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MSK Block

Review Questions





Glycogen Metabolism



Q1-Which one of the following organs isn’t a main glycogen stored organ?

A-Liver B-Kidney C-Muscles

Q2-Mention the function of glycogen in liver & muscles, when is it needed most?

Q3-Why glycogen in muscle convert it & start glycolysis from glucose 6-P rather than glucose?

Q4-Glycogen is?

A- Homodisaccharide B-Hetropolysaccharide C-Homopolysaccharide

Made from?

Q5-Which one of the following is a glycogen bond that link between glucose in a chain?

A-$∝\left(1-4\right)glucosidic linkage$ B-$∝\left(1-6\right)glucosidic linkage$ C-$∝\left(1-8\right)glucosidic linkage$ D-$∝\left(1-2\right)glucosidic linkage$

Q6-When $∝\left(1-6\right)glucosidic linkage$ is formed between 2 alpha-D-glucose molecules in glycogen that means?

Q7-Why does glycogen exist in the cells in discrete cytoplasmic granules?

Q8-Breaking down glycogen to glucose-6-P?

A-Glycogenesis B-Glycolysis C-Glycogenolysis D-Ketolysis

Q9-In glycogenesis, cell mainly tend to synthesize glycogen by which way?

A-Initiate a new chain B-Elongate pre-existing chain C-Catabolize pre-existing chain

Q10-In which case cells need a protein to initiate glycogen synthesis? What is the name of this protein?

Q11-The building block of glycogen is?

1. UMP-glucose B- UDP-glucose C- UTP-glucose D- UGP-glucose

Q12-What is the responsible enzyme for making the$ ∝\left(1-4\right) linkages$ in glycogen?

A-Pyrophosphatase B-Branching enzyme C-glycogen synthase D-Phosphoglucomutase

Q13-What is the responsible enzyme for making the$ ∝\left(1-6\right) linkages$ in glycogen?

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 Q14-What is the enzyme that catalyze the transfer of molecules of glucose from UDP-glucose? What site of this enzyme likely to bind & serve as the site at which the initial glucosyl unit is attached?

Q15-Converting glucose 6-P to glucose 1-P is the first step in?

A-Glycogenesis B-Glycolysis C-Glycogenolysis D-Ketolysis

Q16-What is the responsible enzyme for Converting glucose 1-P to glucose 6-P?

A-Pyrophosphatase B-Branching enzyme C-glycogen synthase D-Phosphoglucomutase

Q17-What is the end result of cleaving $∝\left(1-6\right) linkages$ in glycogen?

A-Glucose 1-P B-Glucose 6-P C-Free glucose D-Fructose 1,6-bisphosphate

Q18-What is the end result of cleaving $∝\left(1-4\right) linkages$ in glycogen?

A-Glucose 1-P B-Glucose 6-P C-Free glucose D-Fructose 1,6-bisphosphate

Q19-What is the Fate of glucose 6-phosphate (G-6-P) in Glycogenolysis?

Q20-Which one of the following cofactors play a role in cleaving $∝\left(1-4\right) linkages $?

A- Pyridoxal phosphate B-Biotin C-Calcium D-NADH

Q21-In glycogenolysis, what is the ratio of glucose 1-Phosphate to free glucose?

Q22-When does glycogenolysis occurs in skeletal muscles?

A-While you’re sleeping B-During exercising C-At rest D-During well-fed state

Q23-Which one of the following stimulate glycogen phosphorylase?

A-Glucose B-Glucose 6-P C-ATP D-AMP

Q24-Which one of the following stimulate glycogen synthase?

A-Glucose B-Glucose 6-P C-ATP D-AMP

Q25-Which one of the following inhibit glycogen phosphorylase?

A-NADH B-Fructose 1,6-bisphosph C-ATP D-AMP

Q26-Calcium concentration increases during?

Q27-What is the maximum number of Calcium ions that can bind to calmodulin protein?

A-2 B-4 C-6 D-8

Q28-What is the function of calmodulin-Ca++ complex?

Q29-Which one of the following is an example of covalent modification of Regulation of Glycogen Metabolism?

A-Calmodulin-Ca++ complex B-Epinephrine C-AMP stimulating glycogen phosphorylase

Q30-Deficiency of Lysosomal α(1-4) glucosidase lead to?

A-McARDLE Syndrome B-Cori disease C-POMPE Disease D-Hemolytic anemia

Q31-Deficiency of glycogen phosphorylase lead to?

A-McARDLE Syndrome B-Cori disease C-POMPE Disease D-Hemolytic anemia

Q32-The hormones, epinephrine and glucagon have which one of the following effects on glycogen metabolism? (Taken from Lippincott)

A-The net synthesis of glycogen is increased.

B-Glycogen phosphorylase is phosphorylated and active, whereas glycogen synthase is phosphorylated and inactive.

C-Both glycogen phosphorylase and glycogen synthase are activated by phosphorylation but at significantly different rates.

D-Glycogen phosphorylase is inactivated by a rise in Ca, whereas glycogen synthase is activated.

F-cAMP-dependent protein kinase A is activated, whereas phosphorylase kinase is inactivated.

Q33- A 34-year-old went to the hospital after weakness & skeletal muscles cramping after exercising. Laboratory tests showed myoglobinemia and myoglobinuria. Glycogen levels were normal & no rise in blood lactate levels, liver enzymes were normal too. What is the most likely glycogen storage disease in this case?

A-McARDLE Syndrome B-Cori disease C-POMPE Disease D-Hemolytic anemia

Q34- A 2-year-old boy was brought into the emergency room, suffering from severe fasting hypoglycemia. On physical examination, he was found to have hepatomegaly. Laboratory tests indicated that he also had hyperlacticacidemia and hyperuricemia. A liver biopsy indicated that hepatocytes contained greater than normal amounts of glycogen that was of normal structure. Enzyme assay likely confirmed a deficiency in which of the following enzymes? (Taken from Lippincott) \*\*(Von Gierke disease) doctors didn’t mention this disorder, but it’s in Lippincott Study Question.

A-Glycogen synthase
B-Glycogen phosphorylase
C-Glucose 6-phosphatase
D-Amylo-α(1→6)-glucosidase
E-Amylo-α(1→4)→α(1→6)-transglucosidase

Explanation: A deficiency of glucose 6-Phosphatase (Von Gierke disease) prevents the liver from releasing free glucose into the blood, causing severe fasting hypoglycemia, hyperlacticacidemia, and hyperuricemia. A deficiency of glycogen phosphorylase would result in a decrease in glycogen degradation, causing fasting hypoglycemia, but not the other symptoms. A deficiency of glycogen synthase would result in lower amounts of stored glycogen. Amylo- α(1→6)-glucosidase removes single glucosyl residues attached to the glycogen chain through an α(1→6)-glycosidic bond. A deficiency in this enzyme would result in a decreased ability of the cell to completely degrade glycogen branches. Amylo-α(1→4)→α(1→6)-transglucosidase deficiency would decrease the ability of the cell to make branches.

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| Answers |
| Q1 | B |
| Q2 | -In liver: a source for blood glucose, during early stages of fasting.-In muscles: fuel reserve (ATP), muscular exercise.  |
| Q3 | To conserve more energy “ATP”. |
| Q4 | C, $∝-D-glucose$ |
| Q5 | A |
| Q6 | There is a formation of new branch. |
| Q7 | Because these discrete granules contain most of the enzymes necessary for glycogen synthesis & degradation. |
| Q8 | C |
| Q9 | B |
| Q10 | In the absence of a glycogen fragment, glycogenin. |
| Q11 | B |
| Q12 | C |
| Q13 | B |
| Q14 | Glycogenin, tyrosine |
| Q15 | A |
| Q16 | D |
| Q17 | C |
| Q18 | A |
| Q19 | Source of energy for skeletal muscles, undergo anaerobic glycolysis |
| Q20 | A |
| Q21 | (8:1), what does that mean? for every 8 molecules of G-1-P there will be one molecule of free glucose produced. |
| Q22 | B |
| Q23 | D |
| Q24 | B |
| Q25 | C |
| Q26 | Muscles contraction |
| Q27 | B |
| Q28 | Activates Ca-dependent enzyme e.g: glycogen phosphorylase |
| Q29 | B |
| Q30 | C |
| Q31 | A |
| Q32 | B |
| Q33 | A |
| Q34 | C |