Unit 5: Metabolism

Concept of Metabolism:

1) Metabolism is the sum total of the chemical reactions of bio molecules in an organisum
The three main purpose of Metabolism:
a) Conversion of food to energy and for cellular process
b) Conversion of food to the building blocks such as proteins, lipids
c) Elemination of toxins.

These enzyme - catalyzed reactions allow organisums to grow and reproduce, maintain their structures and respond to their environment.

The metabolic reactions are categorized into two types:
1) Catabolic reactions: Involving breakdown of compounds
2) Anabolic reactions: Involving building up (synthesis) of compounds (such as proteins, carbohydrates, lipids and nucleic acids).

The catabolism releases energy and anabolism consumes energy. Enzymes are crucial to the metabolic reactions because they allow the organisums to drive the desirable reactions that require energy and will not occur by themselves. By coupling them to spontaneous reactions that release energy.
In living organisums chemical bonds are broken or made as a part of the exchange and transformation of energy.

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1) Endergonic reactions:
- They are chemical reactions that require an input of energy to proceed.
- In these reactions the energy of products is higher than that of the reactants.
- The reactants absorb energy from their surroundings to form products with higher energy content.
- They are often associated with energy-absorbing processes such as photosynthesis where plants capture and store energy from sunlight to convert carbon dioxide and water into glucose.

2) Exergonic reactions:
- They release energy as they proceed. In these reactions, the energy of the products is lower than that of reactants.
- This means the excess energy is liberated and can be used to perform cellular work.
- They are characteristic of energy-releasing processes such as cellular respiration where the breakdown of glucose results in release of energy that is captured in the form of ATP.

→ ATP [Adenosine triphosphate]

1) The energy exchanged or the energy transformed during catabolic reactions happens through the energy currency ATP.
2) ATP is called as energy currency of cell because it is the energy molecule that all cells need in order to do anything within the body.

3) Molecule is used as a battery within the cell and allows the consumption of one of its phosphorus molecules to get converted to ADP.

4) The ATP consists of a nitrogeneous base Adenine, ribose and three serially bonded phosphate groups linked together to the phosphodiester bonds.

5) The readily ~~ready~~ available energy is released by the bond breaking between the second and third bond.

Catabolism:
Ex: Breakdown of glucose by the cellular respiration to produce energy in the form of ATP for particular activities

Anabolism:
Ex: Protein synthesis
Involving assembling of amino acids into the desired protein structures at the cost of or driven by the consumption of ATP

In living organisums catabolic and anabdic experiences are delicately balanced. The energy released during catabolism fuels the ~~energy~~ energy demanding anabolic reactions. ~~Maintain~~ Maintaining this equilibrium is essential for the proper functioning and growth of cells.

*) Cellular respiration:

1) It is a process by which biological fuels are oxidized in the presence of inorganic electron acceptors such as oxygen to produce large amount of energy to drive the production of ATP.

2) Cellular respiration may be described as set of reactions and processes that ~~are~~ take place in the cells of organisums to convert the chemical energy from the nutrients into ATP then release the waste product.

3) Nutrients that are commonly used by plants and animals in cellular respiration are:

1) Sugar
2) Amino acids
3) fatty acids
4) molecular oxygen

Steps:

1) First step is altering the food into its alternate chemical compounds and then getting those molecules into ~~yo~~ your cells — process known as digestion

2) Once inside the cells the phase of turning the digested food into usefull energy begins.

2) The process of digestion results with carbohyd. and other molecules being removed from the consumed food and transported into bloodstream
3) From there the nutrients like glucose will leave the bloodstream through a capillary wall and enter a tissue cell.

Once inside the cell, cellular respiration will completely oxidize glucose molecule releasing high energy electrons. The overall goal is to make ATP a storage form of energy.

For most of the cells the cellular respiration is a four stage process that begins with:

a) Glycolysis:

It means splitting the sugar and occurs in the cytoplasm of the cell. It is a multiple step reaction and involves activity of several enzymes. And in the process two molecules of ATP and two molecules of pyruvate are producted.

When oxygen is present the next stage of cellular respiration takes place:

b) Pyruvate oxidation:

This process happens in the mitochondria of the cell. Each biomolecule is converted into acetyle CoA and carbon dioxide is formed.

~~c) Critic and cycle:~~

c) Citric acid cycle: The acetyle CoA through a series of enzymatic reactions will get converted as carbon dioxide and water.

3) Citric acid cycle:
The acetyl COA

4) Electron transport chain:
The electron transport is a series of membrane bound carriers in mitochondria that pass electrons from one to another and in the process the membrane proteins are able to capture the energy and use them to produce the ATP molecules.

→ Aerobic vs Anaerobic respiration

1) Anaerobic respiration is a part of cellular respiration, It consists of multiple phases and one of the phases is glycolysis which is an anaerobic process (in the absence of oxygen).
2) Glycolysis occurs in the cytoplasm of the cell and does not require oxygen. During glycolysis is broken down into pyruvate molecules producing a small amount of ATP and high energy electron carrier.
3) This phase can occur in the absence of oxygen making it an essential component of both aerobic and anaerobic pathways.

In the absence of oxygen, the pyruvate molecules generated undergo fermentation reaction. So while the aerobic respiration requires oxygen and is more efficient in terms of ATP production produces lesser ATP's and includes the initial ways of glycolysis which does not depend on oxygen