Cheatography

Metabolism & ATP Cheat Sheet

by rhettbro via cheatography.com/133961/cs/27534/

Metabolism

Metabolism is the chemical reactions in the body's cells that change food into energy.

Catabolism	Breaking down
Anabolism	Building up

Metabolism of Carbohydrates

Glycolysis and Gluconeogenesis

Citric Acid Cycle (TCA cycle, Krebs cycle)

Oxidative Phosphorylation

ATP

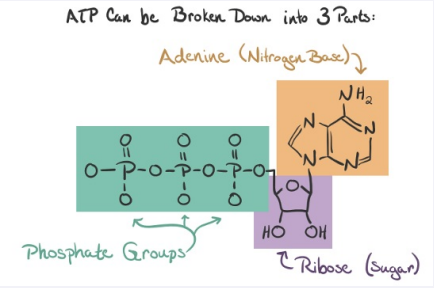
ATP is the nucleotide known in biochemistry as the "molecular currency" of intracellular energy transfer. It provides energy for processes that build molecules and tissues, to transport molecules across the cell membrane, to facilitate enzyme activities, to facilitate motion, and is the product of a few steps in metabolism.

ATP is able to store and transport chemical energy within cells, and also plays an important role in the synthesis of nucleic acids.

ATP (Adenosine triphosphate) to become ADP (Adenosine diphosphate) – one phosphate loss; then can be back to ATP again.

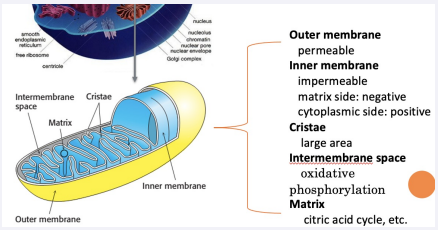
Enzyme control the breaking and making of ATP

ATP structure



ATP hydrolysis

Where steps happen

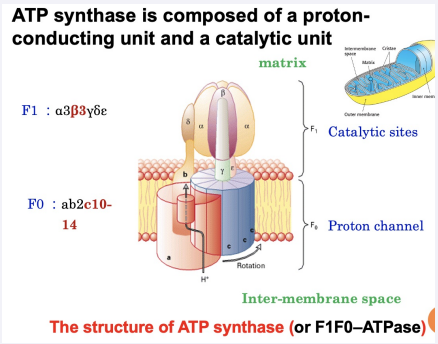


Reactants

ATP + H2O -> ADP + inorganic phosphate

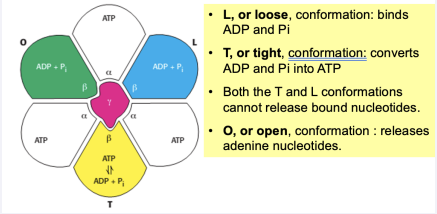
Energy is generated/released by this reacti-on(30.5 kJ/mol)

ATP-ase



y subunit linked alpha and beta

interactions with the highly irregular γ subunit change the activity of β subunits



y subunit linked alpha and beta

Each 360-degree rotation of the γ subunit leads to the synthesis and release of three molecules of ATP.

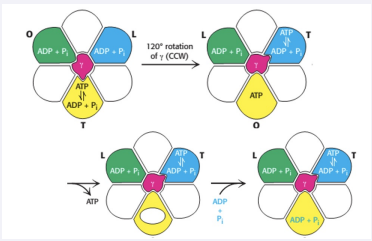
In the "open" state, ADP and phosphate enter the active site;

in the "loose" state.The protein closes up around the molecules and binds them loosely.

In the "tight" state, the enzyme changes shape again and forces these molecules together to form ATP molecule.

Alpha subunit is a regulatory subunit.

Binging-change mechanism for ATP synthase



Stoichiometry of ATP synthesis

Each 360-degree rotation of *c* subunits and γ subunit: synthesis and release of **3** molecules of ATP

***c* subunits**: 10-14, average **12**

Each *c* subunit binds 1 H^+: 12 H^+ required for a 360-degree rotation, each ATP synthesis require **4** H^+ (12/3)

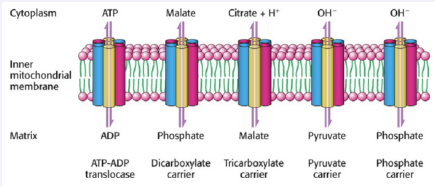
NADH + H^+: 10 H^+ pumped into inter-membrane space for ATP synthesis, so **2.5** (10/4) ATP synthesized

$FADH_2$: 6 H^+ pumped into inter-membrane space for ATP synthesis, so **1.5** (6/4) ATP synthesized

Total ATP produced from aerobic oxidation of glucose in liver:

2×5 NADH + 2×1 $FADH_2$ + 6 ATP – 2 ATP =
$10 \times 2.5 + 2 \times 1.5 + 4 = 32$ ATP

Movement across mitochondrial membrane



Happens in Glycolysis, is how the cell breaks down ATP the use its energy.

Hydro - is greek for "water"

Lysis - is greek for "to split"

in ATP hydrolysis, water is used to split apart ATP to create ADP to get ENERGY.

ATP hydrolysis happens after the bulk of the energy is made in oxidative phosphorylation too!

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