BCH 4054 **PRE-TEST 3** **GROUP NAME _____**
October 13, 2000

This test is take-home and open book, and it is intended that all members of the group contribute to completing it. Only one copy is to be submitted by the group, and all members who participated should sign their names below. **Test is due at the end of class on Monday, October 23.**

Please use dark pencil or ink and write legibly.

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Page	Points
1	_____
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Points

(15) 1. Carbon-carbon bond formation is necessary in anabolic pathways to build up large structures from small molecules. For each of the following enzymes, give the structure of the substrate(s) and product(s) (nucleotides may be abbreviated), and indicate how energy is provided to help make the reaction energetically favorable.

(a) ß-ketoacyl-ACP synthase (fatty acid synthesis)
(b) HMG-CoA synthase (sterol synthesis)
(c) prenyl transferase (sterol synthesis)

(4) 2. To which ***omega*** class do the following fatty acids belong?

(a) oleic acid

(b) palmitoleic acid

(c) linoleic acid

(d) arachidonic acid

(20) 3. Under some conditions the liver oxidizes fatty acids to acetoacetate, which is secreted into the blood and then oxidized in peripheral tissues (such as heart muscle) to produce energy.

(a) Give the overall pathway, indicating by name or structure all intermediates, by which palmitic acid ($C_{16:0}$) is oxidized completely to CO_2 in this fashion, distinguishing which reactions occur in liver and which in heart muscle.

(b) Identify the steps at which ATP, NADH, and $CoQH_2$ are utilized or produced.

(c) Assuming reoxidation of NADH and $CoQH_2$ by the electron transport chain produces 2.5 ATP and 1.5 ATP respectively, calculate the net yield of ATP in liver and in heart muscle from this overall reaction.

(8) 4. (a) The molecular weight of palmitic acid is 256.4 g/mol. From the data in question 3, calculate the total number of **moles** of ATP (both that in liver an in muscle) that would be made from **one gram** of palmitic acid.

(b) Then do the same calculation for the **moles** of ATP that would be produced from complete oxidation of one gram of **glucose** to CO_2 and H_2O via glycolysis and the TCA cycle. (Assume cytoplasmic NADH is reoxidized by the glycerol-phosphate shuttle, and use the ATP yield calculated in Table 21.4, page 705).

(8) 5. Radioactive acetate labeled in the carboxyl carbon ([1-C^{14}]-acetate) was injected in a rat and subsequently several radioactive products were isolated. For each of the following compounds, draw the structure and **circle** the carbon atoms of the compound you would expect to contain radioactivity.

(a) mevalonic acid

(b) squalene

(c) palmitic acid

(d) arachidonic acid

(10) 6. Compare eukaryotic fatty acid oxidation with fatty acid synthesis, giving at least five ways in which the two pathways **differ** from each other.

(12) 7. Describe briefly the role of each of the following vitamins in lipid metabolism:

(a) biotin (vitamin H)

(b) carnitine (vitamin Bt)

(c) vitamin B-12

(d) pantothenic acid

(15) 8. Diagram the intermediates and enzymes of the urea cycle, showing the cellular location of each enzyme and intermediate. (Names or structures okay for intermediates.)

(8) 9. For the four plasma lipoproteins, (a) chylomicrons, (b) VLDL, (c) LDL, and (d) HDL, put the letter or letters corresponding to the lipoprotein(s) for which the following statements are true in the blank to the left of the statement:

_____ contains apoprotein A-1

_____ contains apoprotein B-48

_____ source of cholesterol for tissues

_____ removes excess cholesterol from tissues

_____ transports dietary triglycerides

_____ transports triglycerides synthesized in liver

_____ a substrate for lipoprotein lipase

_____ elevated in familial hypercholesteroemia