

# Fatty acid oxidation-2

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Fatty acids provide highly efficient energy storage, delivering more energy per gram than carbohydrates like glucose. In tissues with high energy requirement, such as heart, up to 50–70% of energy, in the form of ATP production, comes from fatty acid (FA) beta-oxidation.

During fatty acid  $\beta$ -oxidation long chain acyl-CoA molecules – the main components of FAs – are broken to acetyl-CoA molecules.

## Pathway overview

### Fatty acid transport into mitochondria

Fatty acids are activated for degradation by conjugation with coenzyme A (CoA) in the cytosol. The long-chain fatty-acyl-CoA is then modified by carnitine palmitoyltransferase 1 (CPT1) to acylcarnitine and transported across the inner mitochondrial membrane by carnitine translocase (CAT). CPT2 then converts the long chain acylcarnitine back to long-chain acyl-CoA before beta-oxidation.

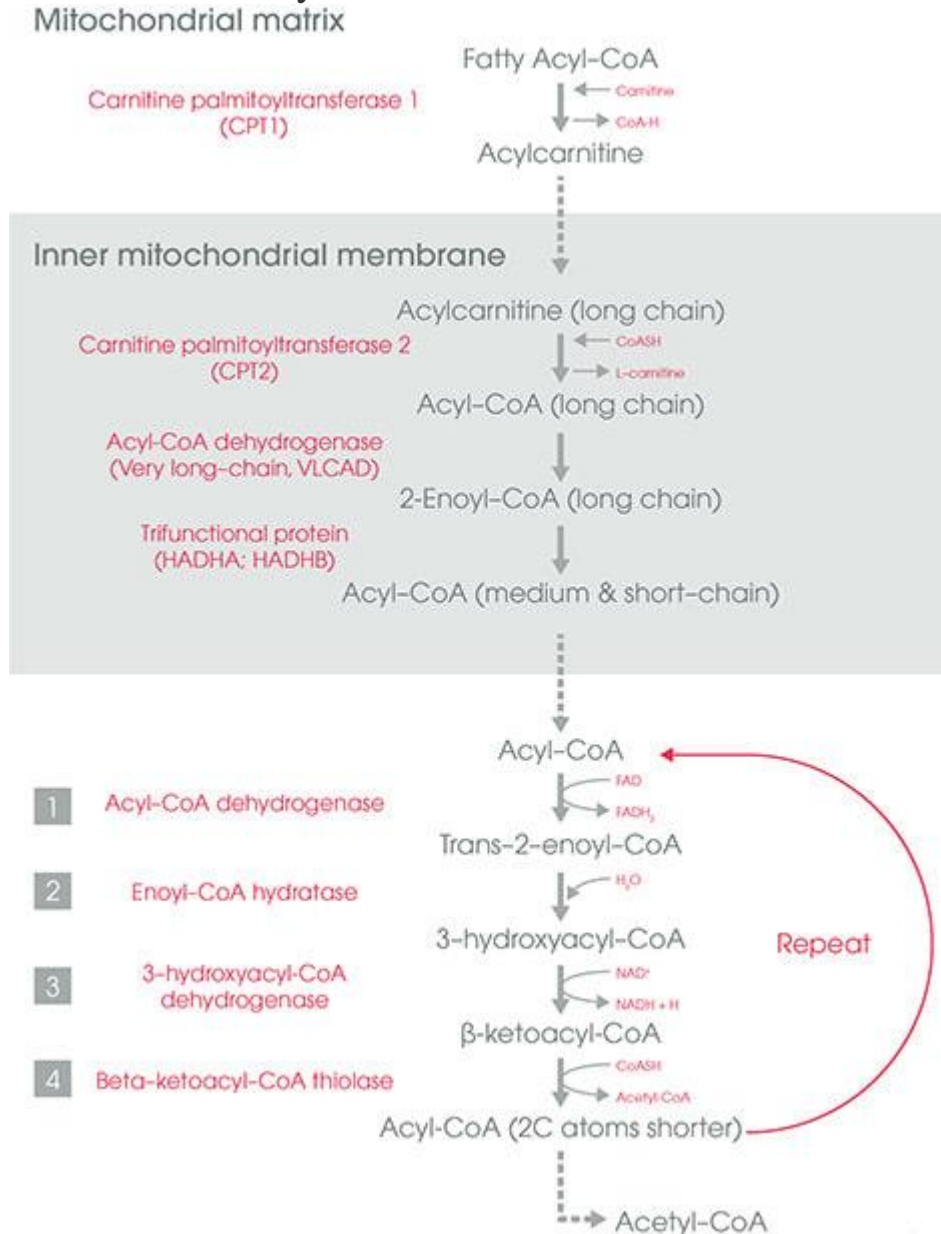
### Beta-oxidation of fatty acid:

Beta-oxidation consists of four steps:

- 1) Dehydrogenation catalyzed by acyl-CoA dehydrogenase, which removes two hydrogens between carbons 2 and 3.
- 2) Hydration catalyzed by enoyl-CoA hydratase, which adds water across the double bond.
- 3) Dehydrogenation catalyzed by 3-hydroxyacyl-CoA dehydrogenase, which generates NADH.

4) Thiolytic cleavage catalyzed beta-ketothiolase, which cleaves the terminal acetyl-CoA group and forms a new acyl-CoA which is two carbons shorter than the previous one.

The shortened acyl-CoA then reenters the beta-oxidation pathway.



*Schematic diagram of fatty acid transport and beta-oxidation in the mitochondria..*

### ATP synthesis

Acetyl-CoA generated by the beta-oxidation pathway enters the mitochondrial TCA cycle, where it is further oxidized to generate NADH and FADH<sub>2</sub>. The NADH and FADH<sub>2</sub> produced by both beta oxidation and the TCA cycle are used by the mitochondrial electron

transport chain to produce ATP. Complete oxidation of one palmitate molecule (fatty acid containing 16 carbons) generates 129 ATP molecules.

THANKYOU