

* cells need energy to do work: mechanical, chemical and transport.

* ATP is the cell energy, managed by energy coupling, the use of exergonic process to drive an endergonic one.

* Sources of ATP: \Rightarrow

1. Adenylate kinase:

- ATP has two "high energy" phosphate groups

* splitting one of them \rightarrow Formation of ADP + inorganic phosphate.

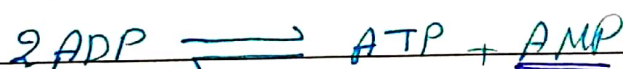
* splitting both of them \rightarrow Formation of AMP + inorganic pyrophosphate

* we can use ADP to form ATP by "Adenylate-kinase" through transfer a phosphate group, giving ATP and AMP.

replenishing \leftarrow between ADP molecules.

ADP

* the conversion is rapid in liver &



muscles.

① control the balance between carb. & F.A metabolism.

② it's an active Intra cellular signal substance (2nd messenger) (cAMP)

③ activation of Glycogen mobilization \rightarrow sugar metabolism.

* All cells under anaerobic metabolism, can't utilize fatty acid as a source of energy, such as RBCs.

2. Creatine phosphokinase / phosphocreatine:

* ATP has a short lifespan, so energy in our bodies is reserved as a form of phosphocreatine due to its long lifespan.

* concentration of phosphocreatine is 34 times that of ATP

* muscle → (17-20 mmol/L)

(5 mmol/L)

creatine + phosphate group → ATP
ATP → ADP + Pi
ADP + Pi → ATP

* Fatigue is associated with depletion of phosphocreatine.

* phosphocreatine system: Rapid, one step, by enzyme creatine kinase, it's anaerobic, one ATP is generated per phosphocreatine molecule. It's the dominant energy system in speed in explosive power events.

3. Anaerobic metabolism:

(Rapid) but ineffective.

* Formation of ATP by oxidation of Glucose or Glycosyl group to pyruvate and lactate. produce 2 ATP. 3 ATP per 1 molecule.

* disadvantage: painful accumulation of lactic acids in muscles.

* Lipids are not a substrate in anaerobic, just glucose and glycogen.

1. hypoglycemia
2. CNS malfunction.

N O T E B O O K

Subject

↳ Aerobic metabolism: (slow)

↳ ATP balance & synthesis.

↳ All of our cells (except RBCs) contain mitochondria which use O_2 and form H_2O while oxidizing food.

- 30% of energy is trapped in ATP.

- rest of energy in acetyl CoA \Rightarrow heat, keep us warm.

↳ for each 1 mole of acetyl CoA \rightarrow we produce 10 mole of ATP

✱ ATP \Rightarrow

- high energy molecule composed of Adenine, ribose, 3 phosphate group.

the energy for each bond of phosphate group is 7.3, ^{usable ribose link} 2.3
 (phosphodiester bond)

\rightarrow importance: - synthesis of macromolecules.

- support endergonic reaction

- transport across membranes

- neuronal transmission

- muscle contraction.

✱ Electron Transport chain. (Redox Reaction.)

- consist of ~~at~~ more than one substance to produce energy

gradually (in small amounts.)

↳ electrons may be transferred from one molecule to the other \Rightarrow

1. directly as electron, Fe^{+2}/Fe^{+3}

2. as hydride ions (H^-)

3. as direct combination of an organic reductant with oxygen.

* Hydrogen when transferred from one molecule to the other, the second molecule should have higher affinity to accept electrons.

* Redox chain

Lower redox potential $\leftarrow A \rightarrow B \rightarrow C \rightarrow D \rightarrow$ higher redox potential

* بالترتيب، الإلكترونات تنتقل من المركب A إلى المركب B، والآن reduction، والآن A هو المركب الذي له أعلى redox potential، والآن B هو المركب الذي له أقل redox potential، والآن C هو المركب الذي له أعلى redox potential، والآن D هو المركب الذي له أقل redox potential.

[ATP synthase enzyme]: enzyme that captures the energy produced from the reactions.

→ to form 1 ATP → by binding energy to ADP and P_i

... إلى ETC

* outer membrane of mitochondria is permeable to most ions as O_2 , CO_2 , NH_3 , monocarboxylic acids [dicarboxylic acids + ATP, ADP need transporters].

* inner membrane is impermeable

* matrix contains enzyme for producing energy.

(oxidative phosphorylation of pyruvate into CoA, citric acid cycle, beta oxidation of F.A., ketolysis)