

# Cellular Respiration

# *Cellular Respiration*

- **Definition**
  - The process by which **glucose** molecules are broken down to release **energy** is called cellular respiration.

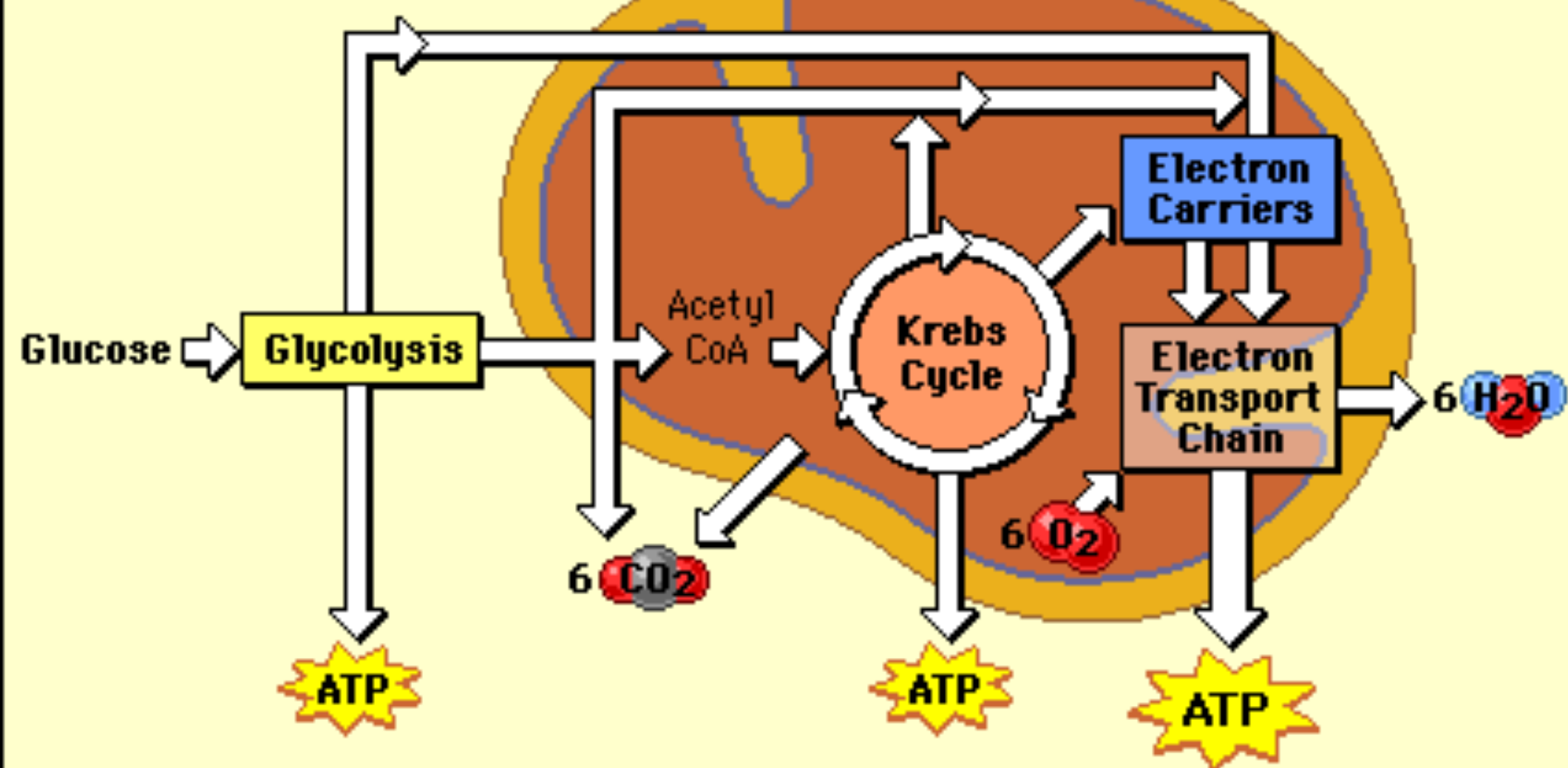
# *Cellular Energy*

- All organisms need a source of **energy**.
- Heterotrophs use the **organic** compounds in food for energy sources.
- Before energy in complex carbohydrates can be used by cells, it must be broken down into simple sugars like glucose.
- This breakdown of glucose is done by our digestive system.



Cytosol

Mitochondrion





# Three Stages of Cellular Respiration

## 1. Glycolysis

- Glucose splits into two
- Lysis = to **burst** or break
- Takes place in the cytoplasm
- Produces 2 **ATP** (energy molecules)
  - It actually makes 4 ATP, but it uses 2 ATP.

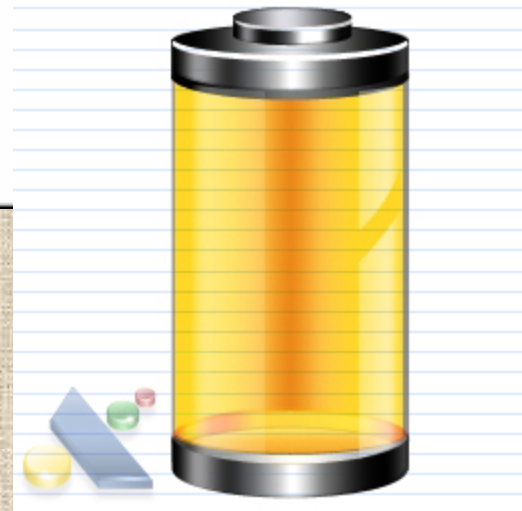
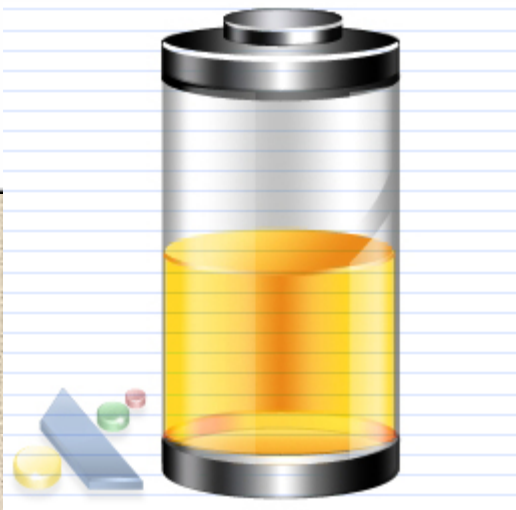
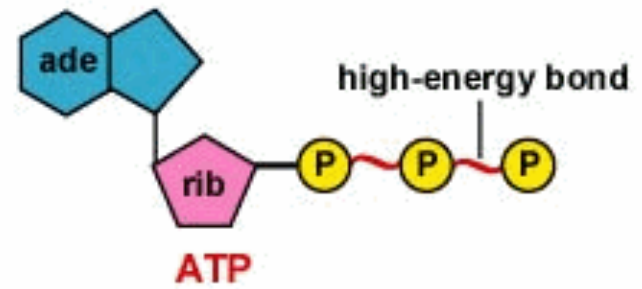
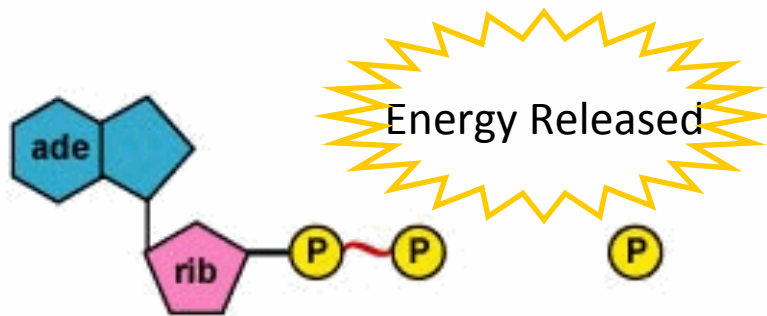
$$4 \text{ ATP} - 2 \text{ ATP} = 2 \text{ ATP}$$

## 2. Krebs Cycle

- Also called the **Citric Acid** Cycle
- Occurs in the Mitochondria
- Requires **Oxygen**
- The glucose, which was already split in two, is broken down further to make **CO<sub>2</sub>**.
  - The CO<sub>2</sub> is released into the atmosphere
- Produces 2 ATP and high-energy **electrons**
  - These electrons are carried by electron carriers (NADH and FADH<sub>2</sub>)

### 3. Electron Transport Chain

- Occurs in the **mitochondria**
- Requires oxygen
- The high-energy electrons are passed down a **chain of proteins**
- At the end of the chain, these electrons are combined with **hydrogen** and **oxygen** to form water.
- This process makes **32 ATP from ADP**
- **Also termed: Oxydative Phosphorylation**



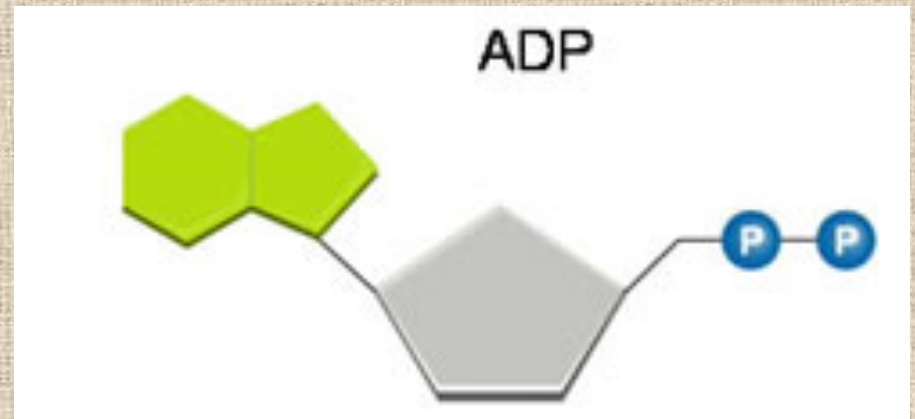


# How are ADP and ATP different?

**A**denosine

**Di**

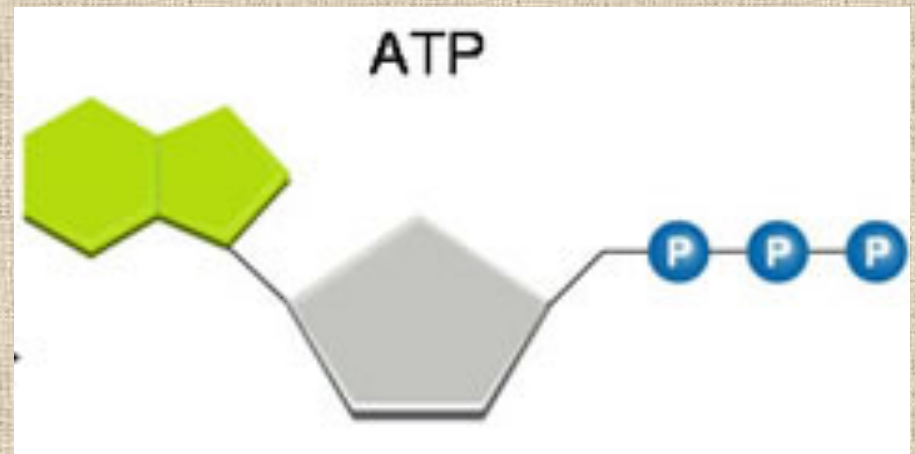
**P**hosphate

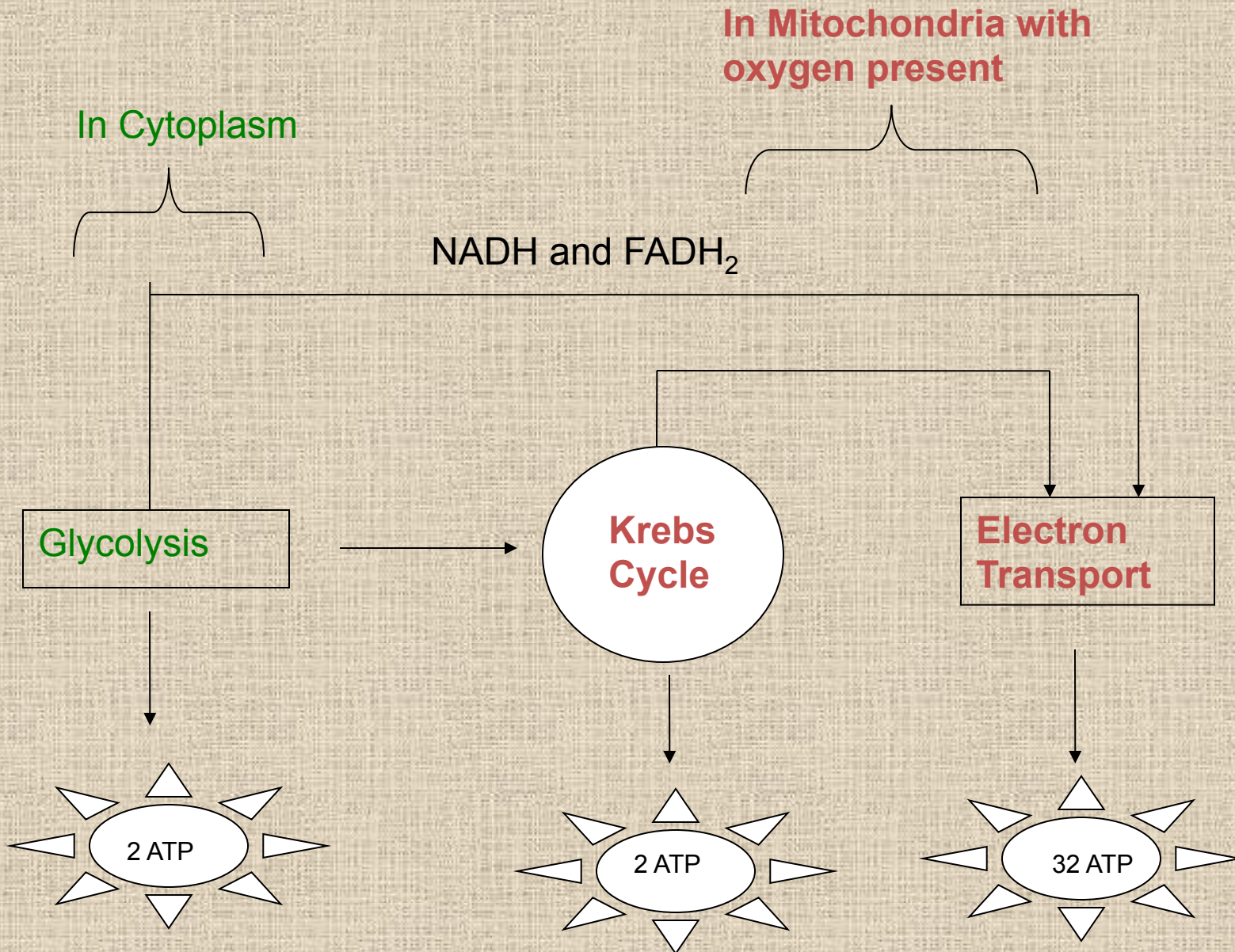


**A**denosine

**Tri**

**P**hosphate





# Cellular Respiration

- Anaerobic = without oxygen
  - Glycolysis
- Aerobic = with oxygen
  - Krebs Cycle and Electron Transport Chain



# Alcoholic Fermentation

- Yeasts (single-celled fungi) and a few other microorganisms use alcoholic fermentation
- Forms **ethyl alcohol** and **CO<sub>2</sub>** as wastes

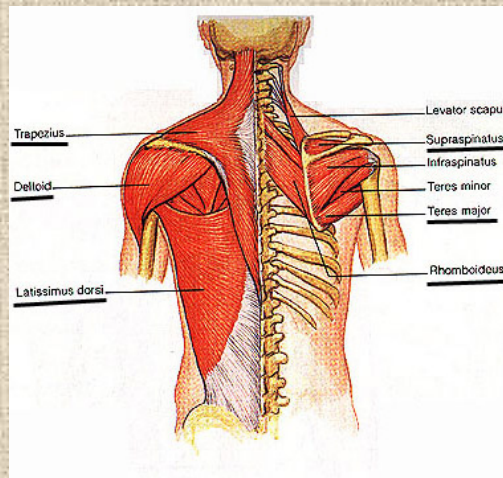


Glycolysis  $\rightarrow$  CO<sub>2</sub> + alcohol + **2ATP**



# Lactic Acid Fermentation

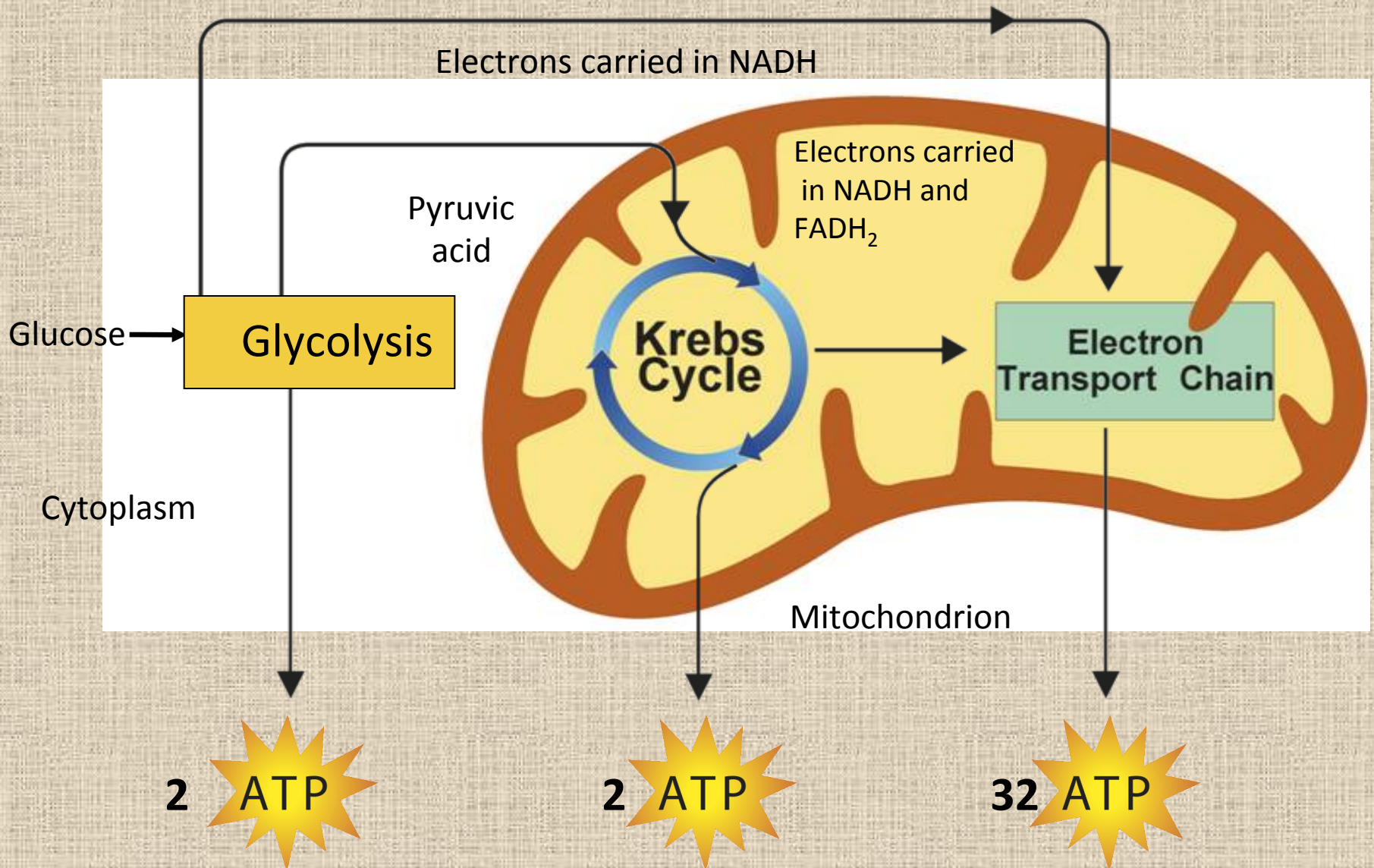
- Lactic acid is produced in your muscles during rapid **exercise** when the body cannot supply enough **oxygen** to the tissues
- Without enough oxygen, the body isn't able to produce all the **ATP** that is required



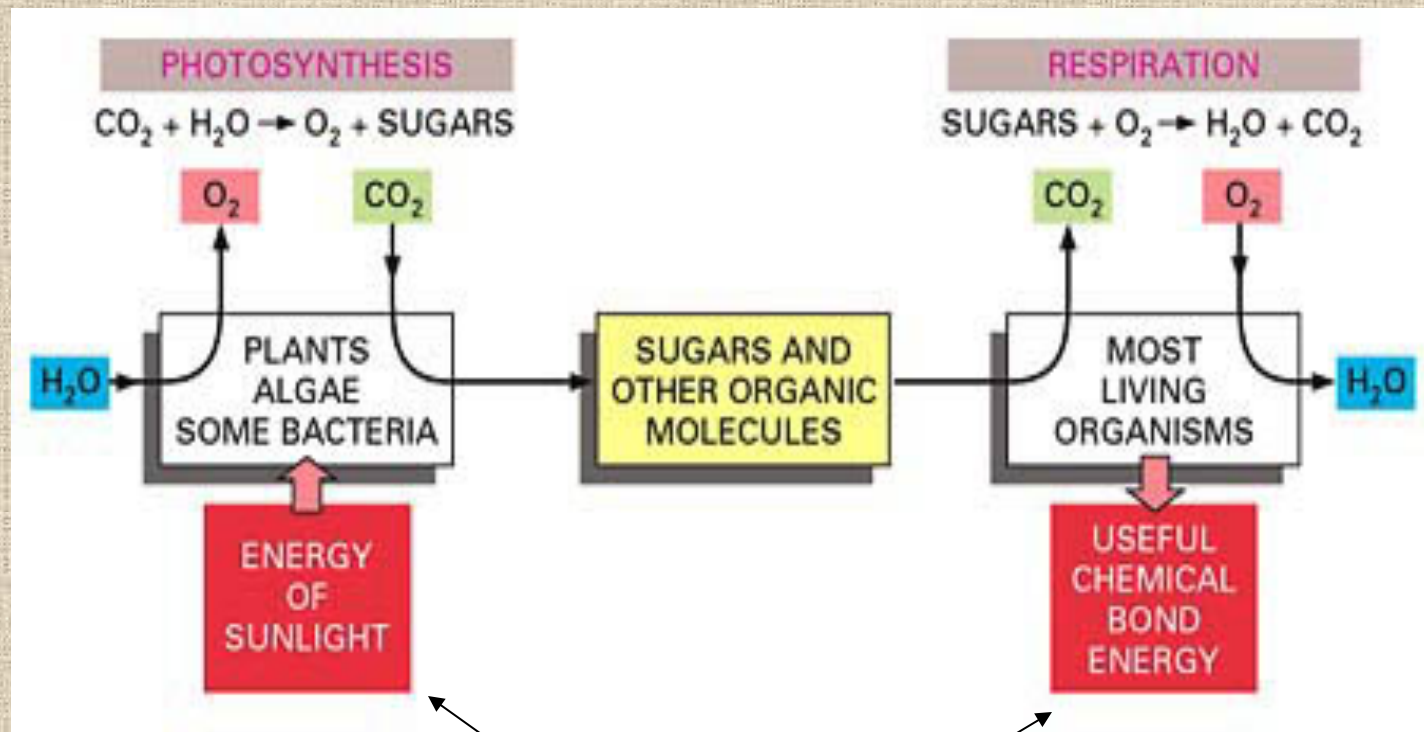
- Lactic acid can also be found in sour milk products like yogurt and some cottage cheeses!



Glycolysis  $\rightarrow$  lactic acid +  $\text{CO}_2$  + **2ATP**



# Compare - Contrast

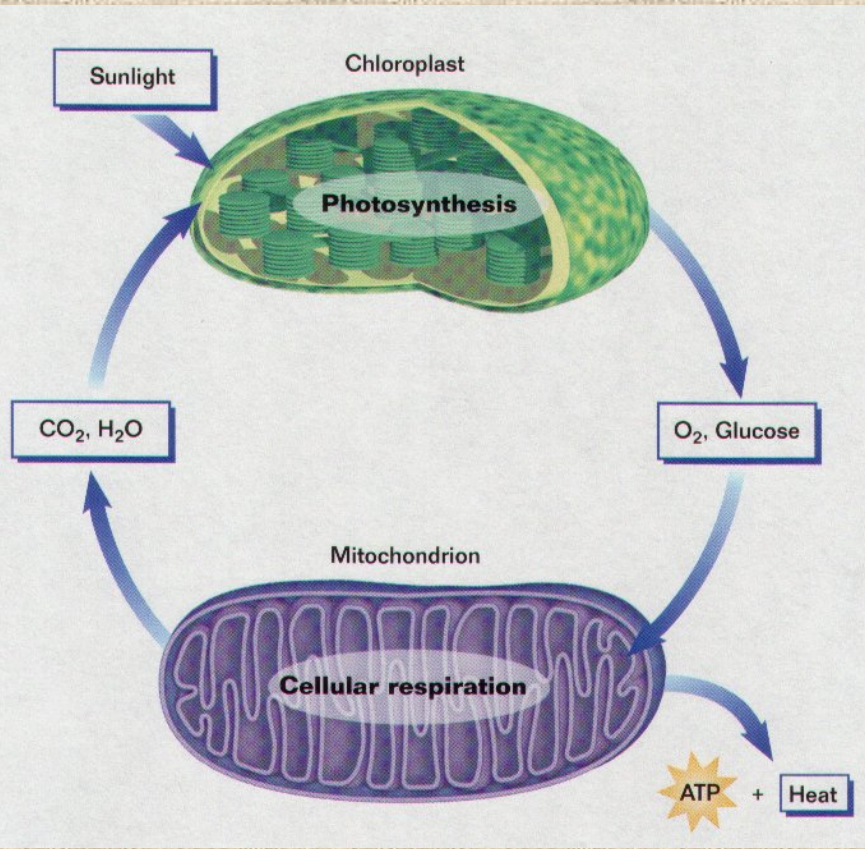


LOOK





# *Get to the Point*



- Main Points:
- 1. Photosynthesis and Respiration are a cycle.
- 2. The purpose of the cycle is to turn light energy from the sun into chemical energy that living organisms can use!!!!



# Photosynthesis and Respiration

	Photosynthesis	Respiration
Function	Energy Capture	Energy Release
Location	Chloroplasts	Mitochondria
Reactants	CO <sub>2</sub> and H <sub>2</sub> O and light energy	C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> (glucose) and O <sub>2</sub>
Products	C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> (glucose) and O <sub>2</sub>	CO <sub>2</sub> and H <sub>2</sub> O and energy (ATP)

**Photosynthesis:**  $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 \text{ (glucose)} + 6\text{O}_2$

**Respiration:**  $\text{C}_6\text{H}_{12}\text{O}_6 \text{ (glucose)} + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy}$