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MEDICAL LABORATORY SCIENCE.

MEDICAL BIOCHEMISTRY II

BCH 204.

Assignment Title: Beta-oxidation of fatty acid

Question: Describe the three stages of Beta oxidation

Beta oxidation may be defined as the oxidation of fatty acid on the β -Carbon atom which results in the sequential removal of a two carbon fragment, acetyl CoA.

Beta oxidation involves three stages and they are activation of fatty acids occurring in the cytosol

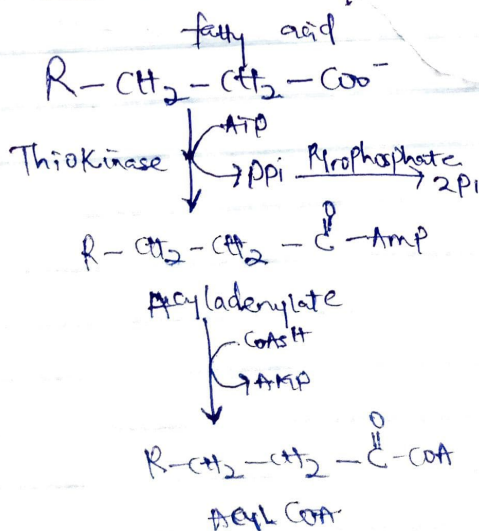
Transportation of fatty acids into mitochondria

β -Oxidation proper in the mitochondrial matrix

β -Oxidation occurs in the mitochondria.

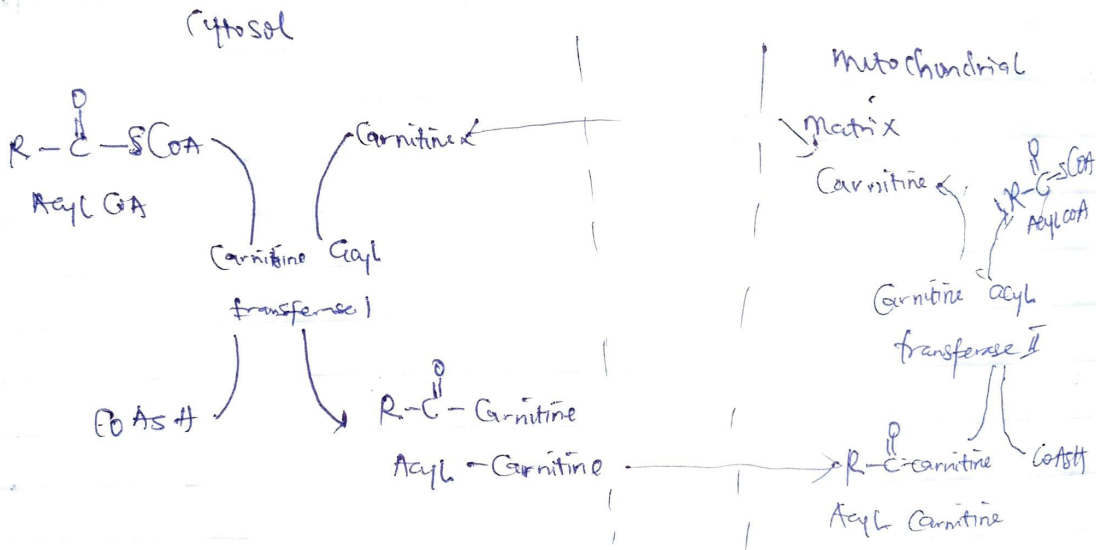
fatty Acid Activation

fatty acids are activated to acyl CoA by thiokinase or acyl CoA Synthetase. This stage occurs in two steps and requires ATP, Coenzymes and Mg^{2+} . This activation of fatty acid takes place on the outer mitochondrial membrane, fatty acid reacts with ATP to form acyladenylate which then combines with Coenzyme A to produce acyl CoA. In the activation, two high energy pyrophosphate hydrolyse PP_i to phosphate (P_i), the immediate elimination of PP_i makes this reaction totally irreversible.

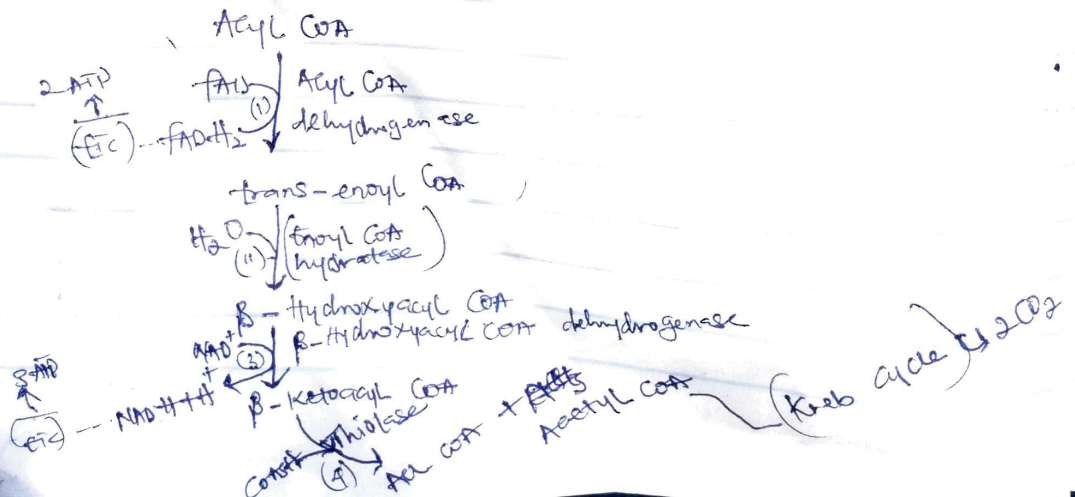


(ii) **TRANSPORT OF Acyl CoA INTO Mitochondria:**
 fatty acids primarily enter a cell via fatty acid protein transport on the cell surface because the inner mitochondrial membrane is impermeable to fatty acids. A specialized Carnitine Carrier system (Carnitine Shuttle) operates to transport activated fatty acids from cytosol to the mitochondria. This stage occurs in four steps.

- Acyl group of acyl CoA is transferred to Carnitine (β -hydroxy γ -trimethyl aminobutyrate), catalysed by Carnitine acyltransferase I (found on the outer surface of inner mitochondrial membrane).
- The acyl-Carnitine is transported across the membrane to mitochondrial matrix by a specific carrier protein.
- Carnitine acyl transferase II (found on the inner surface of inner mitochondrial membrane) converts acyl-Carnitine to acyl CoA.
- The Carnitine released returns to cytosol for reuse.



(iii) **β -oxidation proper**
 Mitochondria.



Each cycle of β -oxidation liberating two carbon unit-acetyl CoA, occurs in a sequence of four oxidation

1) Oxidation: Acyl CoA undergoes dehydrogenation by an FAD-dependent flavoenzyme, acyl CoA dehydrogenase. A double bond is formed between α and β carbons

2) Hydration: Enoyl CoA hydratase brings about the hydration of the double bond to form β -hydroxyacyl CoA

3) CLIFFORD
4) The final reaction in β -oxidation is the liberation of a 2 carbon fragment, acetyl CoA from acyl CoA

5) OXIDATION: β -hydroxyacyl CoA dehydrogenase catalyses the second oxidation and generate NADH; the product formed is β -ketoacyl CoA