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* 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 :-

1. Adenylate kinase :

- ATP has two "high energy" phosphate groups.

* splitting one of them → formation of ADP + inorganic phosphate.
* splitting both of them → formation of AMP + ingrganic pyrophosphate

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

~~replenishing~~ between ADP molecules.

~~of~~ ADP

$$2\,ADP \rightleftharpoons ATP + AMP$$

* 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 massenger) (cAMP)

③ activation of Glycogen mobilization → sugar metabdism.

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

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2. Creatine phosphokinase / phosphocreatine:

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

* concentration of phosphocreatine is 3-4 times that of ATP
* Muscle → (17-20 mmol/L) (5 mmol/L)

← الجدول تبع الدكتور.

* ال creatine بساهم في تخزين ال ATP عن طريق ارتباطه بال phosphate group وعند الحاجة تتركها مشان ترتبط بال ADP وتكوّن ال ATP. "الاحتياج تفاعل سريع جداً حتى اكون ال 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 molec. it's the dominant energy system in speed in explosive power events.

3. Anaerobic metabolism:

* كل الخلايا تقدر تستخدمه.

(Rapid) but ineffective.

* يعني جا بالمركز الثاني في السرعة بتكوين الطاقة.

* 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.
* لو كل الخلايا بدها تستخدمها بالطريقة ، راح تستنفد الجلوكوز الي عندها وتصير توخذ من الدم وهاي رح تسبب:

1. hypoglycemia
2. CNS malfunction.

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4. 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 ⟶ heat, keep us warm.

for each 1 mole of acetyl CoA ⟶ we produce 10 mole of ATP.

※ ATP:

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

the energy for each bond of phosphate group is 7.3, [illegible] بين ribose طاقته حوالي 2.3
(phosphodiester bond)

⟶ importance:
- synthesis of macromolecules.
- support endergonic reaction
- transport across membranes
- neuronal transmission.
- muscle contraction.

※ Electron Transport chain. (Redox Reaction)

- consist of more than one substance to produce energy gradually (in small amounts.)

* electrons may be transfered from one molecule to the other:
1. directly as electron, Fe^{+2}/Fe^{+3}
2. as hydride ions (H^+)
3. as direct combination of an organic reductant with oxygen.

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

* Redox chain

lower redox potential → A → B → C → D → higher redox potential

* بالبداية، بيدخل الالكترون للمركب A وبحالة reduction لأنه مركب B اله أعلى redox potential من A، راح ينتقل الـ ē من (A) الى (B) وهيك بيصير لـ A oxidation وبصير لـ (B) reduction ولأنه (C) اله أعلى redox potential من (B) راح ينتقل اله الـ ē وهكذا..

- طريقة انتاج الطاقة هاي بوجد انزيم: [ATP sythitase enzyme]

capture the energy produced from the reactions.

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

+ بالدليل ETC مشروحة.

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

* inner membrane is impermeable

* matrix contains enzyme for producing energy.
(oxidative phosphorolation of pyruvate into CoA, cytric acid cycle beta oxidation of F.A, Ketolysis)

N O T E B O O K