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BCH 204 Assignment

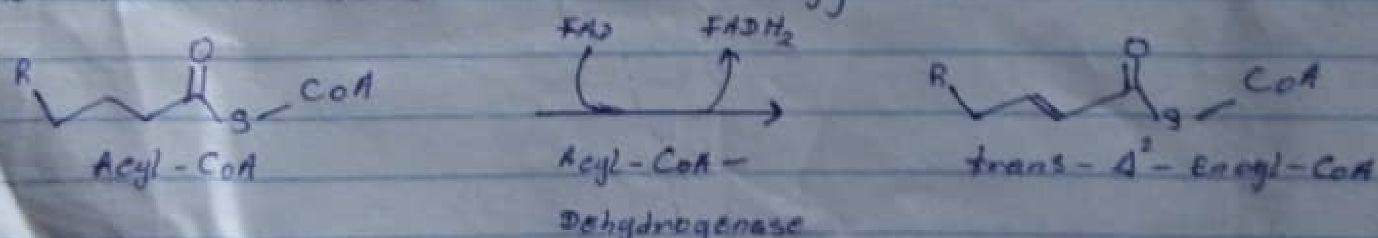
1 Describe the three (3) stages of beta oxidation. (show pathways where necessary).

Answer

Beta Oxidation is a metabolic process involving multiple steps by which fatty acid molecules are broken down to produce energy. Beta Oxidation takes place in four steps: dehydrogenation, hydration, oxidation and thyolisis. Each step is catalysed by a distinct enzyme.

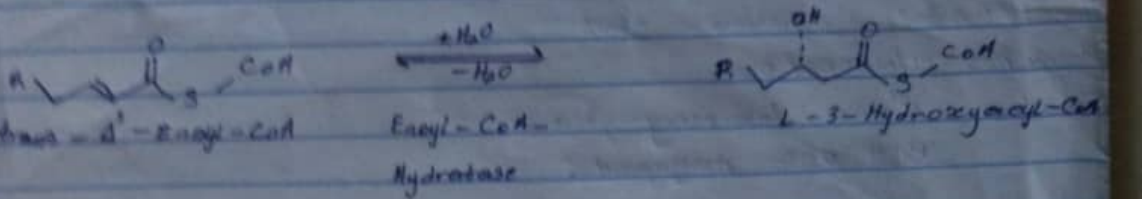
1 Dehydrogenation

In the first step, acyl-CoA is oxidised by the enzyme acyl CoA dehydrogenase. A double bond is formed between the second and third carbons (C_2 and C_3) of the acyl-CoA chain entering the beta oxidation cycle; the end product of this reaction is trans-Δ^2-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.



2 Hydration

In the second step, the double bond between C2 and C3 of trans-Δ^2-enoyl-CoA is hydrated, forming the end product L-β-hydroxyacyl CoA, which has a hydroxyl group (OH) in C3, in place of the double bond. This reaction is catalysed by another enzyme: Enoyl CoA hydratase, This step requires water.



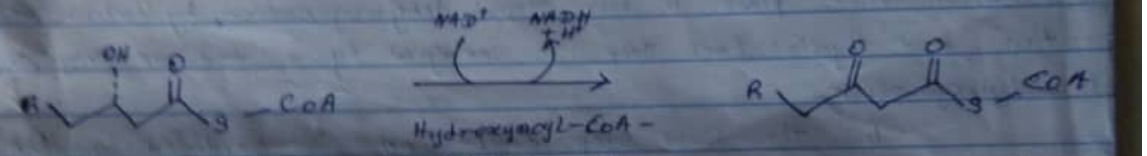
trans-Δ^2-Enoyl-CoA

Enoyl-CoA-Hydratase

L-3-Hydroxyacyl-CoA

3. Oxidation

In the third step, 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.



L-3-Hydroxyacyl-CoA

Hydroxyacyl-CoA-Dehydrogenase

3-Ketoacyl-CoA