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**Describe 3 stages of beta oxidation of fatty acid (show pathways were necessary)**

Beta oxidation is a metabolic process involving multiple steps by which fatty acid molecules are broken down to produce energy.

It occurs in the mitochondria of eukaryotics cells and in the cytosol of prokaryotic cells. For beta oxidation to take place, fatty acids must first enter the cell through the cell membrane, then bind to coenzyme A(CoA), forming acyl CoA and in the case of Eukaryotic cells, enter the mitochondria where beta oxidation takes place.

Three stages of beta oxidation of fatty acids are;

* Dehydrogenation
* Hydration
* Oxidation
* Dehydration

In the first stage, 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-Δ2-enoyl-CoA (trans-delta 2-enoyl CoA). This step uses FAD and produces FADH2, which will enter the citric acid cycle and form ATP to be used as energy.   
Beta Oxidation Step 1

* Hydration

In the second stage, the double bond between C2 and C3 of trans-Δ2-enoyl-CoA is hydrated, forming the end product L-β-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.  
Beta Oxidation Step 2

* Oxidation

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