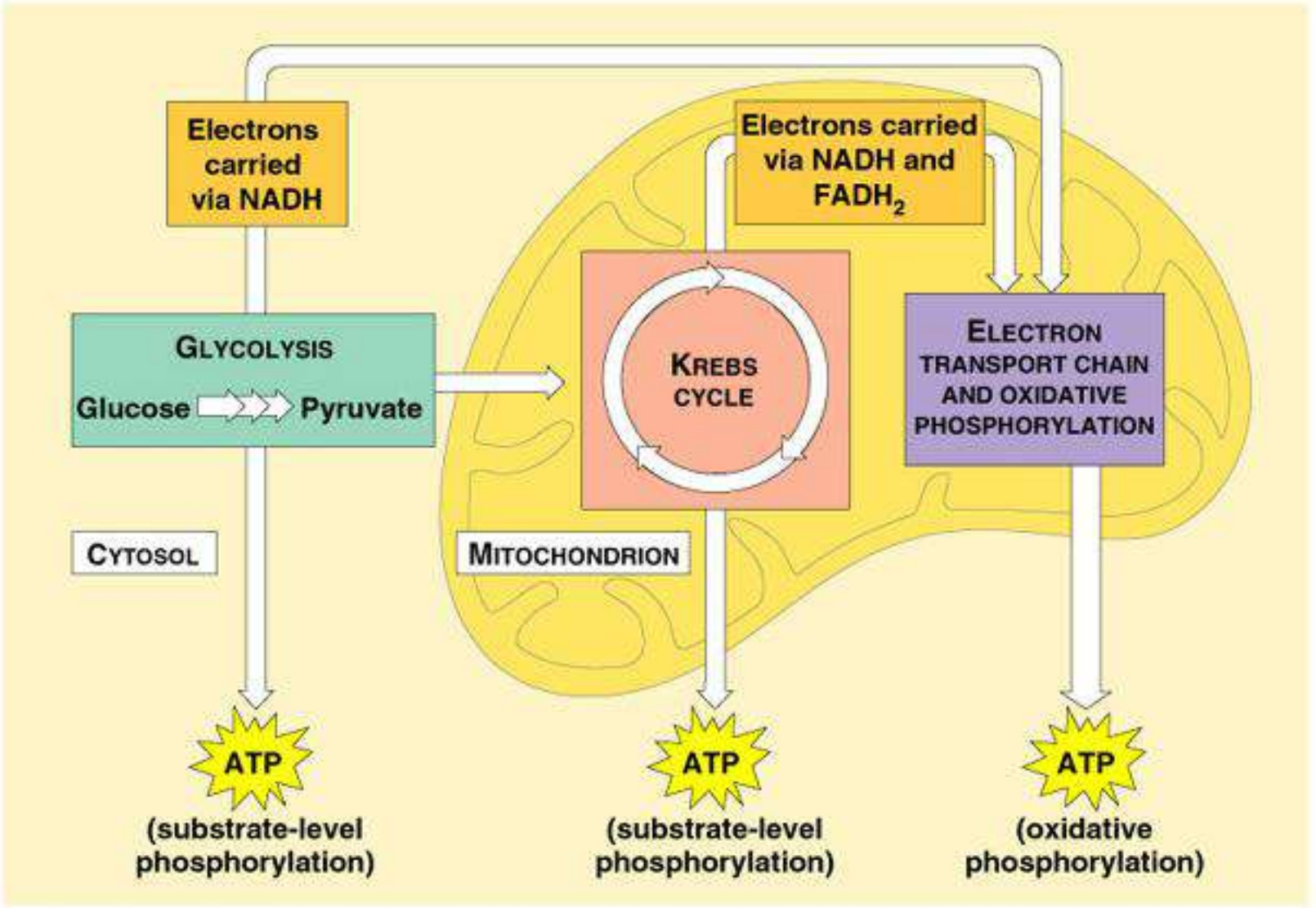
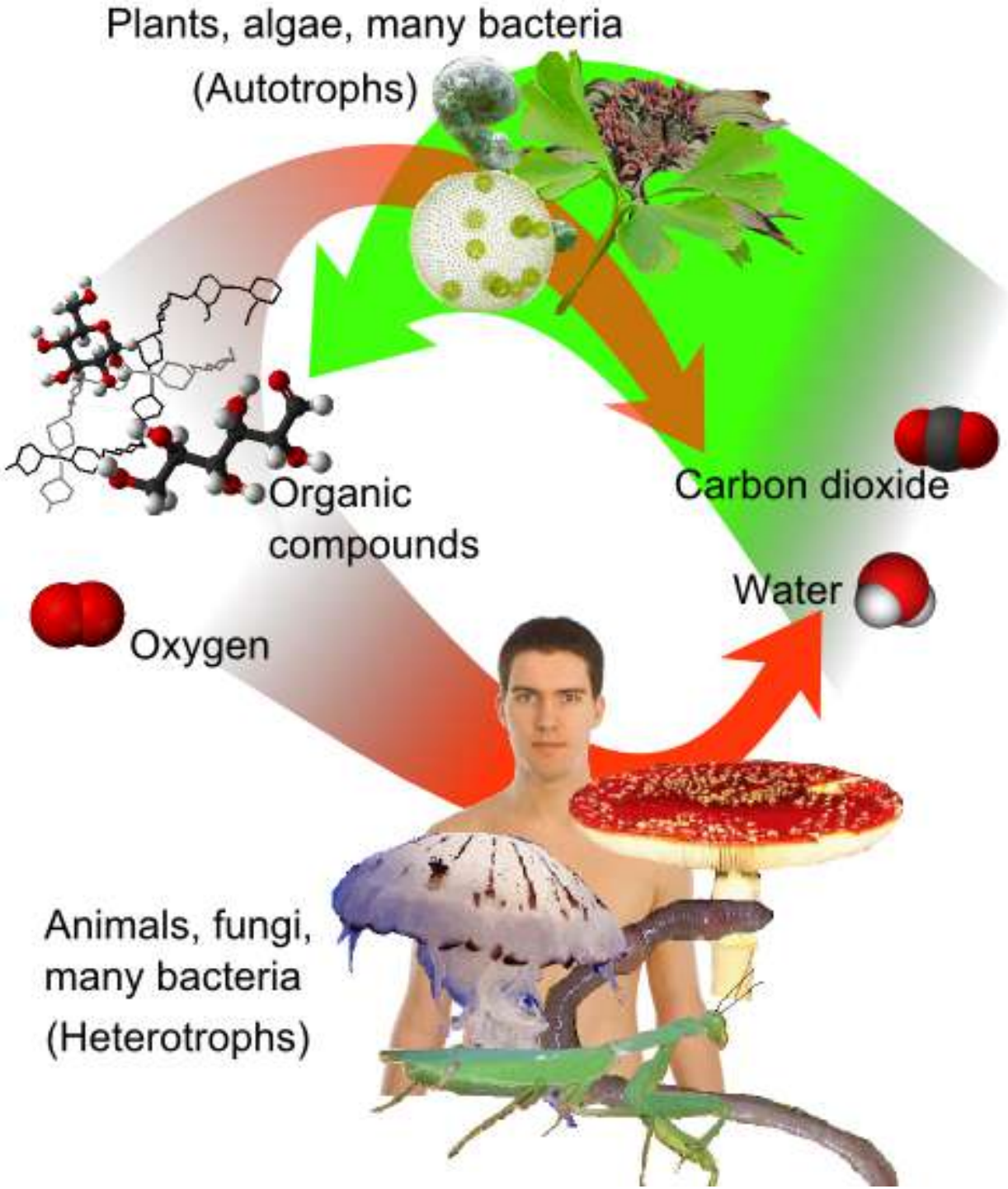
Cellular Respiration

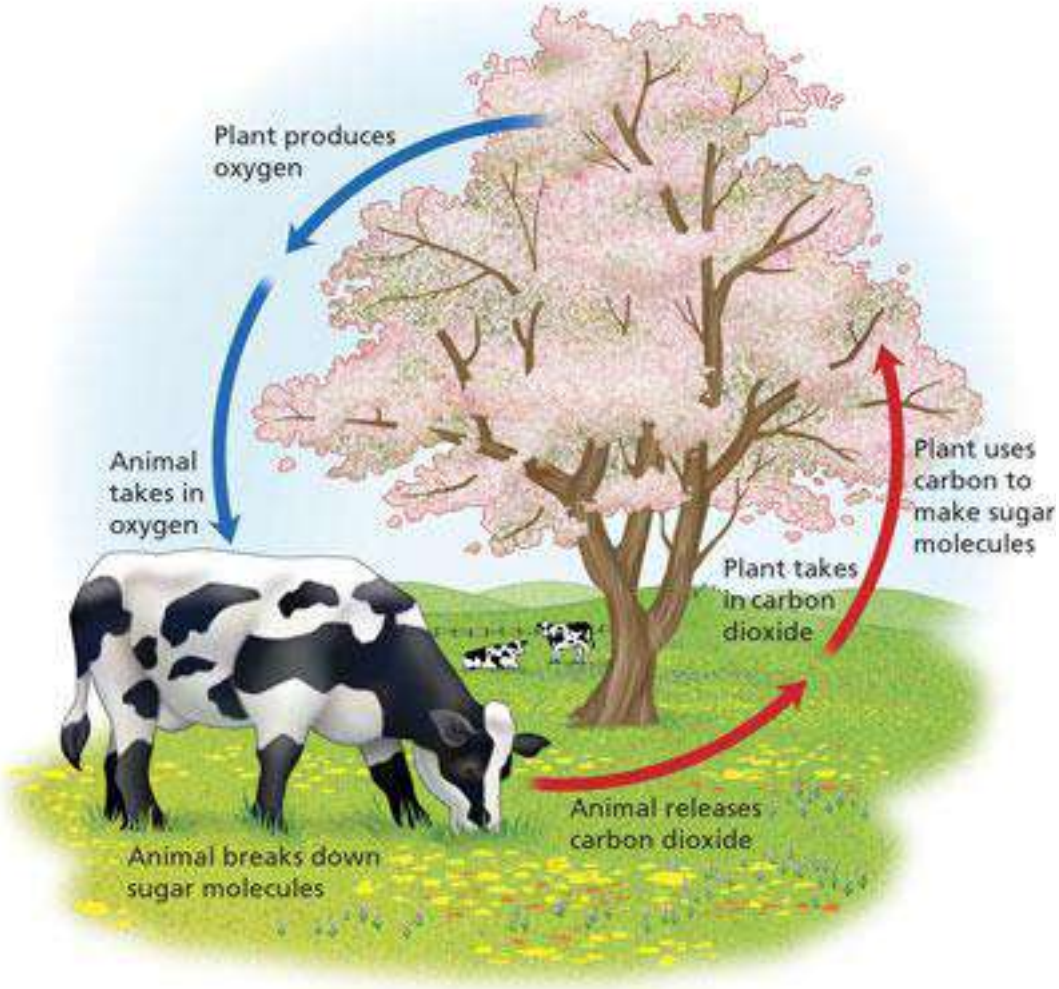


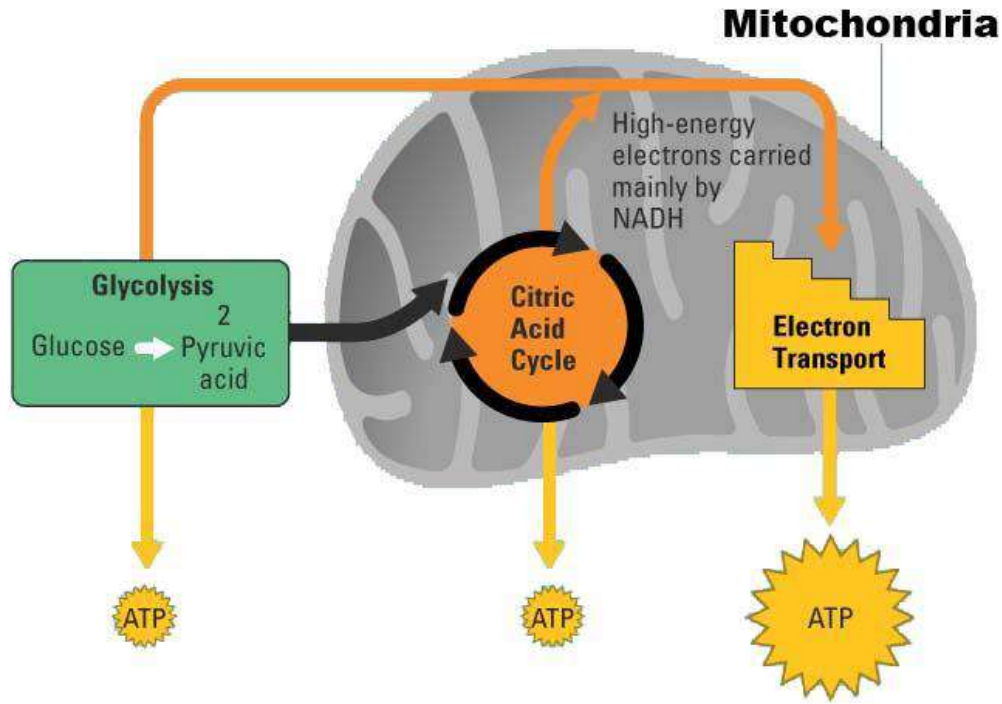
Cellular Respiration

Have you ever wondered why exactly you need to breathe? What happens when you stop breathing?



Cellular respiration is the set of the metabolic reactions and processes that take place in the cells of organisms to convert biochemical energy from nutrients into adenosine triphosphate (ATP), and then release waste products.

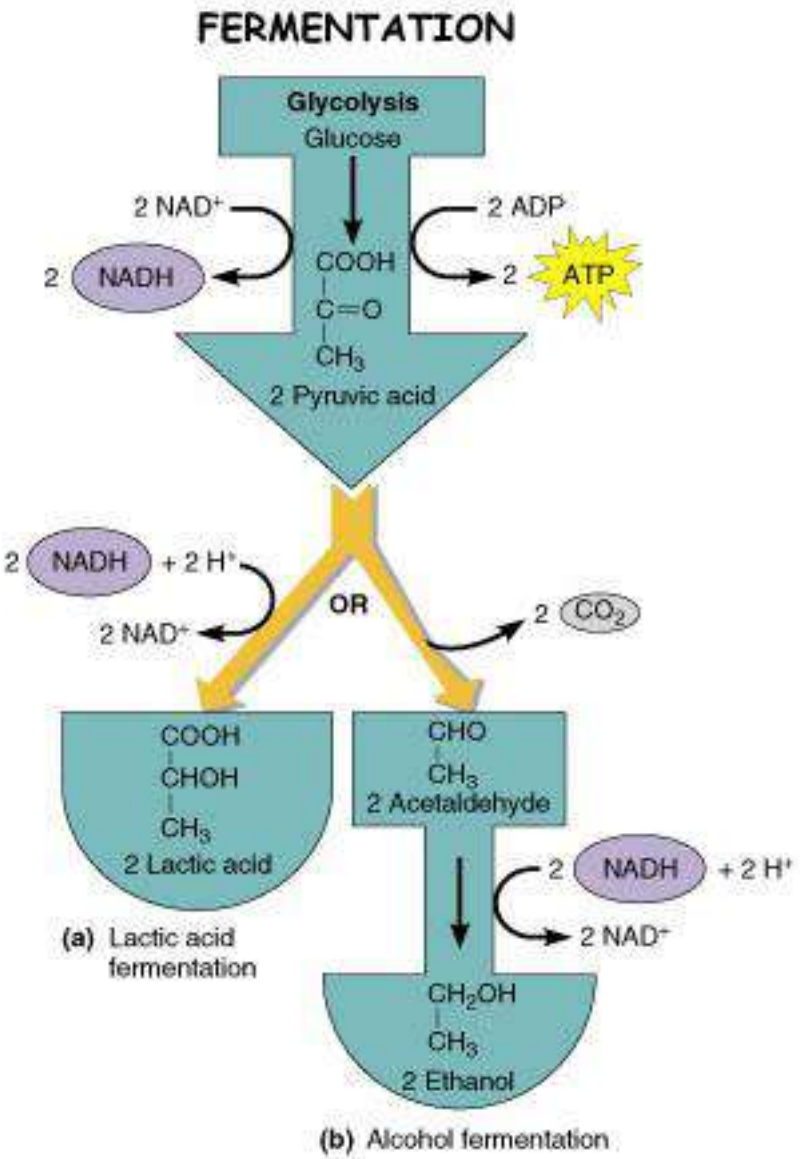




$C_6H_{12}O_6 + 6O_2 \rightarrow 6\ CO_2 + 6H_2O + 36\ ATP$

Respiration occurs in the presence of oxgen - AEROBIC

Without oxygen, another path is taken ....this path is called fermentation, or anaerobic respiration

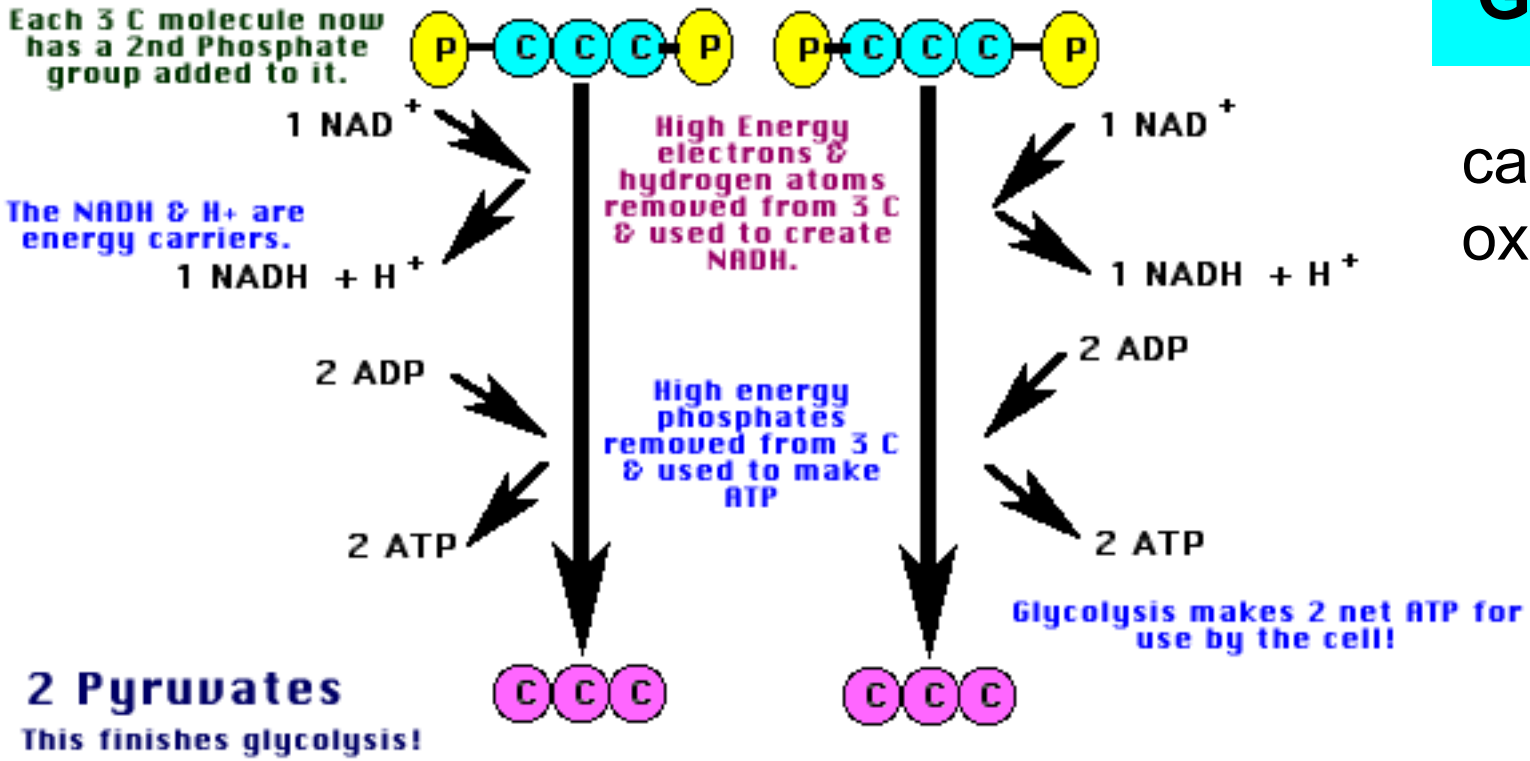


There are three stages

1. Glycolysis
2. Kreb's Cycle (Citric Acid Cycle)
3. Electron Transport Chain

GLYCOLYSIS

can occur without oxygen

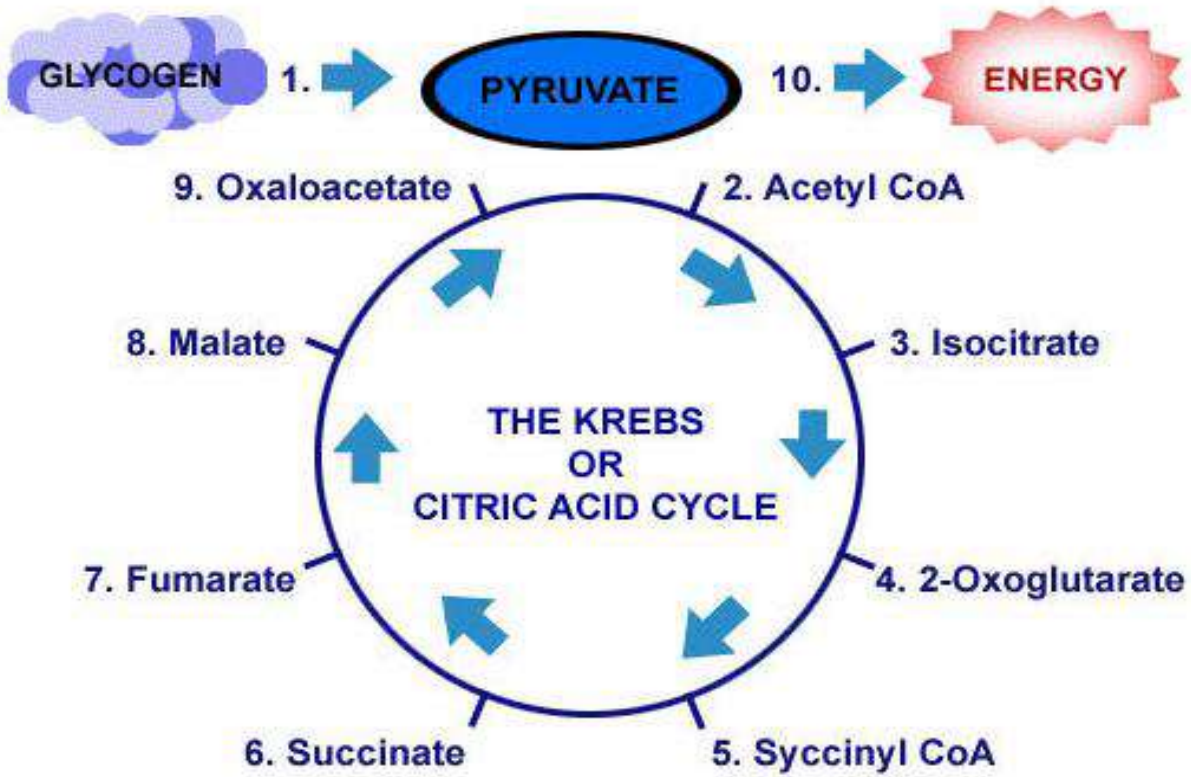


GLYCOLYSIS = "glyco - lysis " is the splitting of a 6 carbon glucose into two pyruvates, each having 3 carbons

net yield of 2 ATP per glucose molecule

net yield of 2 NADH per glucose molecule

2. Citric Acid or Krebs Cycle



It is not necessary to know the individual steps

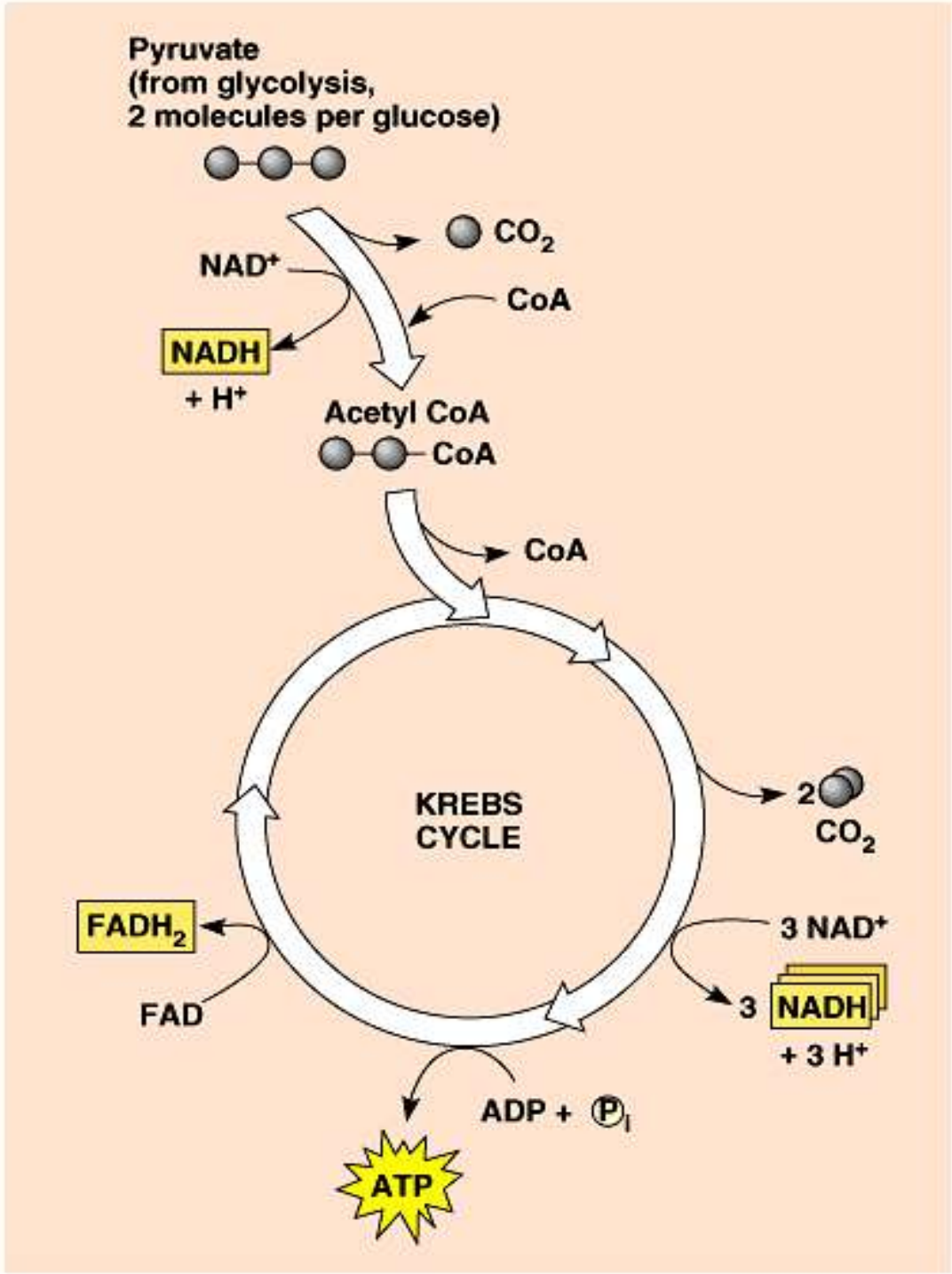
a) occurs in the mitochondria

b) an aerobic process; will proceed only in the presence of O2

net yield of 2 ATP
net yield of 6 NADH and 2 FADH2 --> sent to ETC

e) in this stage of cellular respiration, the oxidation of glucose to CO_2 is completed.

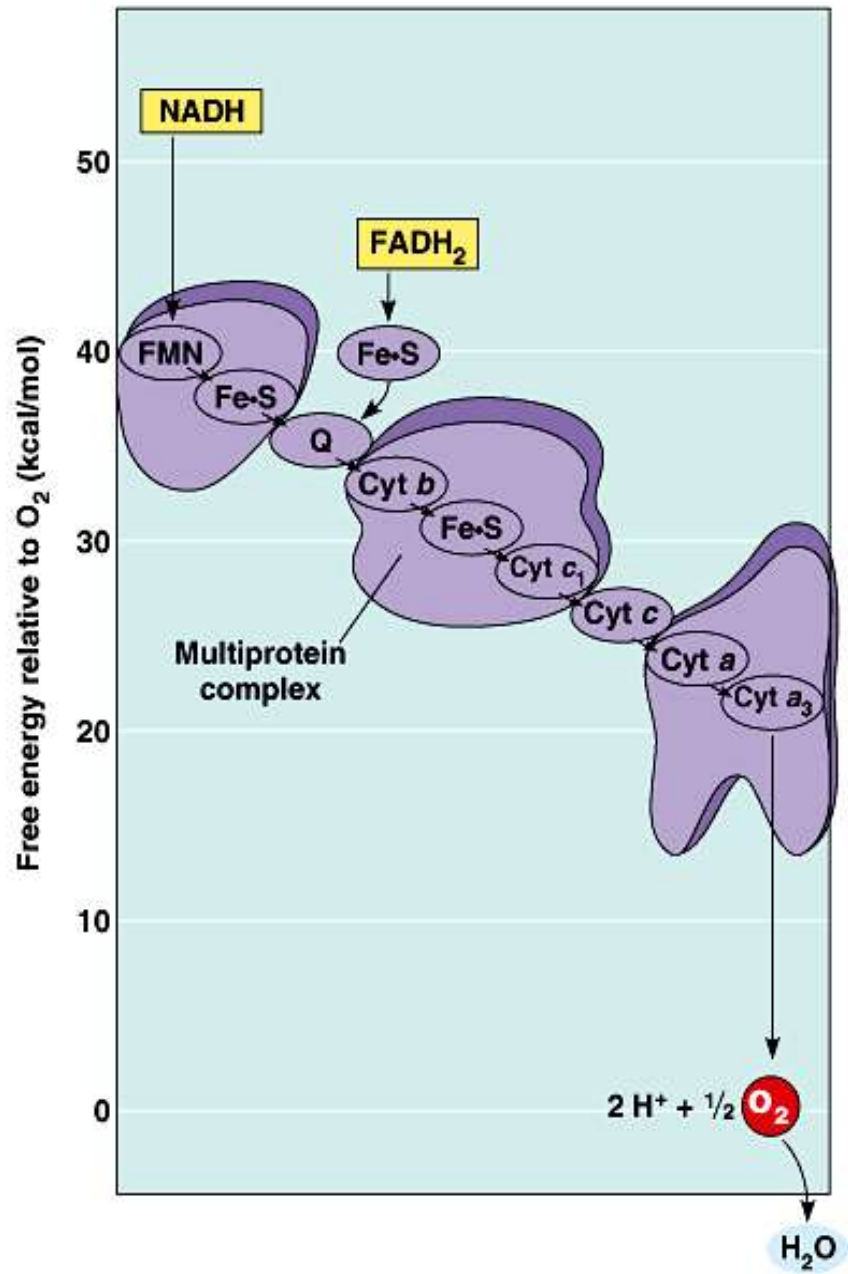
(this is why we exhale carbon dioxide)



3. Electron Transport System:

a) consists of a series of enzymes on the inner mitochondrial membrane
b) electrons are released from NADH and from FADH2 and as they are passed along the series of enzymes, they give up energy which is used to fuel a process called chemiosmosis

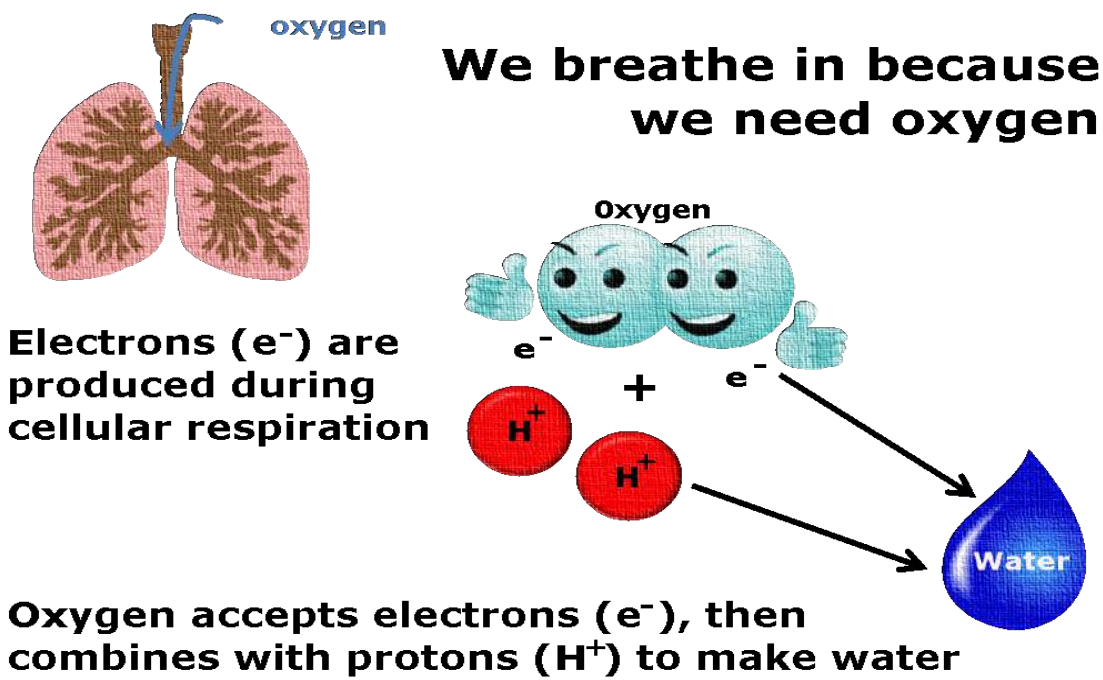
which drives ATP synthesis



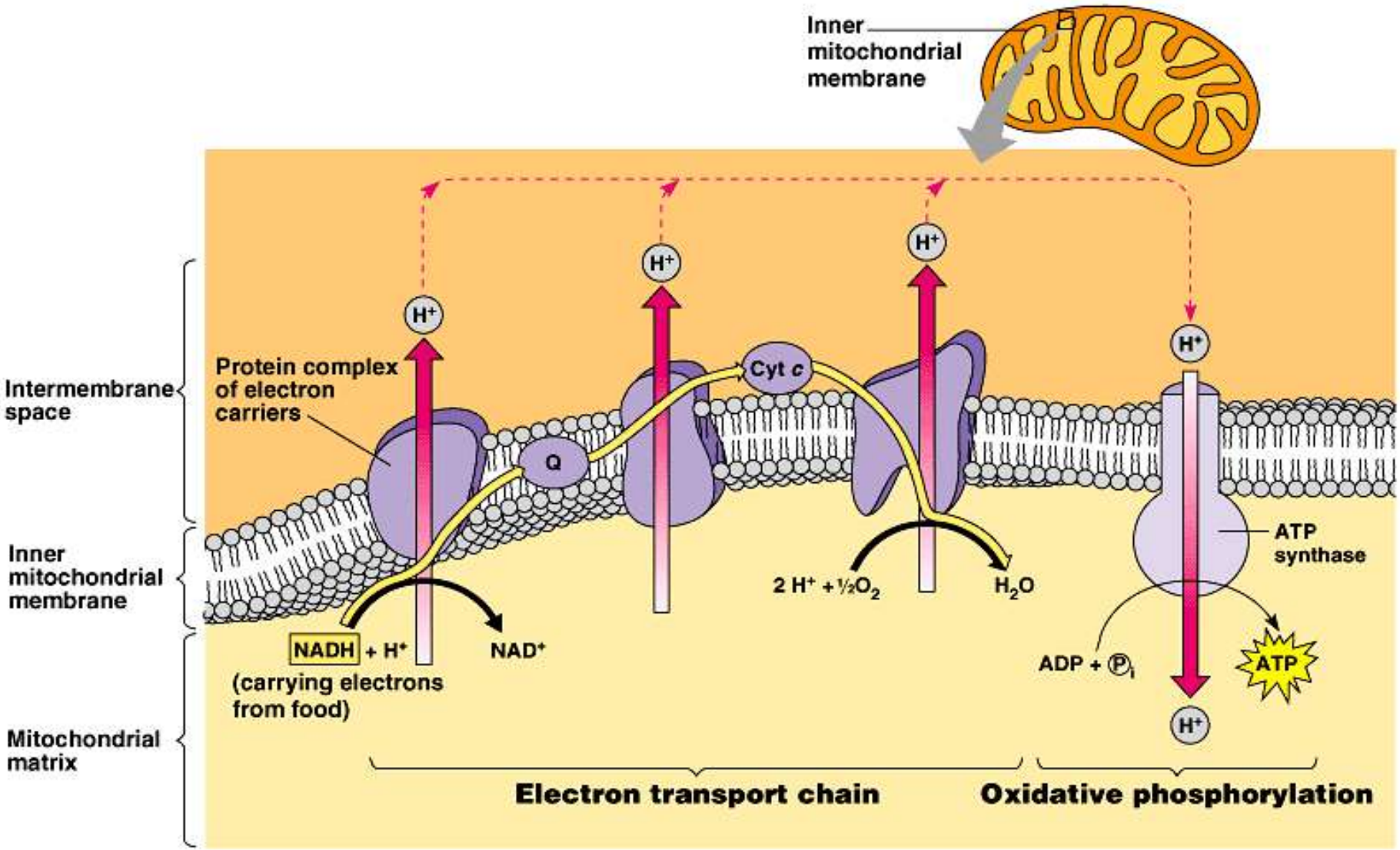
c) net yield of 32 or 34 ATP per glucose molecule
d) 6 H_2O are formed when the electrons unite with O_2* at the end of electron transport chain.

* Note: This is the function of oxygen in living organisms!

Without oxygen to serve as the final electron acceptor, the process shuts down.



Does this picture look familiar?



You've seen this before in photosynthesis.

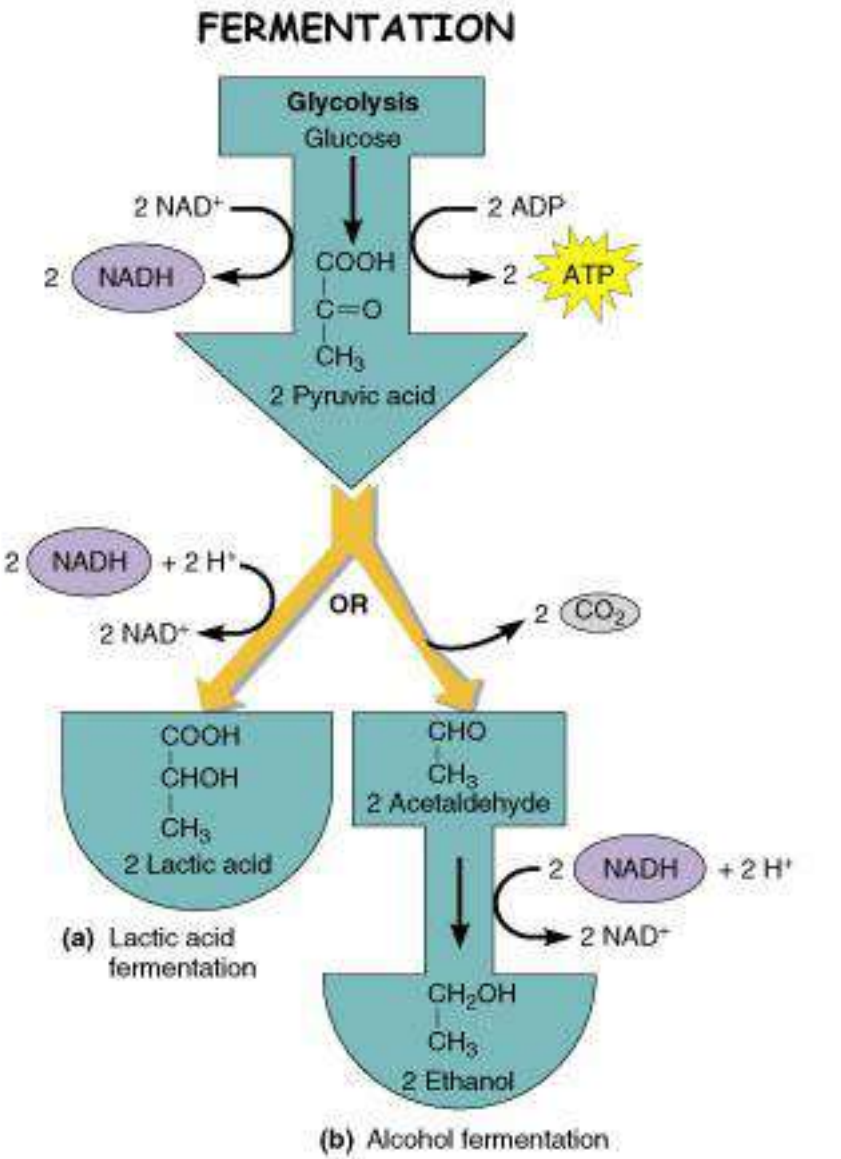
[Animation of the ETC McGraw Hill Animation]

Fermentation

This happens when the Krebs cycle cannot occur due to lack of oxygen

Byproducts of fermentation include lactic acid and alcohol

Lactic Acid in muscle cells can cause muscle cramps.



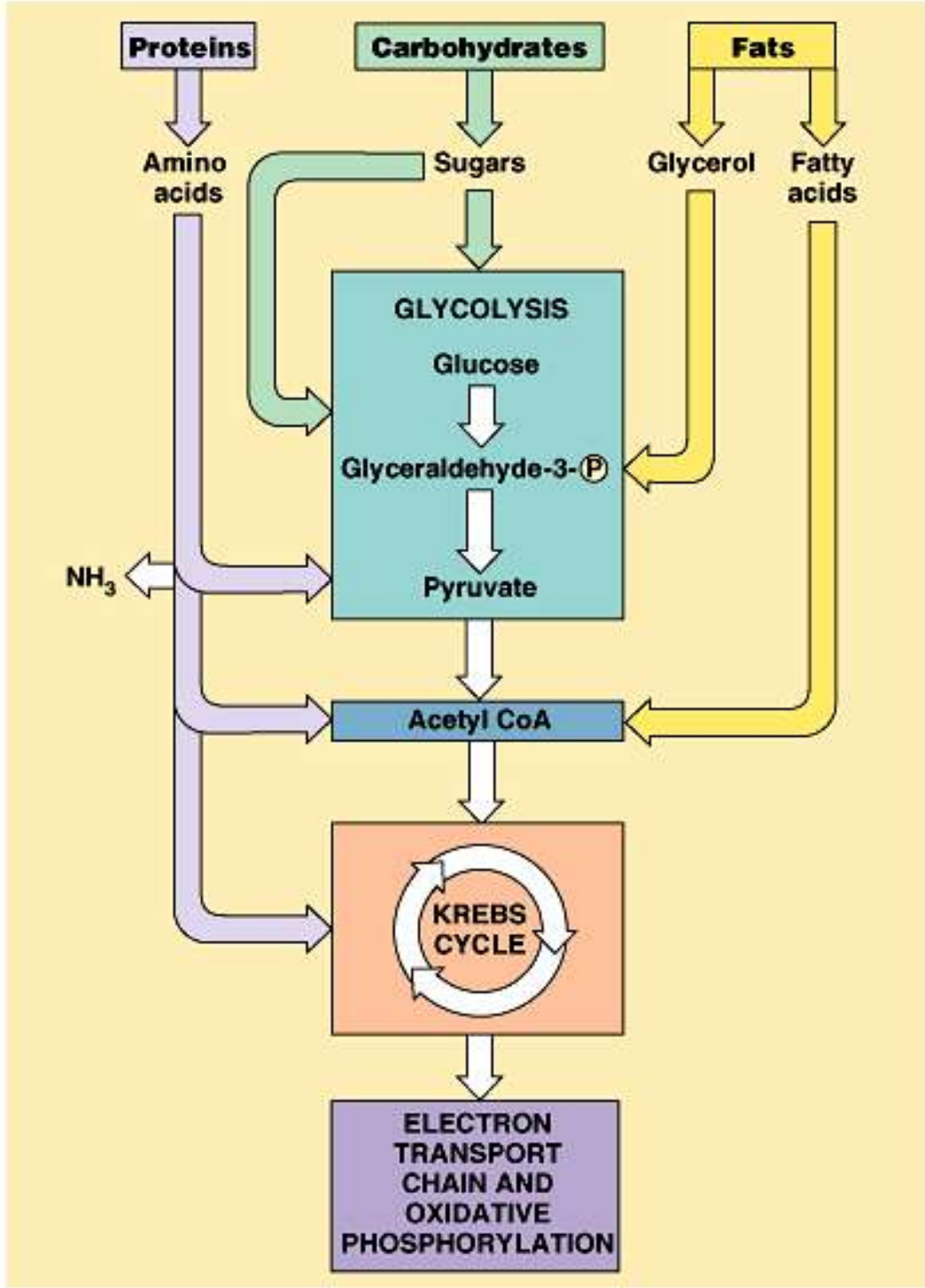
Fermentation is used in making food products and alcohol products.

What are the 3 stages of cellular respiration?

1.

2.

3.



Food for thought

1. What is the purpose of cellular respiration?

2. Where does cellular respiration occur within the cell?

3. What is the waste product of cellular respiration?

Would you go to an oxygen bar?

4. Compare Photosynthesis to Respiration

a. Where does each occur?

b. What are the products of each?

c. What compounds are needed to start the processes?

d. What is the function of the electron transport chain in each process

e. Describe the role of ATPase in both processes.

Self Test

1. In order to produce energy, cells start with glycolysis. If oxygen is NOT present after glycolysis, what process occurs next?

a) Electron Transport Chain b) Krebs Cycle c) Fermentation

2. If oxygen IS present after glycolysis, what process occurs next?
a) Electron Transport Chain b) Krebs Cycle c)Fermentation

3. A process that does NOT require oxygen is known as what?
a) Aerobic b) Anaerobic

4. In glycolysis, glucose is broken into 2 molecules of _____ acid

5. Where does the Kreb's cycle occur? _____

6. What gas is a waste product produced in the Krebs cycle? ____

7. What enzyme is used in the electron transport chain to create ATP?

a. citric acid b. pyruvate c. ATPase

8. Where does glycolyis occur?

a. cytoplasm b. mitochondria c. chloroplast

9. Which process produces the largest amount of ATP?

a. fermentation b. Krebs Cycle c. ETC

10. The oxygen required by cellular respiration is reduced and becomes part of which molecule?

a. ATP b. CO_2 c. H_20

The Mystery of the Seven Deaths

Case Study: http://sciencecases.lib.buffalo.edu/cs/files/cellular_respiration.pdf

In this case study, students learn about the function of cellular respiration and the electron transport chain and what happens when that function is impaired. Students play the role of medical examiner as they analyze the autopsy results to determine the cause of the mysterious deaths of these seven victims.

- Explain the overall purpose of cellular respiration.
- Describe the intermediate metabolites of cellular respiration.
- Explain the function and importance of the electron transport chain.
- Describe the role of oxygen in cellular respiration