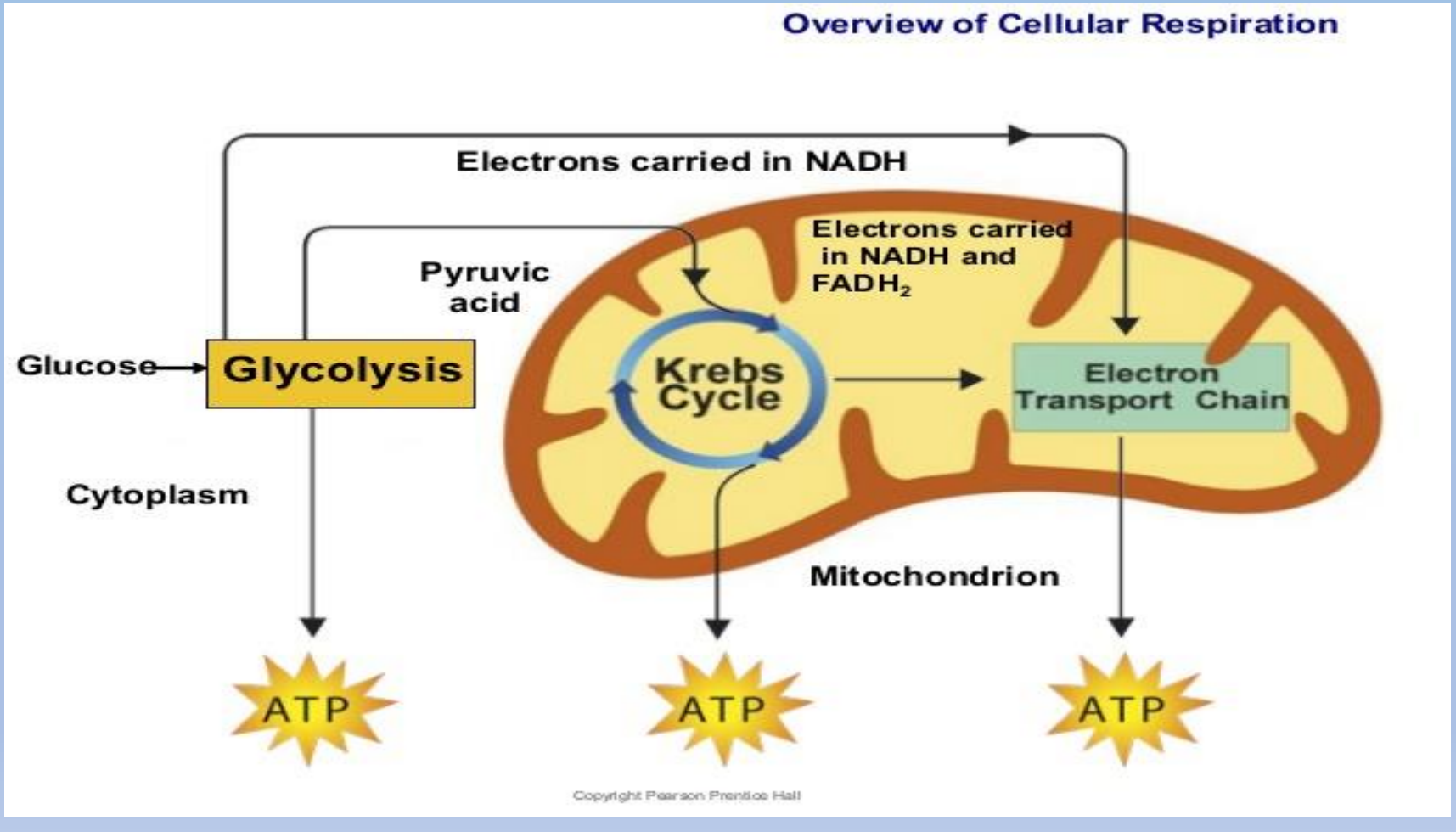
Intro to Cellular Respiration

Cellular Respiration

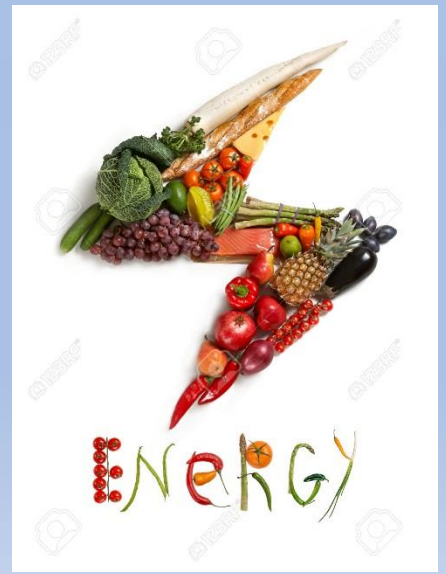


- Heterotrophs get energy from ***food***.

- Food molecules release chemical energy when chemical bonds break.

- Cells break down food & use the stored energy to produce ATP to power the cell's activities.

- Happens in ALL organisms (even autotrophs)
  - cellular respiration gives cells energy in a usable form.



<u>Cellular respiration</u>- releases energy from food in the presence of ***oxygen***.

- Occurs in the mitochondria of a cell

- Chemical equation (symbols):

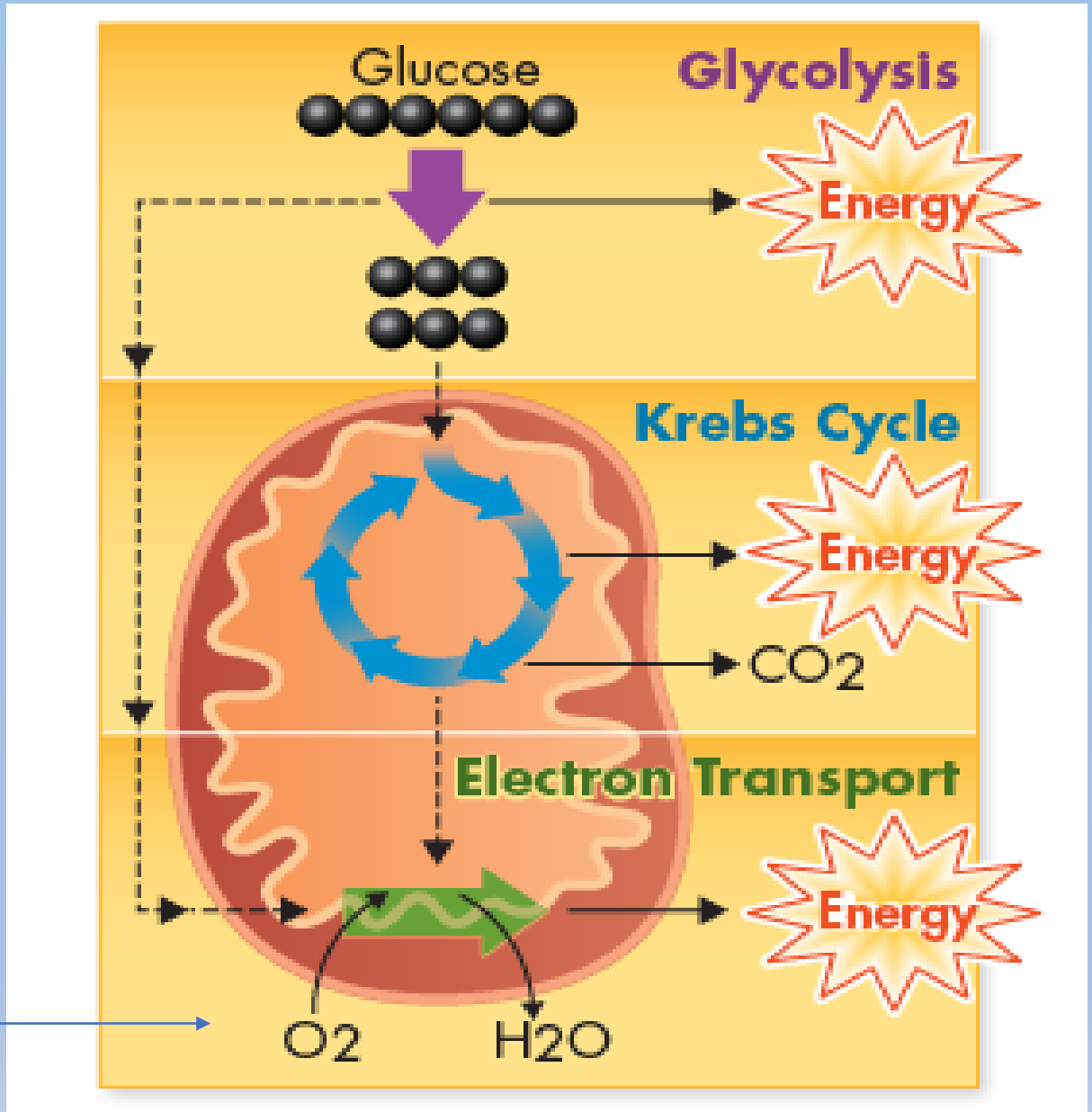
$$6\ O_2 + C_6H_{12}O_6 \rightarrow 6\ CO_2 + 6\ H_2O + \text{Energy}$$

In words:

Oxygen + Glucose→ Carbon dioxide + Water + Energy

Cellular Respiration:

- 3 stages (in order) are:
  1- Glycolysis
  2- Krebs cycle
  3- Electron Transport Chain (ETC)

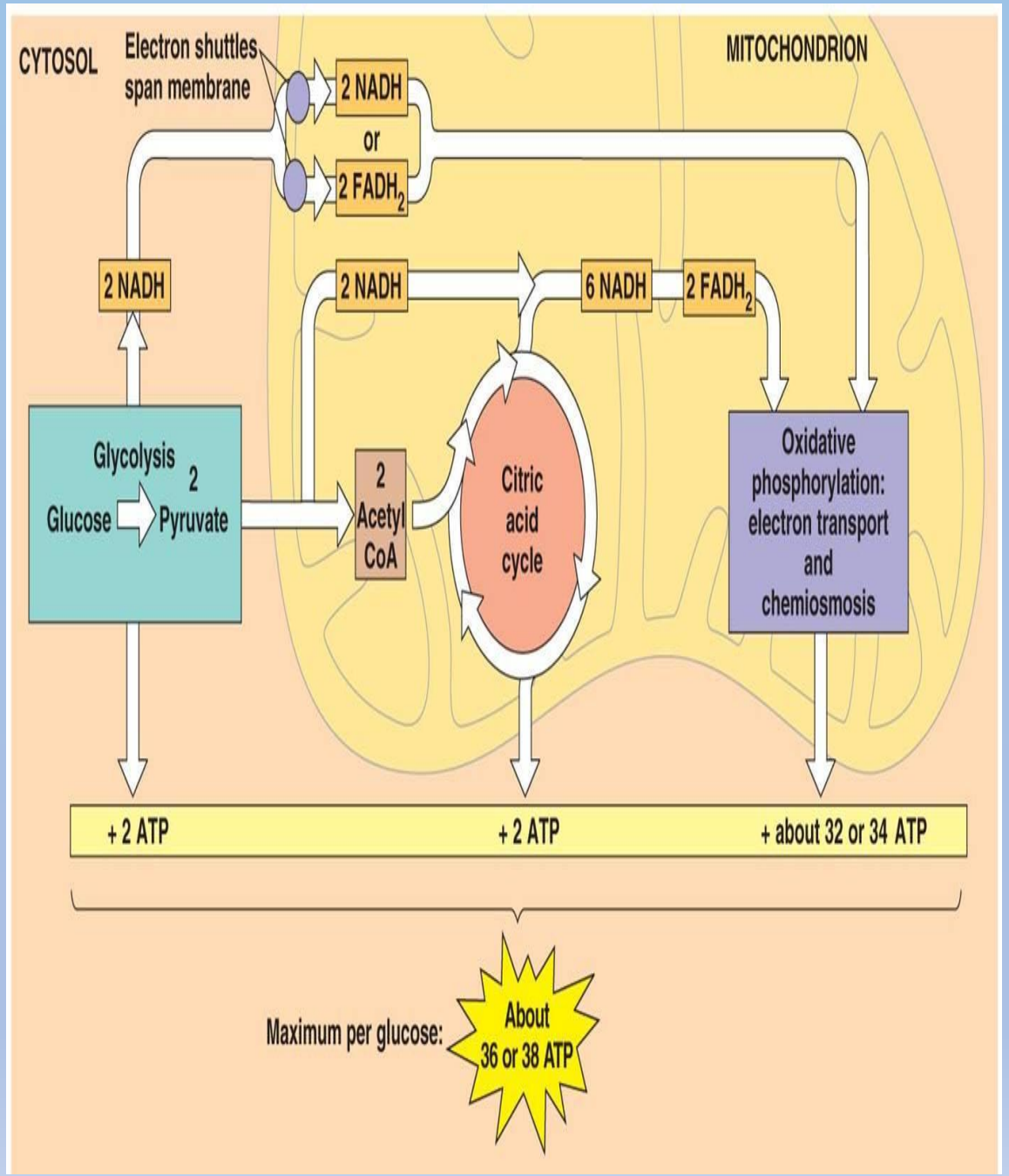


Why you breathe O_2

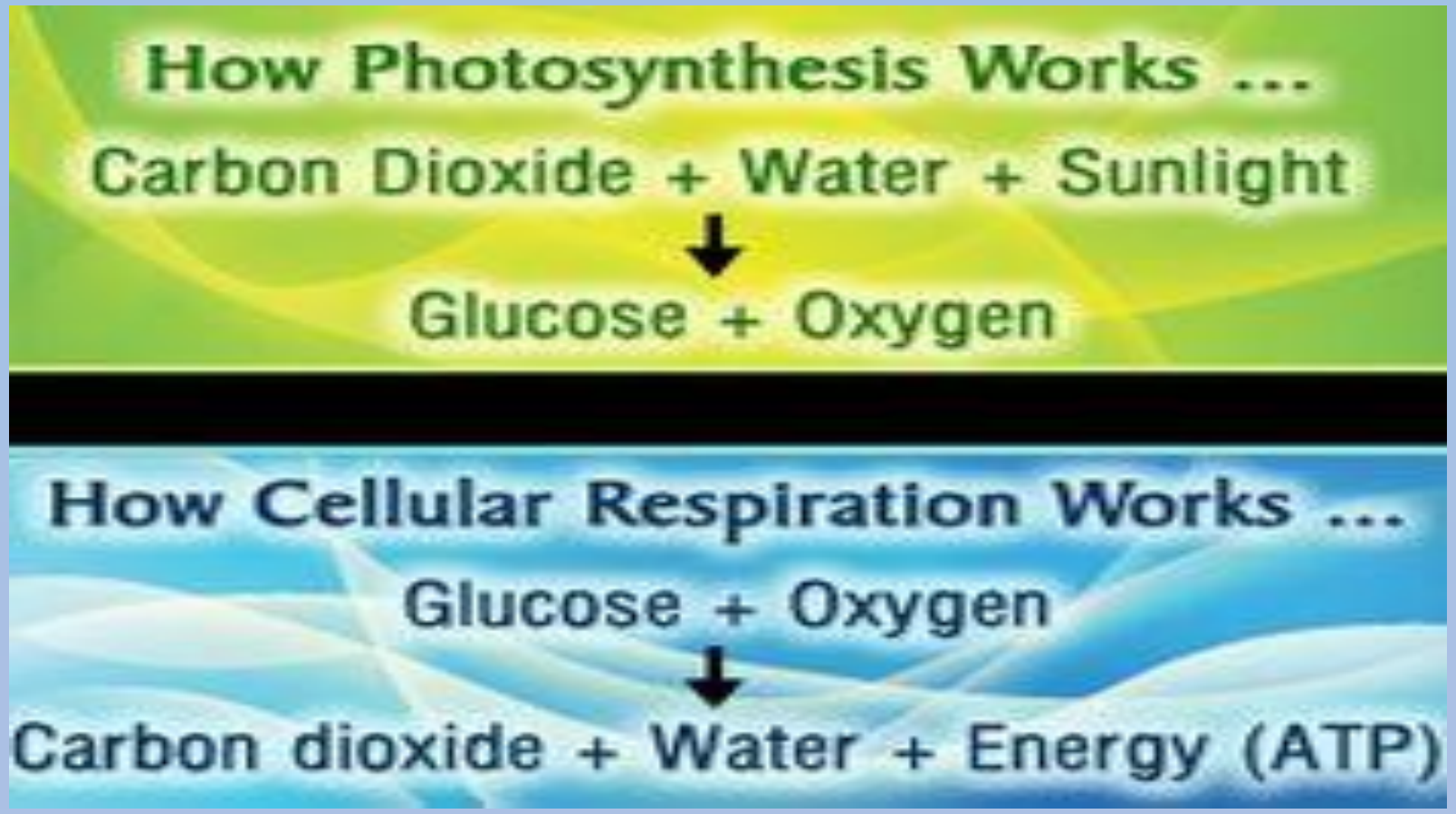
Cellular Respiration:

- Glycolysis: 2 ATP
- Citric Acid: 2 ATP
- ETC: 34 ATP

- NET GAIN per Gluose = **36 ATP**



What do you notice about PS and CR?



They are opposites!

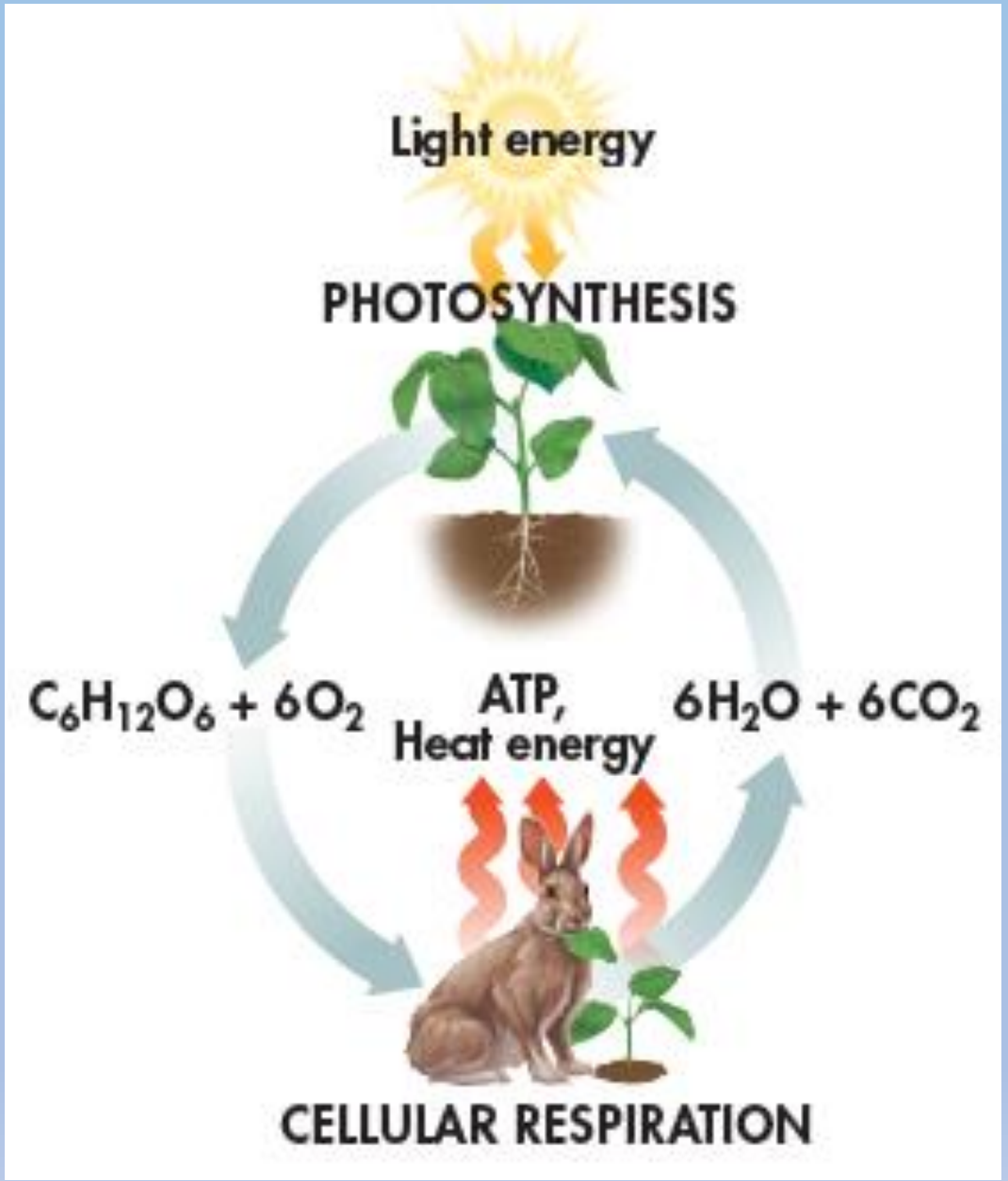
- Photosynthesis & cellular respiration are ***opposite*** processes.
  - PS removes CO_2 from the air; CR returns it.
  - PS releases O_2 into the air; CR uses O_2 from air to release energy from food.

- PS “deposits” energy & CR “withdraws” it.

- The reactants of CR are the products of PS & vice versa.

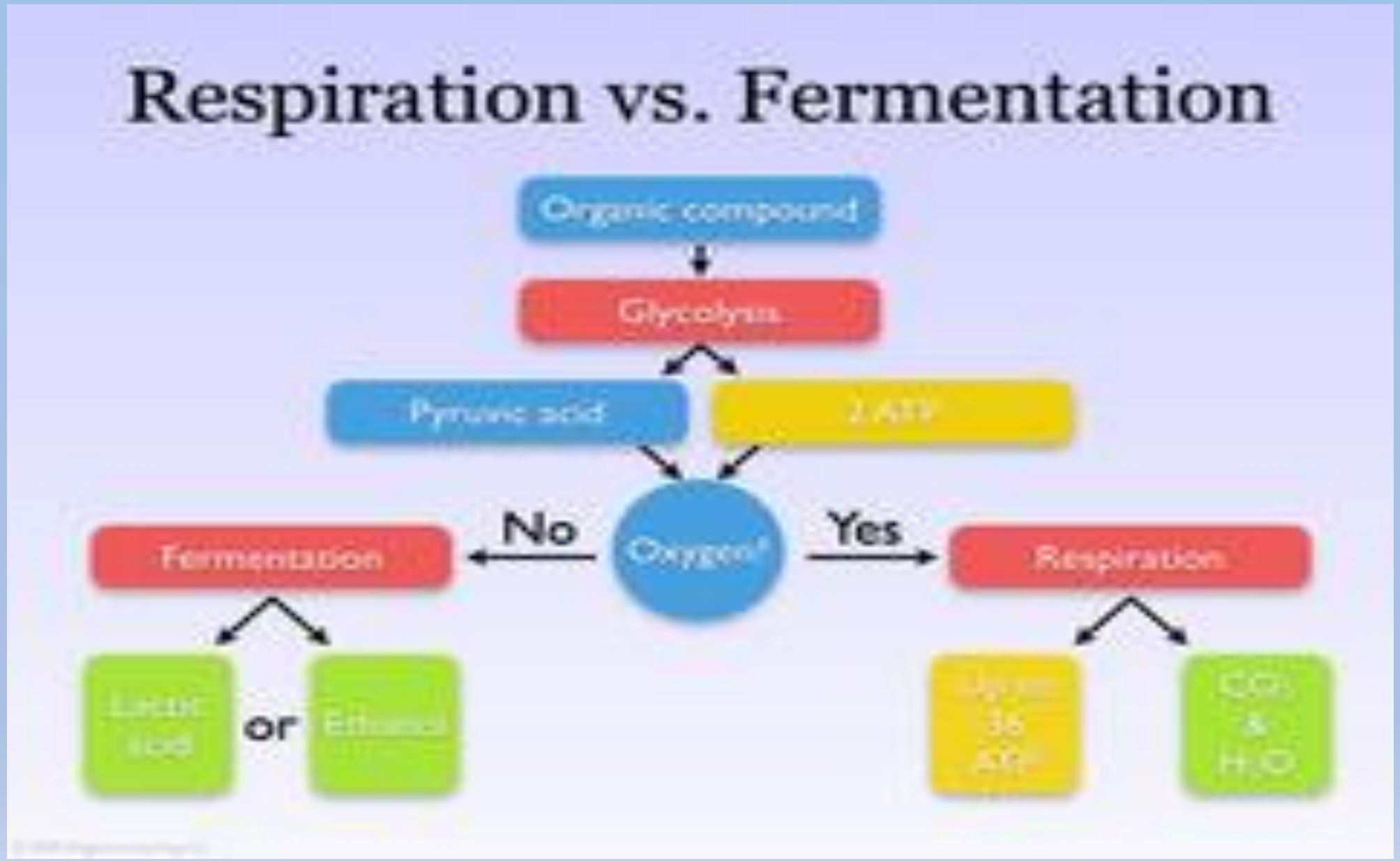
- ***Release*** of energy by ***cellular respiration-*** in plants, animals, fungi, protists, most bacteria.

- Energy ***capture*** by ***photosynthesis***- in plants, algae, & some bacteria.



Intro to Fermentation

Fermentation



- **<u>Aerobic</u>**- process that requires oxygen
  - Krebs cycle & ETC are **aerobic** processes.
  - Krebs & ETC take place inside the ***mitochondria***.

- **<u>Anaerobic</u>**- does not require oxygen
  - Glycolysis is an **anaerobic** process.
  - Glycolysis takes place in the ***cytoplasm***.

- **<u>Fermentation</u>** - energy is released from food molecules in the ***absence*** of oxygen.
  - occurs in the ***cytoplasm*** of cells.

  - 2 types of Fermentation exist:

    -Alcoholic Fermentation

    -Lactic Acid Fermentation

  - Under ***anaerobic*** conditions, fermentation follows glycolysis.

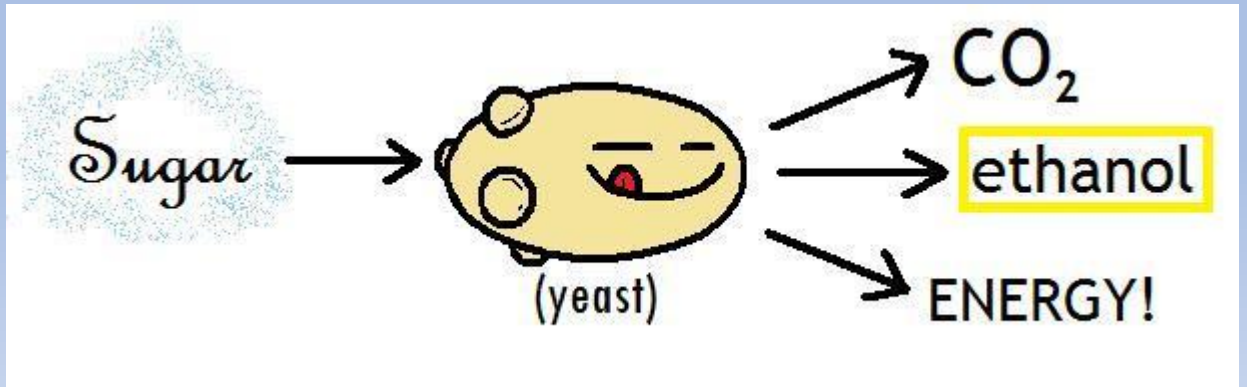
Alcoholic Fermentation:

- Yeast & a few other microorganisms use alcoholic fermentation to produce ethyl alcohol & carbon dioxide.

- used to produce alcoholic beverages & causes bread dough to rise.

- Chemical equation:

Glucose→ Pyruvic acid + NADH → Alcohol + CO_2 + NAD^+



Lactic Acid Fermentation

- Carried out best by human muscle cells under **oxygen deprivation.**

- Lactic Acid is a **toxin** and causes fatigue, soreness and stiffness in **muscles** that have been overworked.

- Chemical equation:

$$\text{Glucose} \rightarrow \text{Pyruvic acid} + \text{NADH} \rightarrow \text{Lactic acid} + \text{NAD}^{+}$$

Lactic Acid & Exercise

- For this sudden burst of energy, cells use the **small amount of ATP** they can normally conserve. This supply runs out in seconds.
- Then fermentation kicks in to produce more ATP for energy, producing **lactic acid** as a byproduct.
- With the build up of **lactic acid** in the body system the only way to get rid of it is adding LOTS of **oxygen**.
- This is why heavy **breathing** is necessary after a race!

- During fermentation, cells convert NADH made by glycolysis back into the electron carrier NAD^+, allowing glycolysis to continue producing ATP.