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Course Title: Medical Biochemistry II

## ASSIGNMENT

Describe the three stages of beta oxidation. (Show pathways where necessary)

1.)

### Dehydrogenation

In the first step, acyl-CoA is oxidized by the enzyme acyl CoA dehydrogenase. A double bond is formed between the second and third carbons (C2 and C3) of the acyl-CoA chain entering the beta oxidation cycle; the end product of this reaction is trans- $\Delta^2$ -enoyl-CoA (trans-delta 2-enoyl CoA). This step uses FAD and produces FADH<sub>2</sub>, which will enter the citric acid cycle and form ATP to be used as energy. Two carbons in the long fatty acid chain, called the alpha and beta carbons, of acyl-CoA are exposed. Acyl-CoA then is attacked by the enzyme, acyl-CoA dehydrogenase, which steals two hydrogen from the alpha and beta carbons. H<sub>2</sub> is passed off to FAD<sup>+</sup>, which changes it to FADH<sub>2</sub>. FADH<sub>2</sub> continues on to aid in energy production. In the meantime, acyl-CoA changes its name to alpha beta-Enoyl-CoA in honor of the lost hydrogen

2.)

### Hydration

In the second step, the double bond between C2 and C3 of trans- $\Delta^2$ -enoyl-CoA is hydrated, forming the end product L- $\beta$ -hydroxyacyl CoA, which has a hydroxyl group (OH) in C2, in place of the double bond. This reaction is catalyzed by another enzyme: enoyl CoA hydratase. This step requires water. After having been attacked, the enzyme, enoyl-CoA hydrate, adds water to alpha, beta-enoyl-CoA, giving hydrogen back to the alpha carbon and adding oxygen to the beta carbon. In response, alpha, beta-enoyl-CoA changes its name to 3-hydroxyacyl-CoA. 3-hydroxyacyl-CoA isn't left alone for long

3.)

### Oxidation

In the third step, the hydroxyl group in C2 of L- $\beta$ -hydroxyacyl CoA is oxidized by NAD<sup>+</sup> in a reaction that is catalyzed by 3-hydroxyacyl-CoA dehydrogenase. The end products are  $\beta$ -ketoacyl CoA and NADH + H<sup>+</sup>. NADH will enter the citric acid cycle and produce ATP that will be used as energy.

In the third step, another enzyme, 3-hydroxyacyl dehydrogenase, swipes the newly gained hydrogen from the oxygen attached to the beta carbon and gives one to NAD<sup>+</sup>, making it NADH. NADH then goes to the electron transport chain to produce energy. In lament of yet more hydrogen loss, the molecule is renamed beta-ketoacyl-CoA.