

## $\omega$ -oxidation of fatty acids

It involves hydroxylation followed by oxidation of  $\omega$ -carbon present as methyl group at the opposite end of carboxylic end of fatty acids. This is a minor pathway for fatty acid degradation. It takes place when  $\beta$ -oxidation is defective because of mutation or carnitine deficiency.

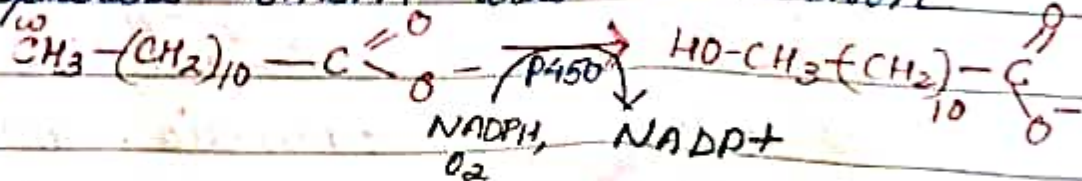
Omega oxidation of fatty acids occurs in liver and kidney of smooth endoplasmic reticulum. This process includes the following steps.

1. Hydroxylation of fatty acid
2. Oxidation of fatty alcohol
3. Oxidation of fatty aldehyde. After these steps the final product of this process enters into mitochondrial matrix and undergoes  $\beta$ -oxidation by the normal route.

### Step 1. HYDROXYLATION

The mixed function-oxidase introduces a HO-group onto the  $\omega$ -carbon of fatty acids. The oxygen for HO-group comes from molecular  $O_2$ .

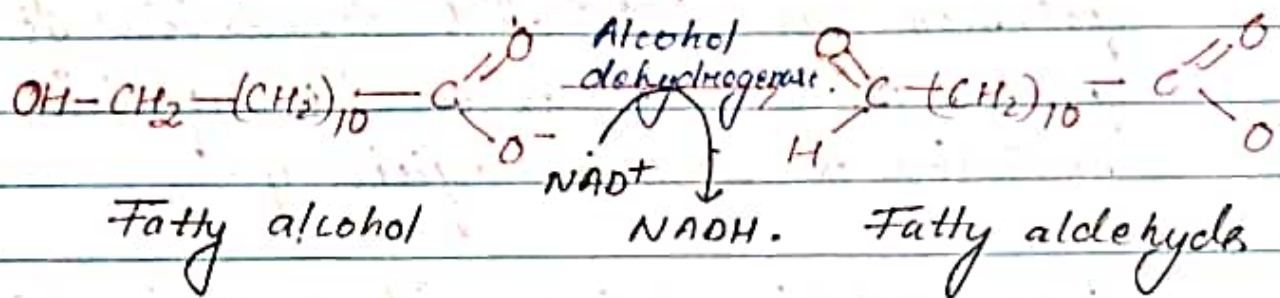
The cytochrome P450 is responsible for this alkane hydroxylation to produce fatty alcohol. During the process NADPH acts as electron donor.



### Step 2. OXIDATION

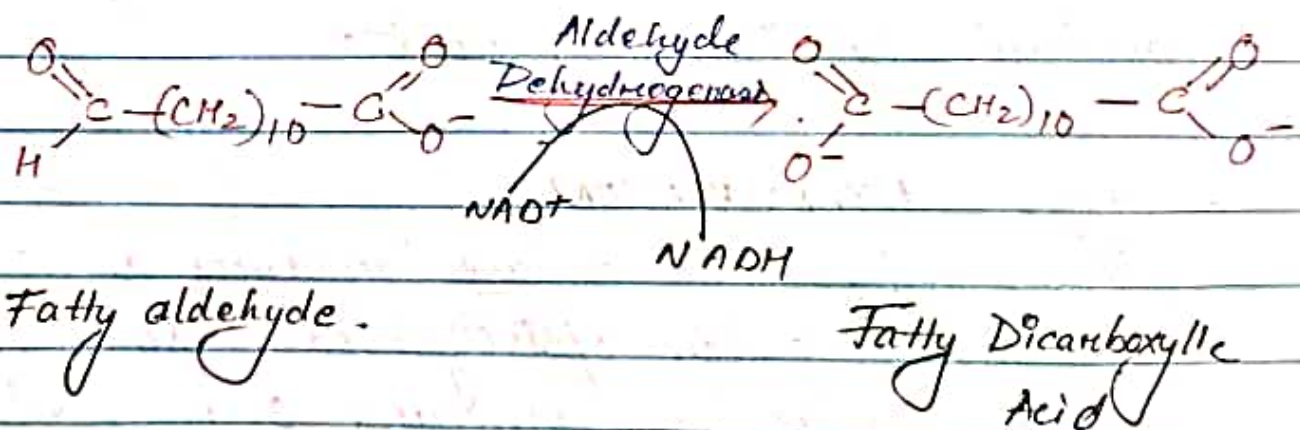
Then the OH group of the fatty alcohol is oxidized

to aldehyde group and produces fatty aldehyde. This reaction is catalyzed by alcohol dehydrogenase. During this step a molecule of  $\text{NAD}^+$  is reduced to  $\text{NADH}$ .



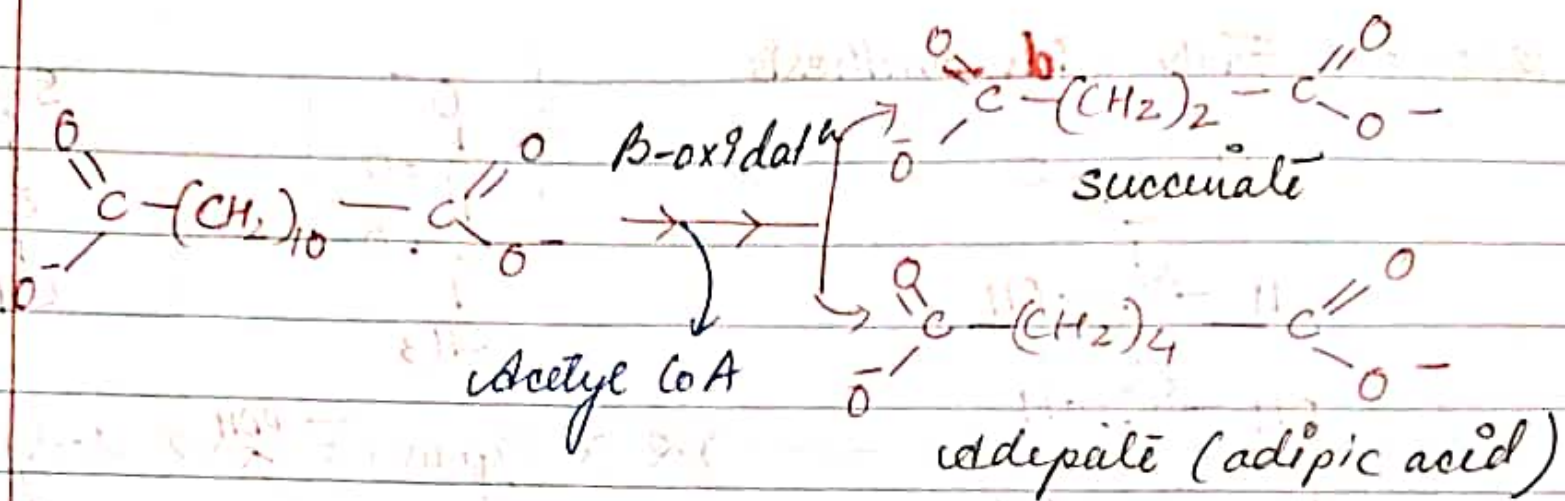
### Step 3: OXIDATION

The aldehyde group is oxidized to carboxylic group by aldehyde dehydrogenase. It produces a fatty acid with carboxylic group at each end. During this reaction another  $\text{NAD}^+$  is reduced into  $\text{NADH}$ .



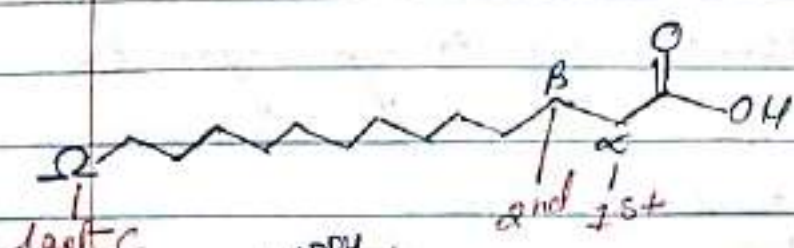
### Step 4: $\beta$ -OXIDATION

The other end of fatty acid can be attached to CoA and the molecule can enter into mitochondria. Inside the mitochondria it undergoes sequence of  $\beta$ -oxidation to produce succinate and adipate.



The succinate enters into citric acid cycle (TCA cycle) and adipate enters into its own metabolic pathway to produce succinyl CoA and acetyl CoA.

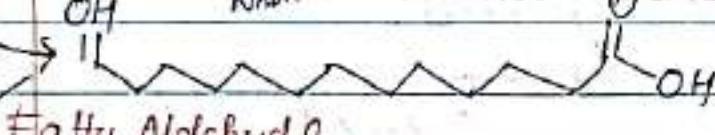
Omega oxidation — liver & kidney (SER)  
 — medium chain fatty a (C6-C12)



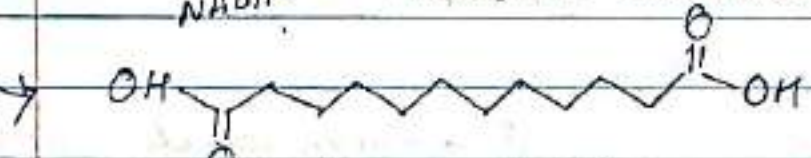
NADPH → NADP<sup>+</sup> HYDROXYLATION [Mixed-function oxidation] [P450]



Fatty Alcohol → Fatty Aldehyde  
 NAD → NADH  
 ALCOHOL OXIDATION  
 Alcohol dehydrogenase

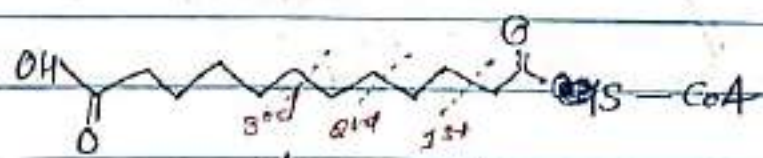


Fatty Aldehyde → Fatty Dicarboxylic Acid  
 NAD → NADH  
 ALDEHYDE OXIDATION  
 Aldehyde dehydrogenase

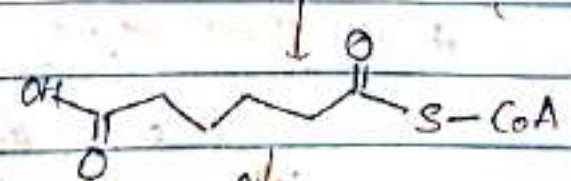


Fatty Dicarboxylic Acid

Fatty Acyl CoA-Synthetase  
 (adds CoA to ω end)

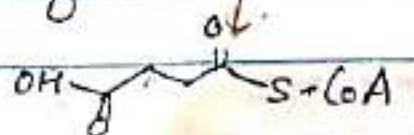


β-oxidation



Adipyl-CoA → Adipate  
 Catabolic Pathway

β-oxidation



Succinyl CoA → TCA