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QUESTION

Describe the three stages of beta oxidation of fatty acids (show pathways where necessary).

Fatty acid β- oxidation is a multistep process by which fatty acids are broken down by various tissues to produce energy. For it to occur, fatty acids must enter the cell through the cell membrane, bind to CoA, forming acyl CoA and enters into the mitochondria in the case of eukaryotic cells. In prokaryotic cells, it occurs in the cytosol.

The three stages of β- oxidation of fatty acids includes;

1. Dehydration
2. Hydration
3. Oxidation
4. Dehydration

In this stage, acyl CoA is oxidized by acyl CoA dehydrogenase. Then a double bond forms between the second and third carbons of the acyl CoA chain, entering into the β-oxidation cycle. The reaction gives trans-∆2-enoyl-CoA (trans- delta 2- enoyl CoA). This stage uses FAD and produces FADH2, which later forms ATP when it enters the citric acid cycle.

1. Hydration

This step requires water. The double bond between the second and third carbon of trans-∆2- enoyl- CoA is hydrated, forming L-β-hydroxyacyl CoA, which has a hydroxyl group in the second carbon, in place of the double bond. This reaction is catalyzed by enoyl CoA hydratase.

Beta Oxidation Step 2

1. Oxidation

The hydroxyl group in the second carbon of L-β- hydroxyacyl CoA is oxidized by NAD+ in a reaction that is catalyzed by 3- hydroxyacyl-CoA dehydrogenase. The reaction gives β-ketoacyl CoA and NADH + H. This NADH will enter the citric cycle to give ATP that is used as energy.

