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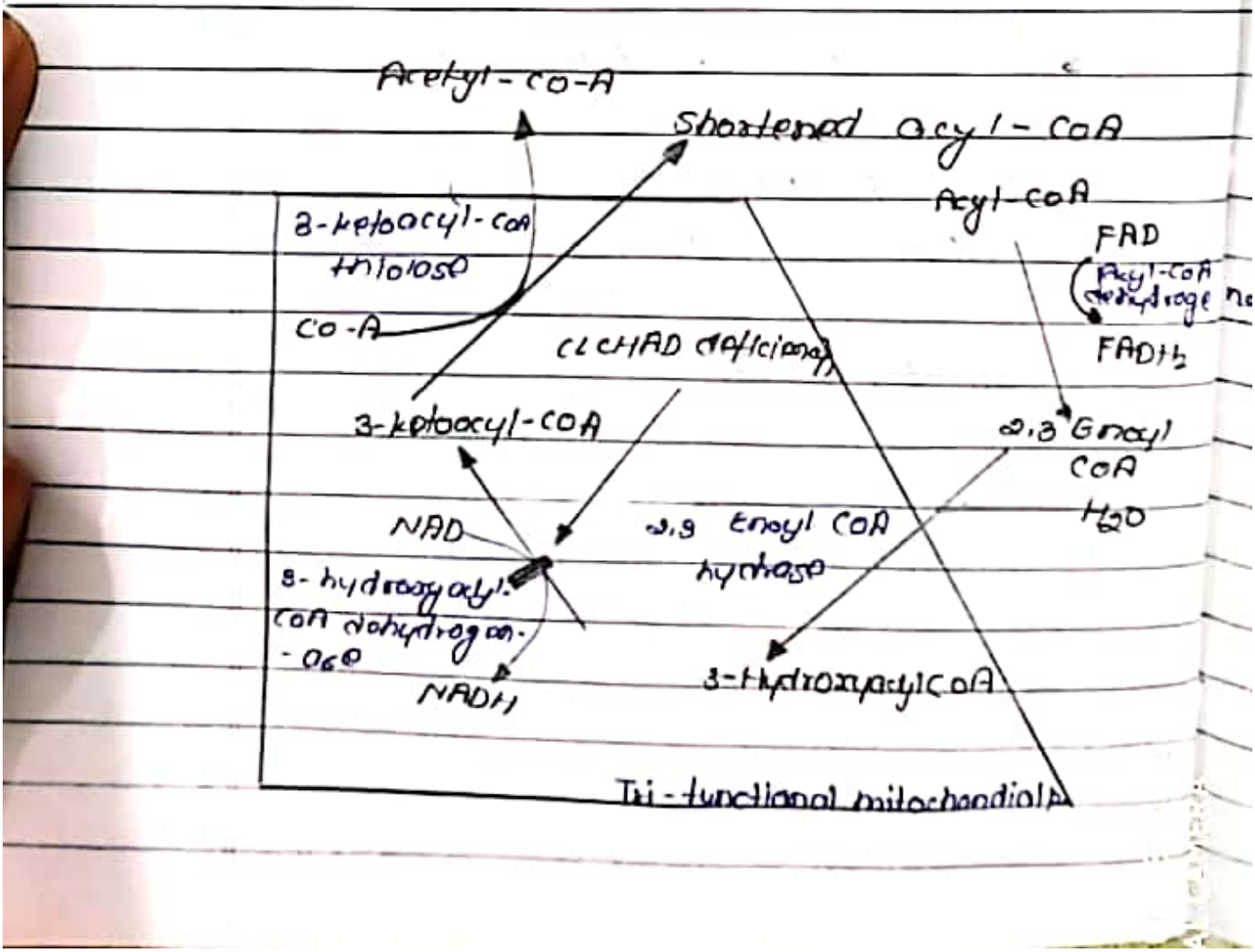
Question :- Write notes on Beta oxidation of fatty Acid ?

Answer :- **Beta Oxidation :-**



Q schematic demonstrating mitochondrial fatty acid beta-oxidation and effects of long-chain 3-hydroxyacyl-Coenzyme A dehydrogenase deficiency, LCHAD deficiency

In biochemistry and metabolism, beta-oxidation is the catabolic process by which fatty acid molecules are broken down in the cytosol in prokaryotes and in the mitochondria in eukaryotes to generate acetyl-CoA, which enters the citric acid cycle, and NADH and $FADH_2$, which are co-enzymes used in the electron transport chain. It is named as such because the beta carbon of the fatty acid undergoes oxidation to a carbonyl group. Beta-oxidation is primarily facilitated by the mitochondrial trifunctional protein, an enzyme complex associated with the

inner mitochondrial membrane although very long chain fatty acids are oxidized in peroxisomes.

## Activation and membrane transport :-

Free fatty acids cannot penetrate cell biological membrane due to their negative charge. Free fatty acids must cross the cell membrane through specific transport proteins. such as the SLC24 family fatty acid trans-port protein. Once in the cytosol the following processes bring fatty acids into the mitochondrial matrix so that beta-oxidation can take place.

(1.) long-chain-fatty-acid -

CoA - ligase catalyzes the reaction between a fatty acid with ATP to give a fatty acyl adenylate, plus inorganic pyrophosphate, which then reacts with free coenzyme A fatty acyl - CoA ester and AMP.

② If the fatty acyl- CoA has a long chain, then the carnitine shuttle must be utilized:

1. Acyl - CoA is transferred to the hydroxyl group of carnitine by carnitine palmitoyltransferase I, located on the cytosolic faces of the outer and inner mitochondrial membranes.

2. Acyl - carnitine is shuttled inside by a carnitine - acylcarnitine translocase, as a carnitine is shuttled outside.

## Odd-numbered saturated fatty acids :-

In general, fatty acids with an odd number of carbons are found in the lipids of plants and some marine organisms. Many ruminant animals form a large amount of 3-carbon propionate during the fermentation of carbohydrates in the rumen. Long-chain fatty acids with an odd no. of carbon atoms are found particularly ruminant fat and milk.

Chains with an odd number of carbon are oxidized in the same manner as even numbered chains, but the final products are propionyl-CoA and Acetyl CoA.

## Clinical significance :-

There are at least 25 enzymes and specific transport proteins in the β - oxidation pathway. Of these, 18 have been associated with human disease or inborn errors of metabolism.

## See also :-

- Fatty acid metabolism
- Fatty acid metabolism disorder
- lipolysis
- Krebs cycle
- Omega oxidation
- Alpha oxidation