

**Bio 366: Biological Chemistry II**  
**Test #1, 100 points (7 pages)**

**READ THIS:** Take a numbered test and sit in the seat with that number on it. Remove the numbered sticker from the desk, and stick it on the back of the last page of the test. Print your name on the top of each page and your social security number on the back of the test (or only the last four digits, if you object). When you have finished, hand in your test and sign your name on the sign-out sheet (according to number) by the door. The answers will be posted outside of Dr. Stewart's office (Bio 229) by early next week. If you wish to challenge an answer, please make a written explanation and hand it in.

**A. True or False. Circle the correct answer. (1 point each, 20 points total.)**

1.    T    F    Most fatty acids have an even number of carbon atoms, usually 14 to 24.
2.    T    F    Glycogen is digested in the human gut by the same enzymes that digest starch.
3.    T    F    Complete oxidation of palmitic acid releases 32 ATP and 36 H<sub>2</sub>O molecules.
4.    T    F    The pentose phosphate pathway produces ribose-5-phosphate, which is essential for nucleic acid synthesis.
5.    T    F    Arachidonic acid is a C<sub>20</sub> compound that is always found as a component of larger lipid molecules.
6.    T    F    Cholesterol is very flexible molecule that can occur in an esterified form in lipoproteins.
7.    T    F    The major steroid hormones of animals are synthesized by independent pathways from C-2 compounds.
8.    T    F    Under normal metabolic conditions, glucose is the major source of metabolic fuel for the brain.
9.    T    F    You have printed your name at the top of each page and your social security number on the back of the last page. (If you do not do this, you will lose 1 point!)
10.   T    F    Gluconeogenesis and glycolysis share many of the same enzymes.
11.   T    F    Amylopectin is the major structural carbohydrate found in plant cell walls.
12.   T    F    EPA (5,8,11,14,17-eicosapentaenoic acid) is an omega-3 fatty acid.
13.   T    F    Amylose has only one nonreducing end per molecule.
14.   T    F    Adipocytes are specialized for the synthesis and storage of triacylglycerols.
15.   T    F    The nuclear genomes of mammals do not code for enzymes with cellulase activity.
16.   T    F    Glycosylation of proteins is very rare.
17.   T    F    Prostaglandins are transported in the bloodstream to their sites of action.
18.   T    F    Bile acids act as detergents in the stomach to emulsify fats for digestion.
19.   T    F    High density lipoproteins (HDL) have densities less than water (1.0 g/mL).
20.   T    F    β- oxidation of fatty acids occurs inside mitochondria.

**B. Match the enzyme/protein/process (2 points each; 40 points total): Write the letter of the correct answer(s) in the blank next to the statement. Some have more than one correct answer; list them all for full credit. The same letter may be used for more than one answer, or may not be used at all.**

- |    |   |    |                                  |
|----|---|----|----------------------------------|
| a. | glucagon                                    | n. | apoprotein B-100                 |
| b. | HMG-CoA reductase                           | o. | lipoprotein lipase               |
| c. | cholesterol ester transfer protein          | p. | glucokinase                      |
| d. | phosphoglucomutase                          | q. | adenylyl cyclase                 |
| e. | inorganic pyrophosphatase                   | r. | cyclooxygenase                   |
| f. | prostaglandin (endoperoxidase) synthase     | s. | LDL receptor                     |
| g. | acyl-CoA cholesterol acyltransferase (ACAT) | t. | monoacylglycerol acyltransferase |
| h. | diacylglycerol acyltransferase              | u. | glycogen synthase                |
| i. | apoprotein E                                | v. | glycogenin                       |
| j. | insulin                                     | w. | glycogen debranching enzyme      |
| k. | glycogen branching enzyme                   | x. | glycogen phosphorylase           |
| l. | pancreatic lipase                           | y. | phospholipase A2                 |
| m. | fatty acid synthase                         | z. | none of the above                |

1. \_\_\_\_\_ The muscle tissues of individuals with McArdle's Disease lack this activity.
2. \_\_\_\_\_ Can release arachidonic acid from the C-2 position phospholipids.
3. \_\_\_\_\_ Is a large, multifunctional enzyme in higher eukaryotes.
4. \_\_\_\_\_ Catalyzes the reaction:  $\text{pyrophosphate} + \text{H}_2\text{O} \rightarrow 2 \text{P}_i$
5. \_\_\_\_\_ Is inhibited by the drug Lovastatin.
6. \_\_\_\_\_ Hydrolyzes triacylglycerols.
7. \_\_\_\_\_ The primary hormone responsible for conversion of glucose to glycogen.
8. \_\_\_\_\_ Activation of glycogen synthase is tightly linked to inhibition of this enzyme.
9. \_\_\_\_\_ A single enzyme that hydrolyzes triacylglycerols at their C-1 and C-2 positions.
10. \_\_\_\_\_ Phosphorylation of Ser-14 on this enzyme causes it to undergo a dramatic conformational change to a more active form.
11. \_\_\_\_\_ Can digest olestra in the gastrointestinal tract of humans.
12. \_\_\_\_\_ Helps form triacylglycerol molecules.
13. \_\_\_\_\_ Catalyzes the rate-limiting step of cholesterol biosynthesis.
14. \_\_\_\_\_ The principle protein in LDL.
15. \_\_\_\_\_ Has amylo-(1,4→1,6)-transglycosylase activity.
16. \_\_\_\_\_ A membrane-bound enzyme that converts ATP to cAMP.
17. \_\_\_\_\_ Is inhibited by aspirin.
18. \_\_\_\_\_ Catalyzes bond cleavage by substitution of a phosphate group.
19. \_\_\_\_\_ Has two active sites, one with transglycosylase activity and the other with  $\alpha(1\rightarrow6)$  glycosidase (hydrolytic) activity.
20. \_\_\_\_\_ Found in chylomicrons, VLDLs, IDLs, and HDLs.

C. Explain the catabolism of glycogen within the cells of the body. Include the reactions of all major enzymes involved. Be succinct; do not write on the back of this page. (7 points)

**D. Describe the process of receptor-mediated endocytosis of LDL. Use diagrams as needed, but explain them in prose. Explain how Familial Hypercholesterolemia relates to this process. Be succinct; do not write on the back of this page. (10 points)**

E. Draw the structures of the following molecules (8 points total):

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1. Epinephrine or adrenaline (1 points):

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2. A branch point of a glycogen molecule, labeling the C atoms of the monomers (3 pts):

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3. Fructose (1 point):

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4. The ketone bodies, including their names (1 point each, 3 points total):

**F. Explain the relationship between saturation of fatty acids and their melting temperatures. (5 points)**

**G. Explain what is meant by the term "isozyme", illustrating with an example presented in class. (5 points)**

H. Fill in the following table of the 20 common amino acids found in proteins, giving the names, and three-letter or one-letter abbreviations. You must have two lines completely correct (including spelling) for each 0.5 point (5 points total).

| Full common name: | 3-letter name: | 1-letter name: |
|-------------------|----------------|----------------|
| 1. Alanine        |                | A              |
| 2. Arginine       | Arg            |                |
| 3.                | Asn            | N              |
| 4. Aspartic acid  |                | D              |
| 5.                | Cys            | C              |
| 6. Glutamine      | Gln            |                |
| 7.                | Glu            | E              |
| 8. Glycine        |                | G              |
| 9.                | His            | H              |
| 10. Isoleucine    |                | I              |
| 11.               | Leu            | L              |
| 12. Lysine        | Lys            |                |
| 13.               | Met            | M              |
| 14.               | Phe            | F              |
| 15. Proline       |                | P              |
| 16.               | Ser            | S              |
| 17. Threonine     | Thr            |                |
| 18. Tryptophan    | Trp            |                |
| 19. Tyrosine      | Tyr            |                |
| 20. Valine        |                | V              |