

Unit: 2
Carbohydrate Metabolism

2.1) Glycolysis:

* Central Metabolic pathway in most cells, occupying a key position in Cellular Metabolism

* It is a series of enzyme catalysed chemical reaction that breakdown a 6-C glucose molecule into 2-3C pyruvate molecules.

* This process results in ATP and $NADH_3$ production

* It is a catabolic process and doesn't require oxygen.

* It consists of 10 steps, each facilitated by a distinct enzyme

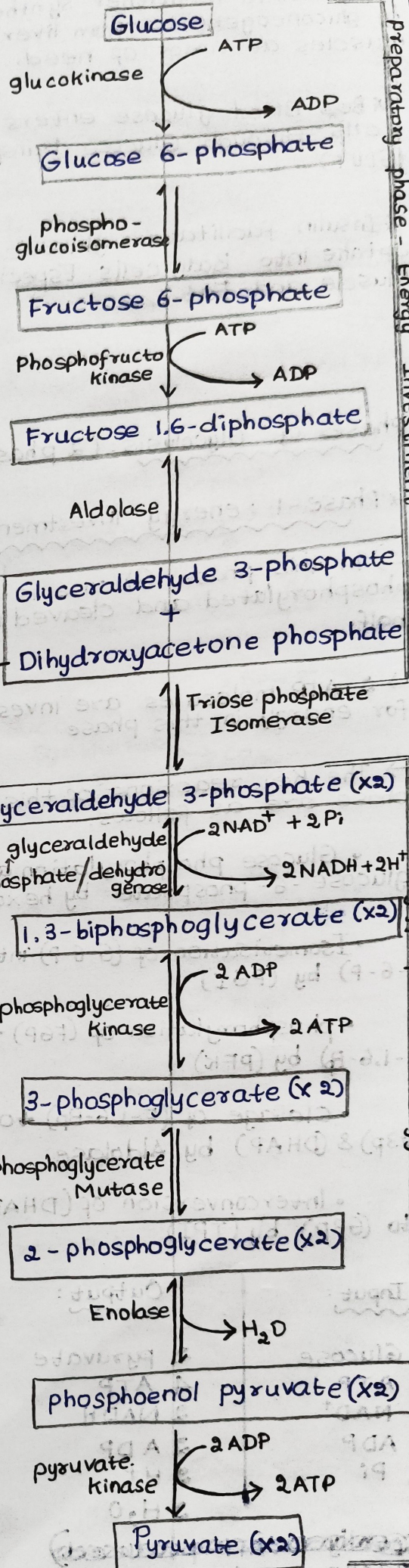
* Glycolysis refers to the breakdown of glucose molecule into smaller units for releasing energy.

How glucose reaches cells?

* Plants store glucose as starch while animals store it as glycogen.

* The glucose polymers are broken down for energy production by glycolysis process

* Glucose enters the body from dietary carbohydrates (digestion \rightarrow absorption in blood) It is also released from liver & muscles at times of feed in the form of glycogen



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 Preparatory phase - Energy Investment
 Payoff phase - Energy Generation

Stored
 * Glucose is further synthesised by gluconeogenesis from liver and muscles at times of need.

* ~~Body~~ Blood glucose enters cells through Glucose transporters (GLUT)

* Insulin facilitates glucose uptake into Body cells. Especially, Muscle and Fat cells.

✓ Phases of Glycolysis: (2 phases)

* Phase - 1 : energy Investment

→ In this phase, Glucose is phosphorylated and cleaved into half.

→ 2 ATP molecules are invested for energy in this phase.

→ The key reactions of this phase are as follows.

- Glucose phosphorylation as glucose - 6 - phosphate by hexokinase
- Isomerisation of (G-6-P) into (F-6-P) by (PGI)
- phosphorylation of (F6P) to (F-1,6-Bp) by (PFK)
- cleavage of (F-1,6-Bp) to (G3p) & (DHAP) by Aldolase
- Interconversion of (DHAP) to (G3p) by (TPI)

<u>Input:</u>	<u>Output:</u>
1 Glucose	2 pyruvate
2 ATP	4 ATP
2 NAD ⁺	2 NADH
4 ADP	2 ADP
2 Pi	2 H ⁺
	2 H ₂ O

~~(Glycolysis produces)~~
~~ATP~~

* Phase - 2 : Energy Payoff

→ In this phase, the 3c molecules are converted to pyruvate

→ 4 ATP and 2 NADH₂ are generated in this phase.

→ The key reactions are as follows.

- oxdatn and phosphorylatn of glyceraldehyde - 3 - phosphate to (1,3-BpG) by (G3PD)
- phosphoryl group transfer from (1,3-BPG) to ADP forming ATP by (PGK).
- 3PG to (2PG) conversion by phosphoglycerate mutase
- Dehydrtn of (2PG) to (PEP) by enolase
- Phosphoryl group transferring from (PEP) forming pyruvate.

✓ Significance: (In Body)

- * Source of Metabolic energy for some cells like brain cells.
- * Precursor for the Synthesis of biomolecules
- * Results in Net prdtn of 2NAD & 2 ATP / Glucose Molecule.
- * Linkage to Metabolic pathways such as Citric acid Cycle Gluconeogenesis.
- * Anaerobic energy prdtn by the body through the Conversion of pyruvate to lactate (in O₂ absense)

[1 NADH → 3 ATP]
 [1 FADH → 2 ATP]