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P.G. Sem II (CCT), Unit-2, Submit 2.3.

Metabolism of Carbohydrates: Glycolysis
Part I

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Introduction :- Glycolysis is the first step of cellular Respiration. It is Common pathway of ATP Synthesis by enzymatic oxidation of hexose, mainly glucose, leading to formation of pyruvate (in the presence of oxygen (aerobic) or absence (anaerobic) of oxygen. During this, a six-carbon ring hexoside molecule is degraded to two molecules of three Carbon pyruvate. In Aerobic glycolysis pyruvate is further oxidised to CO_2 and water through Kreb's Cycle & respiratory chain for the synthesis of a large amount of ATP, whereas, in anaerobic glycolysis, pyruvate gets reduced to lactate or is decarboxylated to acetaldehyde and finally to ethanol. Anaerobic glycolysis occurring in cytosol after lactate accumulates during intense muscular activity or exercise or running leads to Muscle cramps when ATP Requirement of muscle exceeds

Glyceraldehyde-3-PO4 $\xrightarrow[NAD \rightarrow NADH.]{\text{Dehydrogenase.}}$ 1,3 diphosphoglycerate

7. Transfer of energy-rich PO4 form 1.3-biphosphoglycerate to ADP. →

This is a phosphorylation reaction, in which 1,3 diphosphoglycerate phosphorylate to form 3 phospho-glycerate and ATP.

3-Phosphoglycerate $\xrightarrow{\text{Phosphoglycerate kinase}}$ 2 phospho-glycerate.

8. Conversion of 3-phosphoglycerate to 2-phosphoglycerate →

In this step, 3 phosphoglycerate isomerises to form 2 phosphoglycerate under the action of enzyme phosphoglycerate mutase.

3 phosphoglycerate $\xrightarrow{\text{Phosphoglycerate mutase}}$ 2 Phosphoglycerate

9. Dehydration of 2-phosphoglycerate →

A molecule of water is removed by enzyme Enolase, forming phosphoenol pyruvate in presence of Mg^{+2} ions.

2 - phosphoenol Pyruvate $\xrightarrow[Mg^{+2}]{\text{Enolase}}$ [G-6]

phosphoenol Pyruvate

10. Transfer of energy rich Poy form phosphoenolpyruvate to ADP →

This is virtually the last enzymatic step in glycolysis where energy rich Poy is shifted from phosphoenol pyruvate to ADP by enzyme Pyruvate kinase in the presence of Mg^{+2}.

Phosphoenol Pyruvate $\xrightarrow[Mg^{+2}]{\text{Pyruvate kinase}}$ Pyruvate

Regulation of Glycolysis →

Glycolysis is the most primitive pathway of energy synthesizing System and remains linked to other pathways of ATP synthesis. It is influenced mainly by the energy requirement of the cell. However, three enzymes of glycolysis as Hexokinase, phosphofructokinase and Pyruvate kinase are the main enzymes, which are allosteric and are regulated by reactants

and products of glycolysis and Krebs's Cycle.

Hexokinase, in muscle, brings about the formation of glucose-6-PO4, which induces allosteric inhibition of its activity. This keeps the concentration of glucose and glucose-6-PO4 in equilibrium.

PFK (Phosphofructokinase) activity is muscle is regulated by relative concentration of a large no. of substances including its reactants and products.

Pyruvate kinase also an allosteric enzyme; is inhibited by high concentration of ATP, Acetyl Co-A and long chain fatty acids; oxidation of last two provides ATP.

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