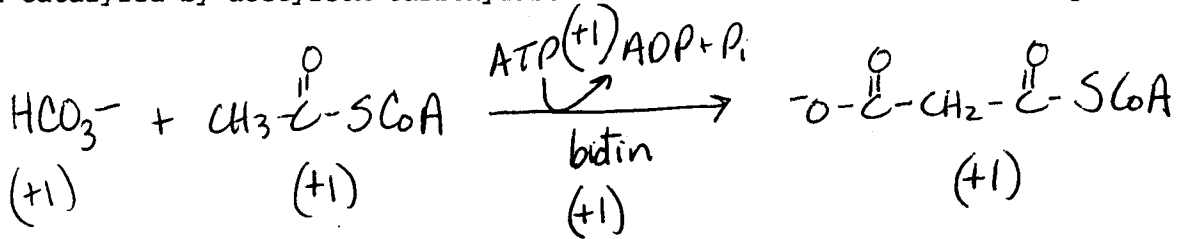


2nd MIDTERM EXAMINATION 22 November 2002
(90 points, 3 pages, 50 minutes)
PLEASE READ EACH QUESTION VERY CAREFULLY!

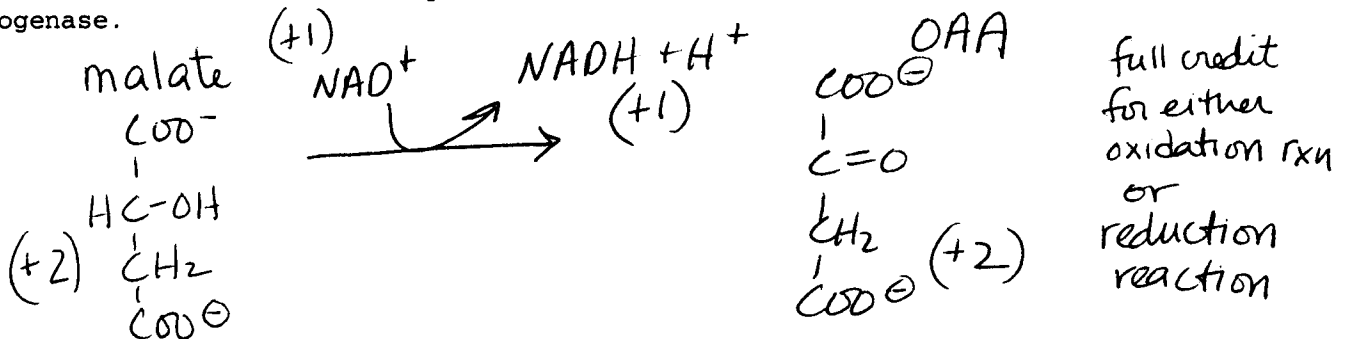
1. (a) (5 points) Write out the structure for the substrates and products of the reaction catalyzed by acetylCoA carboxylase. Indicate cofactors involved by name.



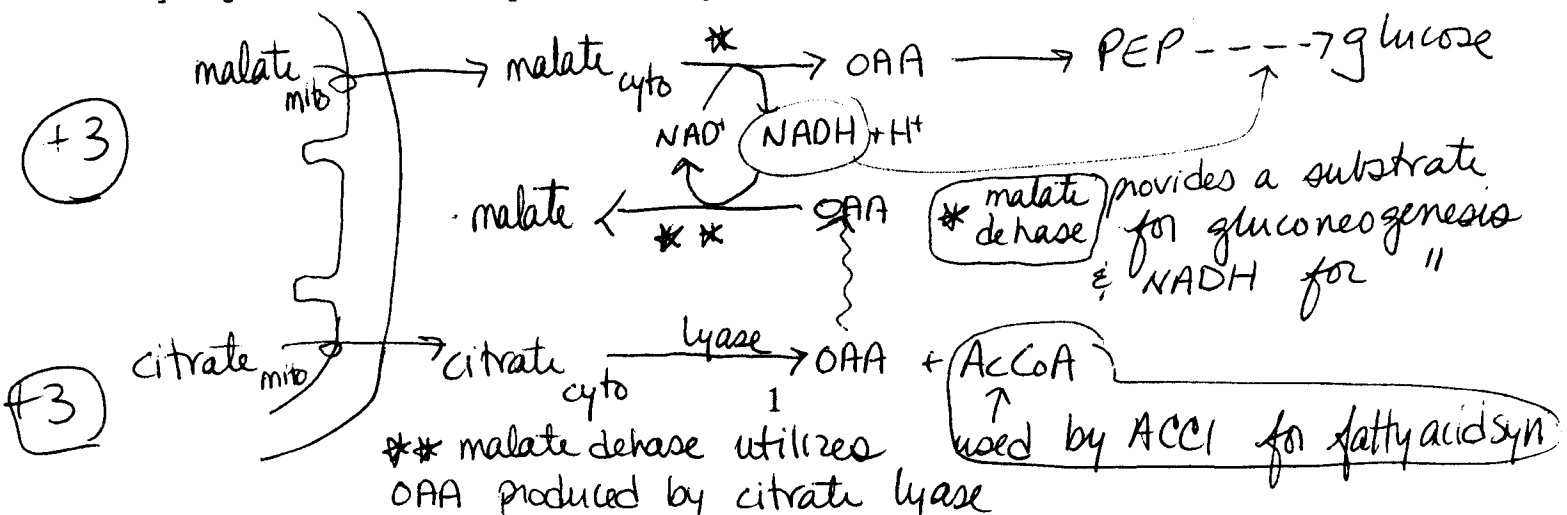
(b) (5 points) What is the function of ACC2, the acetylCoA carboxylase enzyme located within the mitochondrial matrix?

The malonyl/SCoA produced by ACC2 within the mitochondrial matrix functions to inhibit β -oxidation of fatty acids (+5)

2. (a) (6 points) Many, but not all, of the citric acid cycle enzymes located within the mitochondrial matrix have cytosolic counterparts. Write out the structure for the substrates and products of the reaction catalyzed by malate dehydrogenase.



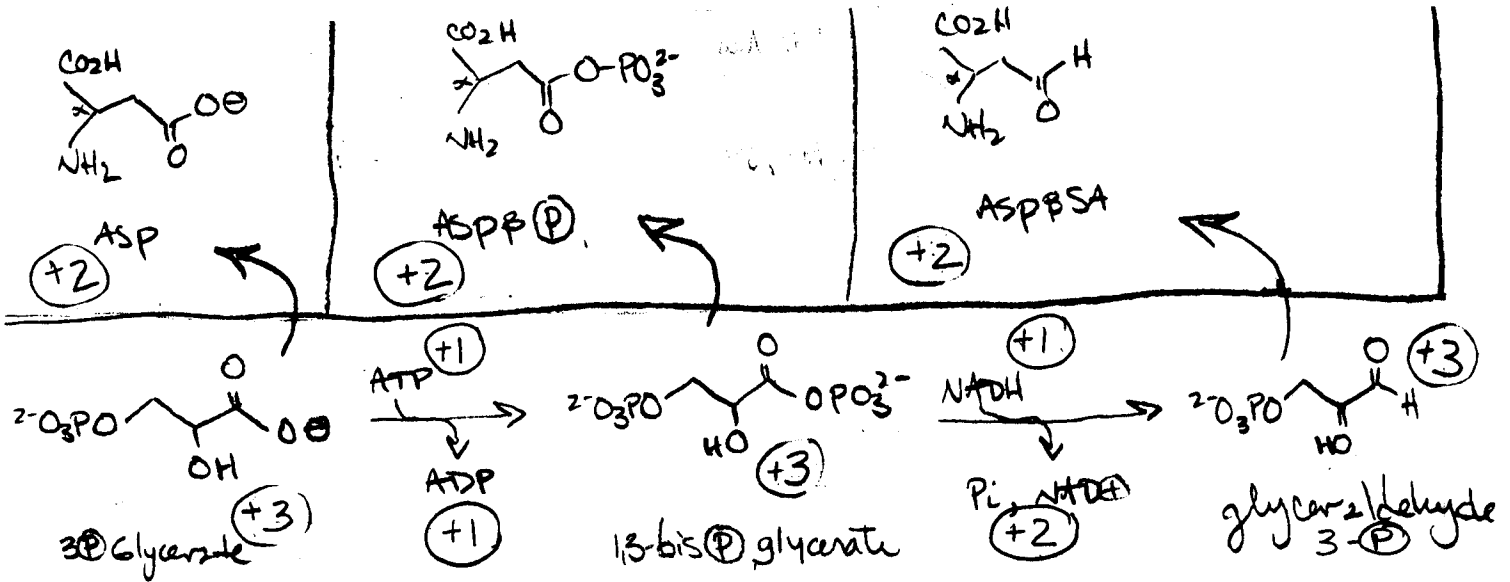
(b) (6 points) Describe the function of the cytosolic isozyme of malate dehydrogenase in the biosynthesis of glucose and fatty acids.



Answer Key

3. (28 points total)

(a) (20 points) Write out two steps in gluconeogenesis that are very similar to the first two steps in the synthesis of threonine from aspartate. Draw out the structures of each reactant and product and indicate exactly where each cofactor comes in. Write either the names or structures of the intermediates in threonine synthesis that are similar to each of the reactants and products.



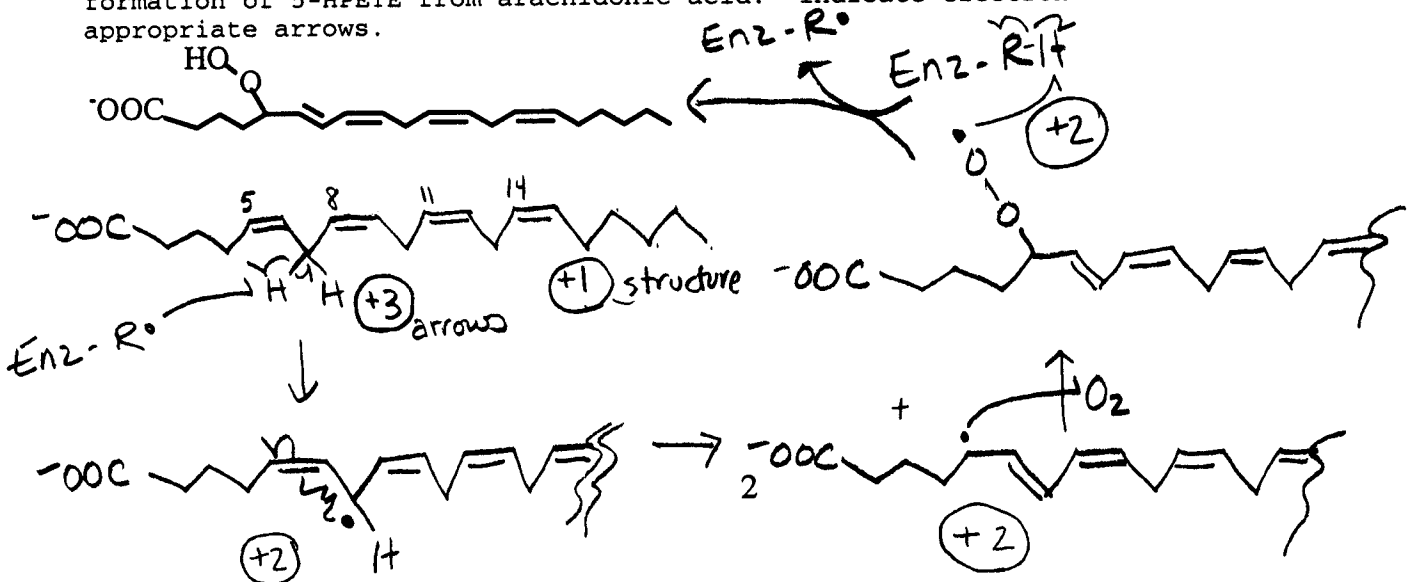
(b) (8 points) For the first two steps in the biosynthesis of threonine from aspartate, what factors ensure that the reaction proceeds in the direction of biosynthesis?

+6 $\frac{\text{Reactant}}{\text{Product}}$ ratios for $\frac{\text{ATP}}{\text{ADP}}$ and for $\frac{\text{NADPH}}{\text{NADP}^+}$ drive reaction

~ $\frac{10}{1}$ $\frac{100}{1}$

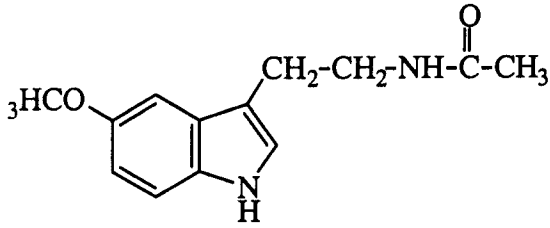
+2 ATP hydrolysis & NADPH oxidation are energetically downhill

4. (10 points) Arachidonic acid (C₂₀:all cis, Δ₅, Δ₈, Δ₁₁, Δ₁₄) is converted by lipoxygenase to the hydroperoxyeicosatetraenoic acid, 5-HPETE shown below. Based on the type of chemistry you have seen for cyclooxygenase, propose a mechanism for the formation of 5-HPETE from arachidonic acid. Indicate electron movements with the appropriate arrows.



Answer Key

5. (30 points) Melatonin (shown below), a hormone produced by the retina and the pineal gland of mammals, is involved in regulation of circadian rhythm. It is synthesized at night. Write out a plausible biosynthetic scheme for the synthesis of melatonin starting from essential amino acid tryptophan. For each reaction, give structures of the reactants and products, and name the cofactors involved. YOU DO NOT NEED TO INDICATE REACTION MECHANISMS!



Melatonin

order can be different -
but must acetylate AFTER
decarboxylation step

