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PHYSIOLOGY

BCH 204

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Describe the three stages of beta oxidation.

Beta oxidation is a metabolic proces involving multiple steps by which fatty acid molecules are broken down to produce energy. It consists in breaking down long fatty acids that have been converted to acyl-CoA chains into progressively smaller fatty Acyl-CoA chains. The overall reaction for one cycle of beta oxidation is:

Cn- acyl- CoA+ FAD+ NAD+ H2O+ CoA=> Cn-2- acyl- CoA+ FADH2+ NADH+H^+ + acetyl- CoA

Three stages of beta oxidation:

1) Dehydrogenation

2) Hydration

3) Oxidation

1) Dehydrogenation: 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 of the acyl-CoA chain entering the beta oxidation cycle; the end product of this reaction is trans-Δ^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.

2) Hydration: In the second stage, the double bond between the second carbon and the third carbon of trans-Δ^2- enoyl- CoA is hydrated, forming the end product L-

beta- hydroxyacyl- CoA, which has a hydroxyl group in the second carbon, in place of the double bond. This reaction is catalyzed by another enzyme: enough CoA hydratase. This stage requires water. The reaction is stereospecific forming only the L isomer.

3) Oxidation: In this stage the hydroxyl group in carbon two of L-beta hydroyacyl CoA is oxidized by NAD+ in a reaction that is catalyzed by 3-hydroxyacyl- CoA dehydrogenase. The end products are beta-ketoacyl CoA and NADH + H. NADH will enter the citric acid cycle and produce ATP that will be used as energy.