

# Difference Between Fatty Acid Synthesis and Beta Oxidation

[www.differencebetween.com](http://www.differencebetween.com)

## Key Difference – Fatty Acid Synthesis vs Beta Oxidation

A **fatty acid** is a **carboxylic acid** composed of a long **hydrocarbon** chain and a terminal carboxyl group. Fatty acids are major components of fats and oils. Hydrocarbon chain of the fatty acid can be **saturated** (no double bonds between carbon atoms) or **unsaturated** (there are double bonds between carbon atoms). They can also be branched or unbranched. Fatty acids are a type of important dietary energy source of animals. When fatty acids are broken down, the catabolic reaction releases a high amount of energy in the form of **ATP**. Hence, many cells use fatty acids as the energy source to produce energy by **catabolism**. Fatty acid synthesis and fatty acid oxidation (beta oxidation) are equally important. Fatty acid synthesis is the production of fatty acid molecules by combining acetyl **coenzyme A** molecules together by fatty acid synthases enzymes. Beta oxidation is the process of breaking down fatty acids into acetyl-CoA by several enzymes. The key difference between fatty acid synthesis and beta oxidation is that **fatty acid synthesis is an anabolic process while beta oxidation is a catabolic process**.

## What is Fatty Acid Synthesis?

Fatty acid synthesis is the formation of fatty acids from acetyl-CoA and **NADPH**. This is an anabolic process which is catalyzed by an enzyme called fatty acid synthase. Fatty acid synthase is a multienzyme complex. They are found in the **cytoplasm** of the cells in both **prokaryotes and eukaryotes**. The precursor molecule acetyl coenzyme A is derived from the glycolytic pathway. It is made in the mitochondrion by pyruvate dehydrogenase enzyme. Fatty acid biosynthesis needs NADPH as the reductant.

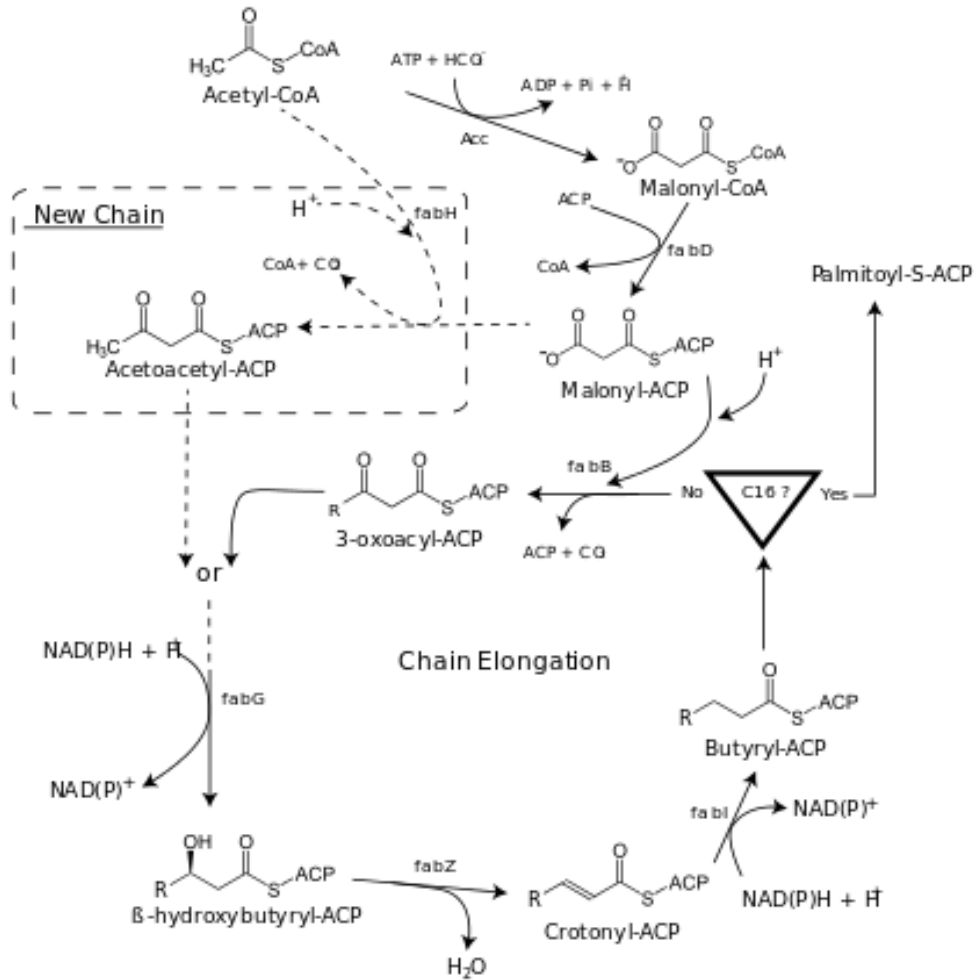


Figure 01: Fatty Acid Biosynthesis

NADPH is produced from oxaloacetate in a two-step reaction. The condensation of two carbon units of acetyl coenzyme A produces long hydrocarbon chains which ultimately produce the fatty acid molecule. The length of the hydrocarbon chain can vary among different types of fatty acids.

## What is Beta Oxidation?

Beta oxidation or fatty acid oxidation is the process of breaking down fatty acid molecules into acetyl-CoA molecules by catabolic reactions. Fatty acids serve as a good source of energy. Therefore, a large amount of energy molecules is released in the form of ATP during the beta oxidation. Fatty acid breakdown occurs in the cytoplasm of prokaryotes and in the mitochondria of eukaryotes. This catabolism is catalyzed by many separate enzymes including mitochondrial trifunctional

proteins. Beta oxidation uses NAD as an electron acceptor during catabolism. The produced acetyl-CoA enters into other metabolic pathways.

## **β-OXIDATION OF FATTY ACIDS**

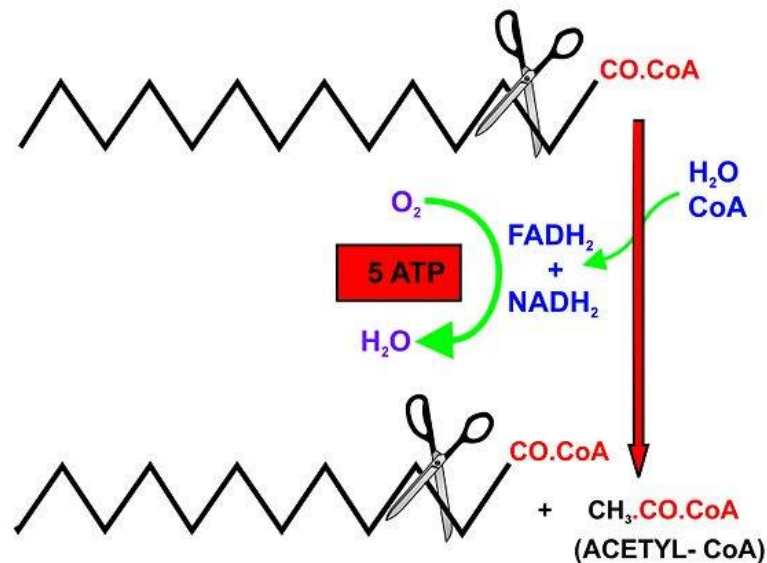


Figure 02: Beta Oxidation

Many tissues oxidize fatty acids to produce energy. However, some tissues do not use fatty acids for their energy requirements. They use glucose as their energy source.

## **What is the difference between Fatty Acid Synthesis and Beta Oxidation?**

### **Fatty Acid Synthesis vs Beta Oxidation**

Fatty Acid Synthesis is the creation of fatty acid molecules from acetyl coenzyme A and NADPH molecules through a series of anabolic reactions by enzymes.

Beta oxidation is the oxidation or breakdown of fatty acids into acetyl coenzyme A and NADH through a series of catabolic reactions by enzymes.

Location	
Fatty Acid Synthesis occurs in the cytoplasm of both prokaryotes and eukaryotes.	Beta Oxidation occurs in the cytoplasm of prokaryotes and in mitochondria of eukaryotes.
Enzymes Involved	
Fatty acid synthesis is catalyzed by fatty acid synthases.	Beta oxidation is catalyzed by many separate enzymes, including mitochondrial trifunctional proteins.
ATP Production	
Fatty acid synthesis does not produce ATP.	Beta oxidation produces high-energy molecule ATP.
Reductant used	
Fatty acid synthesis uses NADPH as the reductant.	Beta oxidation uses NADH and FADH as the reductants.
Initiation of the Process	
Fatty acid synthesis initiates with ACP (acyl group carrier).	Beta oxidation initiates with coenzyme A.

## Summary – Fatty Acid Synthesis vs Beta Oxidation

Fatty acids are a good source of energy. Hence, they are synthesized and oxidized in living organisms. Fatty acid synthesis is the creation of fatty acids from the precursor molecule acetyl coenzyme A. It is an anabolic process that occurs in the cytoplasm of cells. It is catalyzed by a multienzyme complex called fatty acid synthase. Beta oxidation or fatty acid breakdown is the opposite of fatty acid synthesis. During beta oxidation, fatty acids are broken down to acetyl coenzyme A. It is a catabolic process and releases a large amount of energy. This is the difference between fatty acid synthesis and beta oxidation.

## References:

1. Pawar, Prajakta, Makvana, and Rudi. "Oxidation of Fatty Acids – via Beta-Oxidation | Biochemistry Notes." PharmaXChange.info. N.p., 14 Oct. 2013. Web. [Available here](#). 29 June 2017.
2. "Fatty acid synthesis." Wikipedia. Wikimedia Foundation, 02 Apr. 2017. Web. [Available here](#). 29 June 2017.

## Image Courtesy:

1. "Fatty acid synthesis (en) 01" By Gustavo.leite – Own work ([CC BY-SA 4.0](#)) via [Commons Wikimedia](#)
2. "Metabolism4" By Cruithne9 – Own work ([CC BY-SA 4.0](#)) via [Commons Wikimedia](#)

## How to Cite this Article?

**APA:** Difference Between Fatty Acid Synthesis and Beta Oxidation. (2017, July 07). Retrieved (date), from <http://www.differencebetween.com/difference-between-fatty-acid-synthesis-and-vs-beta-oxidation/>

**MLA:** " Difference Between Fatty Acid Synthesis and Beta Oxidation." *Difference Between.Com*. 07 July 2017. Web.

**Chicago:** " Difference Between Fatty Acid Synthesis and Beta Oxidation." *Difference Between.Com*. <http://www.differencebetween.com/difference-between-fatty-acid-synthesis-and-vs-beta-oxidation/> (accessed [date]).



Copyright © 2010-2017 Difference Between. All rights reserved.