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Enzyme Regulatory Strategies – A Short Communication

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Introduction

Metabolic pathways do not run on a continuous basis but are rather regulated according to need [1]. The control of any cellular metabolic process depends on the regulation of enzymes responsible for mediating the reactions involved in that cellular metabolic process or pathway. The regulation of metabolic pathways is very critical and important for living organisms, and the ability to regulate enzymatic activities is required for the survival of living cells. A number of methods are employed to regulate enzymes and the rate of the reaction they catalyze. These methods include; regulation by coarse control (that is, control at the level of gene expression), regulation by covalent modification, regulation by proteolytic activation, regulation by feedback inhibition and regulation by multiple forms of enzymes (that is, regulation by Isoenzymes). Regulatory enzymes are enzymes in a biochemical pathway which, through their response to the presence or absence of certain other biomolecules, controls the metabolic processes or activities of the cell.

Regulation by coarse control

Enzyme regulation by coarse control involve the regulation or control at the level of gene expression (that is, transcription, translation, messenger ribonucleic acid (mRNA) processing or degradation), it simply involves the induction or repression of the enzyme synthesis. Coarse control can be applied to one or all the enzymes in a particular pathway and most frequently comes into play in response to hormonal stimulation or during tissue differentiation or long-term environmental (adaptive) changes. The dynamic range of coarse metabolic control can be large, particularly when a previously absent enzyme is induced and rises to high levels in response to a stimulus (Figure 1).

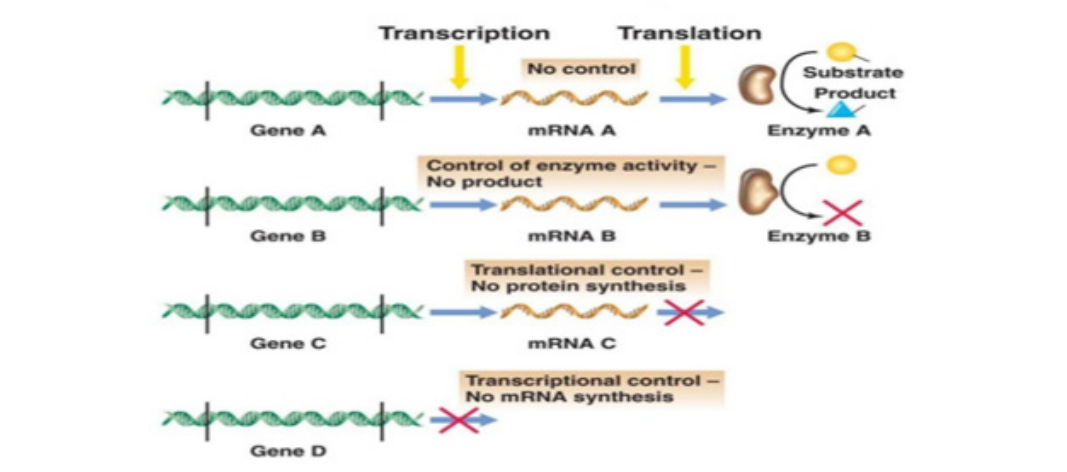

Figure 1: Coarse control regulation of enzymes [1].

Regulation by Covalent Modification

Covalent modification is a means of regulating enzyme activity [2]. The covalent attachment of a molecule to an enzyme (or other protein) can alter its activity. Most of such covalent modifications are reversible reactions (e.g. phosphorylation, acetylation). Some other are irreversible reactions e.g. attachment of a lipid group that localizes the protein to the membrane. Many proteins regulated via phosphorylation-addition of phosphoryl group to hydroxyl oxygen of serine, threonine or tyrosine. Reversible phosphorylation is a common modification for regulating enzyme activity.

Regulation by Proteolytic Activation

Many enzymes, hormones, and other physiologically active proteins are synthesized as inactive precursors (zymogens) that are subsequently converted to the active form by the enzymatic cleavage (proteolysis) of peptide bonds. Some enzymes are synthesized as zymogens, in other to be active, theses proenzymes or zymogens are activated by proteolytic cleavage [3].

Regulation by Multiple Forms of Enzymes (Isoenzymes)

Isoenzymes are enzymes that differ in sequence but catalyze the same reaction. They usually display different kinetic behavior, have differing substrate affinities or are regulated in different manners. The existence of isozymes allows the fine-tuning of processes (e.g. metabolism) by using different amounts of each isozyme for different tissues and developmental stages.

Regulation by Feedback Inhibition

One way in which an organism controls its biosynthetic pathways is by feedback inhibition. This control adjusts the rate of production of the end products of pathways, such as amino acids and nucleotides, to the rate of synthesis of macromolecules, such as proteins and nucleic acids. Control is imposed by the end product itself in a simple and rapid manner: the end product stops production of more of itself by inhibiting the activity of the first enzyme unique to its pathway. Consequently, if an end product is not continually removed into macromolecules, additional end product is not made. The organism benefits from feedback inhibition, because it avoids wasting resources of carbon, nitrogen, and energy on end products which are not used. Certainly, it is a widespread and effective metabolic control. Many biosynthetic pathways in bacteria have feedback inhibition, and a few instances are also known for higher organisms.

References

1. Nelson DL, Cox MM (2008) Lehninger Principles of Biochemistry. (5th Edtn) W.H. Freeman, United States p.26.
2. Stryer L, Berg JM, Tymoczko JL (2012) Biochemistry. (7th Edtn) Palgrave, Macmillan, United States pp.312-324.
3. Hans N, Walsh KA (1976) Role of proteolytic enzymes in biological regulation. Proc Natl Acad Sci 73: 3825-3832.

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