

Lectures 21-22 – GLYCOLYSIS AND GLUCONEOGENESIS

1. The M₄ isozyme of lactate dehydrogenase:
 - A. primarily is located in heart muscle.
 - B. is allosterically inhibited by lactate.
 - C. would be impaired by a nutritional deficiency of niacin.
 - D. is activated by phosphorylation.
 - E. is allosterically inhibited by pyruvate.

2. The gluconeogenic enzyme that is activated by citrate is:
 - A. glucose-6-phosphatase.
 - B. fructose-1,6-bisphosphatase.
 - C. pyruvate carboxylase.
 - D. fructose-2,6-bisphosphatase.
 - E. phosphoenolpyruvate carboxykinase (PEPCK).

3. Hexokinase is allosterically inhibited by
 - A. ATP.
 - B. citrate.
 - C. fructose-6-phosphate.
 - D. glucose-6-phosphate.
 - E. phosphorylation catalyzed by protein kinase A.

4. The phosphofructokinase-1 and pyruvate kinase reactions are similar in that both:
 - A. generate ATP.
 - B. involve a "high energy" sugar derivative.
 - C. involve three-carbon compounds.
 - D. involve six-carbon compounds.
 - E. are irreversible in the cell.

5. Glyceraldehyde 3-phosphate dehydrogenase:
 - A. catalyzes the formation of a product that is a low energy phosphate compound.
 - B. reduces glyceraldehyde 3-phosphate.
 - C. produces NADH as a product.
 - D. is an enzyme in the citric acid cycle.
 - E. requires FAD as a cofactor.

6. A gluconeogenic enzyme that requires GTP is:
 - A. glucose-6-phosphatase (G6Pase).
 - B. fructose-1,6-bisphosphatase (F1,6Bpase).
 - C. phosphoglycerate kinase (PGK).
 - D. phosphoenolpyruvate carboxykinase (PEPCK).
 - E. acetyl CoA carboxylase (AcCoA carboxylase).

7. Identify the SPECIFIC ISOZYME FORM of lactate dehydrogenase responsible for regenerating NAD^+ during anaerobic glycolysis in skeletal muscle.
8. What is the ATP-requiring reaction that is unique to gluconeogenesis but not to glycolysis?
9. What is the allosteric regulator that activates glycolysis in the liver and whose concentration is controlled by hormone in response to blood glucose?
10. Identify **one** glycolytic enzyme that uses ATP and **one** that produces ATP.
11. The glycolytic substrate for phosphoglycerate kinase is:
12. Identify the amino acid that is an allosteric inhibitor of pyruvate kinase:
13. In the liver, to accelerate gluconeogenesis glucagon action decreases the concentration of an important intracellular allosteric regulator and causes the phosphorylation of a glycolytic enzyme. Identify a) this important regulator, and b) name the glycolytic enzyme that is phosphorylated.
14. Identify an allosteric regulator that inhibits phosphofructokinase-1 but has no effect on fructose-1,6-bisphosphatase:
15. Starting with fructose-6-phosphate and proceeding to pyruvate what is the net yield of ATP?
16. Describe how the intracellular concentration of fructose-2,6-bisphosphate is regulated by insulin.

ANSWER KEY

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1. C
2. B
3. D
4. E
5. C
6. D
7. Identify the SPECIFIC ISOZYME FORM of lactate dehydrogenase responsible for regenerating NAD^+ during anaerobic glycolysis in skeletal muscle.
M₄ OR LDH5
8. PYRUVATE CARBOXYLASE
9. FRUCTOSE-2,6-BISPHOSPHATE
10. USES: HEXOKINASE OR GLUCOKINASE OR PHOSPHOFRUCTOKINASE-1
PRODUCES: PHOSPHOGLYCERATE KINASE OR PYRUVATE KINASE
11. 1,3-BISPHOSPHOGLYCERATE
12. ALANINE
13. a) FRUCTOSE-2,6-BISPHOSPHATE b) PYRUVATE KINASE
14. Identify an allosteric regulator that inhibits phosphofructokinase-1 but has no effect on fructose-1,6-bisphosphatase:
PROTONS (H^+) or ATP
15. THE YIELD IS 3 ATP BECAUSE THE HEXOKINASE/GLUCOKINASE REACTION WOULD BE BYPASSED
16. INSULIN ACTIVATES PROTEIN PHOSPHATASE CAUSING DEPHOSPHORYLATION OF THE PFK-2/FRUCTOSE-2,6-BISPHOSPHATASE TANDEM ENZYME. DEPHOSPHORYLATION LEADS TO ACTIVATION OF PFK-2 WHICH THEN PRODUCES FRUCTOSE-2,6-BISPHOSPHATE