Lecture on Lipid oxidation

MoU activity between

Dept of Biotechnology Vivekanand College, Kolhapur(Autonomous)

and

Dept of Zoology

RCCS College , Kolhapur

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β-Oxidation of Faaty Acid-

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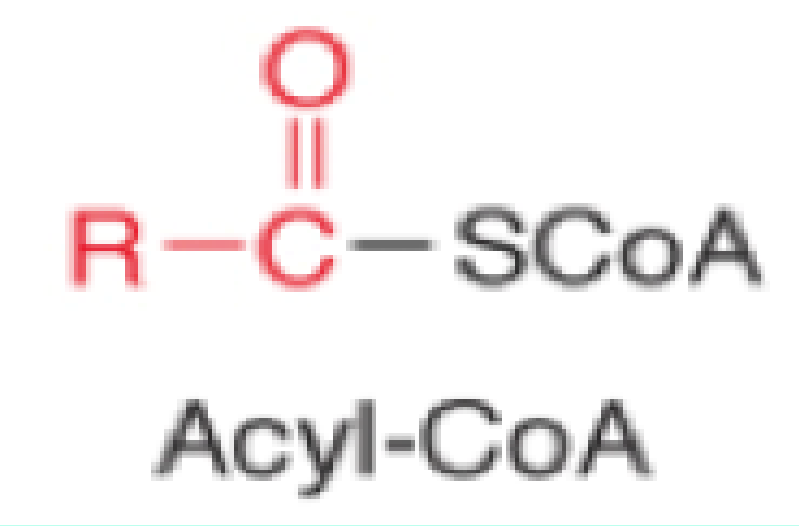
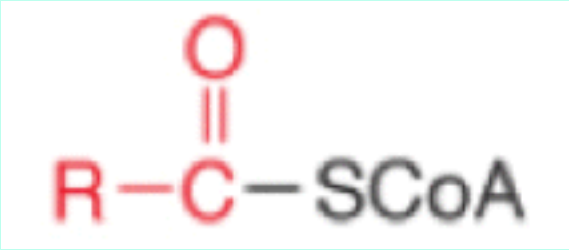
Fatty acid activation

"Fatty acid activation". A reaction that is catalyzed by an enzyme on outer membrane of mitochondria, called "acyl-CoA synthetase".

The FA + ATP + SCoA are used to produce acyl-SCoA +AMP + Pi in presence of Thiolase enzyme.



The difference between acetyl CoA and acyl-CoA.



In “acetyl CoA” the “R” is a methyl group.

In “acyl-CoA” the “R” is any length of $-(CH_2)_n-CH_3$

Lipids can be used to make ATP.

This is accomplished through “ß- oxidation”

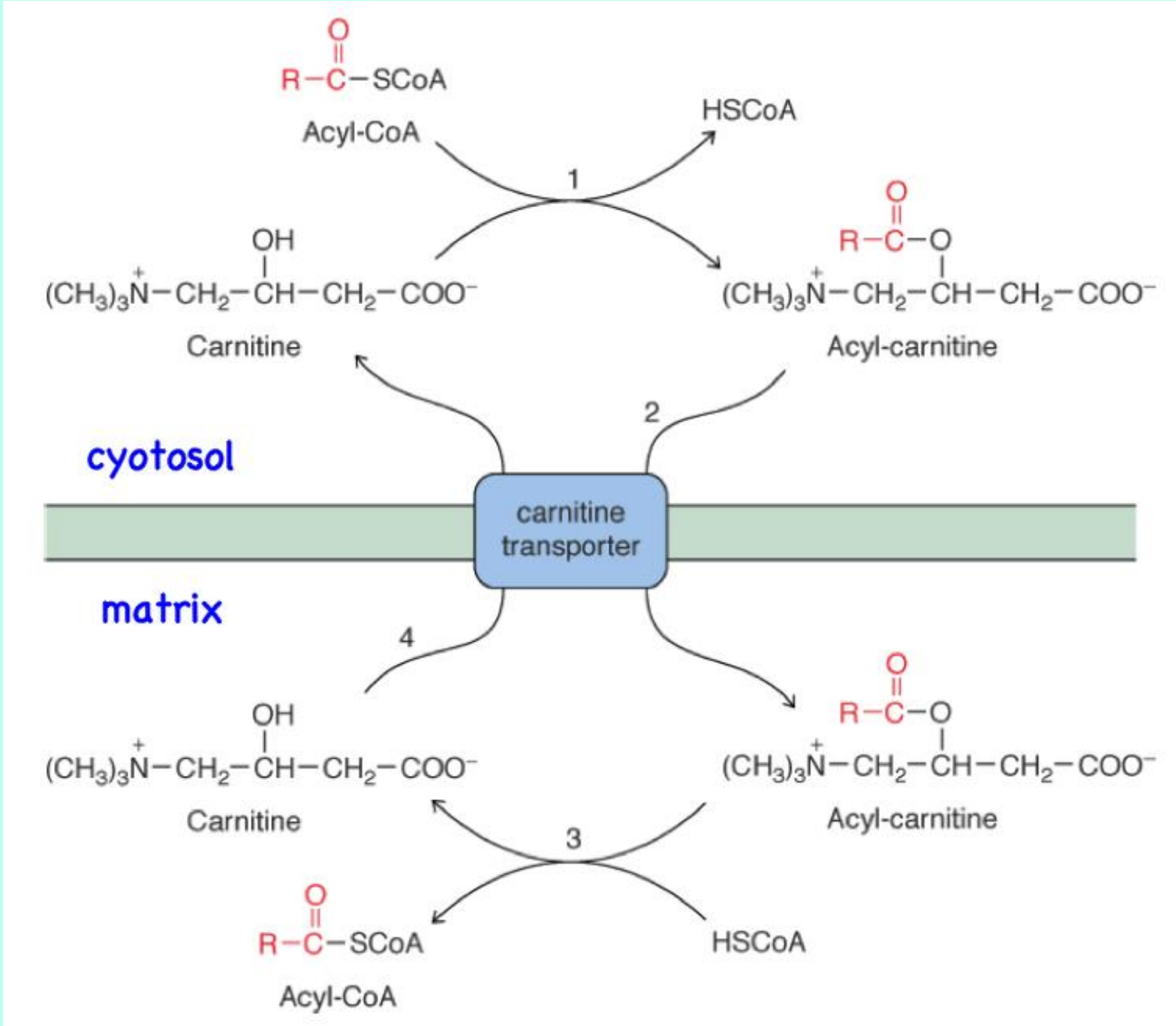
and it occurs in the mitochondrial matrix of

Eukaryotes and Cytosol of Prokaryotes.

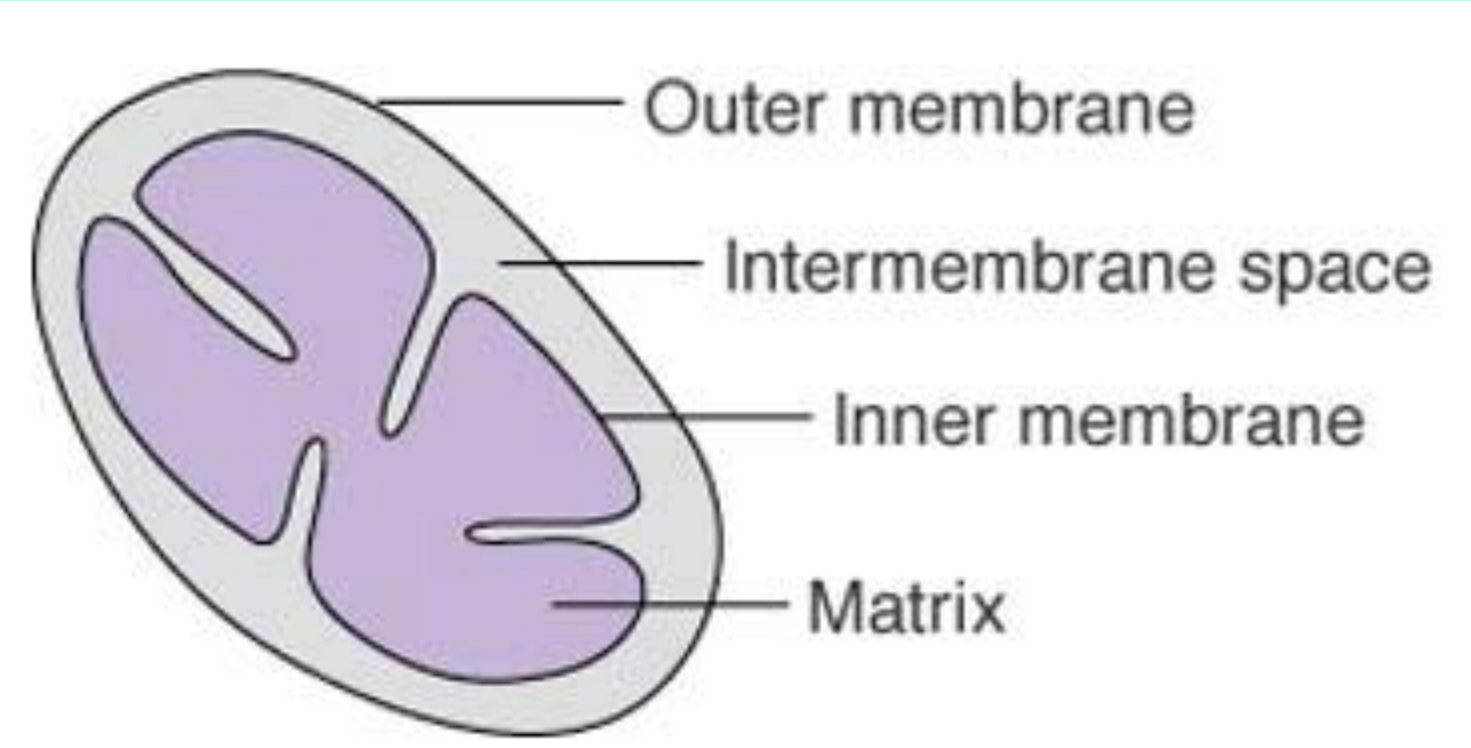
How are lipids moved into the matrix?

Use the “carnitine shuttle”.

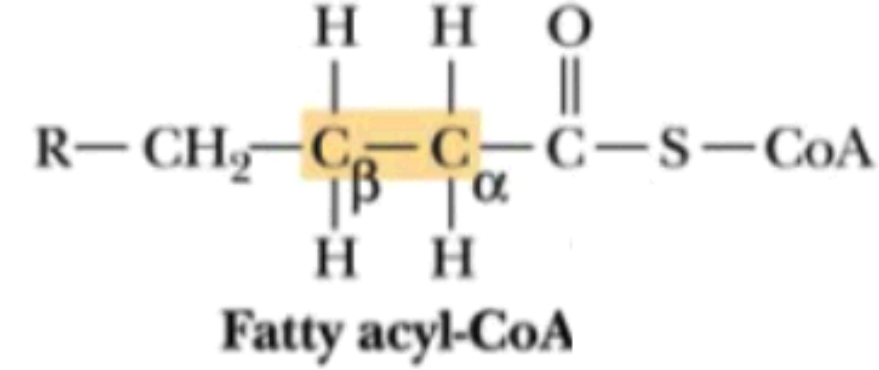
Carnitine shuttle.



mitochondria



The “ß” in “ß-oxidation” refers to the fact that the reaction takes place at the ß-carbon, which is the carbon that is 2, away from the carbonyl group (COO).



Fatty acyl-CoA

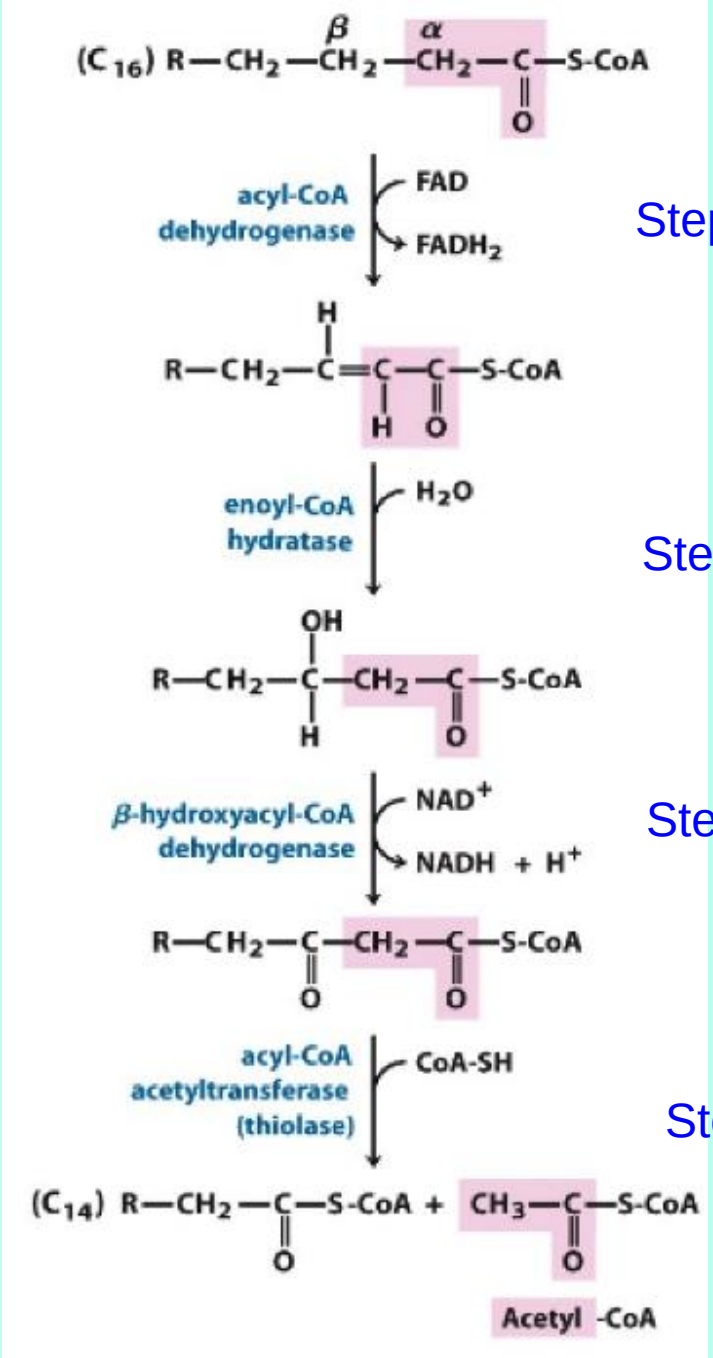
ß- oxidation is a 4-step reaction that is used to break down the fatty acid-CoA, 2 carbons per cycle.

The 4 steps of β-oxidation yield:

An acyl-CoA that is 2 carbons shorter than what was started with,

plus,

a molecule of acetyl-CoA, and some reduced QH_2.



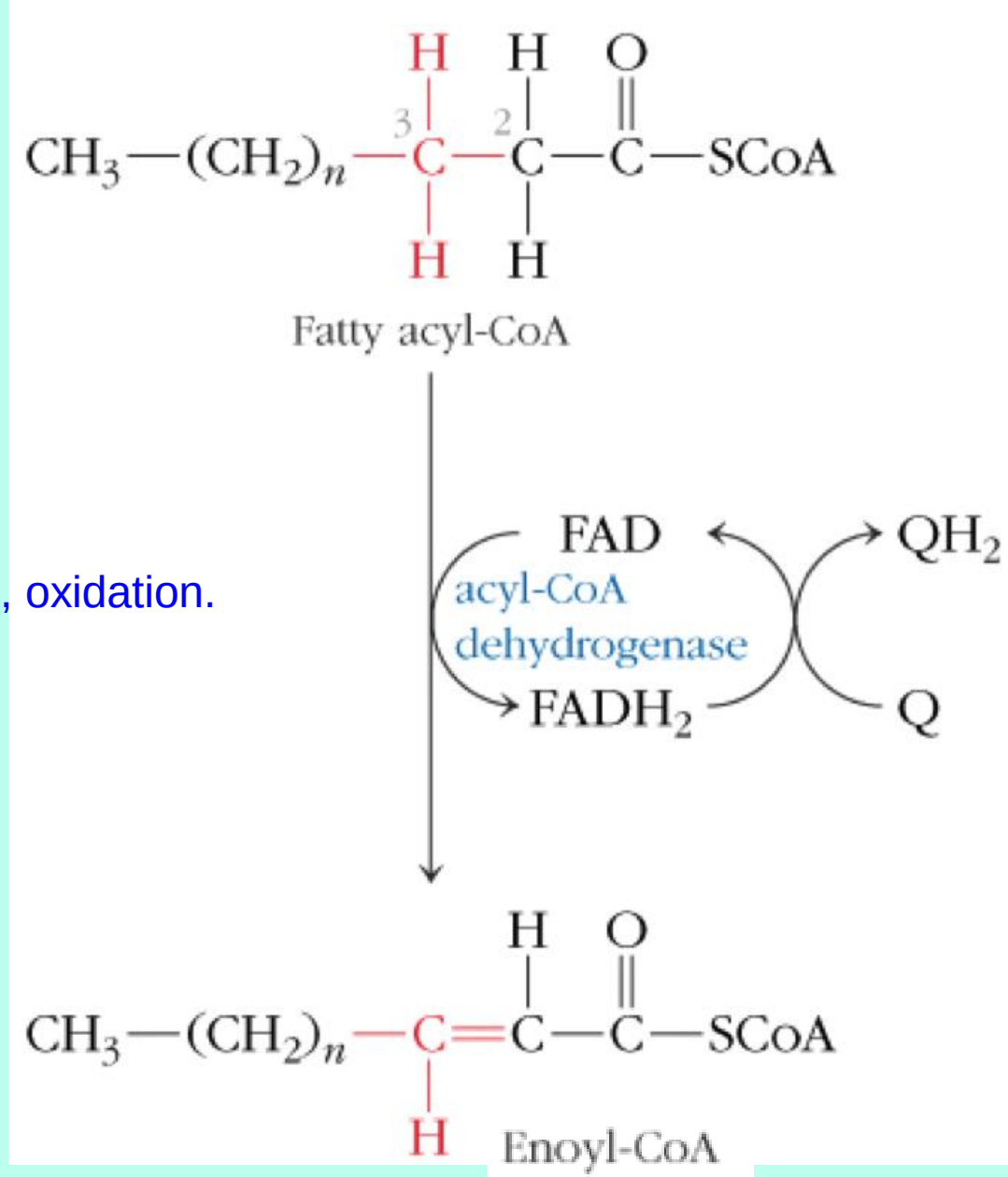
Step 1, oxidation

Step 2, hydration

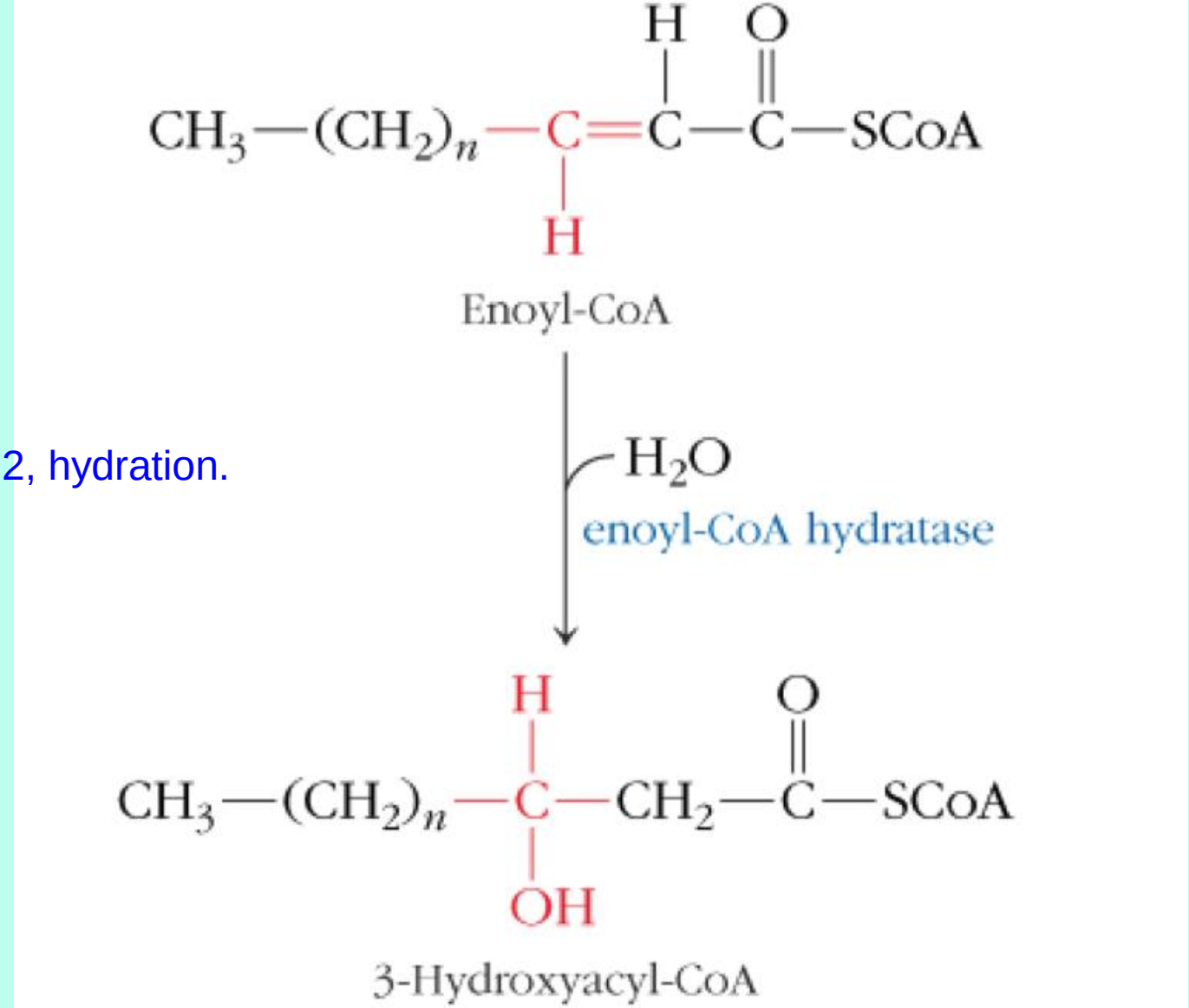
Step 3, oxidation

Step 4, thialysis

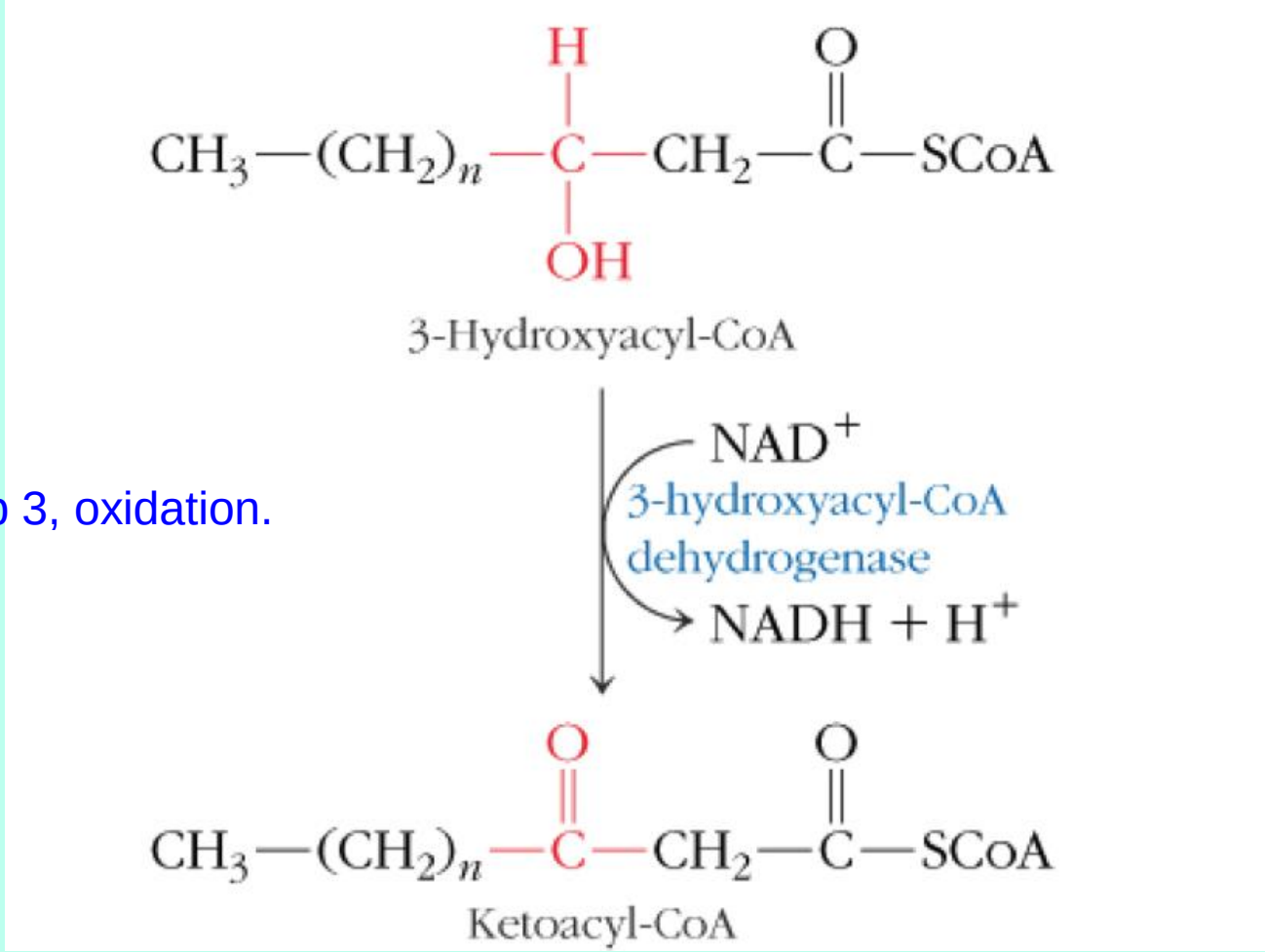
Step 1, oxidation.



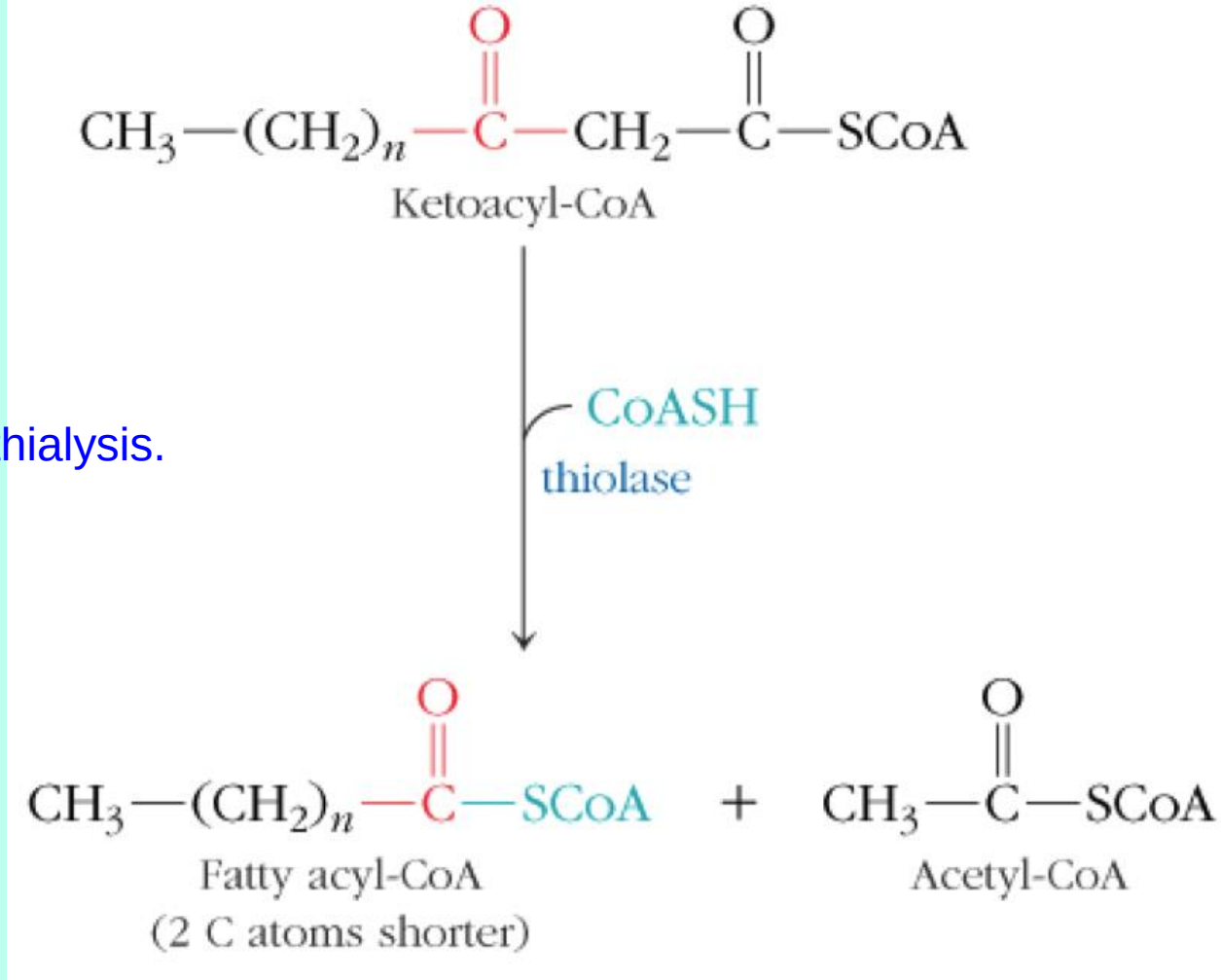
Step 2, hydration.



Step 3, oxidation.



Step 4, thialysis.



β-oxidation yields:

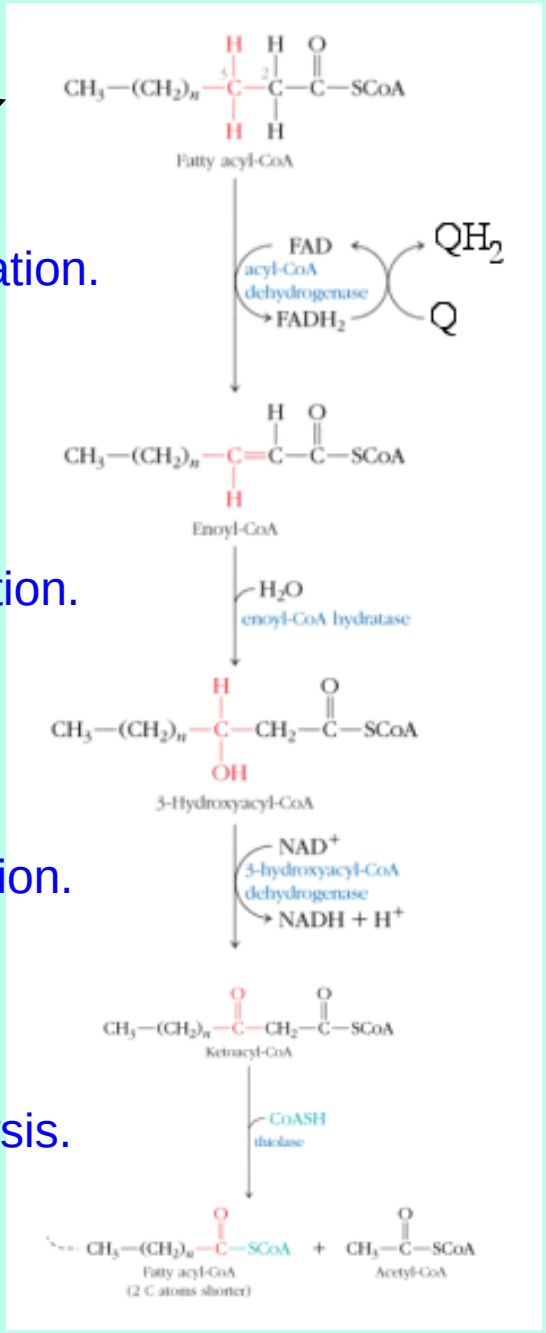
Acyl-CoA that is 2 carbons shorter than what was started with,

plus,

acetyl-CoA, and reduced cofactors QH_2 and $FADH_2$.

QH_2 is used to make ATP by OP.

$FADH_2$ is used to make NADH, which is then used to make ATP by OP.



Energetics of β-oxidation of Palmitic acid(16 C)

8 Acetyl CoA are produced in 7 rounds of oxidation = 1Acetyl CoA in TCA generates 12 ATPs thus for **8*12=96 ATPs.**

1FADH2= 2 ATPs fr 7 rounds 7 FADH2 , for 7FADH2 = **7*2=14 ATPS.**

1NADH+H= ATPs fr 7 rounds 3 NADH+H, for 7NADH+H= **7*3=21 ATPS.**

gain of ATPs= 96+14+21= 131

Out of which 2 ATPs are utilised for activation of fatty acids

Thus net gain / palmitic acid molecule is 131-2= 129 ATPs

THANKS ALL OF YOU