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**Assignment**

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

**Answer**

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 FADH2, 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. The stages of Beta oxidation are:

* Activation of Fatty acid
* Transportation of the fatty acid
* Oxidation/Degradation of fatty acids

1. **Activation of Fatty acid**: Once the fatty acids make their way into the cytoplasm of target cells, the fatty acids are activated via a two-step process into acyl CoA molecules. The first step of this process transfers an adenine monophosphate component from ATP onto the fatty acid, thereby releasing a pyrophosphate and forming acyl-AMP. The pyrophosphate is then hydrolysed by pyrophosphatase into two orthophosphates; this drives the activation reaction forward. In the second step, the acyl-AMP reacts with a coenzyme A molecule to form acyl-CoA and release the AMP. Once the fatty acid is activated, it must now be transported into the matrix of the mitochondria. To do this, the acyl-CoA reacts with carnitine to form acyl carnitine. This molecule then moves across the inner mitochondrial membrane via a transporter protein called translocase. Once inside the matrix, the acyl-carnitine is transformed back into acyl-CoA and the carinitine is shuttled back into the cytoplasm via the translocase transporter.
2. **Transportation of the Fatty acid**: Transport of fatty acyl CoA into mitochondria is transported through the garniture shuttle system.
3. **Oxidation/Degradation**: Oxidation/degradation of fatty acids. Degradation to 2-carbon fragments (as acetyl CoA) in the mitochondrial matrix(β-oxidation). Forming fatty acyl CoA and in the case of eukaryotic cells, enter the mitochondria, where beta oxidation occurs.

