

Enzyme regulation

- The cells of our body are capable of making many different enzymes.
- In living systems hundreds of different enzyme catalysed reactions occur simultaneously.
- Regulation of enzyme activity is important to coordinate the different metabolic processes.
- It is also important to maintained cellular homeostasis i.e. to maintain the internal environment of the organism constant.
- These reactions must be regulated for the proper functioning of a living system.
- Regulatory enzymes exhibit increased or decreased catalytic activity in response to certain signals.
- An enzyme's catalytic activity can be directly controlled through structural alterations that influence the enzyme's substrate-binding affinity.

Enzyme activity regulation-

The enzyme activity can be regulated by controlling enzyme quantity and by controlling efficiency of enzyme.

1. Control of Enzyme Quantity

As enzymes are protein in nature, it's synthesized from amino acids under genetic control and degraded after doing their work.

✓ Quantity of the enzyme within cells depends on:

- Rate of synthesis and degradation (Ex. Liver arginase enzyme increases after protein rich meal).
- Induction of Synthesis:

Constitutive enzymes: Synthesis don't depends on inducers.

Inducible enzymes: Synthesis depends on Inducers for example, induction of Lactase enzyme in bacteria grown on glucose media.

- Repression: Decrease in the rate of enzyme synthesis by substances called repressors (low mol. wt substance) and repression is sometimes called feedback regulation. For example dietary cholesterol decreases the rate of synthesis of HMG CoA reductase (β -hydroxy β -methyl glutaryl CoA reductase) involves in cholesterol biosynthesis.

- Concentration of substrates, coenzymes and metal ion activator: Presence of substrate, coenzyme or metal ion activator causes changes in the enzyme conformation decreasing its rate of degradation.

2. Control of catalytic efficiency of enzymes

Allosteric Regulation:

- Allosteric enzyme is formed of more than one protein sub unit. It has two sites; a catalytic site for substrate binding and another site called allosteric site , where effectors binds.
- Enzymatic activity can be controlled by positive and negative effectors/ metabolites through non-covalent interaction. This form of control is termed Allosteric regulation.
- Positive effectors/allosteric activators -Binding of the effectors to the enzyme increases its activity e.g. ADP is allosteric activator for phosphofructokinase enzyme.
- Negative effector or allosteric inhibitor- Binding of the effectors to the enzyme causes a decrease in its activity, e.g. -ATP and citrate are allosteric inhibitors for phosphofructokinase enzyme.
- Glucose-6-phosphate is allosteric inhibitor for hexokinase enzyme