Chapter 21 Problems

Glycogen Metabolism

1. Choice is good. Glycogen is not as reduced as fatty acids are and consequently not as energy rich. Why do animals store any energy as glycogen? Why not convert all excess fuel into fatty acids?

2. If a little is good, a lot is better. α-Amylose is an unbranched glucose polymer. Why would this polymer not be as effective a storage form of glucose as glycogen?

3. Telltale products. A sample of glycogen from a patient with liver disease is incubated with orthophosphate, phosphorylase, the transferase, and the debranching enzyme (α-1,6-glucosidase). The ratio of glucose 1-phosphate to glucose formed in this mixture is 100. What is the most likely enzymatic deficiency in this patient?

8. Not all absences are equal. Hers disease results from an absence of liver glycogen phosphorylase and may result in serious illness. In McArdle disease, muscle glycogen phosphorylase is absent. Although exercise is difficult for patients suffering from McArdle disease, the disease is rarely life threatening. Account for the different manifestations of the absence of glycogen phosphorylase in the two tissues. What does the existence of these two different diseases indicate about the genetic nature of the phosphorylase?

11. Two in one. A single polypeptide chain houses the transferase and debranching enzyme. Cite a potential advantage of this arrangement.

14. Passing along the information. Outline the signal-transduction cascade for glycogen degradation in muscle.

15. Slammin' on the breaks. There must be a way to shut down glycogen breakdown quickly to prevent the wasteful depletion of glycogen after energy needs have been met. What mechanisms are employed to turn off glycogen breakdown?