

SNS COLLEGE OF ALLIED HEALTH SCIENCE
Affiliated to The Tamil Nadu Dr M.G.R Medical University, Chennai



DEPARTMENT OF CARDIAC TECHNOLOGY

COURSE NAME: BIOCHEMISTRY

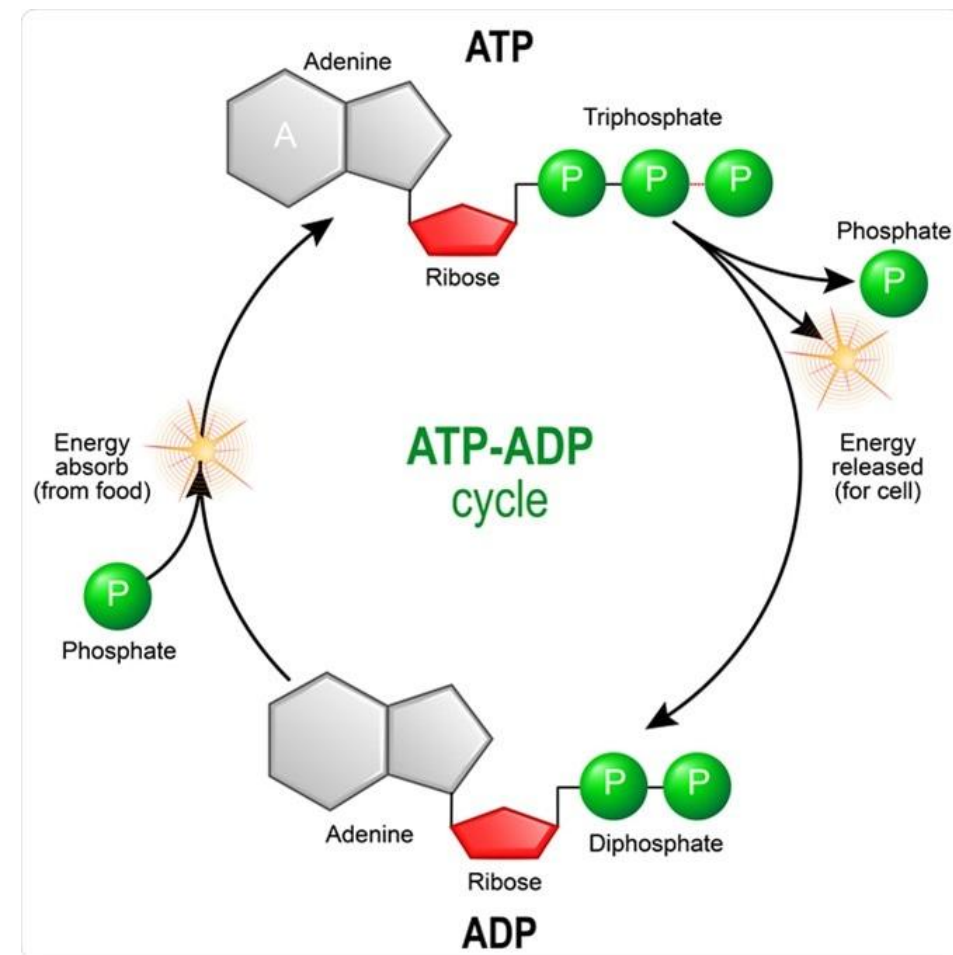
UNIT : 1

TOPIC : GLUCOSE METABOLISM – GLYCOLYSIS

FACULTY NAME: MITHRA V

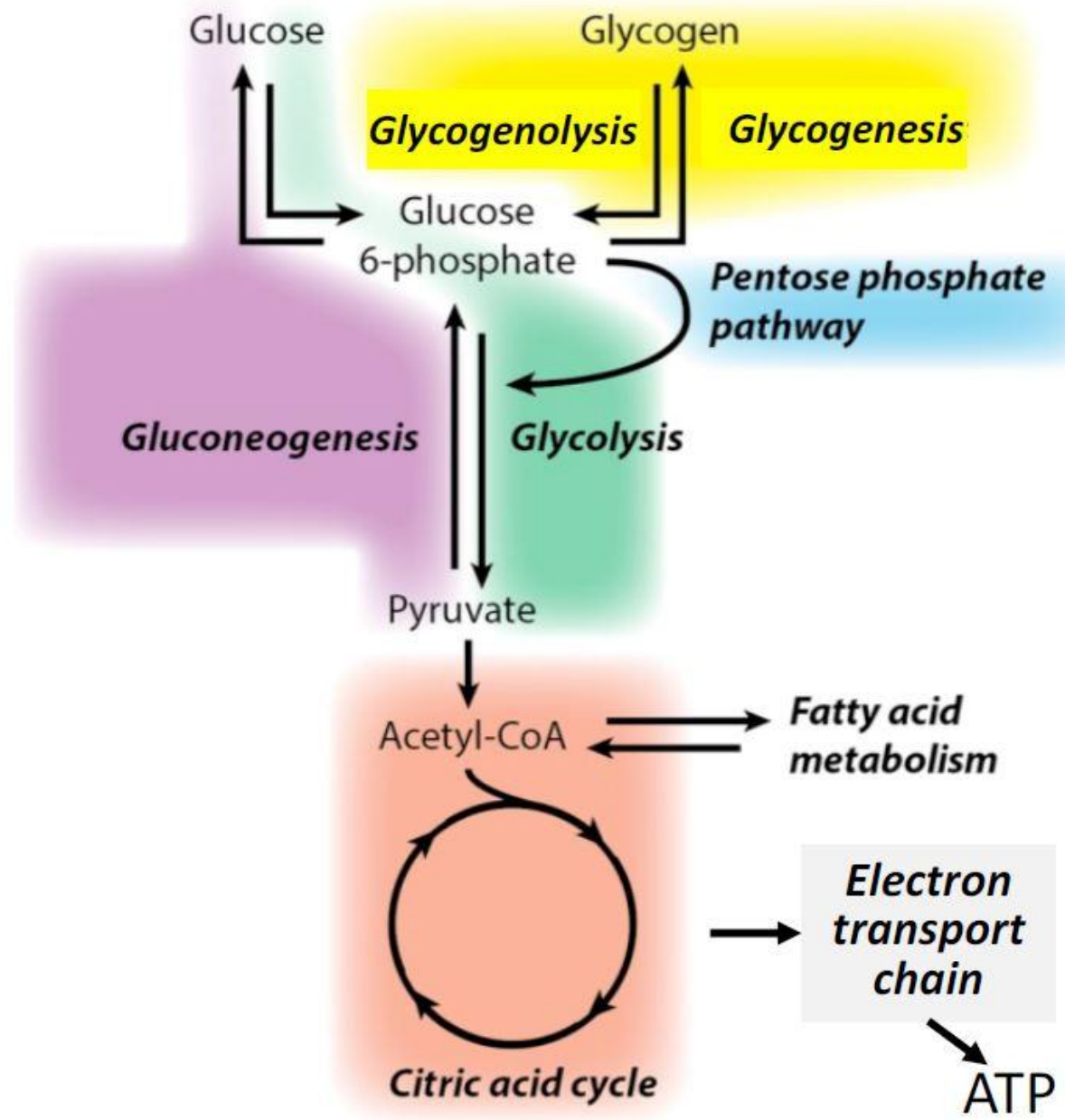
GLUCOSE METABOLISM (DEFINE)

- Metabolism - Chemical reactions in the body's cells that **change food into energy**.
- Glucose metabolism - Necessary to provide cells with energy which is important for cell survival and specific cellular functions such as signaling in neural cells.
- Involves chemical reactions that convert carbohydrates into **glucose**, providing **energy for cells**.



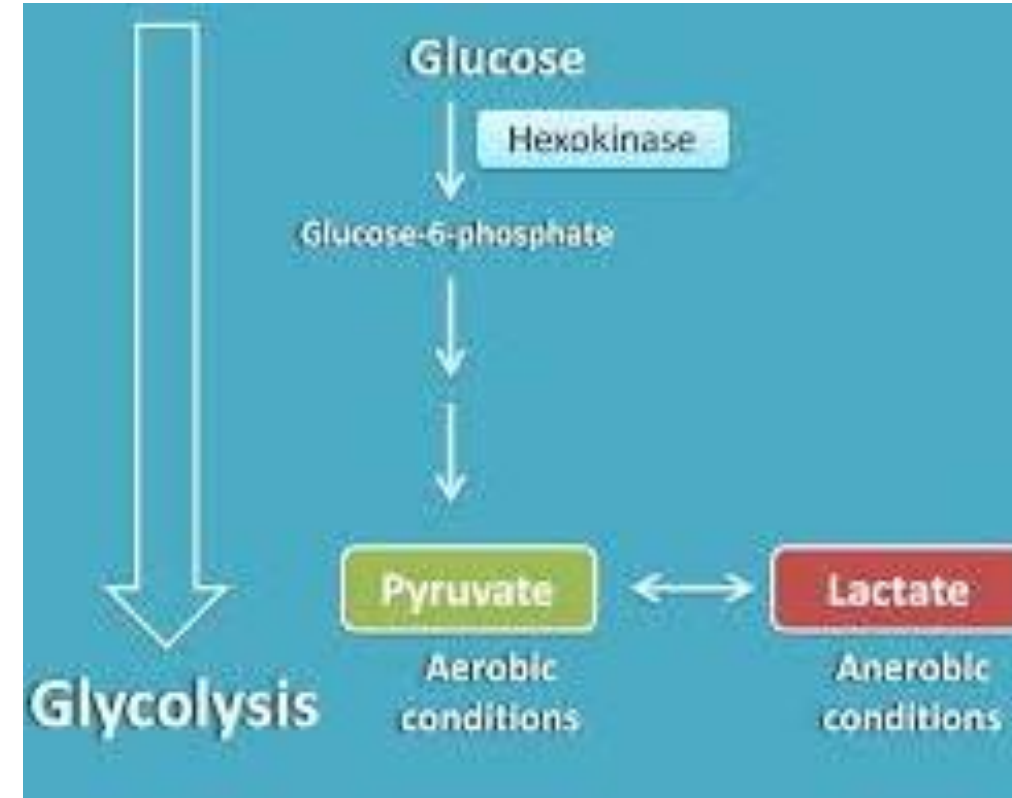
MULTIPLE PROCESSES

- **Glycolysis:** Biochemical pathway breaking down glucose into **pyruvate (aerobic)** or **lactate (anaerobic)**, producing ATP in the cytoplasm.
- **Gluconeogenesis:** Synthesis of glucose from **non-carbohydrate precursors** (e.g., glycerol, lactate, pyruvate, oxaloacetate, amino acids) when dietary glucose is low. It is essentially the reverse of glycolysis and generates ATP.
- **Glycogenolysis:** **Breakdown of glycogen** in liver and muscle cells into glucose-1-phosphate and glucose to provide immediate energy and maintain blood glucose during fasting.
- **Glycogenesis:** **Synthesis of glycogen** from glucose for storage, allowing excess glucose to be stored in the liver and muscles for later use.



GLYCOLYSIS

- Glycolysis: A biochemical pathway in the cytoplasm of cells where glucose is broken down into pyruvate (aerobic) or lactate (anaerobic), producing ATP.
- Also called the **Embden-Meyerhof-Parnas (E.M.P.) pathway**.
- **Phases of Glycolysis:**
- **Preparatory Phase (Energy Investment):** Glucose is converted to glyceraldehyde 3-phosphate - five reactions, consuming 2 ATP.
- **Payoff Phase (Energy Generation):** Glyceraldehyde 3-phosphate is converted to pyruvate through five reactions, producing 4 ATP and 2 NADH.



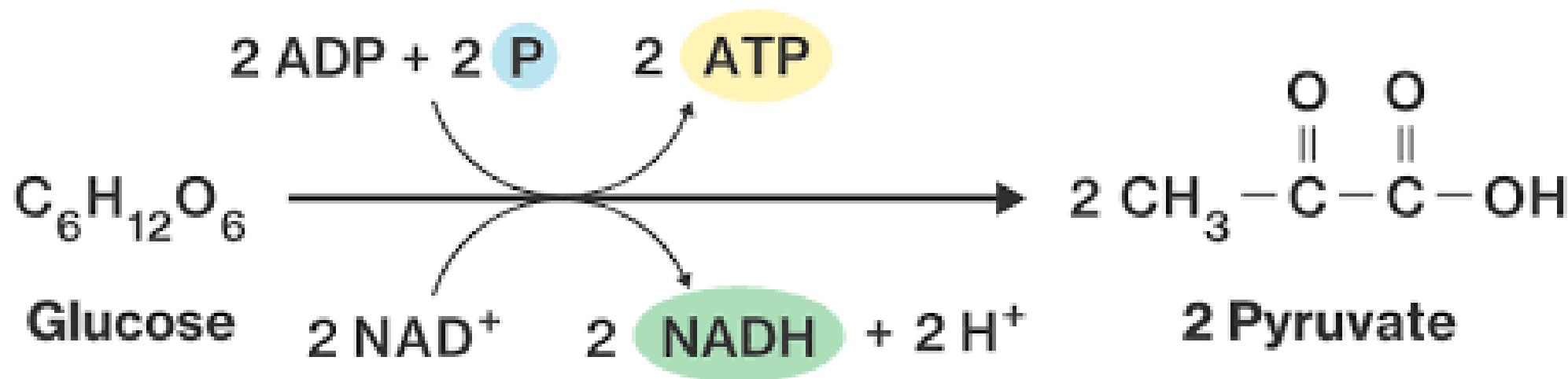
STEPS OF GLYCOLYSIS



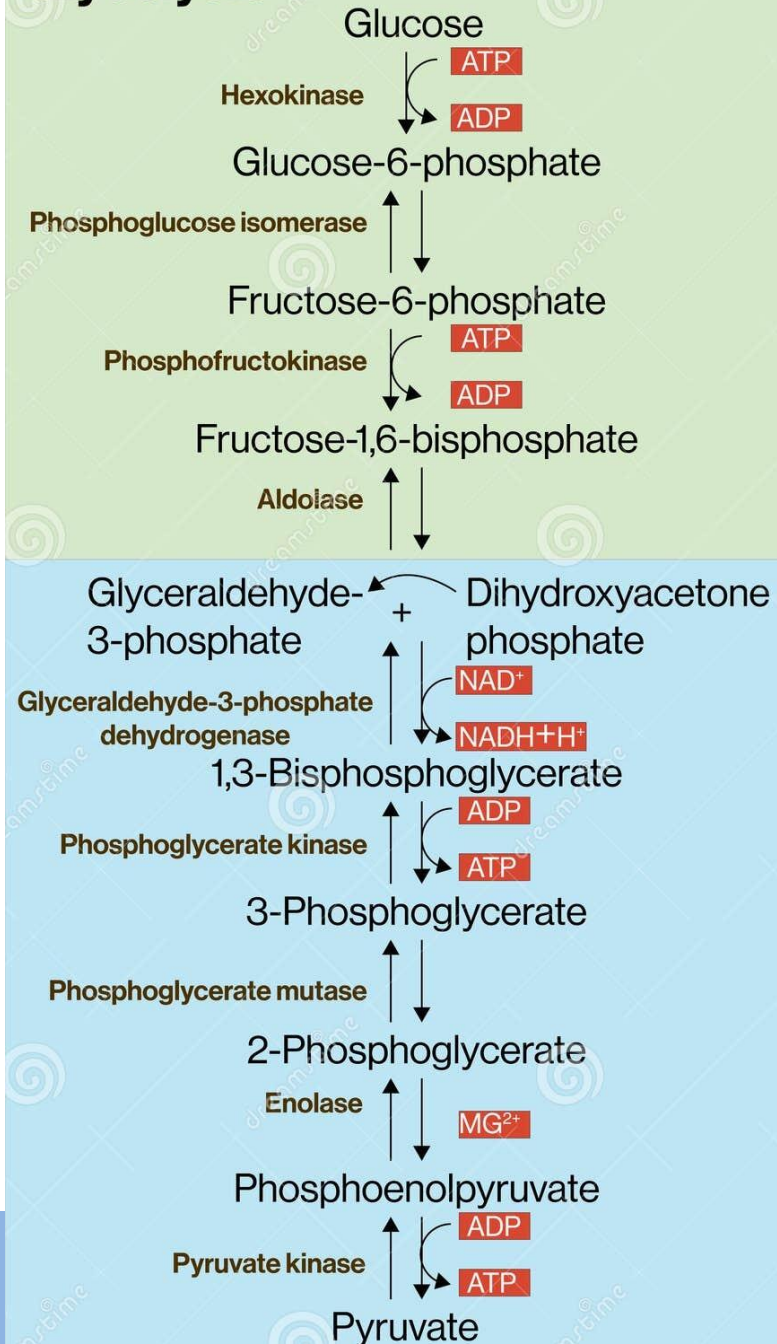
- **Phosphorylation of Glucose:** Glucose $\rightarrow$ Glucose 6-phosphate (Hexokinase, 1 ATP used).
- **Conversion to Fructose 6-phosphate:** G-6-P $\rightarrow$ Fructose 6-phosphate (Phosphoglucose isomerase).
- **Phosphorylation of F-6-P:** F-6-P $\rightarrow$ F-1,6-bisphosphate (Phosphofructokinase-1, 1 ATP used).
- **Cleavage:** F-1,6-bisphosphate $\rightarrow$ Glyceraldehyde 3- P + Dihydroxyacetone phosphate (Aldolase).
- **Interconversion:** Dihydroxyacetone P $\rightarrow$ Glyceraldehyde 3- P (Triose phosphate isomerase).
- **Oxidation:** G-3-P $\rightarrow$ 1,3-Bisphosphoglycerate (G-3-phosphate dehydrogenase, produces NADH).
- **Phosphoryl Transfer:** 1,3-Bisphosphoglycerate $\rightarrow$ 3-Phosphoglycerate (Phosphoglycerate kinase, 1 ATP).
- **Phosphate Shift:** 3-Phosphoglycerate $\rightarrow$ 2-Phosphoglycerate (Phosphoglycerate mutase).
- **Dehydration:** 2-Phosphoglycerate $\rightarrow$ Phosphoenolpyruvate (Enolase).
- **Phosphoryl Transfer:** Phosphoenolpyruvate $\rightarrow$ Pyruvate (Pyruvate kinase, produces 1 ATP).

NET REACTION

- Glucose + 2 NAD⁺ + 2 ADP + 2 Pi --> 2 Pyruvate + 2 NADH + 2 H⁺ + 2 ATP + 2 H₂O
- Overall, glycolysis converts **one six-carbon** molecule of **glucose** into **two three-carbon** molecules of **pyruvate**.
- The end product of glycolysis in the **aerobic** condition is **pyruvate** and **anaerobic** conditions is **lactate**.



Glycolysis



ENZYMES

- 1 Hexokinase
- 2 Phosphoglucose isomerase
- 3 Phosphofructokinase-1
- 4 Aldolase
- 5 Triosephosphate isomerase
- 6 Glyceraldehyde 3-phosphate dehydrogenase
- 7 Phosphoglycerate kinase
- 8 Phosphoglyceromutase
- 9 Enolase
- 10 Pyruvate kinase

PRODUCTS

2 ATP
2 NADH
2 Pyruvate

REFERENCES

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THANK YOU