BCH 4054 **HOUR TEST 3** **NAME**_____
March 22, 2002

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Points

(6) 1. Describe two roles that citrate has in fatty acid biosynthesis.

2. At least seven separable proteins are involved in the biosynthesis of fatty acids in bacteria.

(7) (a) Identify the seven by **name** or **abbreviation**. (Use the shortened names and abbreviations we used in class).

(2) (b) Which of the proteins in (a) contains a prosthetic group to which intermediates are covalently bound?

(2) (c) Which of the proteins in (a) contains a very reactive cysteine sulfhydryl group that participates in the reaction.

(6) 3. To which ***omega*** class do the following fatty acids belong?

(a) alpha linolenic acid (9,12,15-$C_{18:3}$)

(b) gamma linolenic acid (6,9,12-$C_{18:3}$)

(c) *cis*-vaccenic acid (11-$C_{18:1}$)

(d) linoleic acid (9,12-$C_{18:2}$)

(e) prostaglandin E_2

(f) prostaglandin F_3

(10) 4. Following are five characteristics of one or more of the reactions of cholesterol biosynthesis. Associate each characteristic with one or more of **five** stages of cholesterol biosynthesis from acetyl-CoA, by placing the number or numbers of the stages in the blank to the left of the characteristic: (A characteristic may be associated with more than one stage).

_____ (a) Release of inorganic pyrophosphate

_____ (b) Requirement for NADPH

_____ (c) Requirement for O_2

_____ (d) Release of CO_2

_____ (e) Requirement for ATP

Stages:

1. acetyl-CoA → mevalonate
2. mevalonate → isopentenyl-PP
3. isopentenyl-PP → squalene
4. squalene → lanosterol
5. lanosterol → cholesterol

(4) 5. What intermediate compound must cholesterol be converted to in order to form vitamin D from ultraviolet light exposure? (Name **or** structure okay)

(6) 6. The prosthetic group for transaminases cycles between two forms. One form is covalently bound to the enzyme; the other is not covalently bound but carries the nitrogen atom that has been removed from an amino acid. Give the structure of **both forms**, showing the covalent linkage to the enzyme for the first form.

(6) 7. The urea cycle contains three amino acids not found as a component of proteins. Give the **name** and **structure** of **two** of these amino acids that must cross the mitochondrial membrane as part of the cycle.

(6) 8. The nitrogen atoms for urea synthesis come from glutamic acid. Identify the **two** reactions in which glutamate is involved in giving up its nitrogen for this cycle. (Give **reactants** and **products** –name or structure—and the **name of the enzymes**.

(4) 9. The biosynthesis of triglycerides and phospholipids begins with the reduction of dihydroxy acetone phosphate to glycerol phosphate.

(a) What phospholipid is initially formed from glycerol phosphate?

(b) What nucleotide is utilized to activate the intermediates for synthesis of other phospholipids from the initial one?

(10) 10. 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 B-100.	_____	Transports dietary triacylglycerols.
_____	Contains apoprotein B-48.	_____	Transports triacylglycerols made in liver
_____	Contains apoprotein A-1.	_____	Is degraded by lipoprotein lipase.
_____	Contains apoprotein C-1.	_____	Is a precursor of LDL.
_____	Source of cholesterol for tissues.	_____	May remove cholesterol from cells.

(6) 11. Following are several "C-1" derivatives of tetrahydrofolic acid, followed by statements referring to one or more of these forms. Identify the form or forms referred to in the statement by putting the appropriate letters in the blank next to the statement.

(a) N_5-formyl THFA (b) N_{10}-formyl-THFA (c) N_5, N_{10}-methenyl THFA

(d) N_5, N_{10}-methylene THFA (e) N_5-methyl THFA

_____ The C-1 is at the oxidation level of formic acid.

_____ The C-1 is at the oxidation level of formaldehyde.

_____ The C-1 is at the oxidation level of methanol.

_____ This derivative furnishes two carbon atoms of the purine ring.

_____ This derivative furnishes the methyl group of methionine.

_____ This derivative is formed when serine is converted to glycine.

(6) 12. Guanine contains five nitrogen atoms, each derived from an amino acid. Draw the structure of guanine, and with arrows indicate the amino acid source of each nitrogen atom.

(9) 13. The **first committed step** in a biosynthetic pathway is usually a step of the pathway that is regulated. Identify the first committed step in each of the following pathways, by giving the reactants and products of the reaction:

(a) fatty acid biosynthesis

(b) sterol biosynthesis

(c) purine biosynthesis

For Questions 14-18, check the blank corresponding to the **best** answer. (2 points each question).

14. Prostaglandins are formed from arachidonic acid by action of the enzyme _____, while leukotrienes are formed from arachidonic acid by action of the enzyme _____.

____ lipoxygenase, thiolesterase
____ cyclooxygenase, thiolase
____ lipoxygenase, cyclooxygenase
____ cyclooxygenase, lipoxygenase
____ thiolesterase, thiolase
____ thiolase, thiolesterase

15. Squalene is formed by the head-to-head condensation of

____ geranyl pyrophosphate
____ isopentenyl pyrophosphate
____ dolichol pyrophosphate
____ farnesyl pyrophosphate
____ dimethylallyl pyrophosphate

16. Glutamine synthetase in bacteria is regulated by covalent modification. Each subunit of the enzyme is **activated** by

____ addition of a phosphate from ATP
____ removal of a phosphate group by a phosphatase
____ addition of an AMP group from ATP
____ removal of an AMP group by a transferase
____ addition of a UMP group from UTP
____ removal of a UMP group by a transferase

17. The activated form of ribose involved in the synthesis of both purine and pyrimidine nucleotides is

____ ribose-5-phosphate
____ ribose-5-pyrophosphate
____ ribose-1-phosphate
____ ribose-1-pyrophosphate
____ ribose-5-phosphate, 1-pyrophosphate
____ ribose-1-phosphate, 5-pyrophosphate

18. In the synthesis of urea, the **immediate precursor** of urea (i.e., the reactant in the reaction forming urea) is

____ citrulline
____ carbamoyl phosphate
____ arginine
____ ornithine
____ aspartate