

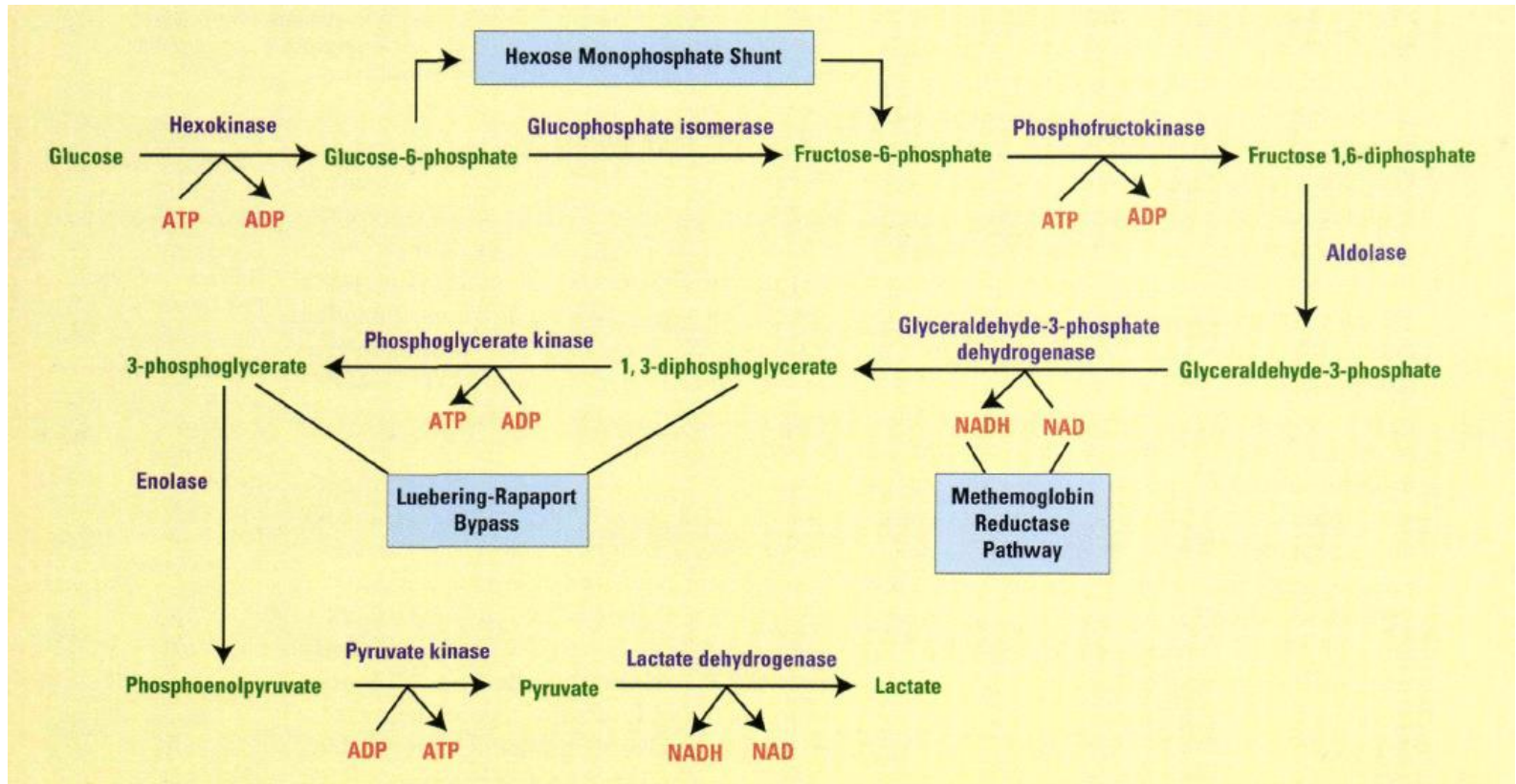


Erythrocyte Metabolism

Lecture-8


METABOLISM OF RED BLOOD CELLS

- Glucose only fuel used by RBC
- Embden-Meyerhof pathway – 90% glycolysis
- Gives 2 ATP
- Hexose- Monophosphate shunt- 10% glycolysis.

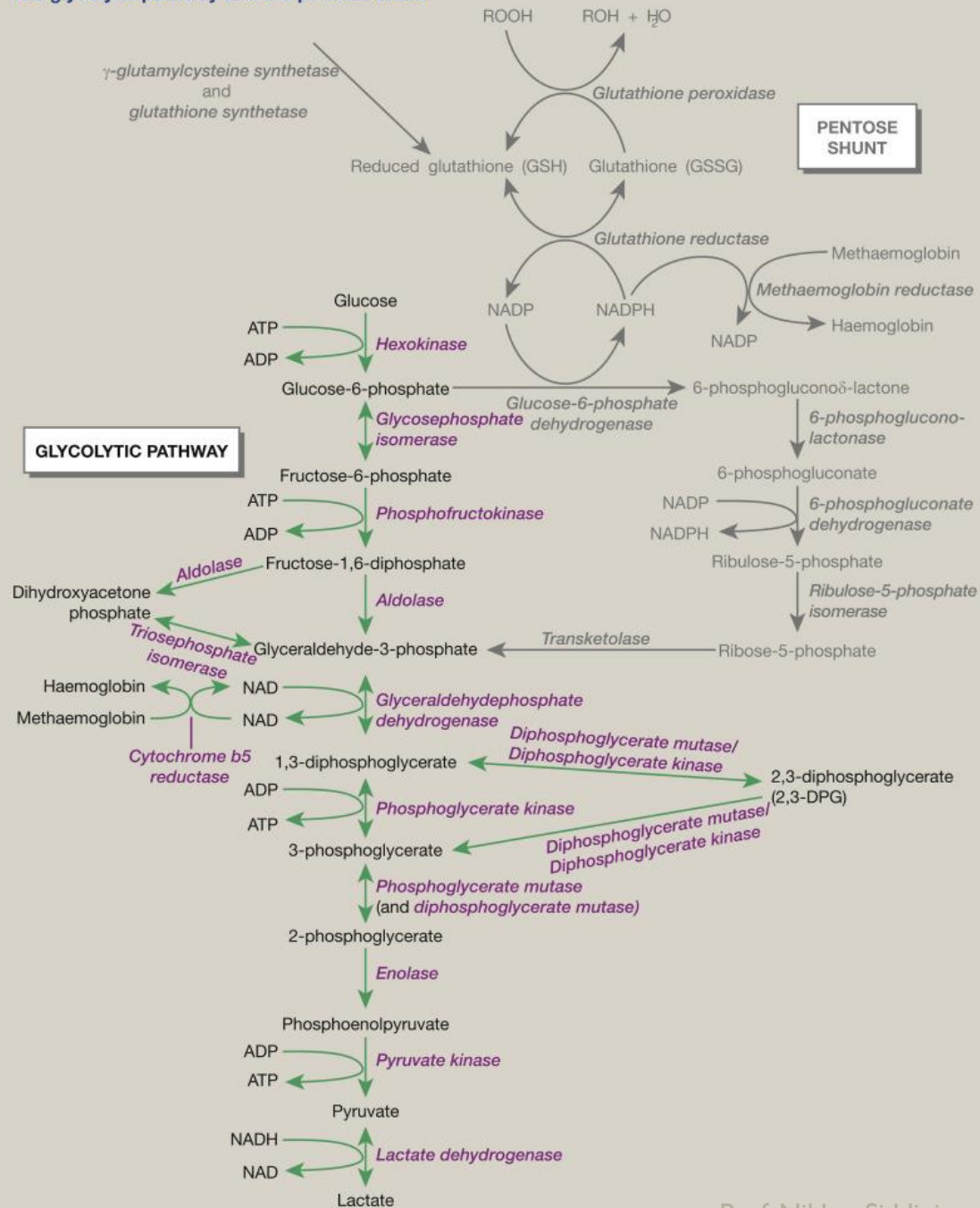


Carbohydrate Metabolism

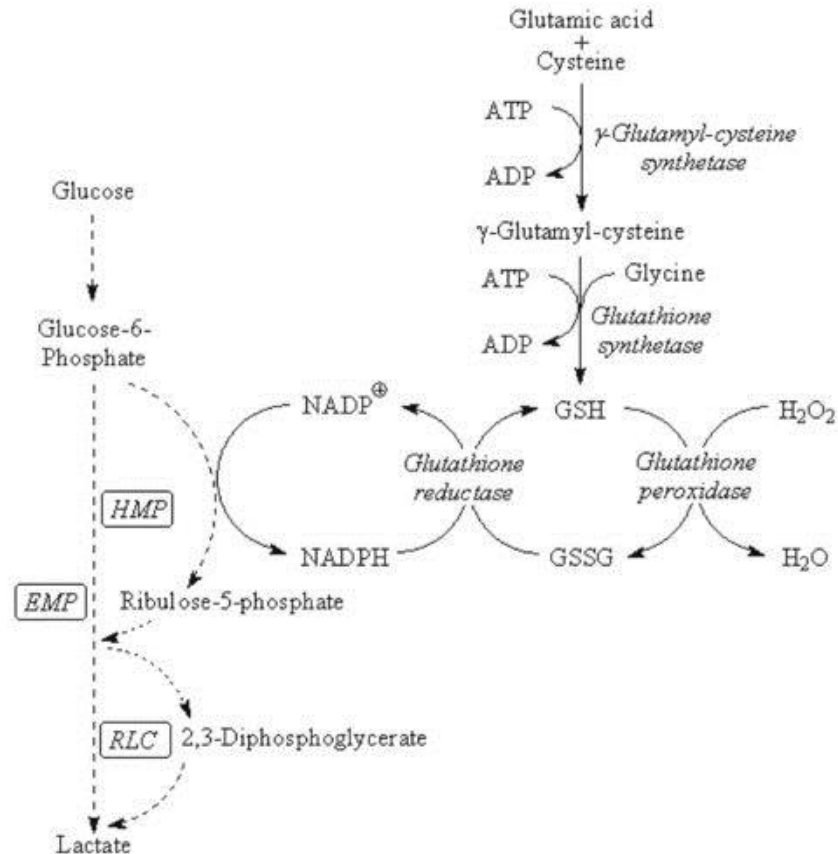
- Glycolysis, HMPshunt, 2-3 bis phosphoglycerate cycle are involved in function of erythrocyte.

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- **NADH (prevents oxidation of Hb to methemoglobin) and NADPH protects the erythrocyte from endogenous and exogenous oxidants.**

The glycolytic pathway and the pentose shunt



Interrelationship of hexose monophosphate and glutathione pathways. *GSH*, Reduced glutathione; *GSSG*, oxidized glutathione.

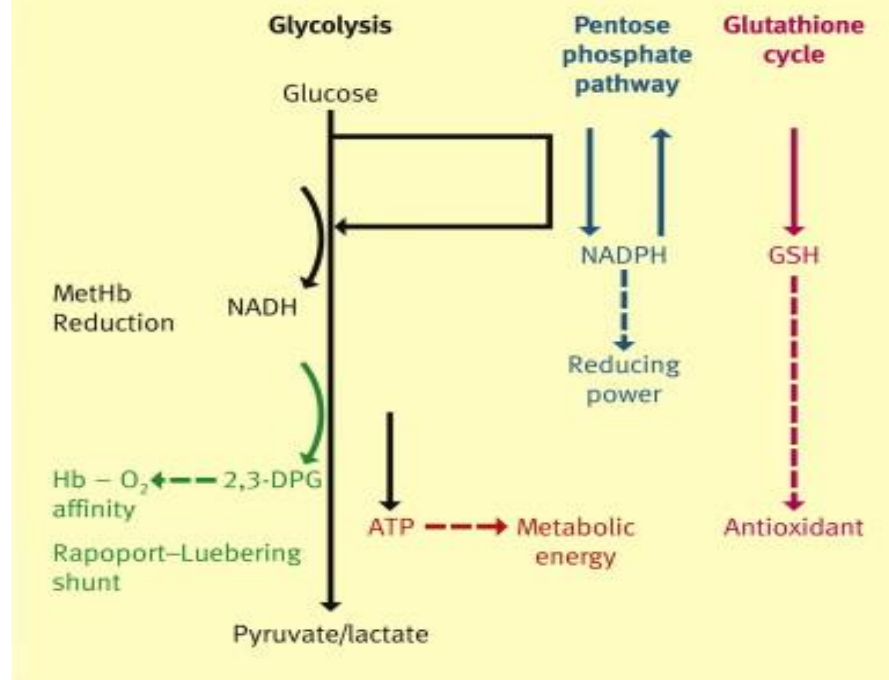


Glycolysis

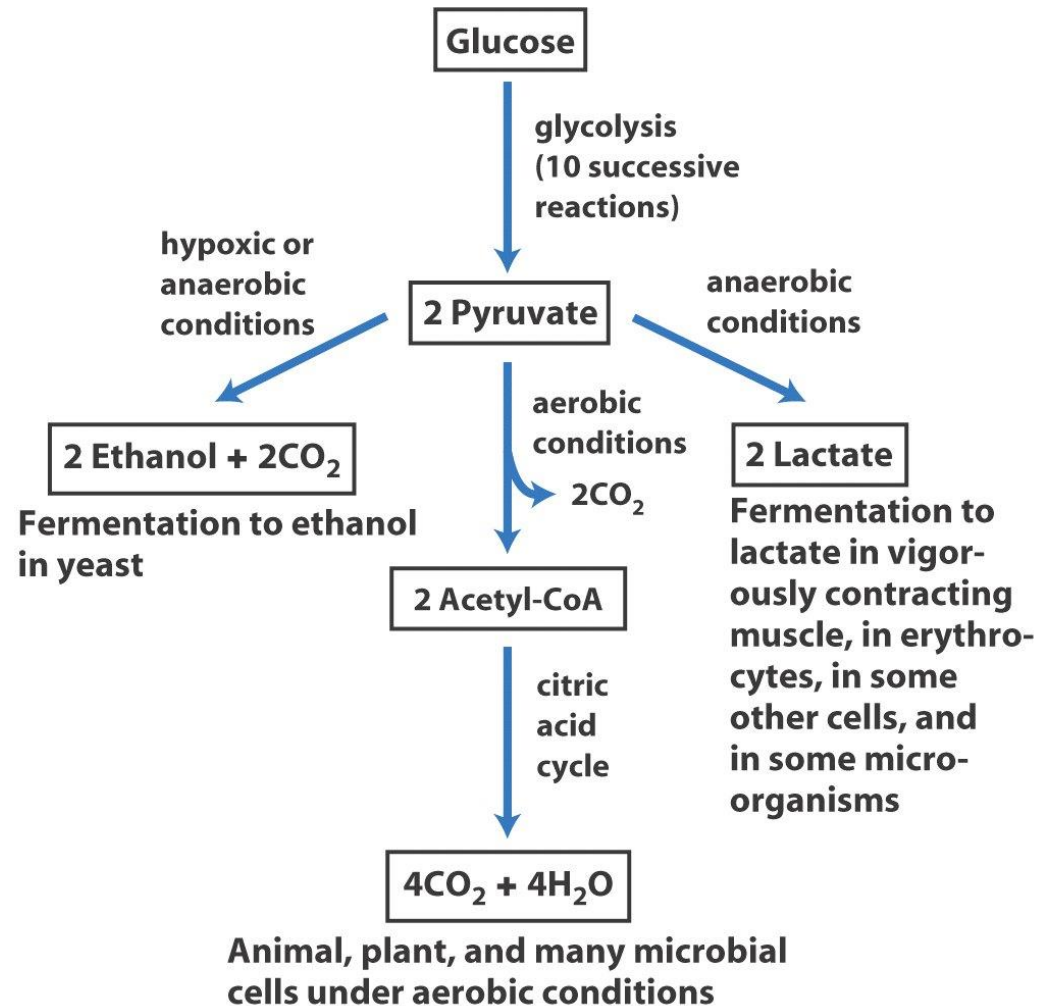
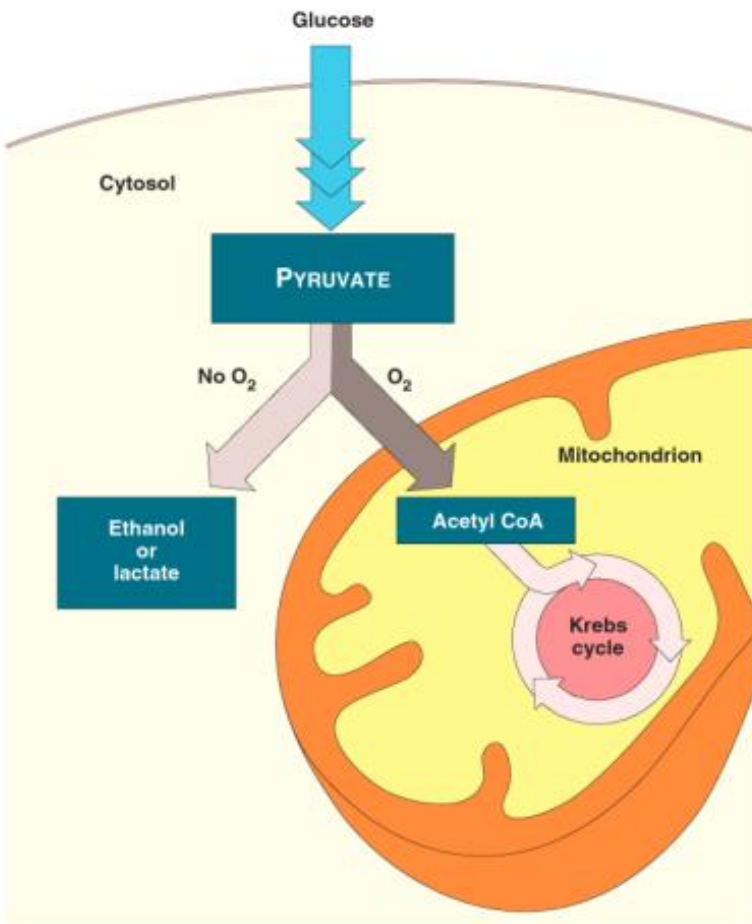
- Degradation of glucose to two molecules of pyruvate or lactate by sequence of enzyme catalyzed reactions constitutes the process of glycolysis.
- It is a catabolic pathway. If glucose is degraded to pyruvate then it is called as *aerobic glycolysis*.
Usually it occurs in presence of oxygen.
- If glucose is degraded to lactate then it is anaerobic glycolysis.
- Usually it occurs in the absence of oxygen. It is also called as *Embden-Meyerhof pathway*, because the reactions of glycolytic pathway were elucidated by Embden and Meyerhof.

- The mature RBC derives its energy from anaerobic respiration via the glycolytic (Embden–Meyerhof) pathway, in which one molecule of glucose is converted to two of pyruvate, providing energy as adenosine triphosphate (ATP) and reducing power as NADH.

Outline of the metabolic pathways in the mature red blood cell




Related metabolic processes



Ageing and destruction of RBCs

- RBCs have a life span in the circulation of 120 days.
- Senescent RBCs are phagocytosed by macrophages of the reticuloendothelial system, mainly in the marrow, liver and spleen.

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- Iron from the haem group is available for erythropoiesis after transfer to the marrow bound to transferrin.
 - The porphyrin ring is converted through a series of reactions to bilirubin.

Glucose-6-phosphate dehydrogenase deficiency

- In some individuals, 10-fold less active glucose-6-phosphate dehydrogenase is produced in RBC due to sex linked defective gene. About 100 million of world population carry defective gene.
- The less active glucose-6-phosphate dehydrogenase becomes inactive in presence of certain drugs.
- So, the affected individuals are normal until they are exposed to those drugs. Glucose-6-phosphate dehydrogenase deficiency occurs when drugs like aspirin, primaquine anti-malarial drug and sulfonamide are administered to these individuals.
- *Favism* is a hemolytic response to the consumption of fava beans due to glucose-6-phosphate dehydrogenase deficiency
- Since NADPH production is blocked in these individuals due to the deficiency of glucose-6-phosphate dehydrogenase the susceptibility of RBC to hemolysis is increased.