BIOENERGETICS

[DEPTH OF BIOLOGY]

Study of energy change in biochemical reaction

- **1ST LAW OF THERMODYNAMICS/ LAW OF CONSERVATION OF ENERGY**

Energy remain constant/ only changes from one form to another [DEPTH OF BIOLOGY]

- **2ND LAW OF THERMODYNAMICS-** all spontaneous process increase the entropy of universe

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REACTIONS

EXERGNOIC	ENDERGONIC
Energy is released	Energy is consumed

Various terms used in bioenergetics;

1. Gibbs free energy (G)
2. Enthalpy (H)
3. Entropy (S)

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1. Actual energy available to do work changes in free energy helps in predicting the feasibility of chemical reaction. [DEPTH OF BIOLOGY]

(ΔG)= +ve endergonic

(ΔG)= −ve exergonic

Eg- ATP + H_2O → ADP + P_i *{-7.3 cal/mol}*

At equilibrium (ΔG)= 0

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If in a reaction there are multiple steps then each step will have their own (ΔG)

- **$\Delta G = \Delta G^{o} + RT + \ln [B]/[A]$**

- ΔG^{o}= standard free energy [1.0 mol/lit]
- T= absolute temperature
- R= gas consatnt [1.987 cal/mol]
- In= natural logarithm
- [A]= concentration of A
- [B]= concentration of B

- At equilibrium $\Delta G=0$, $\Delta G^{o}= -RT$

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- ΔG is an additive value for pathway, sum of the ΔG will tell us whether reaction will occur or not. [DEPTH OF BIOLOGY]

2. ***Enthalpy –*** measure of change of heat content of the reactant compared to product [DEPTH OF BIOLOGY]

ΔH= -ve exothermic (release heat)

ΔH= +ve endothermic (absorb heat)

3. Entropy- quantitative expression of degree of order of randomness of system

It is maximum at equilibrium

- $\Delta G = \Delta H - T\Delta S$ {T=K=273}

HIGH ENERGY COMPOUNDS

Energy rich compounds that contain acid anhydride bond and liberate 7 cal/mol at 7pH or more [DEPTH OF BIOLOGY]

- <7cal/mol – low energy compound
- Most of the high energy compound conain phosphate, so they called high energy phosphate
- [except acetyl Co-A]- does not contain phosphate

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REDOX POTENTIAL

- Quantitative measure of tendency of redox pair to gain or loose electron
- Redox pair given specific redox potential (E^o volts) at pH=7 at 25 ^oC
- Free energy changes in oxidation , reduction reaction directly proportional to tendency of reactant to loose electron

More –ve R.P. = more tendency to loose e-

More +ve R.P. = more tendency to accept e-

e- will flow from –ve to +ve R.P.

BIOLOGICAL SIGNIFICANCE OF ATP

- Main source of energy for most cellular process.
- Building block of ATP= C, H, O, N, P. [DEPTH OF BIOLOGY]
- Muscle contraction, blood circulation, overall movement of cell.
- Used to move substance across concentration gradient of plasma membrane. [DEPTH OF BIOLOGY]

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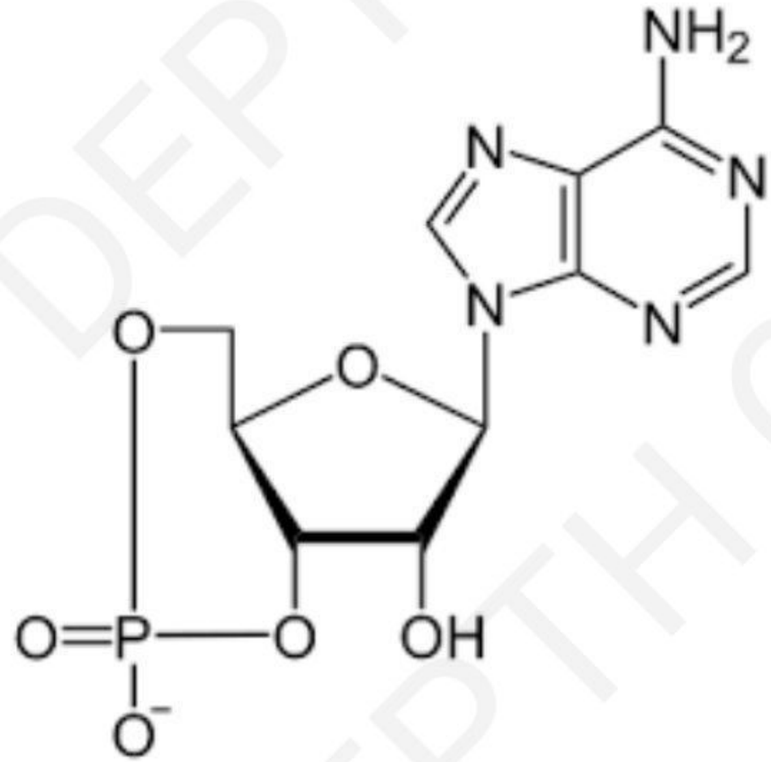
SIGNIFICANCE OF c-AMP

- Secondary messenger – important in biological process
- Synthesised from ATP [DEPTH OF BIOLOGY]

ATP → (Adenyl cyclase) → C-AMP

Located on inner side of plasma membrane



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- c- AMP is used for intracellular signal transmission.

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- Transferring the effect of hormone like glucagon & adrenaline which cannot pass through cell membrane. [DEPTH OF BIOLOGY]

- Associated with kinase function in several biochemical process including the regulation of glycogen sugar & lipid metabolism by activating protein kinase

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