

BIOENERGETICS

[DEPTH OF BIOLOGY]

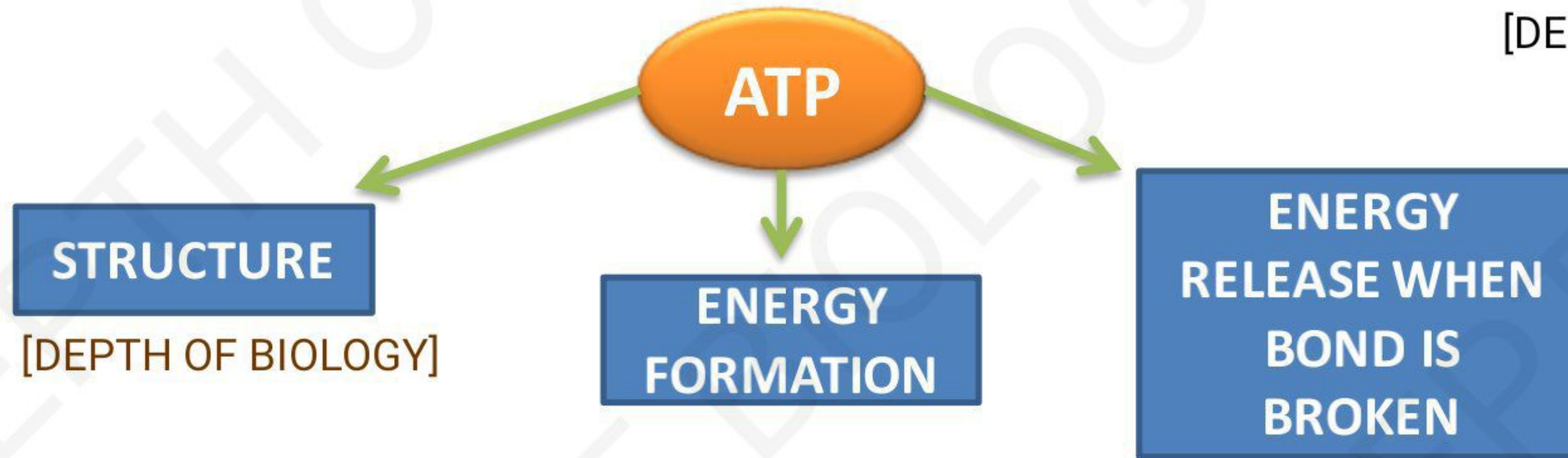
It is a branch of biochemistry that deals with the formation & conversion of energy in the living organisms. [DEPTH OF BIOLOGY]

Adenosine triphosphate, or ATP, is an important molecule found in all living cells. It readily diffuses around the cell and provides energy for cellular processes.

ATP is made in the light-dependent reaction in photosynthesis from adenosine diphosphate (ADP) and an inorganic phosphate group (P_i). This requires energy. [DEPTH OF BIOLOGY]

- ATP releases energy in the light-independent reaction when a bond between inorganic phosphate groups is broken, producing ADP and an inorganic phosphate group.

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*GLYCOLYSIS CYCLE

*CITRIC ACID/ KREB CYCLE

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- Some energy rich phosphate compounds

| Compounds | ΔG° (kCal/mol) [DEPTH OF BIOLOGY] |
|---------------------------|---|
| Phosphoenol pyruvate | - 14.8 |
| Carbamoyl phosphate | - 12.3 |
| Cyclic AMP | - 12.0 |
| 1,3 – Bisphosphoglycerate | - 11.8 |
| Phosphocreatine | - 10.3 |
| Acetyl phosphate | - 10.3 |
| Pyrophosphate | - 8.0 |
| Acetyl CoA | - 7.7 |
| ATP → ADP + Pi | - 7.3 |

STRUCTURE OF ATP

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- Energy released from redox reaction must be conserved by cells if it used to derive various energy function
- In living organisms the released energy is conserved primarily in the form of phosphorylated compound in particular ATP

This most important energy rich phosphate compound consists of ribonucleoside adenosine. [DEPTH OF BIOLOGY]

- To this adenosine their phosphate molecule are bounded in the series to the 5th position of ribomoeity

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- The phosphate molecule is attached to the ribomoeity via phosphate bond

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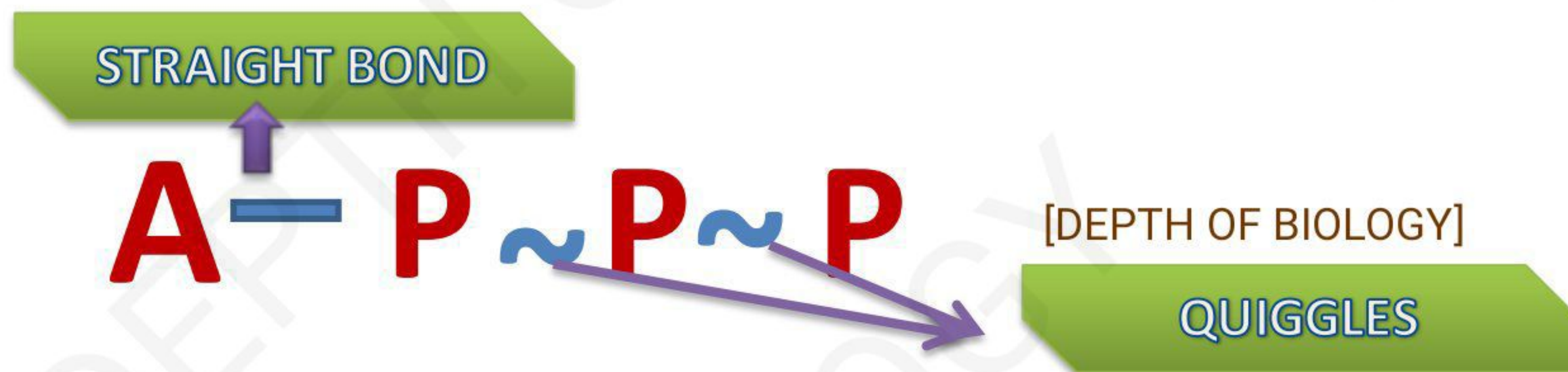
- Next 2 phosphate bonds are phospho anhydride bonds

***NUCLEOSIDE-** *nitrogen base + sugar molecule*

***NUCLEOTIDE-** *nitrogen base + sugar molecule +phosphate*

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- Phosphoanyhdride bond of β & γ phosphoryl group are energy rich bonds symbolised as quiggles.



- ATP can be represented as ***ADENOSINE- P~P~P***
- The bond between 2nd & 3rd phosphoryl groups contain 7.3 Kcal/mol energy . 1st & 2nd phosphoryl group is 6.5 Kcal/mol energy.
- Like this phosphocreatine act as high energy reservoir of ATP in the muscles

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ATP + CREATINE = phosphocreatin + ADP

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ATP FORMATION

Combustion of carbohydrate , protein & lipids

Other mechanism

1. COMBUSTION OF CARBOHYDRATE-

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2. COMBUSTION OF LIPIDS-



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3. COMBUSTION OF PROTEINS-

Amino acid  Acetyl co-A + CO₂

OTHER MECHANISM

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1. FROM VITAMIN K-

vitamin K  α topophenol

Vitamin k- ATP + hydroxymethyl quinone

2. SUBSTRATE LEVEL PHOSPHORYLATION-

In glycolytic cycle

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3. IN LOHMAN'S REACTION-

In muscles high energy phosphate of creatine~P is transferred to ADP to form ATP is lohman's reaction

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4. MYOKINASE REACTION-

In muscles 2 ADP molecule can react to produce 1 ATP & 1 AMP molecule in the presence of myokinase enzyme

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FUNCTIONS OF ATP

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- ***The possible functions of ATP-***
- Intracellular signaling
- DNA and RNA synthesis
- Amino acid activation in protein synthesis
- Photosynthesis
- Movement
- Respiration
- Growth [DEPTH OF BIOLOGY]
- Reproduction

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BMR

[DEPTH OF BIOLOGY]

- Basal metabolic rate is the rate of energy expenditure per unit time by endothermic animals at rest. It is reported in energy units per unit time ranging from watt to ml O₂/min or joule per hour per kg body mass J/.

CREATINE PHOSPHATE

[DEPTH OF BIOLOGY]

Phosphocreatine, also known as creatine phosphate or PCr, is a phosphorylated form of creatine that serves as a rapidly mobilizable reserve of high-energy phosphates in skeletal muscle, myocardium and the brain to recycle adenosine triphosphate, the energy currency of the cell.