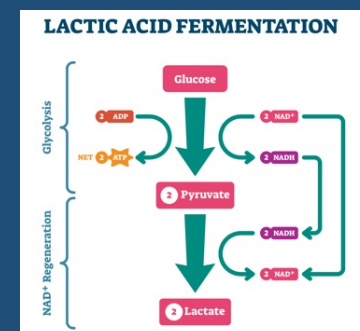
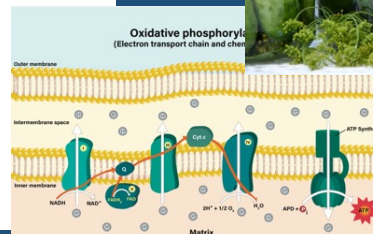
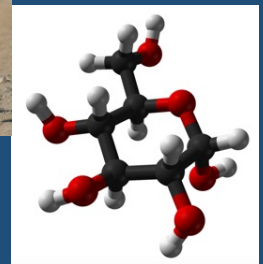
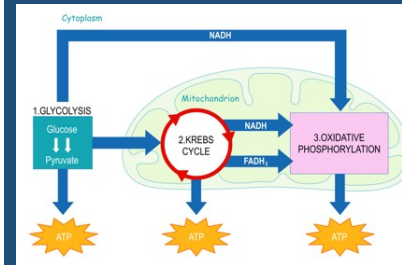
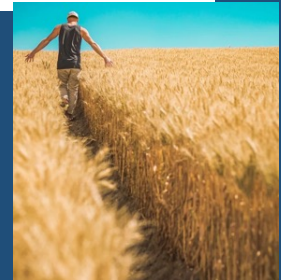
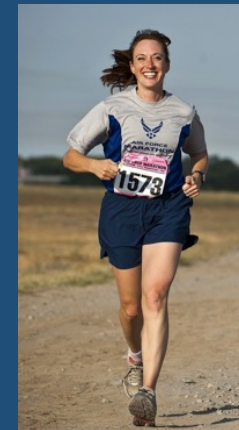


Introduction to Cellular Respiration & Fermentation

- Aerobic Respiration
- Glycolysis
- Pyruvate Oxidation
- Electron Transport Chain
- Applications
- Anaerobic Respiration and Fermentation
- Lactic Acid
- Microorganisms
- Alcohol Fermentation



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Cellular Respiration Intro - 1

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ACCESS THE SITE**



Oxidate It - 2

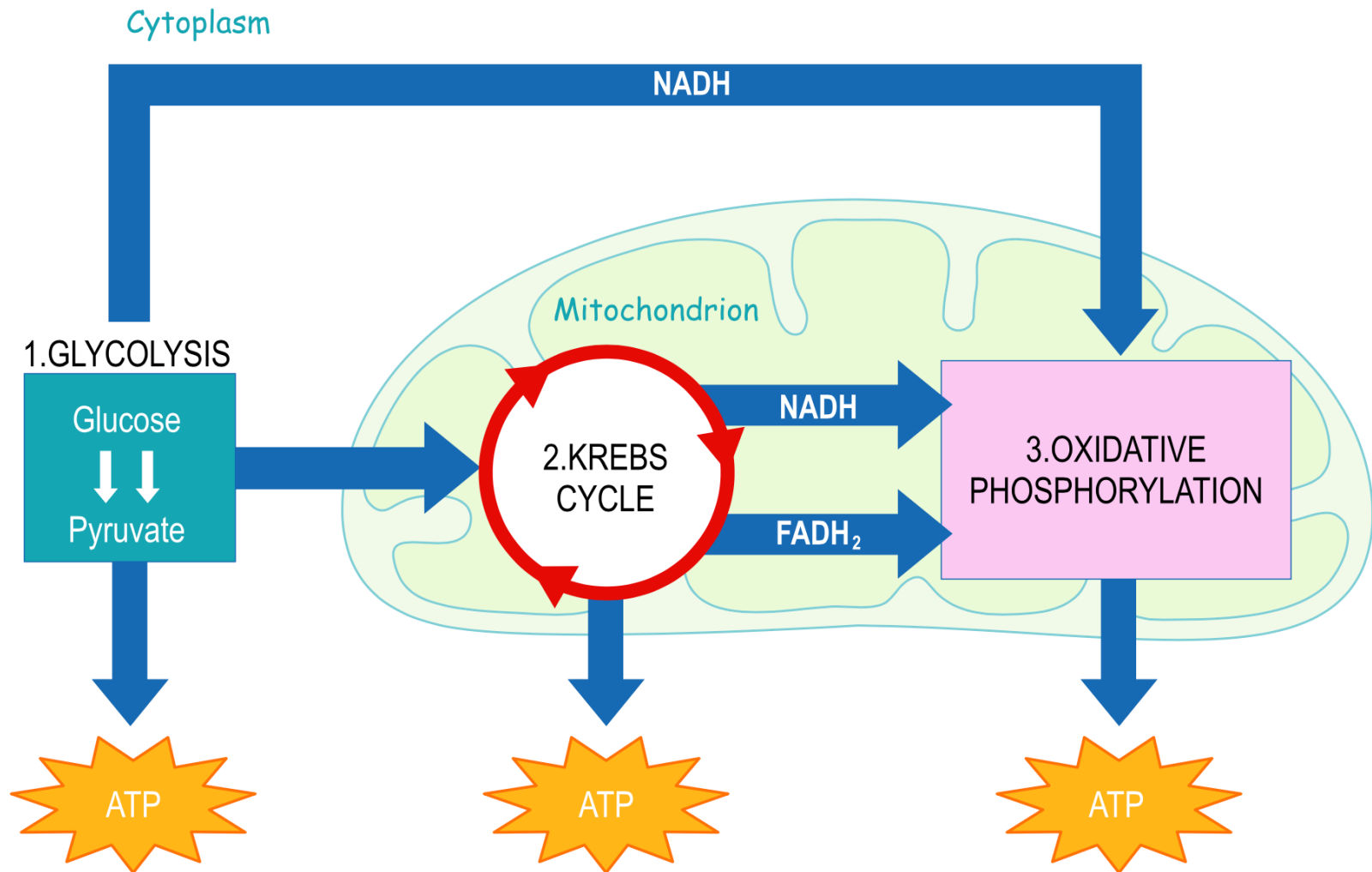


Cellular Respiration

- _____
- Glucose is the fuel for cellular respiration
- Glucose bonds are broken, and energy is released as ATP
- Without a steady supply of ATP, the cell would die within seconds

Glucose + Oxygen → Carbon Dioxide + Water + ATP

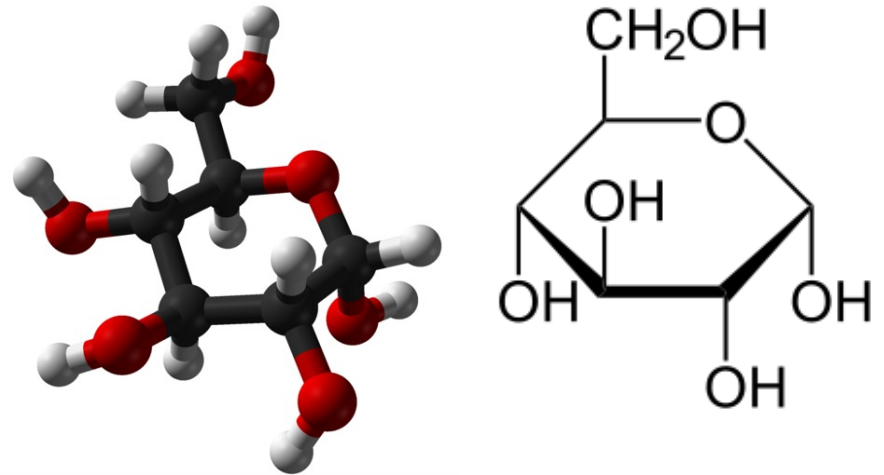
Aerobic Respiration – With O_2



Cellular Respiration

Glucose is the most efficient source of fuel to make ATP however, cells may use other molecules if necessary.

- _____
- _____
- _____

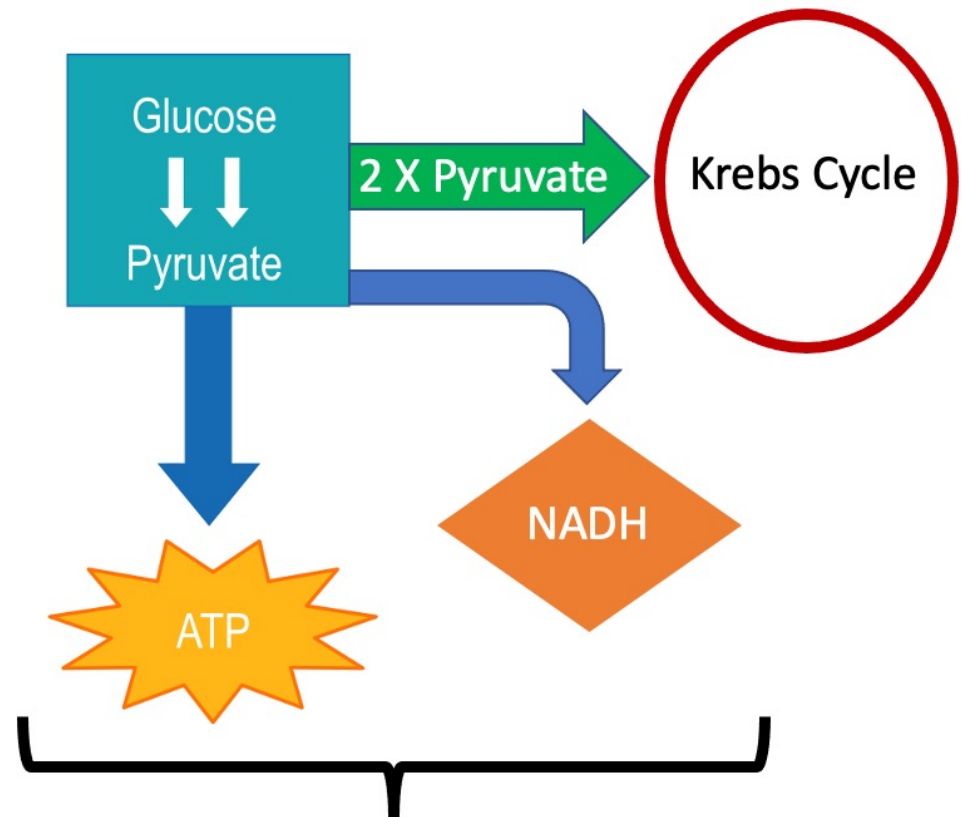


Glucose – $C_6H_{12}O_6$

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Glycolysis

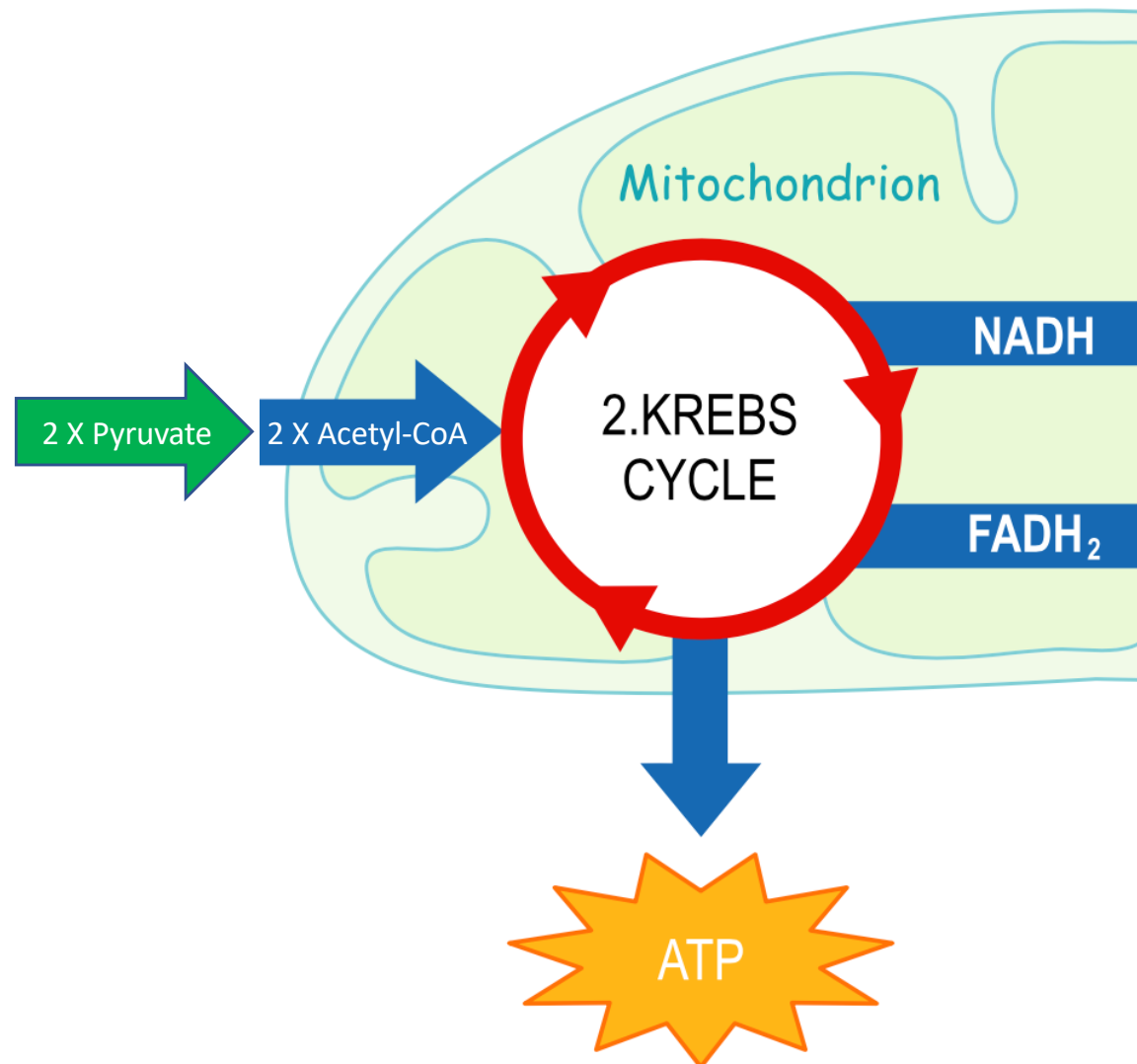
- Glycolysis takes place in all living cells
- A glucose molecule is split into 2 pyruvic acid (pyruvate) molecules which results in the net gain _____



2 ATP and 2 NADH are produced for every glucose molecule.

Step 2 – Pyruvate Oxidation and the Krebs (Citric Acid) Cycle

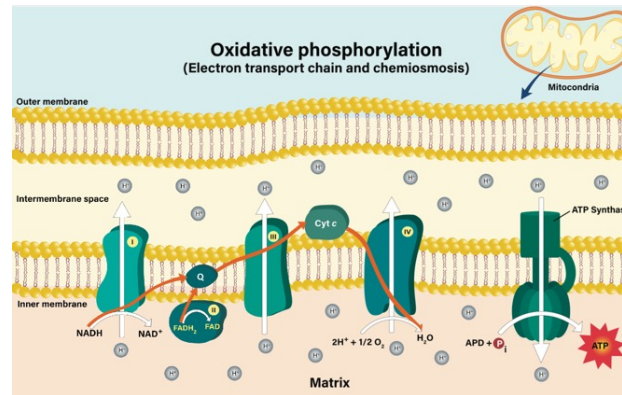
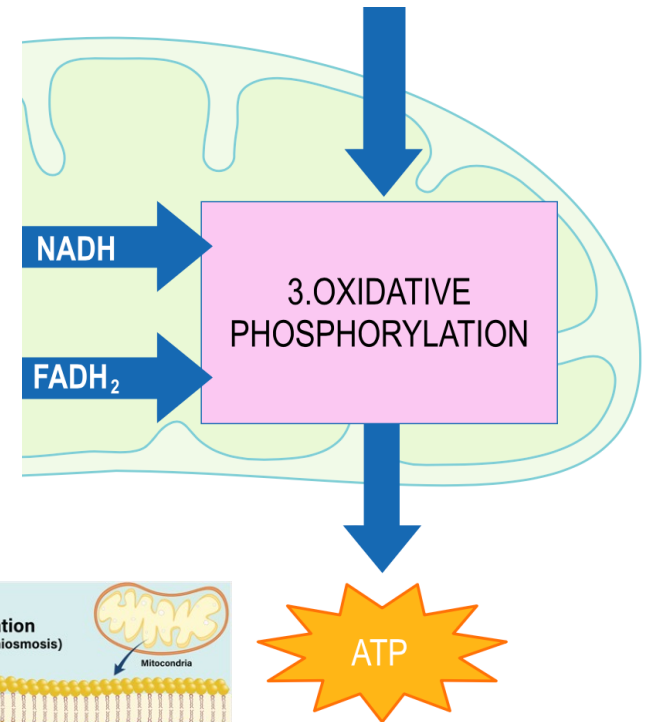
- Each of the two pyruvate molecules produced in glycolysis are transported to the mitochondria and are oxidized to create CO_2 , NADH, and one acetyl-CoA



- _____

Step 3 – The Electron Transport Chain

- Products from the Krebs Cycle come into the electron transport chain (ETC) where their energy is used to pump H^+ ions across a membrane creating a gradient



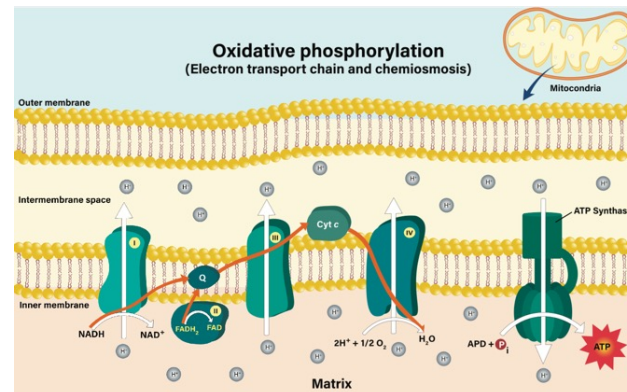
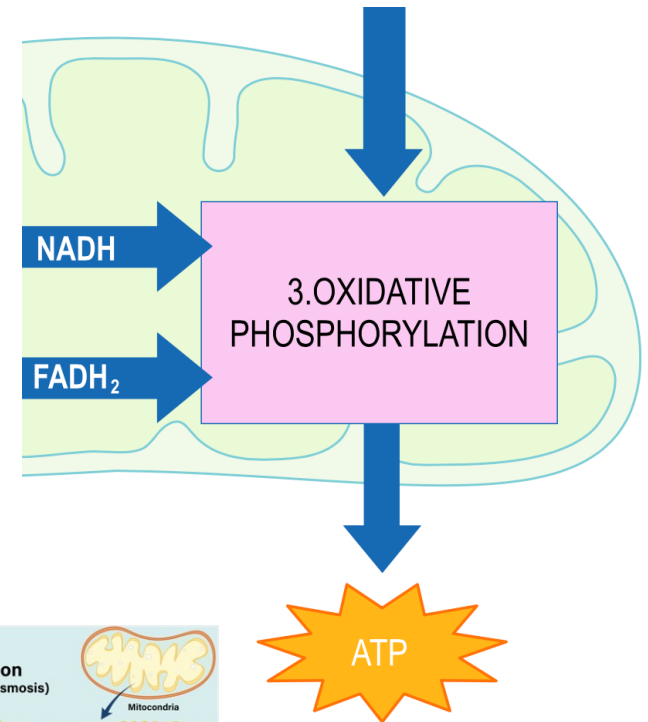
Step 3 – The Electron Transport Chain



3

- When the electrons reach the end of the ETC, they combine with oxygen and 2H^+ to form water

- _____



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Cellular Respiration

Therefore, cellular respiration under aerobic conditions (oxygen is present) has the following formula:



Cellular Respiration

But why does O_2 need to be present for aerobic respiration to occur?

Cellular Respiration

But why does O_2 need to be present for aerobic respiration to occur?



4

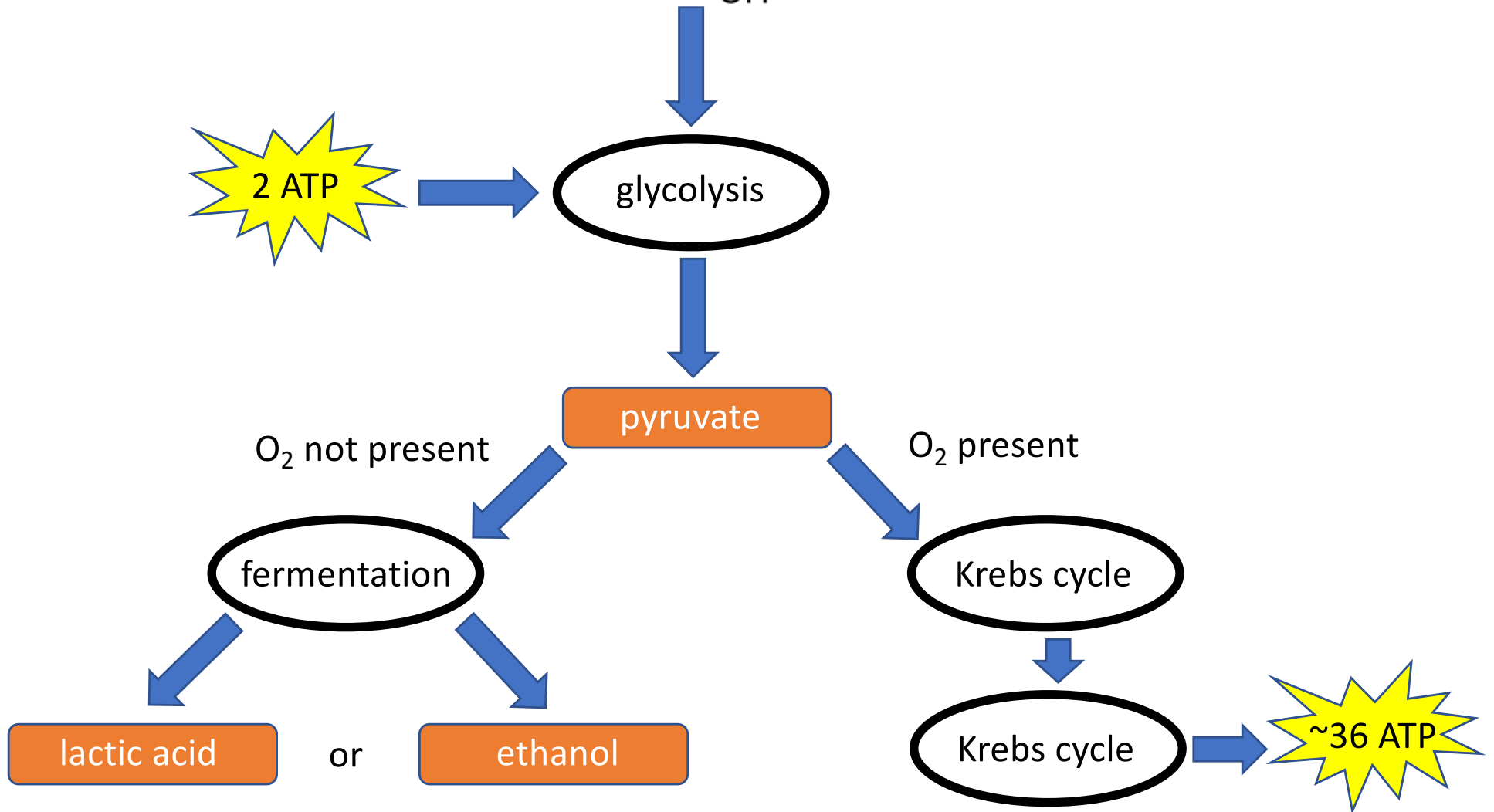
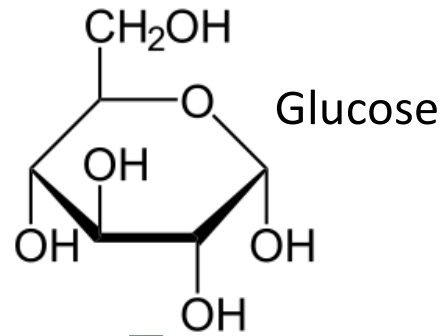
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ACCESS THE SITE**

Cyanide

- _____
- This prevents the uptake of O_2 which stops the ETC
- This reduces the amount of ATP produced resulting in coma and death



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Anaerobic Respiration/Fermentation

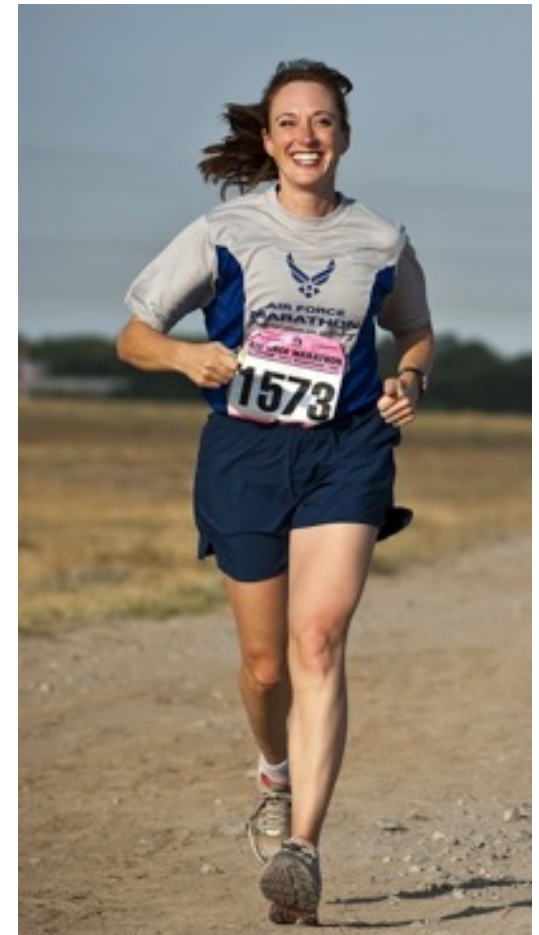
- Anaerobic respiration will occur in the cytoplasm if O_2 is not present
- This allows glycolysis to continue
- There are two types of anaerobic respiration:
 1. _____
 2. _____

Lactic Acid Fermentation

- Occurs in the cytoplasm of animals, some bacteria, and fungi
- _____
- However, glycolysis continues to provide some energy for your body to keep you alive
- Pyruvic acid

Lactic Acid in Animals - Accumulation of Lactic Acid

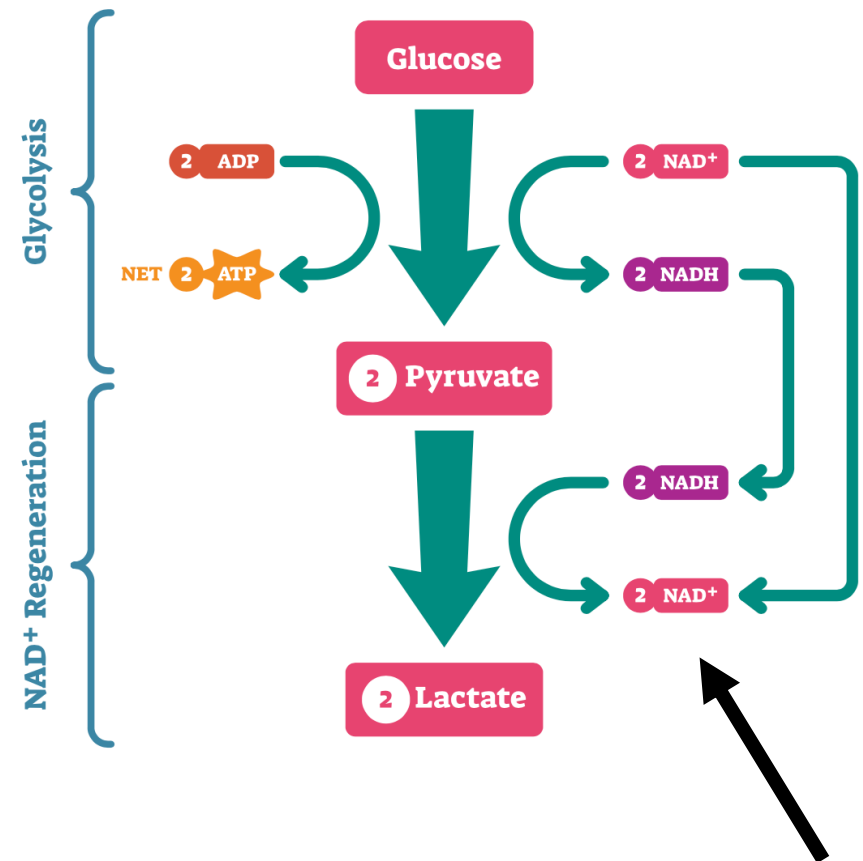
- An example of this is when you work hard and find your muscles fatiguing
- Lactic acid accumulation cannot continue forever, your body must rest eventually
- When this occurs, you start doing what?



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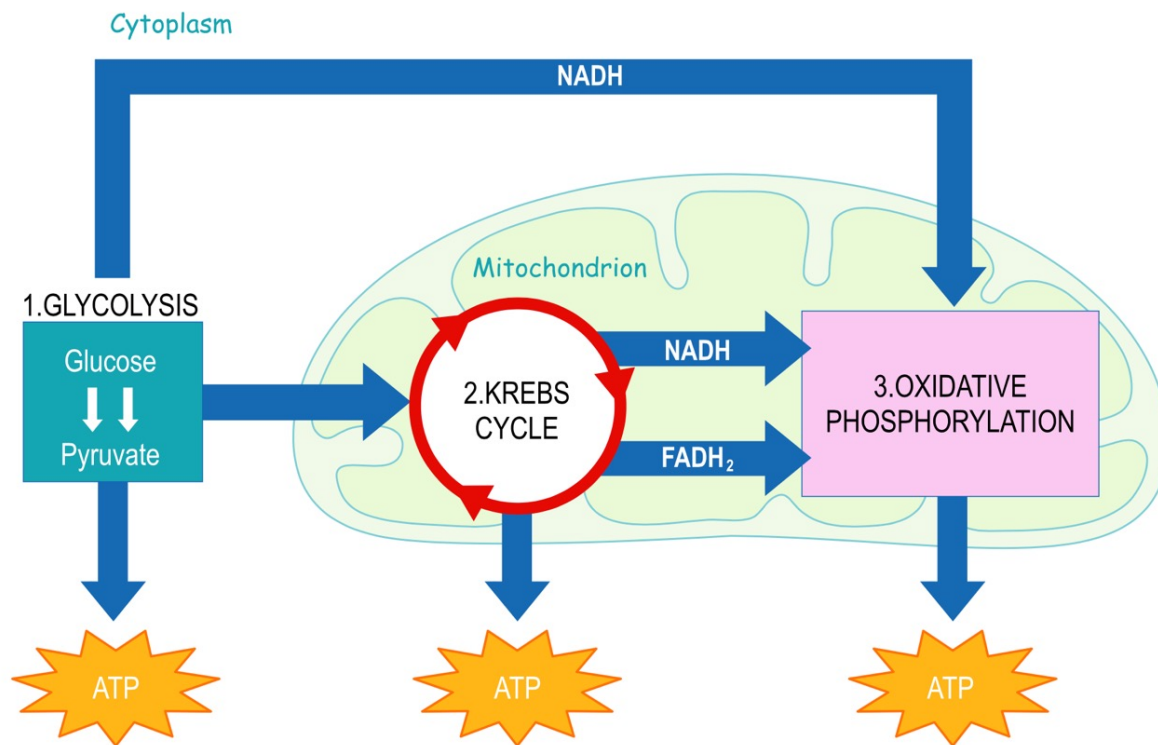
Lactic Acid Fermentation

LACTIC ACID FERMENTATION



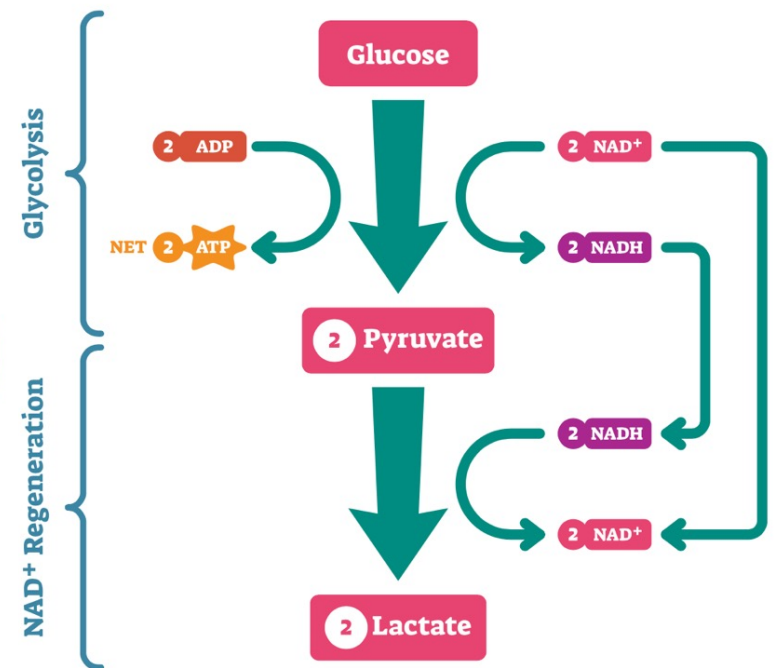
- _____
- Once O₂ is present again, lactic acid (a.k.a. lactate) is oxidized back to pyruvate, which then goes through the Krebs Cycle

Aerobic vs. Anaerobic Cellular Respiration



Aerobic Cellular Respiration

LACTIC ACID FERMENTATION



Anaerobic Cellular Respiration

Lactic Acid Buildup in Muscles

- A Lactic Acid build-up in muscles is generally thought to be responsible for the fatigue felt during exertion

- _____

- _____

Lactic Acid in Microorganisms

We utilize lactic acid fermentation in microorganisms to create many foods such as:

- pickles, sauerkraut, green olives, some varieties of sausage, and certain milk products, such as buttermilk, yogurt, and some cheeses



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Alcohol (Ethanol) Fermentation

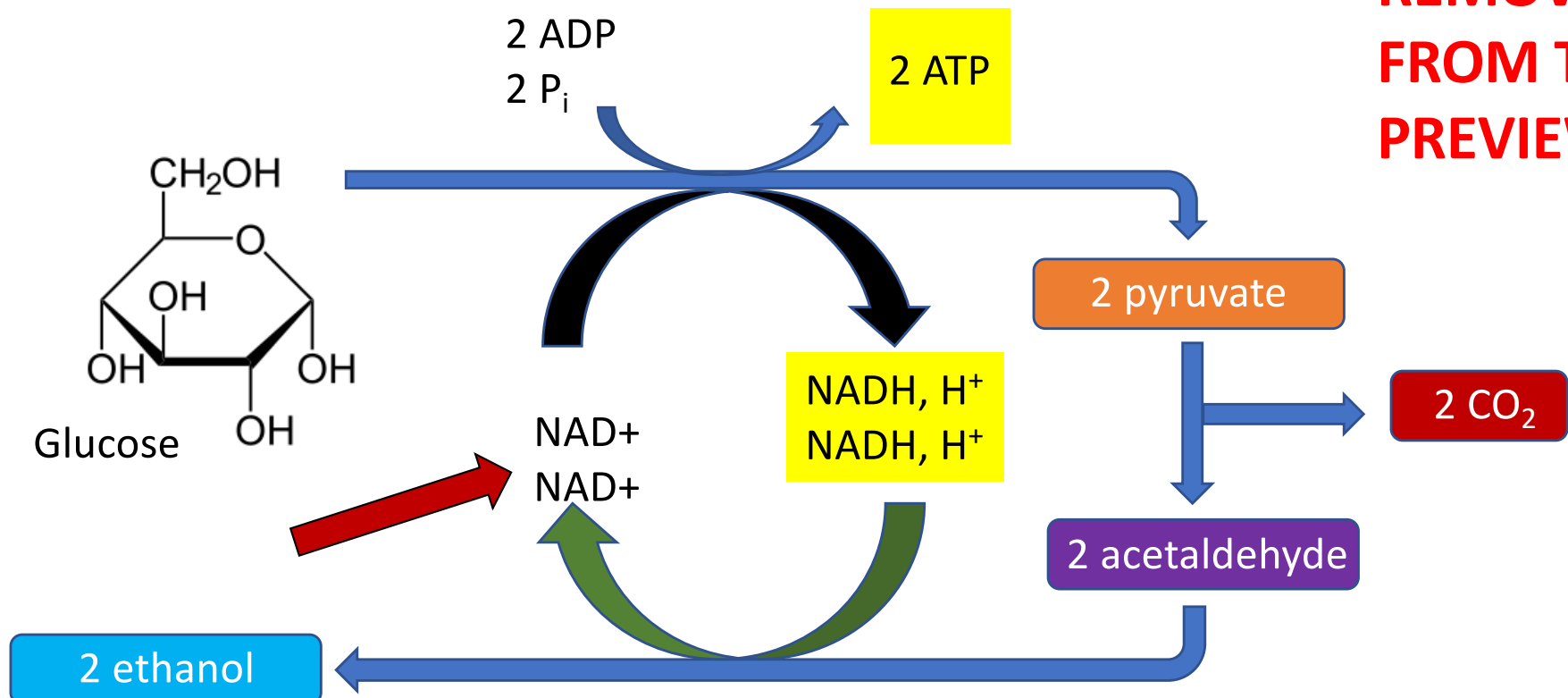


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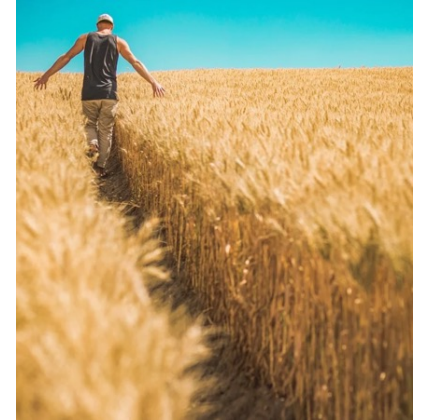
- Occurs in plant cells, bacteria, and yeast

- _____



Alcohol Fermentation - Beer

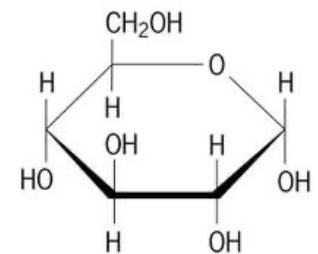
- Beer comes



- The grains are ground up and water and enzymes are added



- _____

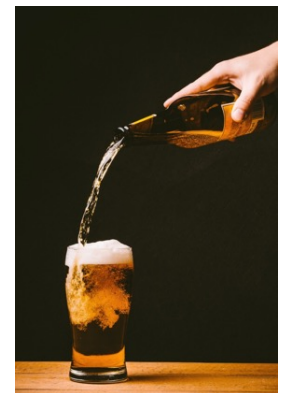


Alcohol Fermentation - Beer

- The resulting mixture is placed in fermenters (oxygen-free environment) where yeast is added
- _____
- The resulting solution is 10% ethanol and 90% water



Fermenters



Alcohol Fermentation - Ethanol

- _____



- The ethanol can also be used to fuel some cars
- Fuel that is part ethanol is cleaner and renewable unlike many other petroleum products



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Alcohol Fermentation - Wine

- The yeast consumes the sugar and produces CO₂ and ethanol
- The ethanol is distilled into wine
- Different grapes give you different wines
 - e.g., Merlot, Pinot Noir, etc.



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Answer the following

- 1) What is the main difference between champagne and wine?
- 2) What is the difference between champagne and sparkling wine?