



Ch. 7: Cellular Respiration

STEM VARSITY



Catabolic pathways yield energy by oxidizing organic fuels:

Fermentation - A partial deflation of sugar or other organic fuel that occurs without the use of oxygen.

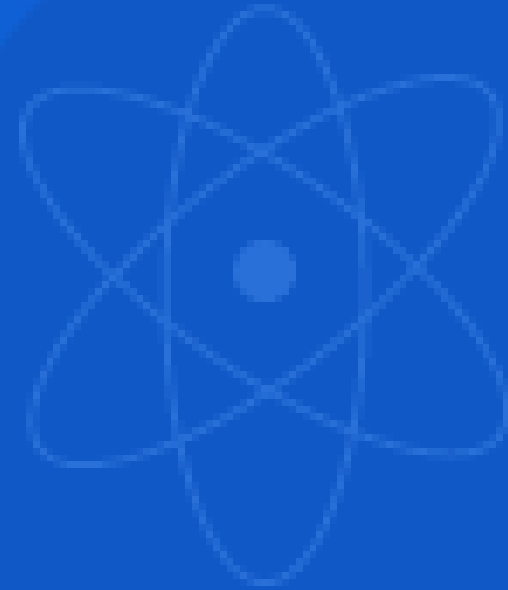
Aerobic Respiration - The most efficient catabolic pathway in which oxygen is consumed as a reactant along with organic fuel.

Cellular Respiration - The complex aerobic process of breaking down glucose.





In cellular respiration most electrons move "downhill" by glucose \longrightarrow NADH \longrightarrow ETC \longrightarrow Oxygen.



Glycolysis - A process occurring in the cytosol that begins the degradation process by breaking glucose into two molecules called pyruvate.



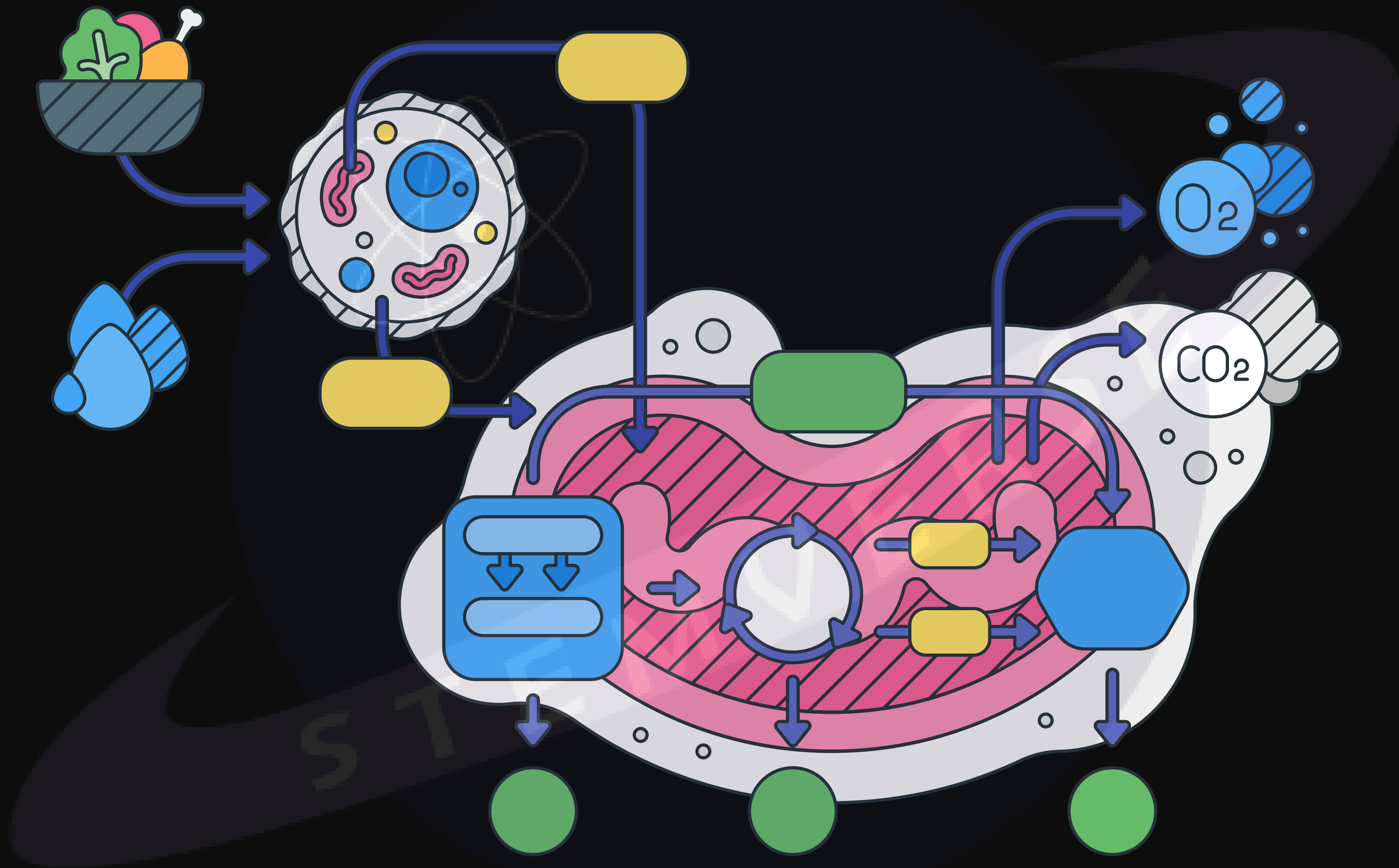
3 Stages of Aerobic Respiration



- 1) Glycolysis
- 2) Pyruvate processing (oxidation) + Citric acid cycle
- 3) Oxidative phosphorylation (ETC & Chemiosmosis)



Oxidative Phosphorylation - The mode of ATP synthesis that is powered by redox reactions of the ETC.



After pyruvate is oxidized, the citric acid cycle completes the energy-yielding oxidation of organic molecules:

Acetyl CoA - A highly reactive compound that feeds its acetyl group into the citric acid cycle.



During oxidative phosphorylation, chemiosmosis couples electron transport to ATP synthesis:

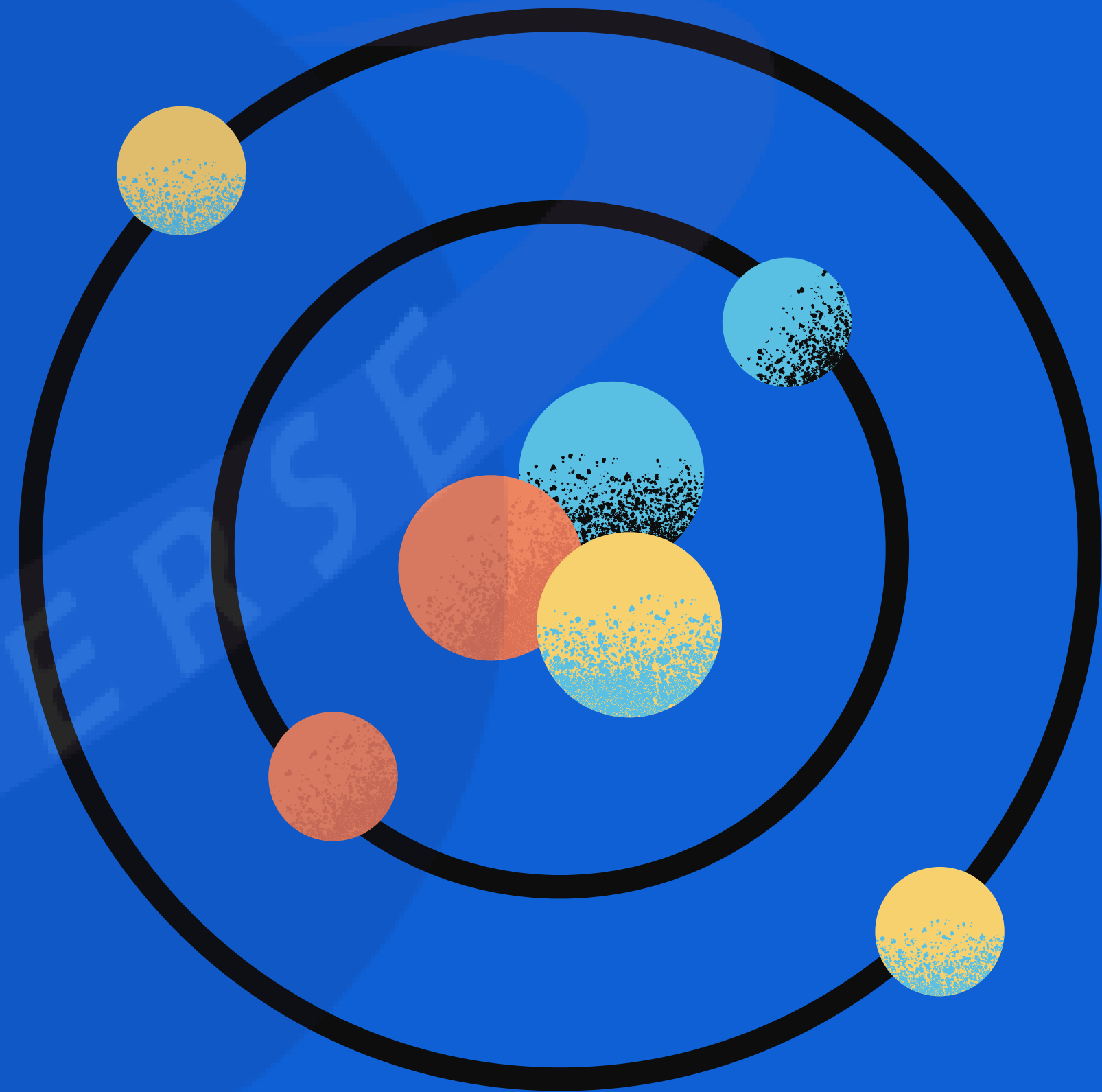
Cytochromes - The remaining electron carriers between ubiquinone (CoQ) and oxygen (proteins).

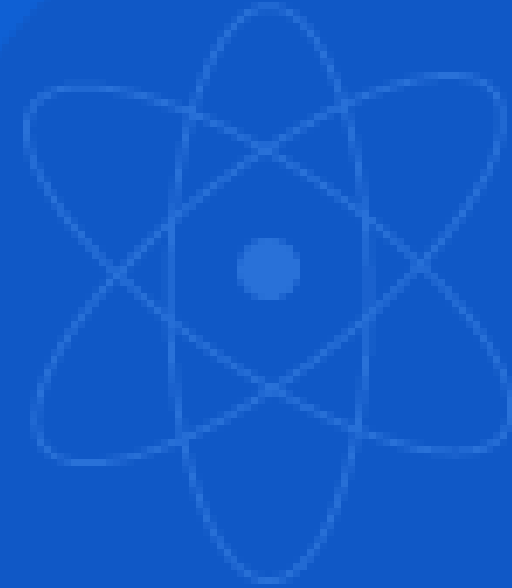
ATP - Synthase - The enzyme that makes ATP from ADP and inorganic phosphate.

Chemiosmosis - The process in which energy stored in the form of a hydrogen ion gradient across a membrane is used to drive cellular work (synthesis of ATP)

Ex. is the Proton-motive force (H^+ gradient).

Electrons move from glucose \rightarrow NADH \rightarrow ETC \rightarrow proton-motive force \rightarrow ATP





Fermentation and anaerobic respiration enables cells to produce ATP without the use of oxygen:

Fermentation is a way of harvesting chemical energy without using either oxygen or any electron transport chain.

Alcohol Fermentation - Pyruvate is converted to ethanol (ethyl alcohol) in 2 steps.

Lactic Acid Fermentation - Pyruvate is reduced directly by NADH to form lactate as an end product with no release of CO₂.

Obligate Anaerobes - Carry out only fermentation or anaerobic respiration.

Facultative Anaerobes - Organisms including yeast and bacteria that make enough ATP to survive using either fermentation or respiration.

Beta Oxidation - Breaks the fatty acids down to two-carbon fragments, which enter the citric acid cycle as Acetyl CoA.