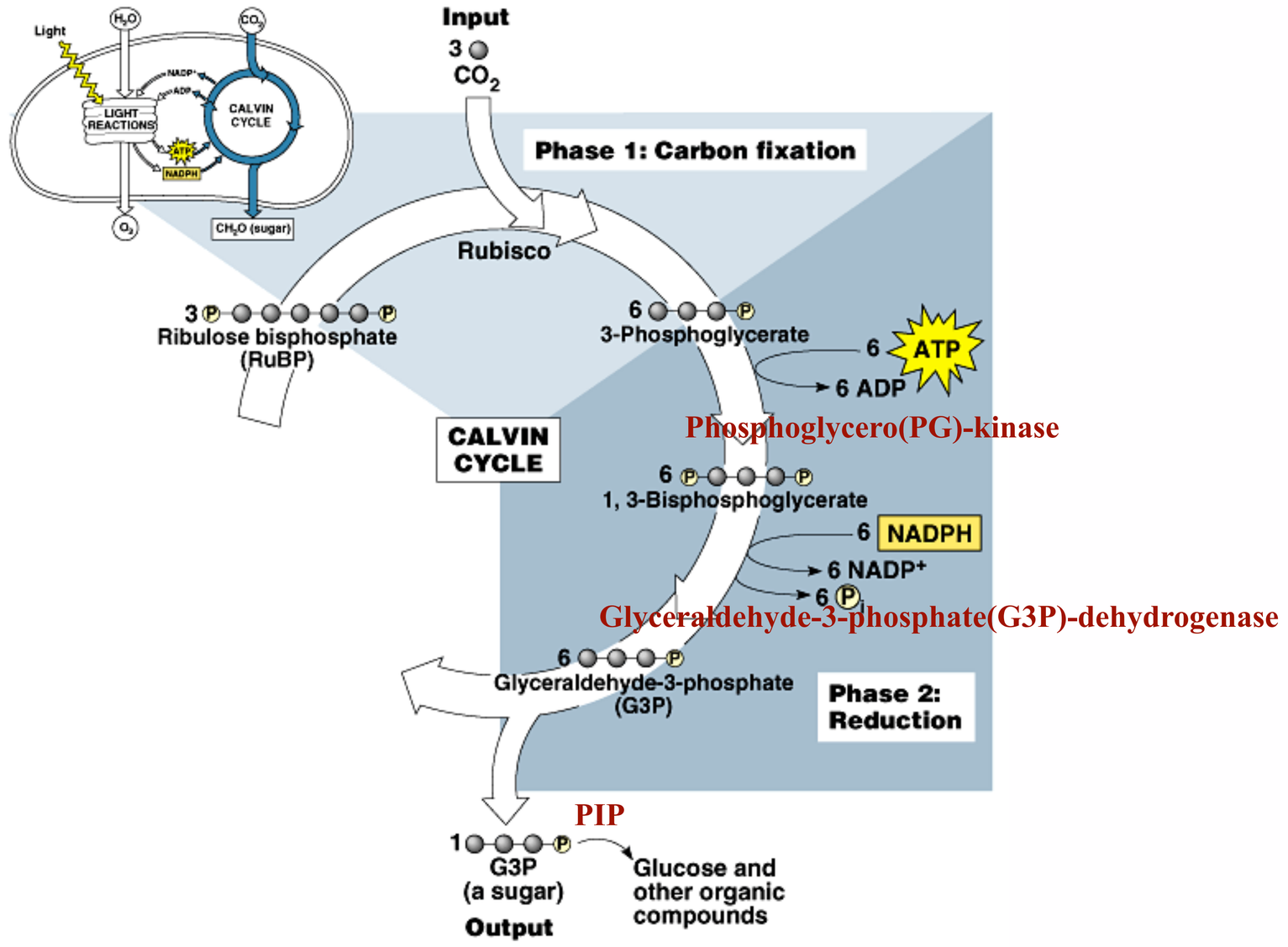


What comes out: ADP ADP

hexokinase phosphoglucoisomerase PFK* Glyceraldehyde-3-phosphate (G3P)-dehydrogenase

stimulates [ADP] [AMP]

inhibits [ATP] high



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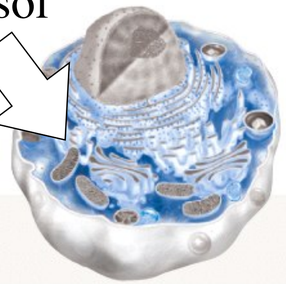
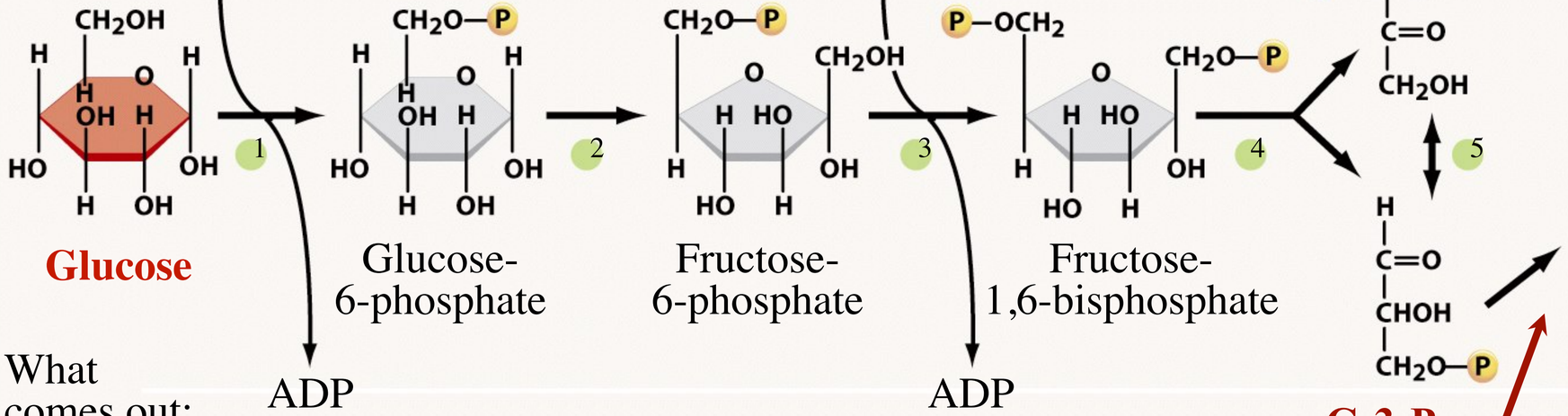
All 10 reactions of glycolysis occur in cytosol



GLYCOLYSIS

What goes in: ATP

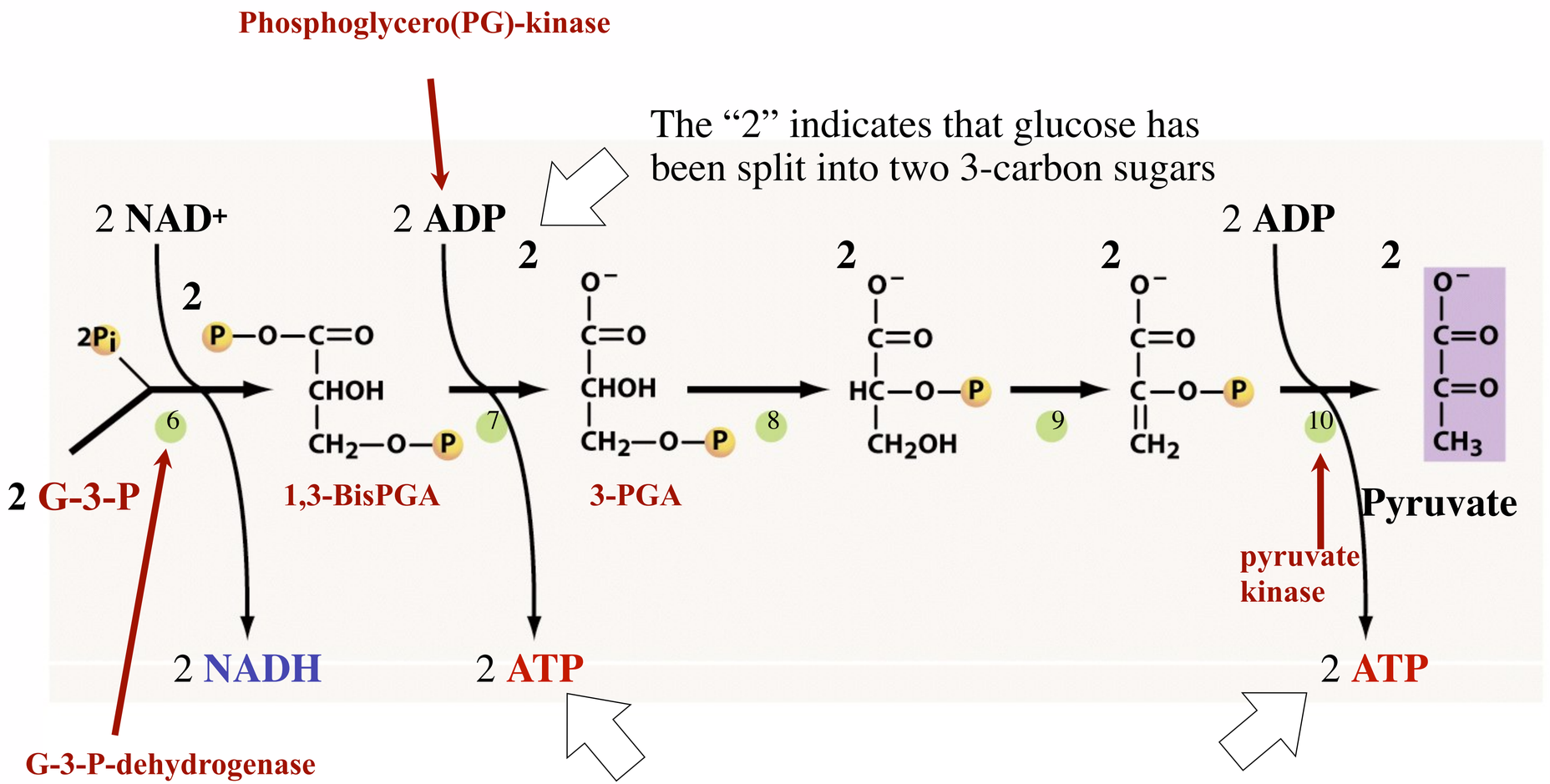


What comes out:

Glyceraldehyde-3-phosphate(G3P)-dehydrogenase

Glycolysis begins with an energy-investment phase of 2 ATP

Energy **payoff** phase



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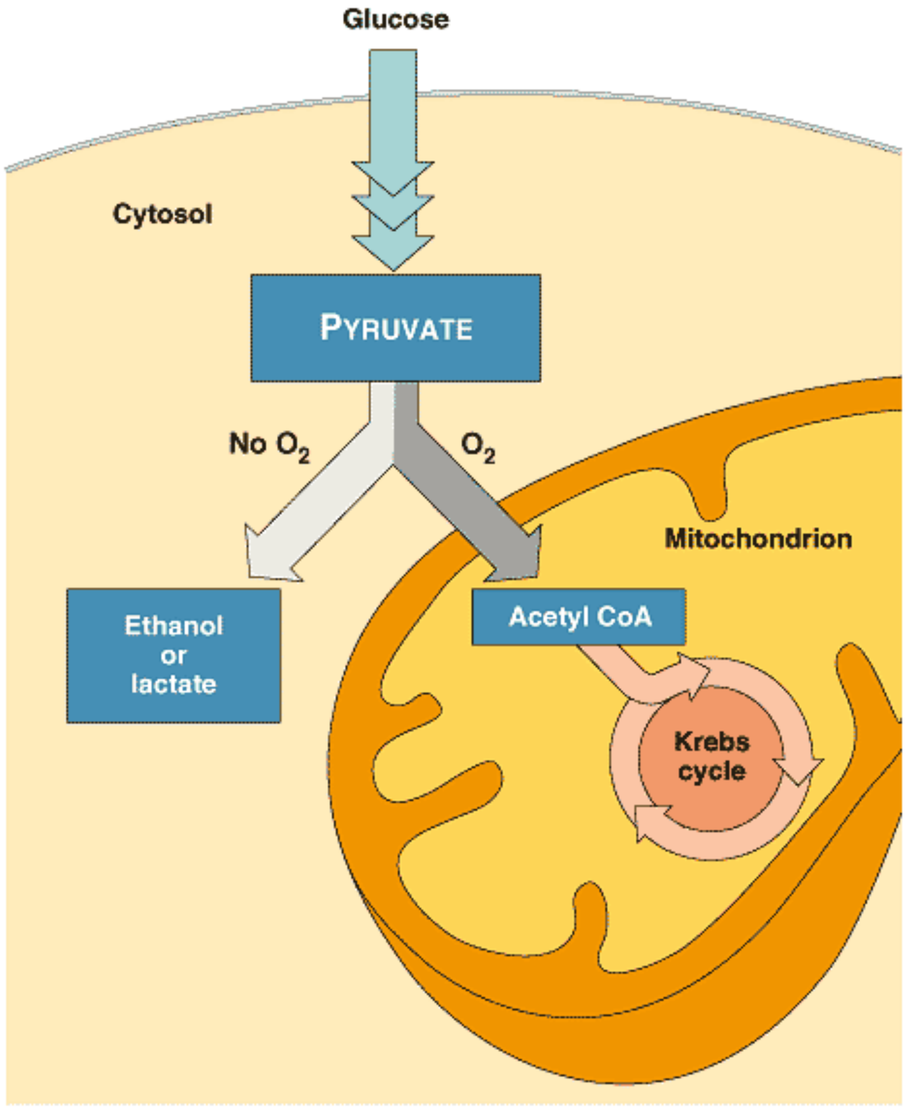

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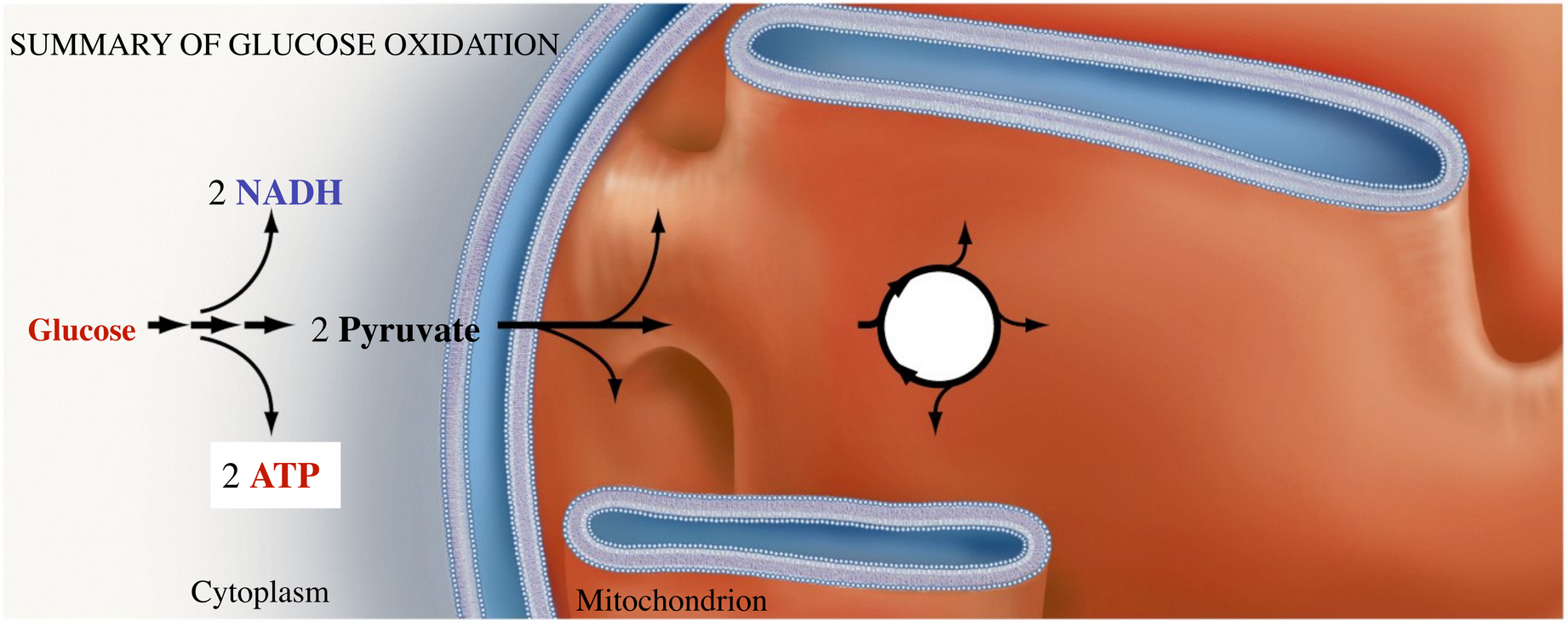
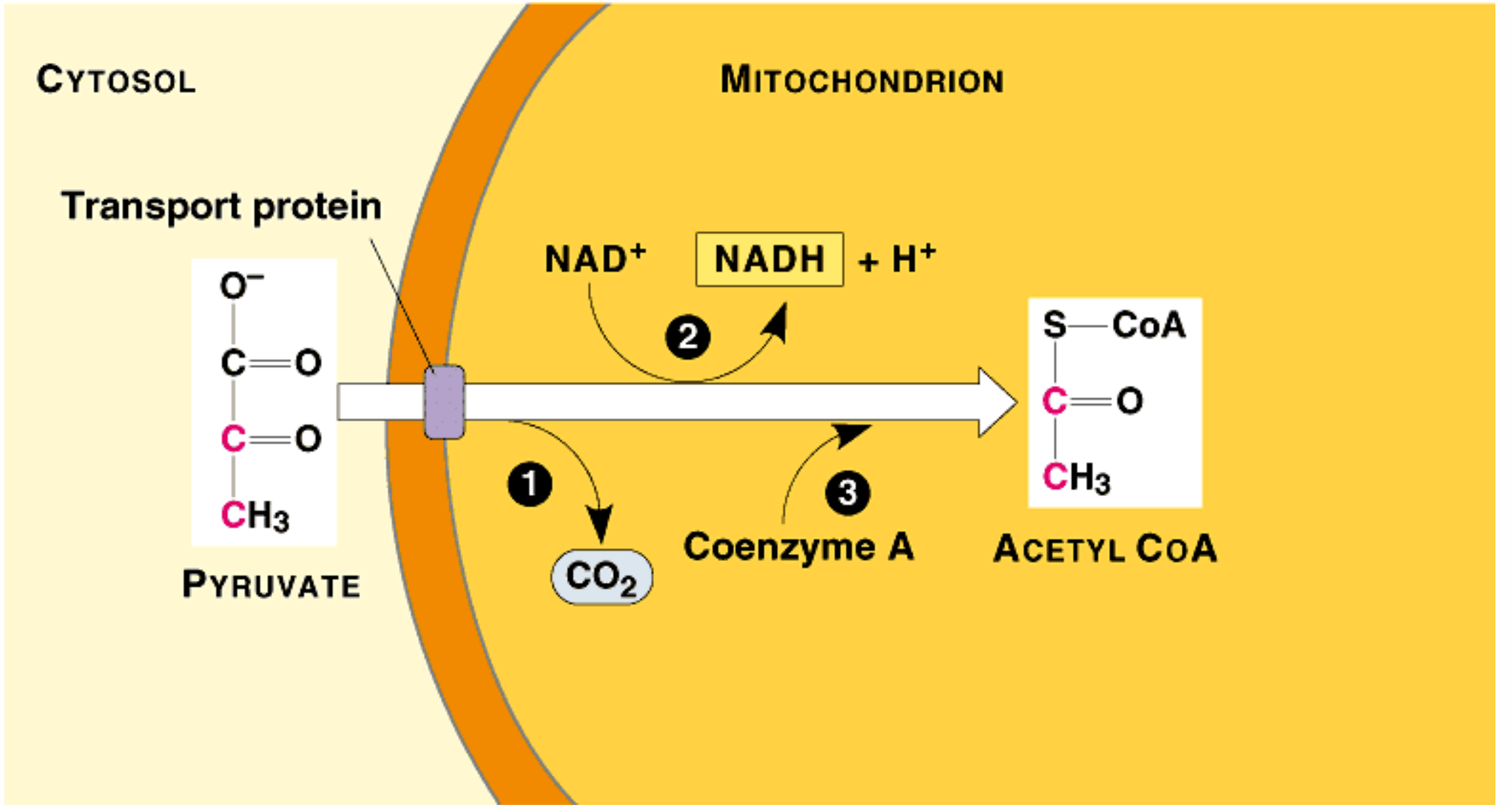
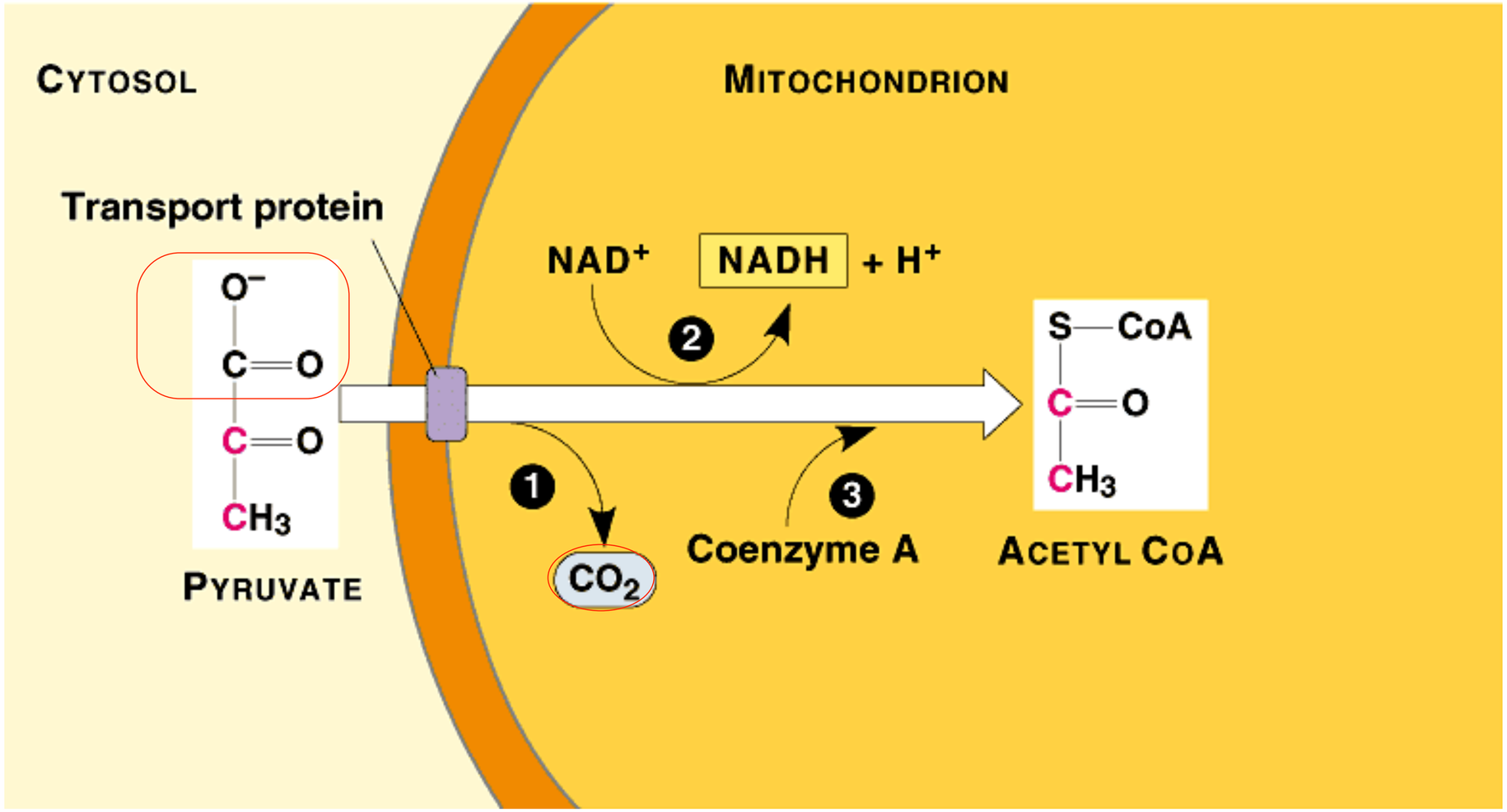
Where do we go next?

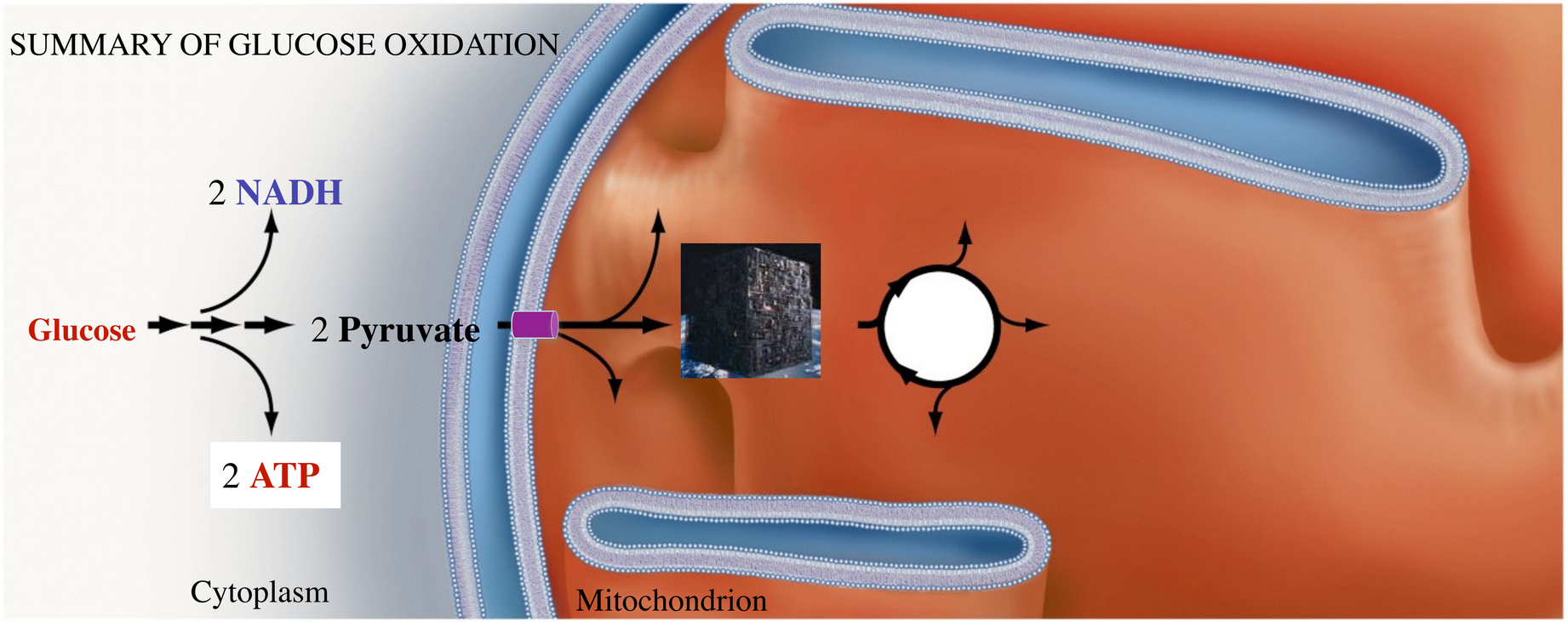


Pyruvate Dehydrogenase Multienzyme Complex

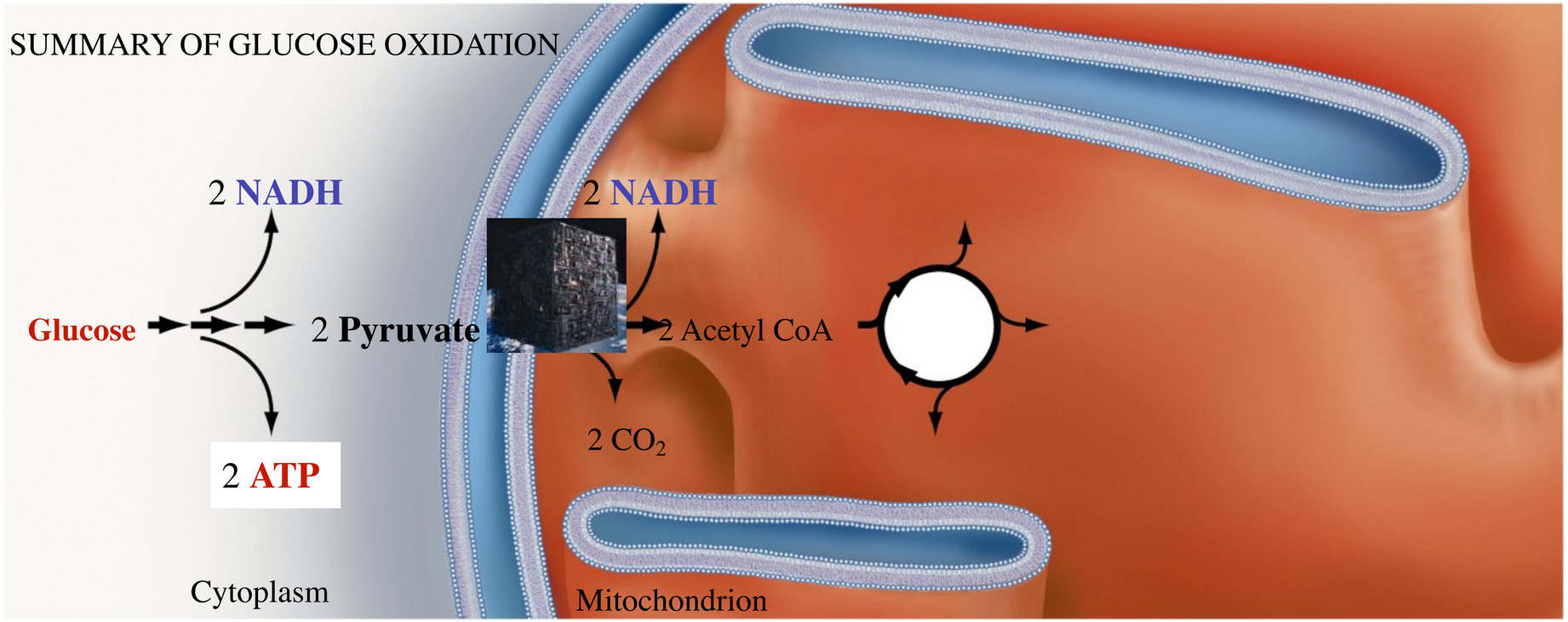

CYTOSOL
MITOCHONDRION
Transport protein
NAD+
NADH
+ H+
2
1
3
CO2
Coenzyme A
S—CoA
C=O
CH3
ACETYL COA
O−
C=O
C=O
CH3
PYRUVATE

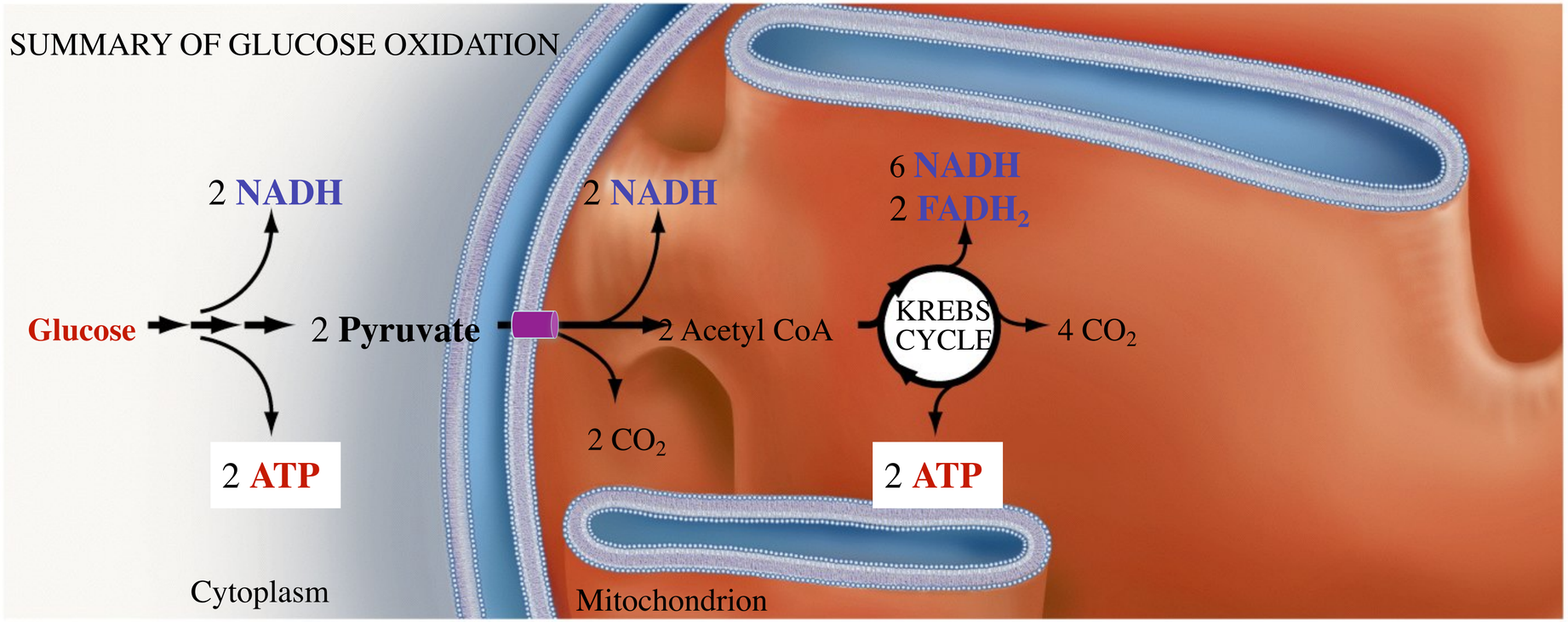

CYTOSOL
MITOCHONDRION
Transport protein
NAD+
NADH
+ H+
2
1
3
CO2
Coenzyme A
PYRUVATE
ACETYL COA
S—CoA
C=O
CH3
O−
C=O
C=O
CH3

If you have O2, enter the Matrix



Where do we go next?




SUMMARY OF GLUCOSE OXIDATION
2 NADH
Glucose
2 Pyruvate
2 ATP
Cytoplasm
2 NADH
2 CO2
2 Acetyl CoA
6 NADH
2 FADH2
KREBS CYCLE
4 CO2
2 ATP
Mitochondrion

Is this what the Citric Acid Cycle looks like?

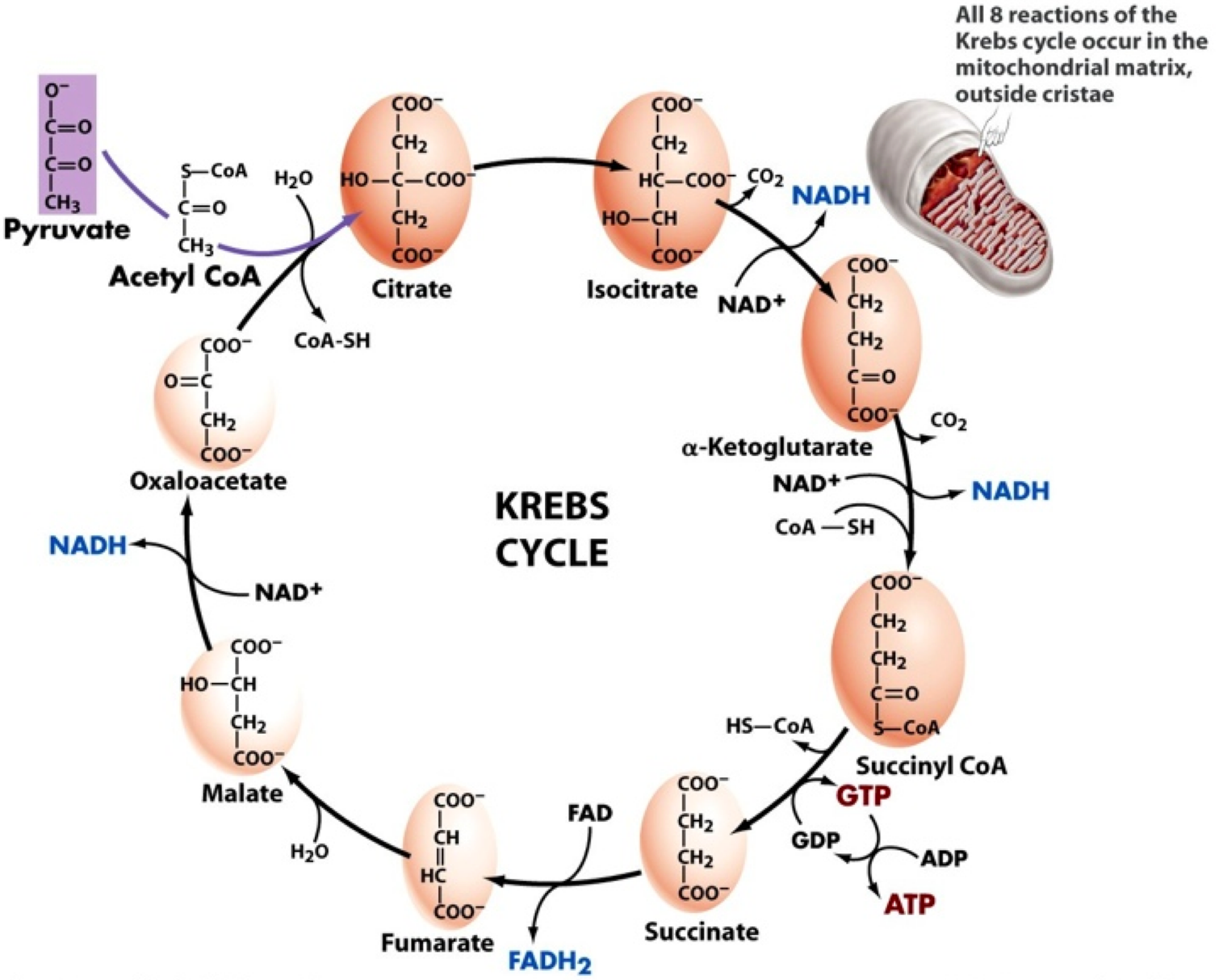


Figure 9-14 Biological Science, 2/e

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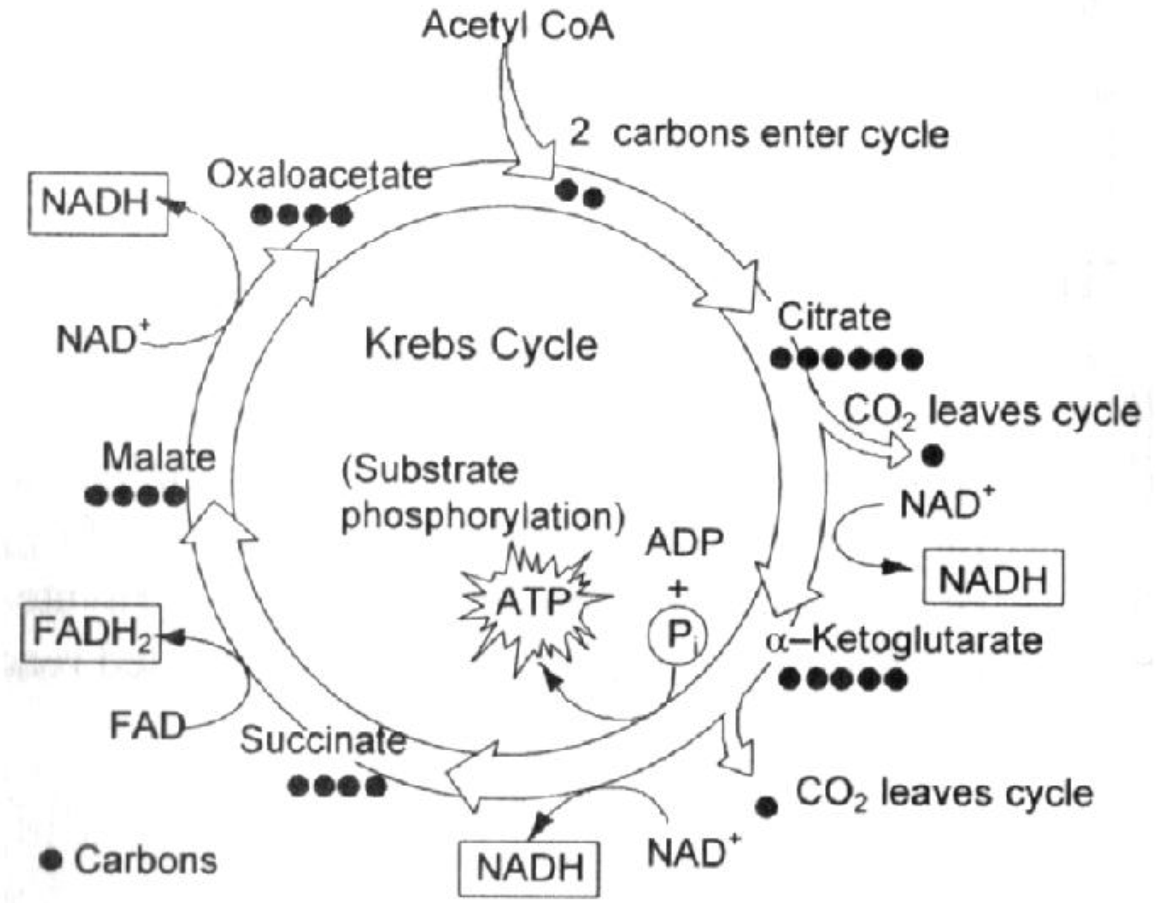
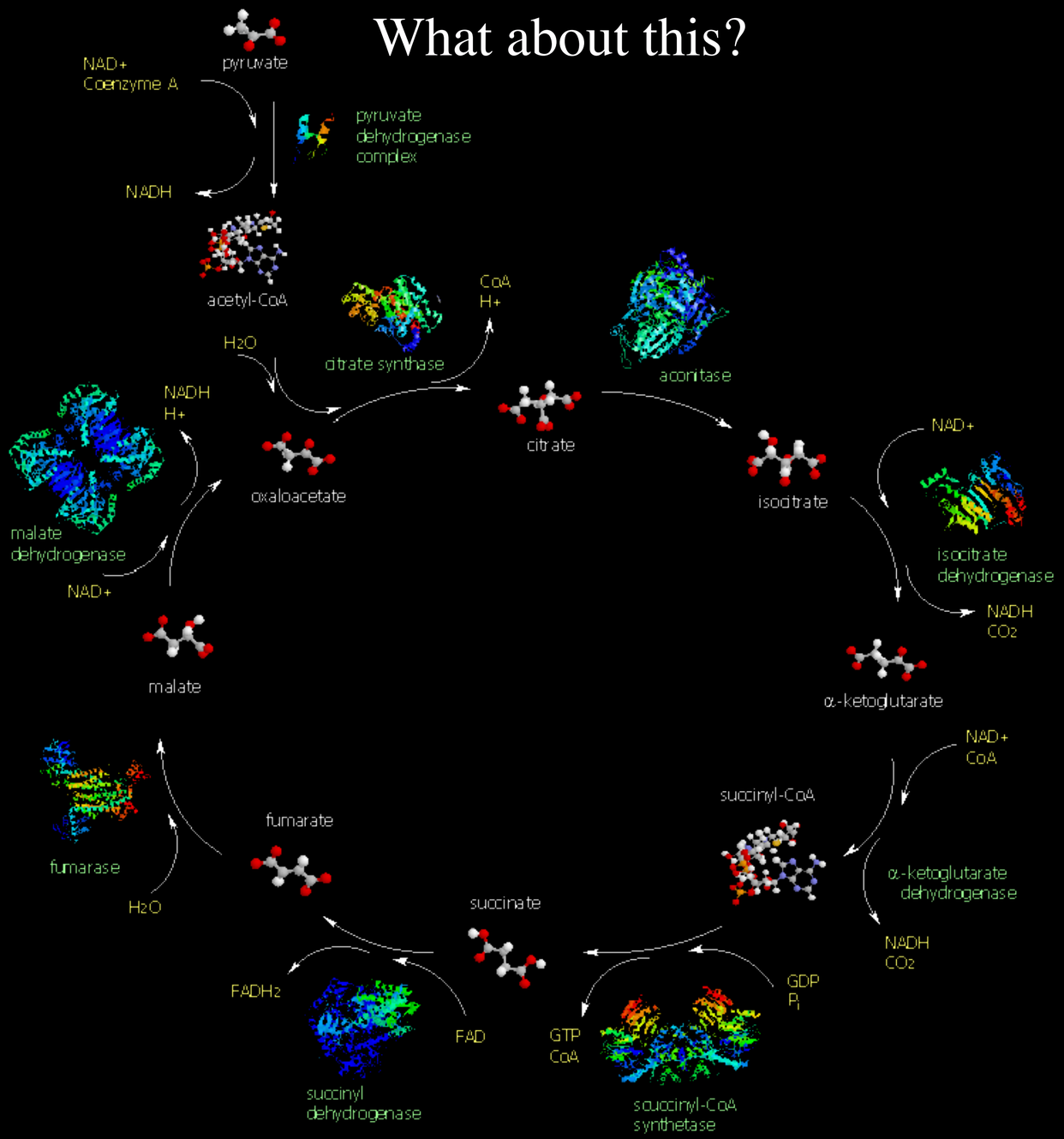
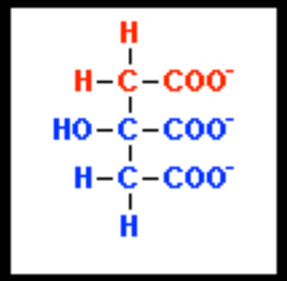
Is this what the Citric Acid Cycle really looks like?

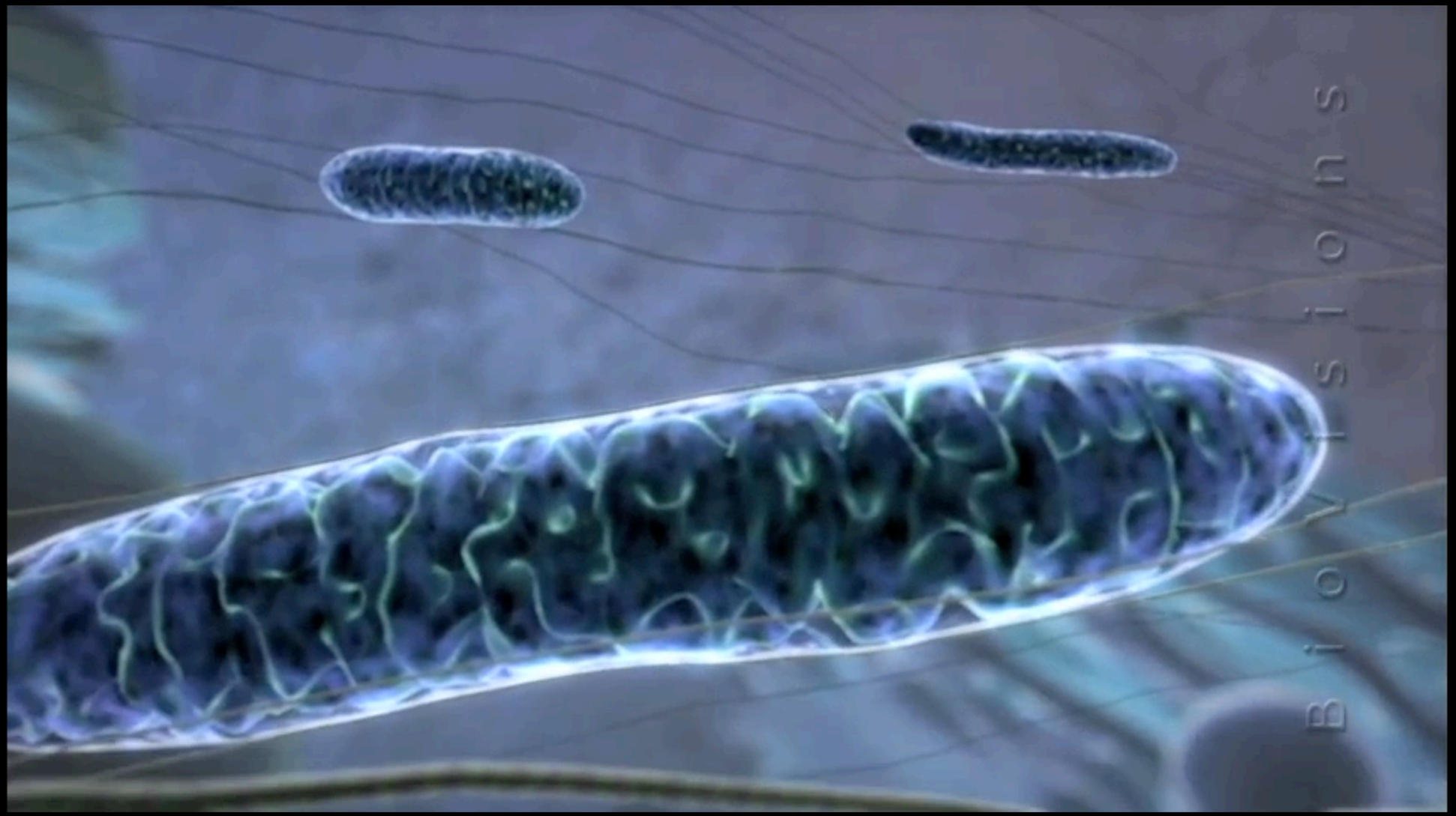


What about this?



Actually…




Biovisions

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f. Explain how I can get paid in the summer to work by the beach in Malibu CA at a REU.

You joined the MSU CF lab

Stand up

If you did PCR-based experiments on human CF gene

…using genomic DNA sequence analysis

…primer design & annealing conditions testing

…using human cells w/ genomic purification

…use of PCR, Gel Electrophoresis, Digital Photodoc system, Epoch Spectrophotometer, more

…gave multiple scientific talks

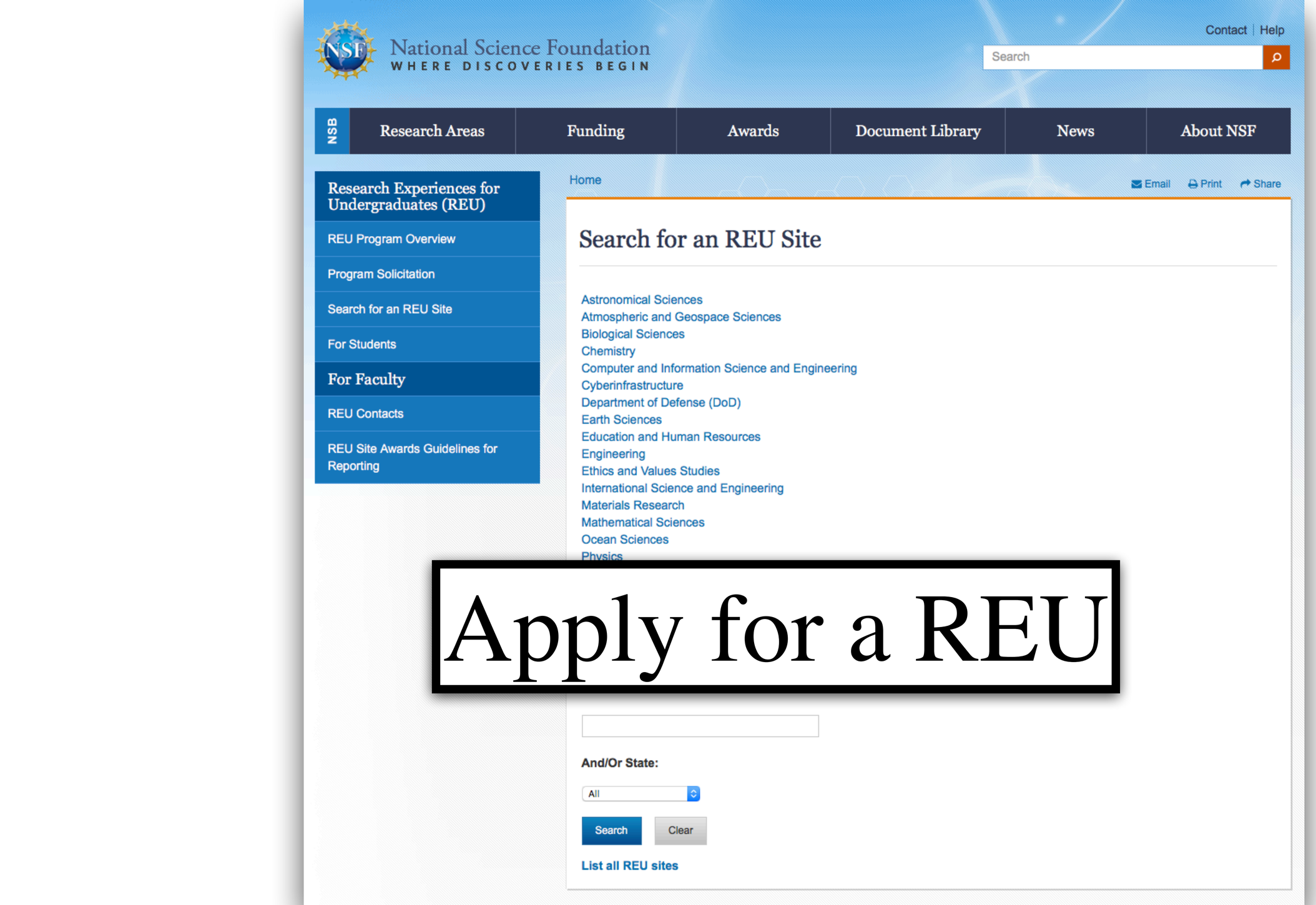
…read scientific papers

…wrote multiple drafts of manuscripts

HIGH FIVES ALL AROUND

THIS IS WHAT SCIENTISTS DO

[it's not *pretend*, and it's not ever really *finished*]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Program Solicitation
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REU Site Awards Guidelines for Reporting
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Biological Sciences
Chemistry
Computer and Information Science and Engineering
Cyberinfrastructure
Department of Defense (DoD)
Earth Sciences
Education and Human Resources
Engineering
Ethics and Values Studies
International Science and Engineering
Materials Research
Mathematical Sciences
Ocean Sciences
Physics
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And/Or State:
All
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Clear
List all REU sites

Apply for a REU

Dr. Luckic,
Ni Hao!
I am currently on a bullet train going about 300 km/hr on its way to Beijing. So far I have visited Shanghai, Nanjing, Yangzhou, Da Feng, and Siyang. My research at Nanjing Forestry University involved gene cloning and transformation in a popular chinese tea plant. My experience here has been incredible and I can't thank you enough for giving me this opportunity and preparing me for this work. I am the youngest and one of the few student that has experience in the lab. I hope you are hearing from Your summer! -Joanna

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East Lansing, MI, 48823
USA

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07 AUG 2014 PM 8 L

The treehouse area was expanded in 2012, incorporating more found natural woods and creating a wondrous multistory indoor climber...and secret tunnels!

Photo by Andy Wissman

Dr. Luckie, I am so glad I was able to do an REU internship this summer at the Danforth Center in St. Louis (thanks again for the letter of rec!). I got to focus on a project related to the evening complex in the circadian clock of plants. Basically I was able to validate some interactions in tobacco using Co-IPs and Western detections (lots!). I've learned a ton here and St. Louis is a really cool city. Thanks for suggesting the REU programs back in LB 145. Hope all is well.

-Jessica Goldsworthy

Dr. Douglas Luckie
W-26D Holmes Hall, Michigan State
East Lansing, MI 48823

Opportunities

This semester was a reasonably novel experience in the USA for Intro Bio. You experienced a more authentic science research experience much like in an “annex” of Luckie’s research lab, instead of cookbook labs every week.

As course ends, remember I can be a resource for you.

- I can advise & write letters of ref when you apply to REUs
- you can volunteer in my laboratory, or others at MSU
- please update your resume to represent best what you’ve done and learned.
- if you got most of your experiments to work this semester, consider publishing your final paper with my help.

YOU

EXPERIENCE

Cystic Fibrosis Lab Internship **January 2023-May 2023**

Research intern with Douglas B. Luckie, Ph.D., Director of MSU Cystic Fibrosis Research Laboratory, Michigan State University, East Lansing MI (cf.psl.msu.edu)

— Planned, pursued and presented experimental results on a research project aimed at using a PCR-based strategy to identify the {your mutation} of the human CFTR gene.

- Gained experience with polymerase chain reaction (PCR), DNA sequence analysis, primer design, troubleshooting, genomic DNA extraction and agarose gel electrophoresis methods.

— Initiated a secondary research project to test the Yaku et al 2008 method using intentional mismatch to reduce rate of false positives when using PCR to diagnose SNPs.

- Gained skills in experimental design, DNA sequence comparisons and analysis via BLAST, comparative primer design and testing.

— Participated in all aspects of lab work which included: preparation of solutions; maintaining lab notebook; and reading/presenting published research/figures in journal club as well as own research data/ findings in formal talks during research seminar settings, and authoring manuscripts for publication.