**BIOSCI 1820**
**FINAL EXAM**
**APR 2002**

# KEY

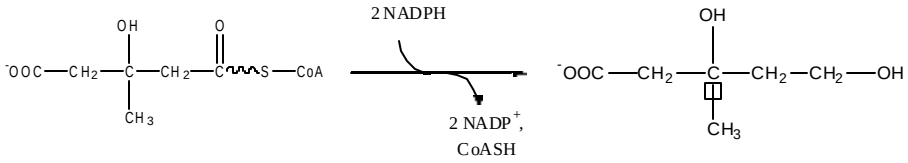
I. Recitation section:

A. In the paper from Jagendorf and Uribe, the proton gradient across isolated chloroplasts was shown to "drive" the synthesis of ATP. Although they referred to compounds such as EDTA and Triton as "uncouplers", they are not uncouplers in the way we now know these reagents to work. Chose one (EDTA or Triton) and indicate why it would inhibit ATP production.

EDTA -- chelates $Mg^{2+}$ so ATP synthase can't work (ATP always bound to Mg)

Triton -- detergent that solubilizes the membrane

B. Name an inhibitor of the following reaction: Lovastatin (mevionlinic acid, or mevinolin)




C. What is the name of the enzyme that catalyzes this reaction?

HMG CoA reductase

D. A metabolic disease frequently found amongst the Philadelphia-area Mennonite community and arises from a defect in the ability of an enzyme to fold. What is the name of this enzyme?

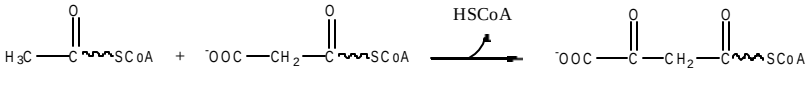
Maple Syrup Urine Disease: Branch Chain α keto acid Dehydrogenase

E. Individuals heterozygous for familial hypercholesterolemia have ~2-fold higher circulating concentrations of LDL in the blood. Does this make sense? Why/why not?

Only $^1/_2$ of the available number of LDL receptors exist, so there is an observable defect/decrease in LDL endocytosis.

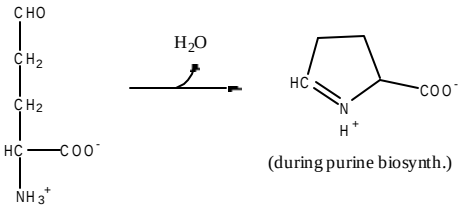
II. Draw the structures of the products of the following reactions:

A.



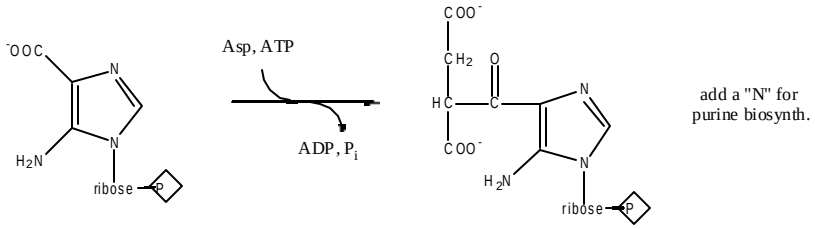

(fatty acid synth.)

B.



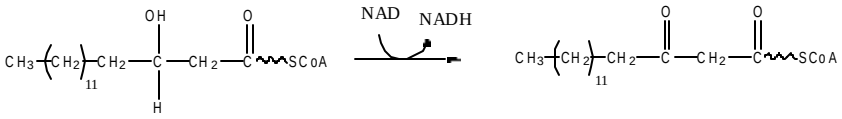

(during purine biosynth.)

C.



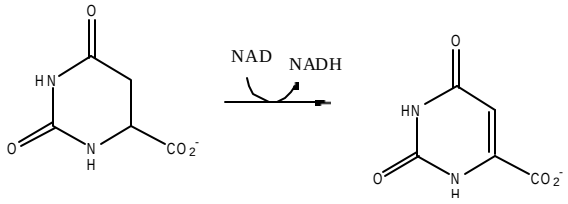

add a "N" for purine biosynth.

D.



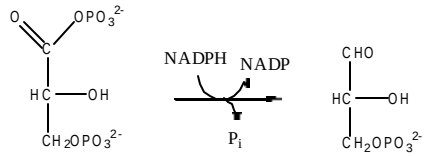

(FA oxdn)

E.




(pyrimidine biosynth.)

F.




(Calcium cycle/PS)

(3-PG)

III. Multiple Choice

1. All of the following circulating factors bind to receptors that cross the plasma membrane once, except:

A. epidermal growth factor
B. fibroblast growth factor
C. epinephrine
D. platelet derived growth factor
E. none of the above (all factors bind to single-spanning membrane proteins)

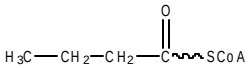
uses a G protein-coupled receptor

2. Activated Gα subunits (i.e. those bound to GTP can do the following in the cell except:

A. activate adenylate cyclase
B. increase calcium release from the ER
C. activate protein kinase C
D. activate acyl Co-A carboxylase
E. stimulate fatty acid breakdown
F. none of the above (Gα subunits bound to GTP do all of the above)

3. How many ATPs in theory can be obtained from the complete oxidative metabolism of the following fatty acid?

A. 27
B. 29
C. 31
D. 17
E. 15




(2 x 12) + 5 = 29

4. Which of the following co-factors is required for the reaction catalyzed by a transaminase?

A. pyridoxal phosphate
B. biotin
C. thiamine
D. lipoic acid
E. NAD

5. Which of the following is found in both the granal and stromal lamellae?

A. Photosystem I
B. Photosystem II
C. Rubisco
D. Cytochrome bf
E. ATP synthase

6. When NADP is limiting, plants undergo cyclic electron flow in which electrons flow to cytochrome bf directly from:

A. Quinone
B. Ferrodoxin
C. Plastocyanin
D. P700
E. Pheophytin

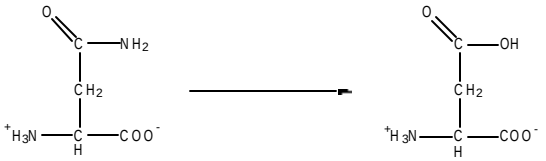
7. Which of the following is used as a 'tag' during glycerosphingolipid synthesis?

A. ACP
B. CTP
C. CoA
D. UDP-glucose
E. GTP

8. Which of the following is true?

A. inosine monophosphate is a precursor of UTP and CTP
B. pyrimidine biosynthesis is activated by ATP and GTP
C. the methyl group on TMP is added by carboxylation and reduction of UMP
D. purine biosynthesis is inhibited by high levels of PRPP
E. synthesis of CTP is a common target for anti-cancer drugs

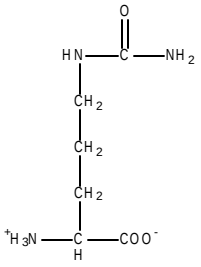
IV. Unlike most cells, some circulating lymphocytes in the blood are unable to make their own asparagine; one treatment for people who have acute lymphoblastic leukemia is to infuse asparaginase into their bloodstream, thus wiping-out the supply of circulating asparagine and killing the cancer cells. Draw the full structures of the reactants and products in the reaction catalyzed by asparaginase:



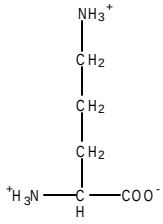
Asn Asp

V. In addition to amino acid metabolism, we have discussed a number of non-stereotypical amino acids that serve as intermediates in amino acid metabolism but are not incorporated into proteins. Match the name and the strucutre of some bona finde amino acids and amino acid metabolites below:

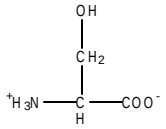
A. ornithine
B. citrulline
C. homoserine
D. serine
E. cysteine
F. homocysteine
G. methionine
H. arginine



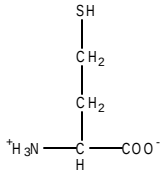
B



A



D



F

VI. Short Answer

A. Carbamoyl phosphate is used in two distinct metabolic pathways that we have discussed: What are they?

1. pyrimidine biosynthesis
2. urea cycle

B. What is the name of the amino acid from which creatine-phosphate -- the metabolite that keeps ATP levels constant in the muscle -- derives?

arginine

C. What is the name of the polypeptide hormone that stimulates glycogen breakdown and glucose release from the liver?

glucagon

D. What is the name of the fragments that form as a result of the 5' to 3' synthesis of DNA on the lagging strand?

okazaki

E. What is the name of the amino acid from which Dopa -- the neurotransmitter implicated in Parkinson's Disease -- derives?

tyrosine

F. During the last Pittsburgh marathon, one participant at mile ~20 became convinced that he was being chased by aliens (this is true). Around the time that the aliens were approaching, what was the metabolite being utilized by his brain for energy?

ketone bodies

G. What other organ in the body can utilize this metabolite for energy?

heart

H. What are the names of the two products produced from the action of phospholipase C upon its activation by a Gα-GTP?

diacyl glycerol (DAG) and $IP_3$ (inositol triphosphate)

I. Although being able to store and break-down glycogen, why doesn't skeletal muscle release glucose into the bloodstream?

it lacks glucose-6-phosphatase

VII. Draw an A-T base pair (don't worry about the sugar or phosphate, but indicate with dashed lines the positions of the hydrogen bonds).