Problem Set 5 answers

MCDB 108B

1. a) In McArdle's disease, muscle phosphorylase is deficient, but liver phosphorylase is normal. Therefore, you would expect glucose and glycogen metabolism in the liver to be normal and the control of blood glucose by the liver also to be normal.
b) Normal glycogen metabolism in the liver means that the amount of liver glycogen would be the same as in unaffected people.
c) Defective muscle glycogen phosphorylase means that glycogen breakdown is impaired. Moderately increased concentrations of muscle glycogen would be expected.
d) During vigorous exercise, blood lactate levels normally rise as muscle tissue exports the lactate generated through glycogen breakdown. The defect in muscle phosphorylase limits the extent to which glycogen is degraded in the muscle. This in turn reduces the amount of lactate exported during exercise, so the rise in blood lactate levels would not be as great in the affected person.
e) Glucagon exerts its effects primarily on liver, not muscle. In patients with McArdle's disease, blood glucose levels increase normally in response to glucagon.
f) Epinephrine exerts its effects on both liver and muscle. However, muscle glycogen does not support blood glucose. Thus even though muscle phosphorylase is deficient, blood glucose levels should be normal.

2. See lecture on exercise.

3. a) acetyl Co-A inhibits PDH and activates PC.
   b) 1. little to no oxaloacetate to run TCA cycle. 2. glucagon inhibits acetyl-CoA carboxylase, therefore no free fatty acids (FFAs) are synthesized.
   c) 1. req'd for TCA cycle in brain. 2. req'd for glucose production in liver.
   d) 1. True. alanine → pyruvate → oxaloacetate 2. False. Entry of acetyl-CoA (2 C's) results in 2 CO_2's that leave the TCA cycle. Therefore, no <u>net</u> formation of oxaloacetate from acetyl-CoA.

4.

	glucagon	epinephrine	Insulin
F6P → F1,6 BP in:			
liver	↓	↓ (or un)	↑
muscle	un	↑	
pyruvate → acetyl CoA			↑
acetyl CoA → malonyl CoA	↓		↑
glycogen → Glucose 1P	↑		
TAG → FFAs + glycerol	↑		↓
cAMP levels	↑		↓
HMG CoA → mevalonate	↓		

5. See lecture on β-oxidation.

6. See PDF on fatty acid synthesis.