



Transport of glucose into the cells. Aerobic and anaerobic glycolysis. Gluconeogenesis. Synthesis and degradation of glycogen.

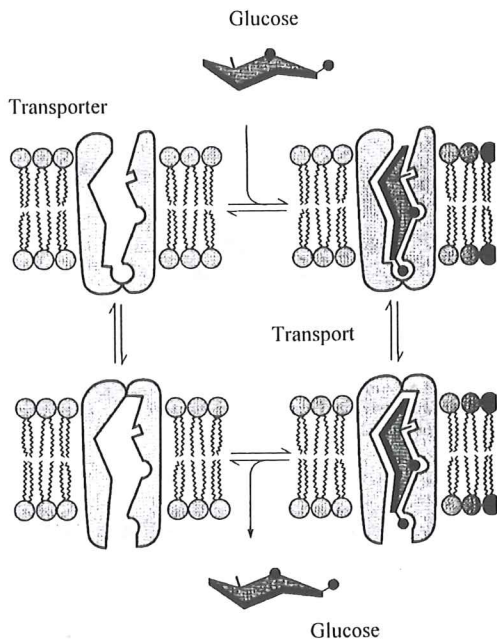
### Sources of Saccharides in Food

1. Give the main sources of glucose in our food.
2. Which other monosaccharides can be contained in food?

### Transport of Glucose into Cells

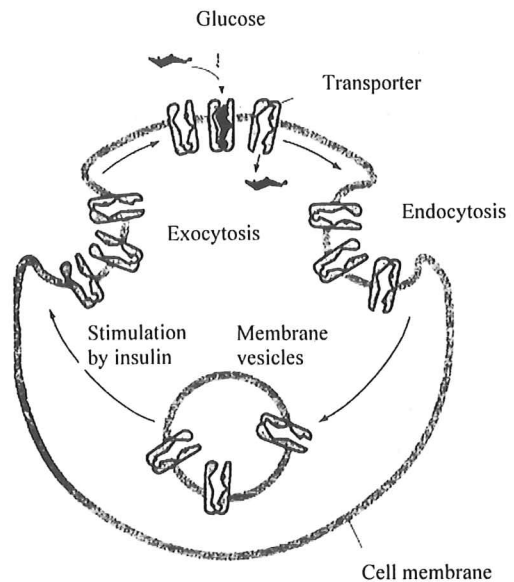
#### A) Transporters Non-Dependent on Insulin

(liver, erythrocytes, CNS, kidney, placenta)



#### B) Transporters Dependent on Insulin

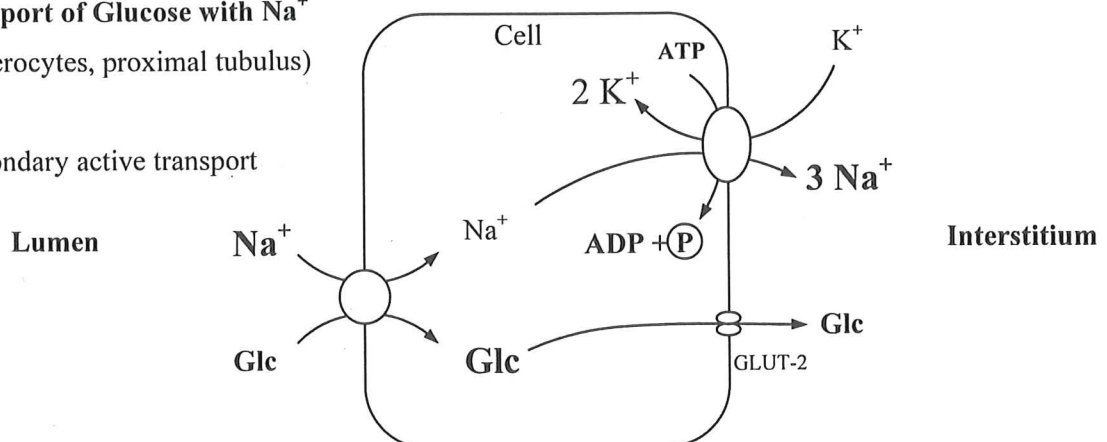
(GLUT 4: muscle, adipose tissue)



#### C) Symport of Glucose with Na<sup>+</sup>

(enterocytes, proximal tubulus)

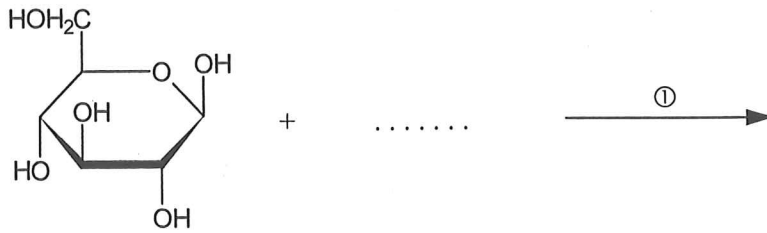
Secondary active transport



3. Describe various mechanisms of glucose transport into the cells using figures above.

**Glucose-6-P:** initial compound of glucose metabolism in cells

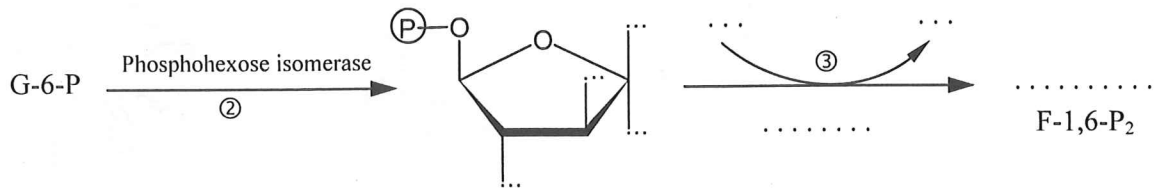
4. Complete equation of G-6-P formation.



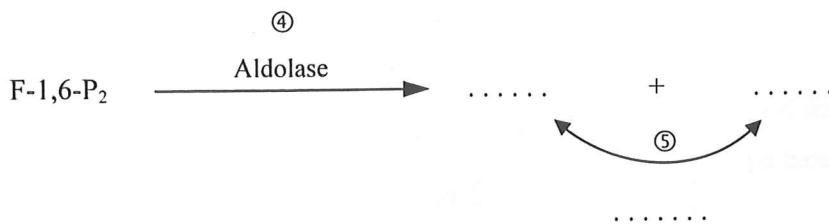
5. What enzymes will catalyze the formation of G-6-P? Characterize the differences between them (substrate specificity,  $K_M(\text{Glc})$ , regulation of activity, localization in tissues).
6. Name all metabolic pathways that G-6-P can enter in the cell. Give also their localization within the cells.

**Glycolysis**

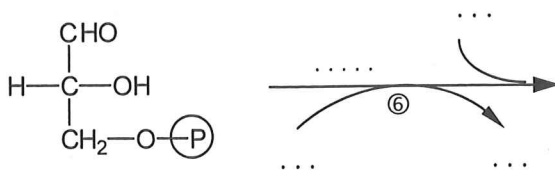
7. Complete the following scheme:



8. Are any of these reactions regulated? Give examples of regulation.
9. Compare this phase of glucose metabolism with the similar metabolism of fructose.
10. Draw the formulas of products that are formed by cleavage of fructose-1,6-bisphosphate. Which of the two products will be metabolized in following processes of glycolysis?



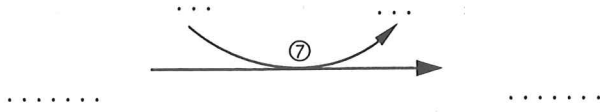
11. Assess the energetic requirements (as ATP) of trioses formation from glucose.
12. Describe the formation of 1,3-bisphosphoglycerate:



13. Explain the origin of both phosphates in the molecule and the type of bond.

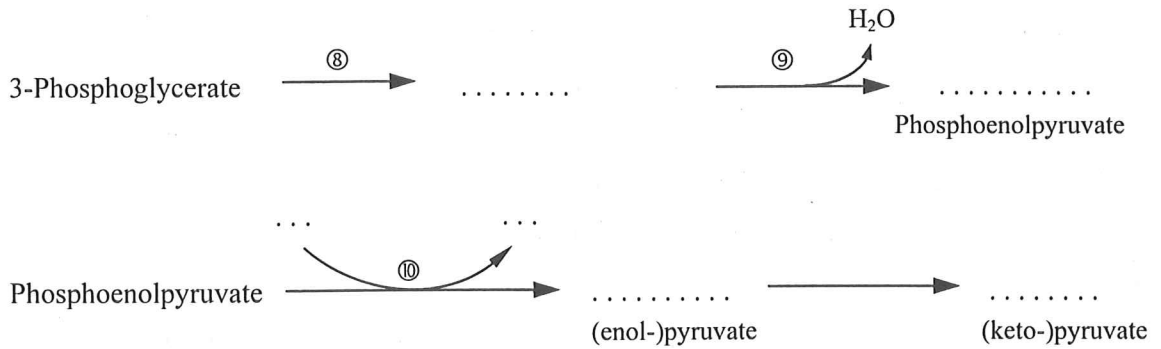
14. What cofactor is required for this reaction?

15. The following step in glycolysis is a substrate phosphorylation. Complete and explain:

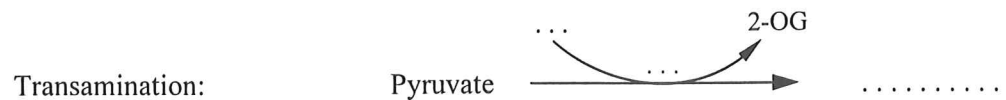
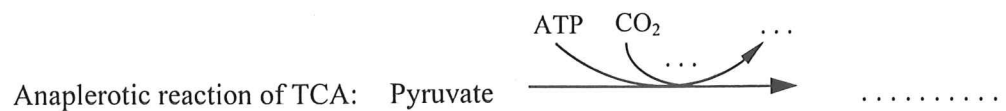
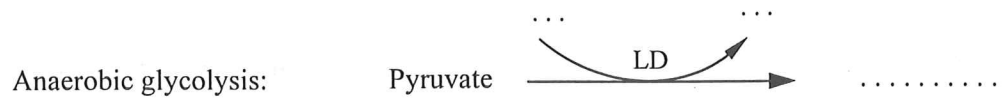
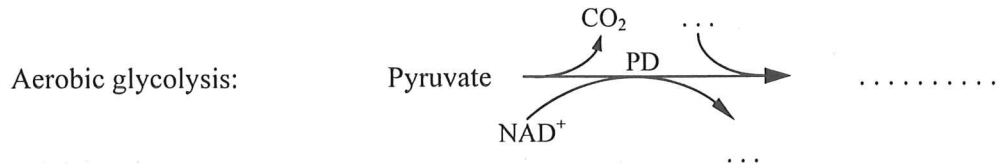


16. In which cell is 1,3-bisphosphoglycerate converted to 2,3-bisphosphoglycerate? What is the significance of this process?

17. Characterize further conversions of 3-phosphoglycerate:



**Metabolisms of Pyruvate**



18. Which cofactors take part in oxidative decarboxylation of pyruvate?
19. In which cells does anaerobic glycolysis typically run? Explain why.
20. Lactate dehydrogenase occurs in the form of several isoenzymes. Characterize these forms.
21. Which metabolic processes are named as Cori cycle? What is its significance?
22. Why is duration of anaerobic glycolysis in muscle time-limited?
23. Explain, why NaF is added into the tubes for blood sampling, when glucose should be determined.
24. Compare the energetic yield of aerobic and anaerobic glycolysis.

### **Gluconeogenesis**

25. Compare the processes of glycolysis and gluconeogenesis.
26. Which reactions of glycolysis are irreversible?
27. Describe the course of phosphoenolpyruvate synthesis, its energy requirement and location.
28. What is the function of malate dehydrogenase in gluconeogenesis?
29. What compounds are the substrates for gluconeogenesis?
30. Assess the energy requirements of gluconeogenesis.
31. Explain, at which metabolic conditions will gluconeogenesis occurs and what the reason is for it.
32. How is gluconeogenesis affected by insulin and glucagons?
33. In which tissues does gluconeogenesis occur?
34. What is the usage of glucose formed by gluconeogenesis in liver? Which enzyme enables the extrahepatic utilization of glucose synthesized in liver?

### **Synthesis and Degradation of Glycogen**

35. Characterize the structure of glycogen.
36. Explain the terms:  $\alpha$ -1,4- and  $\alpha$ -1,6-glycosidic bond, non-reducing and reducing end of glycogen.
37. In which way is glucose activated before the synthesis of glycogen?
38. Name the enzymes catalyzing the synthesis of glycogen. What is their function?
39. Characterize the degradation of glycogen. What enzymes take part in it? What is their function?
40. Characterize the basic principles of regulation of glycogen synthesis and degradation.