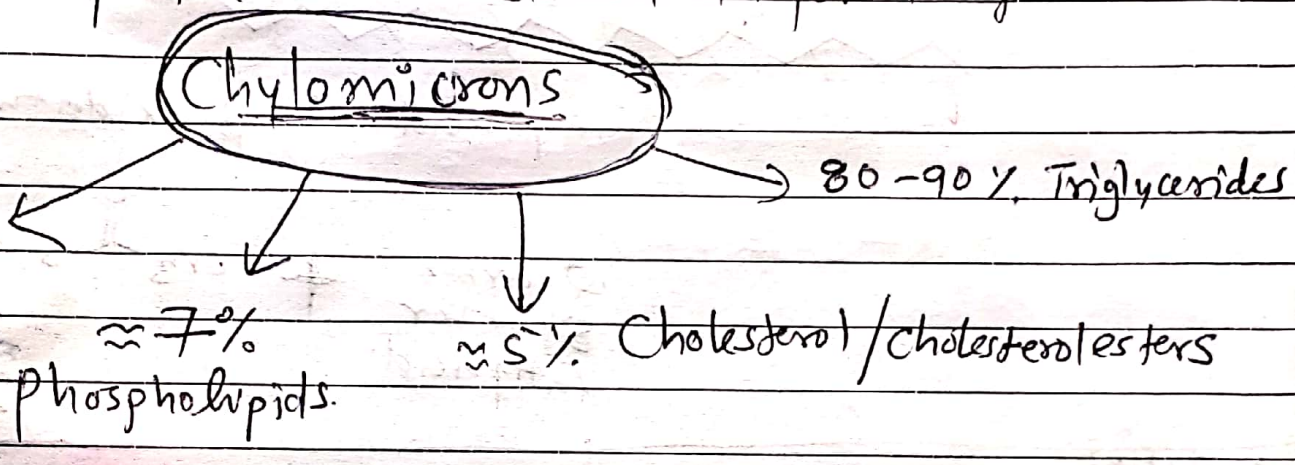
Lipid Metabolism

In our body lipid molecules such as triglycerides, Cholesterol, Cholesteroylesters & various phospholipids - absorbed and transported in the blood in form of



Chylomicron → outer layer is composed of apolipoprotein (B-48)

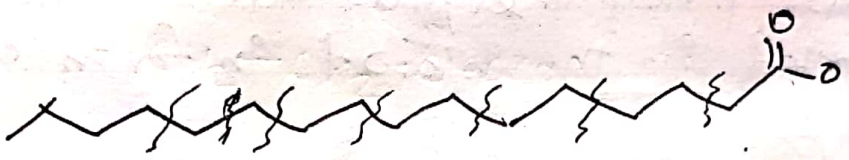
↳ Inner core is full of lipid material & Cholesterol.

Metabolism of fat :- mainly oxidized by β-oxidation process in which the β-carbon of the fatty acid in first reaction oxidized and removal of the 2 carbon fragment from the intact fatty acid. In each β-oxidation cycle the fatty acid becomes 2 carbon shorter.

Teacher's Signature :

Major pathway of

β-Oxidation: Process in which oxidation of fatty acid occurs at β-carbon atom. and removal of the 2 carbon fragment in form of acetyl Co-A.



fatty acid ↓ β-oxidation

2 Carbon shorter fatty acid + $CH_3-C(=O)-SCoA$

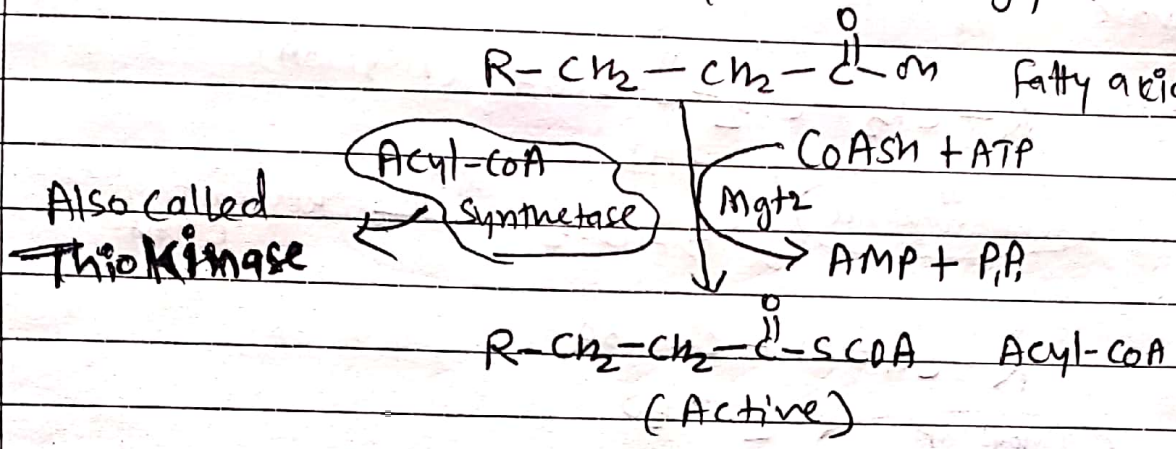
β-oxidation

Location: Mitochondria matrix of liver & other cells

Before starting fatty acid β oxidation, there are three steps involved.

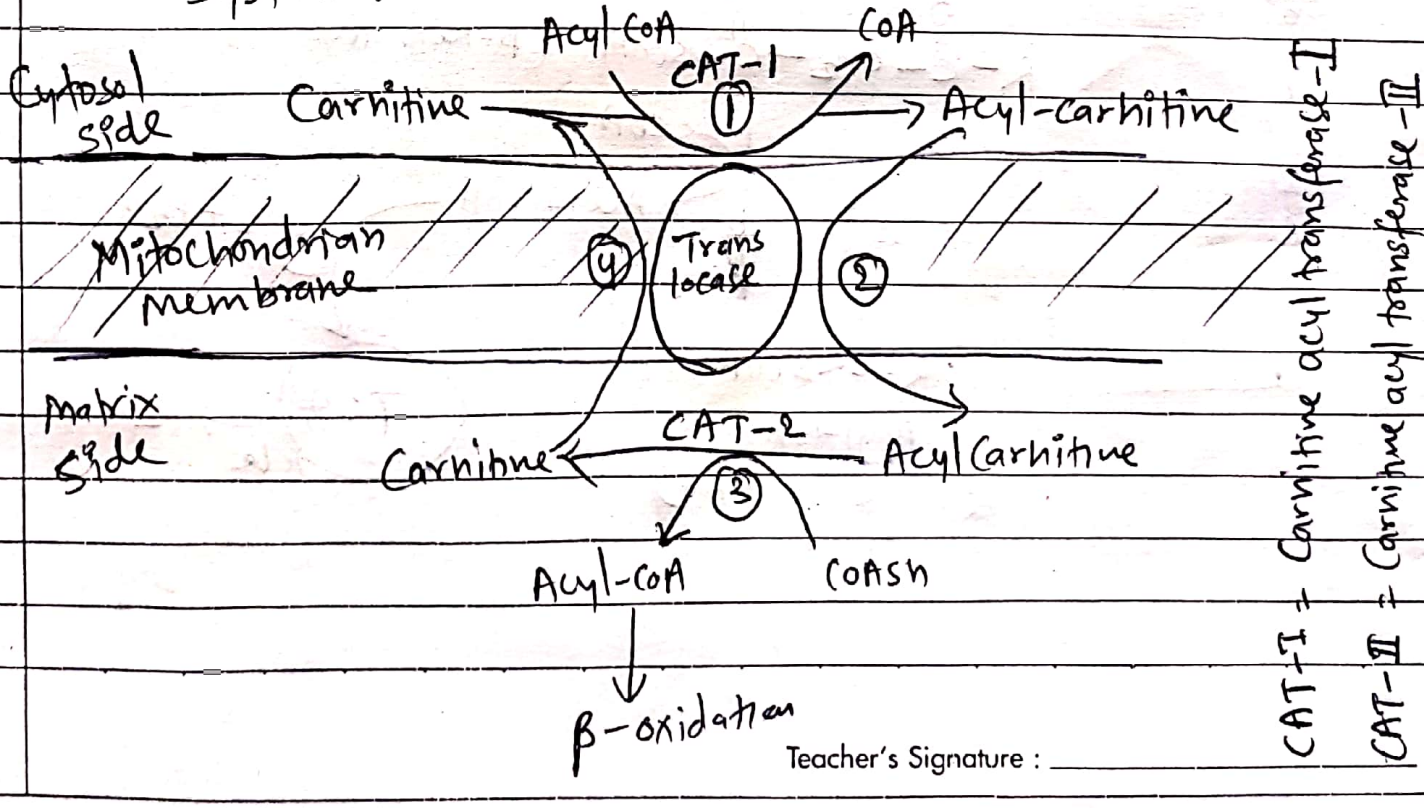
1. Activation of fatty acid to acyl-CoA
2. Transfer of acyl-CoA in to mitochondria by Carnitine transport system
3. Then reaction of β-oxidation in mitochondria

① Activation of fatty acid :- This reaction or activation step happened in cytosol which require energy (ATP)



② Transportation of acyl-CoA to mitochondria :-

This is happened through the action of Carnitine (β-hydroxy-γ-trimethyl ammonium butyrate) System.



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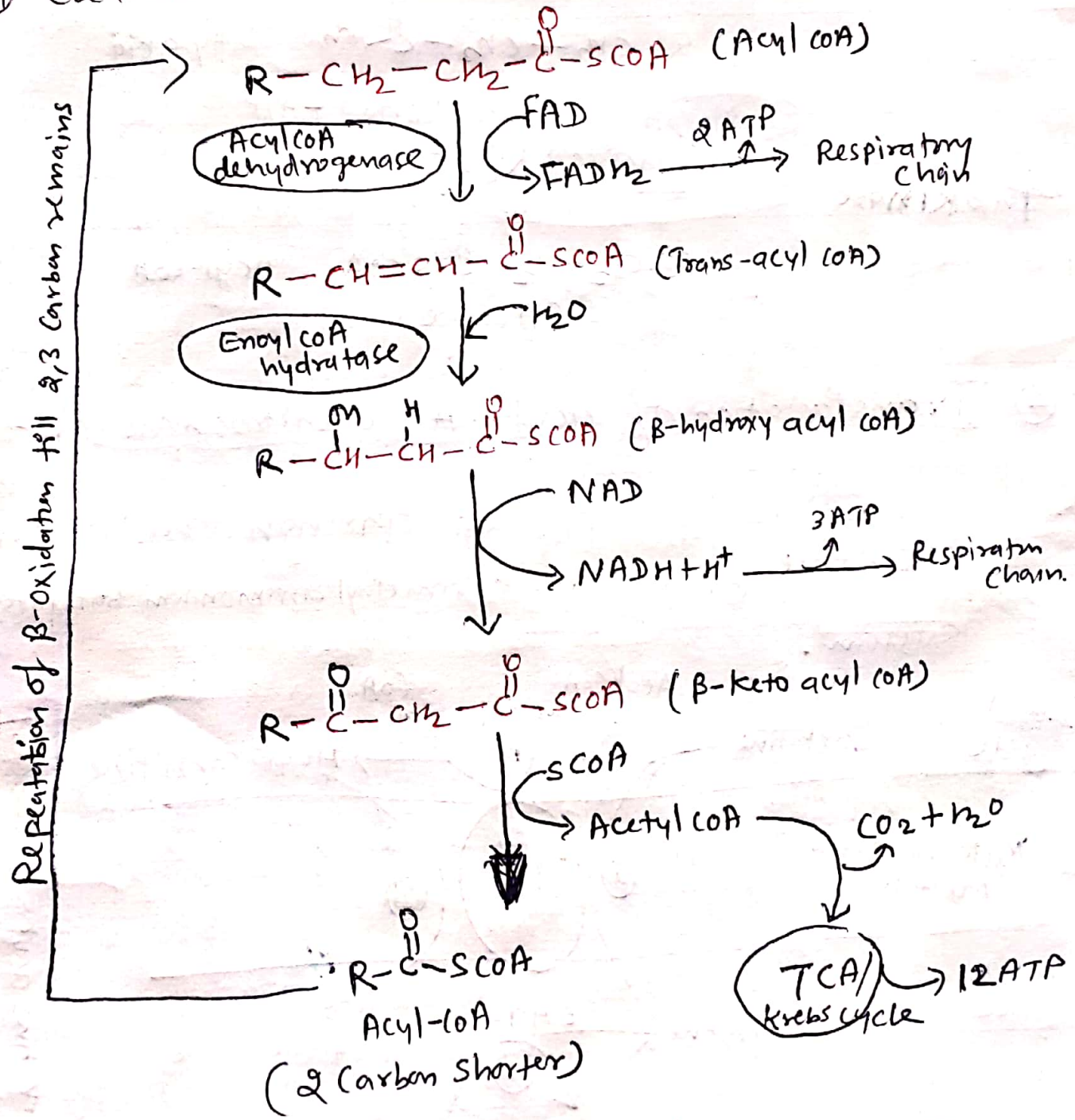
(3) β-oxidation of acyl-CoA :- Mainly four reactions involved in β-oxidation process.

(1) Oxidation by FAD
(2) Hydration
(3) Oxidation by NAD
(4) Cleavase



Bio energetics of β-oxidation :=>

for example, palmitic Acid, it is 16 Carbon Chain fatty acid.

So for complete β oxidation of palmitic acid generate ↓

(1) 8 Molecule of acetyl CoA (enter in kreb's cycle)
(2) 7 Molecule of $FADH_2$
(3) 7 Mol. of $NADH+H^+$

(1) 8 X 12 ATP = 96 ATP
(2) 7 X 2 ATP = 14 ATP
(3) 7 X 3 ATP = 21 ATP

131 ATP

→ Total gain in complete β oxidation of one mol. of palmitic Acid. is 131 ATP

→ 2 ATP utilized / loss during activation of palmitic Acid.

→ So one Mol. of palmitic Acid = 129 ATP through β-oxidation

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Regulation of β-oxidation :=>

Enzymatic regulation

↓

Carnitine acyltransferase-I (CAT-1)

↓

It Catalyze rate limiting step in β-oxidation i.e. formation of Acyl Carnitine

CAT-I is allosterically inhibited by malonyl-CoA

Hormonal regulation

Well fed state

↓

Insulin will be ↑

↓

So ↑ level of malonyl CoA (In TCA)

↓

So β-oxidation will be ↓

Starvation

↓

↑ level of Glucagon

↓

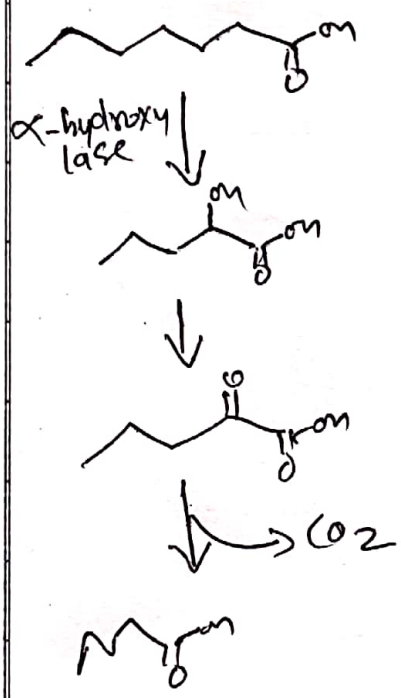
↓ level of Malonyl CoA

↓

↑ in β oxidation due to ↑ activity of CAT-I

Minor pathway for catabolism of fatty acids

α-oxidation (alfa)



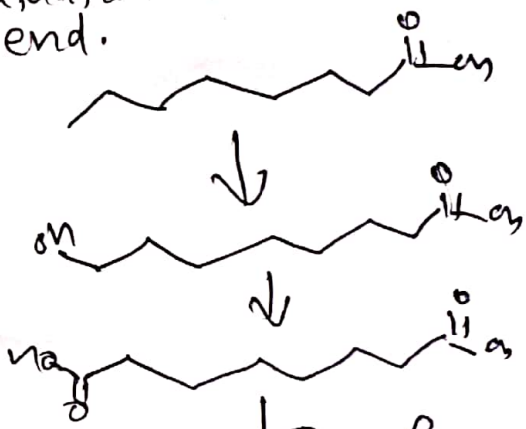
Removal of one carbon at a time in the form of CO_2

→ Mainly decarboxylase activity

→ This process use to convert even number Fattyacid to odd no. fattyacid in brain cells

ω-oxidation (omega)

Oxidation start at last end.



Then β oxidation start from both end.

→ Mainly required/happen when dicarboxylic fattyacid require in body such as pimelic acid.

a precursor for biochemical synthesis of biotin