Topic: oxidation of fats

Class: B.Sc Part –III (Hons.)

Paper- V

Group – A

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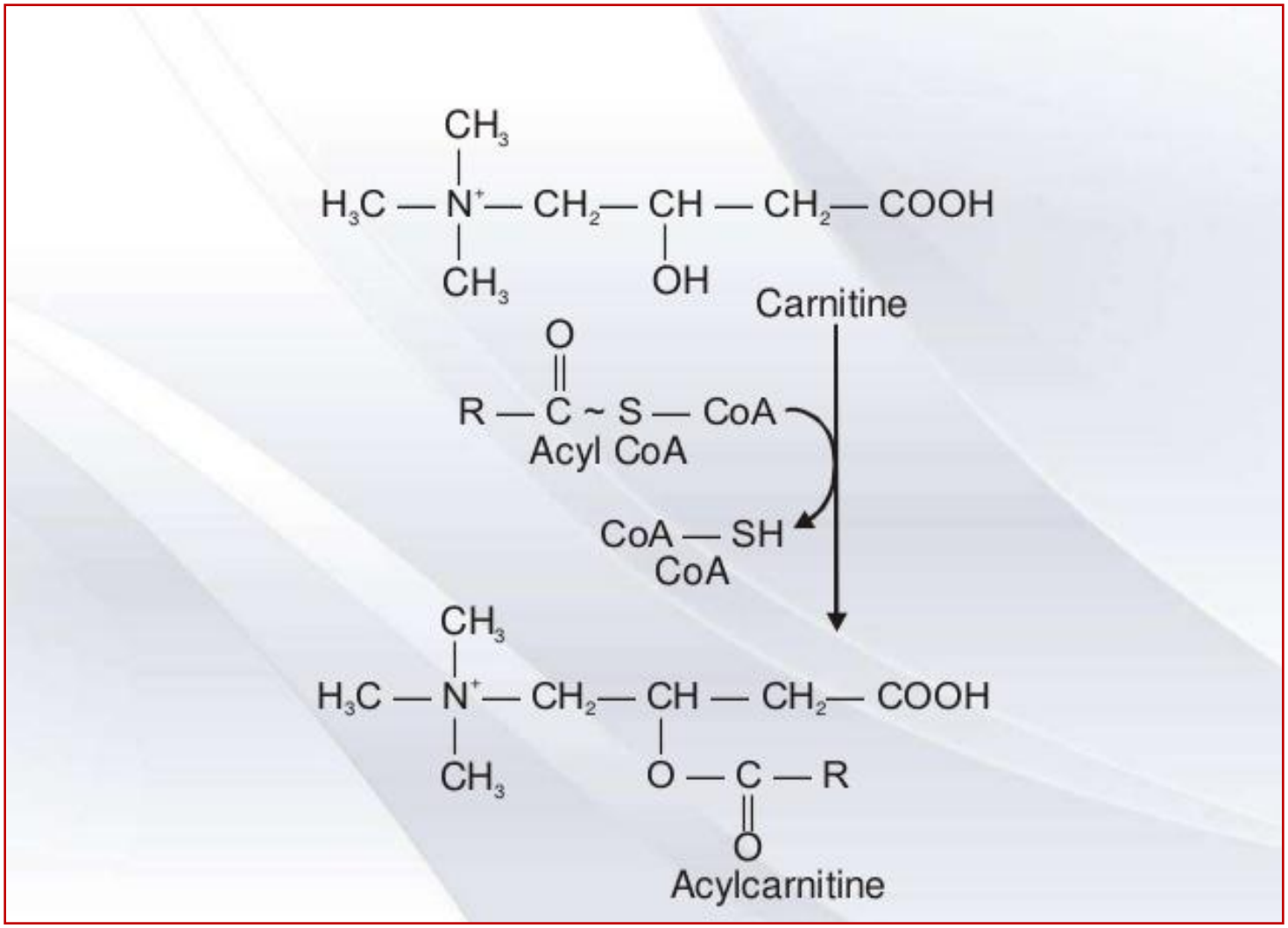
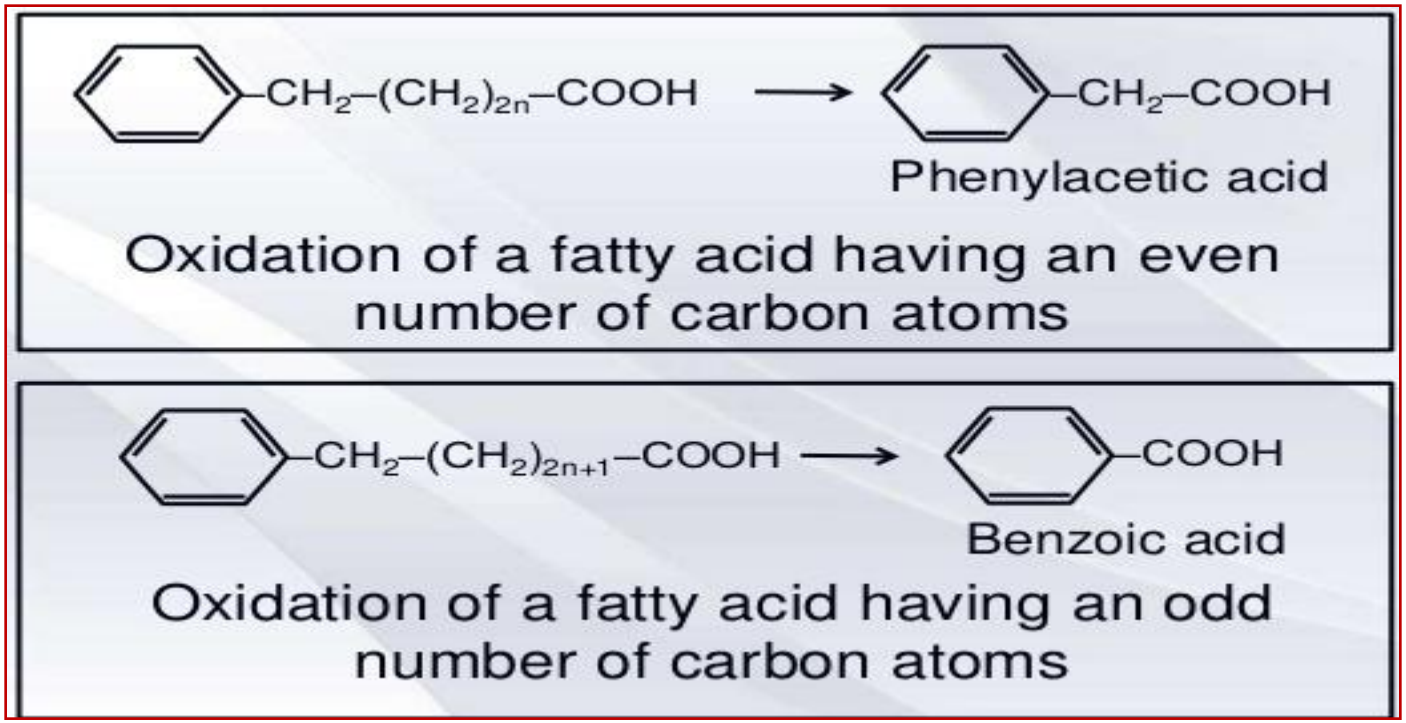

CH3
H3C — N+ — CH2 — CH — CH2 — COOH
CH3
OH
Carnitine
O
R — C ~ S — CoA
Acyl CoA
CoA — SH
CoA
CH3
H3C — N+ — CH2 — CH — CH2 — COOH
CH3
O — C — R
O
Acylcarnitine

- On the outer surface of inner mitochondrial membrane, carnitine reacts with acyl CoA
- Acyl group is transferred to carnitine, forming acylcarnitine
- This reaction is catalysed by carnitine- palmitoyl transferase I
- Acylcarnitine moves to the inner surface of the membrane
- Acylcarnitine reacts with the CoA present in the matrix
- The acyl group is transferred to CoA
- This reaction is catalysed by carnitine- palmitoyl transferase II
- Free carnitine moves back to the outer surface of the membrane
- Carnitine and acylcarnitine are transported across the membrane by an enzyme
- The enzyme is carnitine-acylcarnitine translocase
- It is present in the inner mitochondrial membrane

- This major pathway for oxidation of fatty acids was elucidated by Knoop
- He labeled the methyl end of fatty acids with a phenyl group and fed them to animals
- The end products of oxidation were recovered from urine and were identified
- It was seen that when fatty acids having an even number of carbon atoms were fed, phenylacetic acid was recovered from urine
- When fatty acids having an odd number of carbon atoms were fed, benzoic acid was recovered from urine
- Knoop's experiments Phenylacetic acid Benzoic acid –CH2–(CH2)2n–COOH –CH2–COOH –CH2–(CH2)2n+1–COOH –COOH Oxidation of a fatty acid having an even number of carbon atoms Oxidation of a fatty acid having an odd number of carbon atoms

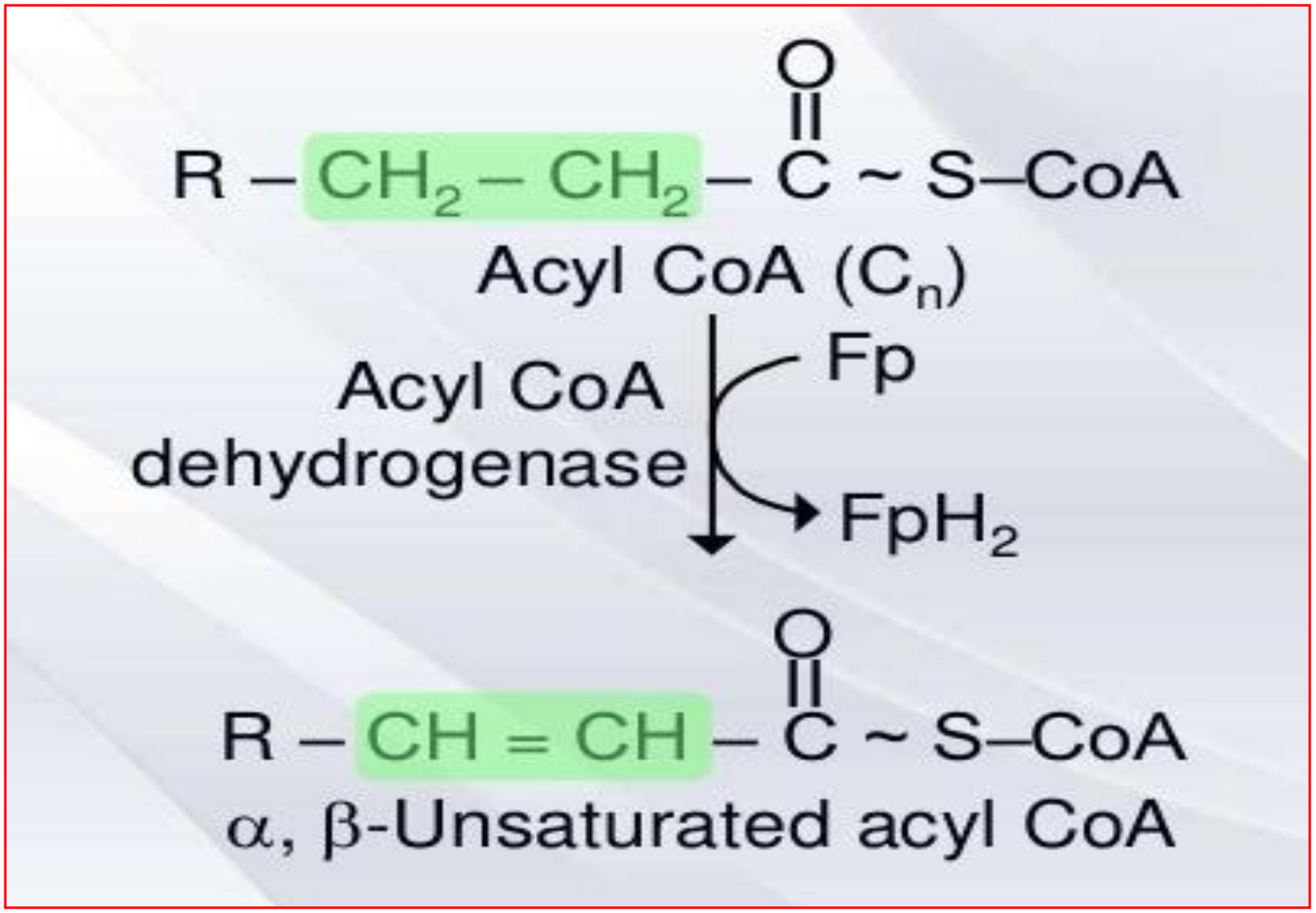
Knoop's experiments



- Knoop concluded that oxidation of fatty acids occurs at the carboxyl end
- It involves removal of the last two carbon atoms from the carboxyl end in one cycle
- This was termed as b-oxidation as the b- carbon (C3) is oxidized in each cycle
- If the fatty acids has an even number of carbon atoms:
- The last two carbon atoms on the methyl end remain tagged with the label
- The final product is phenylacetic acid
- If the fatty acids has an odd number of carbon atoms:
- The last carbon atom on the methyl end remains tagged with the label
- The final product is benzoic acid

Reactions of beta-oxidation pathway

- The first reaction that acyl CoA under- goes is dehydrogenation
- It is catalysed by acyl CoA dehydro- genase, a flavoprotein
- FAD, which is a prosthetic group of the enzyme, accepts the hydrogen atoms
- One hydrogen atom is removed from a- carbon and one from b-carbon of acyl CoA
- A double bond is formed between a- and b-carbon atoms
- The product is alpha, beta-unsaturated acyl CoA


R – CH2 – CH2 – C ~ S–CoA
O
Acyl CoA (Cn)
Acyl CoA dehydrogenase
Fp
FpH2
R – CH = CH – C ~ S–CoA
O
α, β-Unsaturated acyl CoA