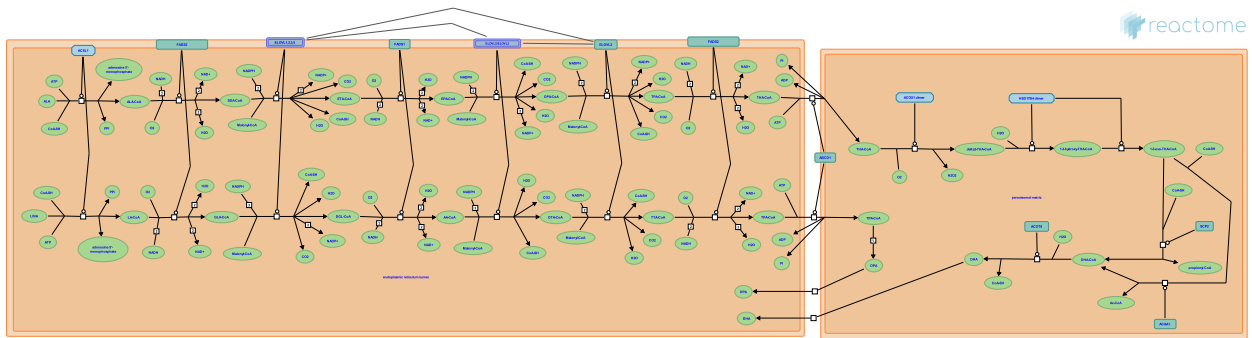


alpha-linolenic (omega3) and linoleic (omega6) acid metabolism



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This is just an excerpt of a full-length report for this pathway. To access the complete report, please download it at the [Reactome Textbook](https://reactome.org/textbook).

25/04/2024

Introduction

Reactome is open-source, open access, manually curated and peer-reviewed pathway database. Pathway annotations are authored by expert biologists, in collaboration with Reactome editorial staff and cross-referenced to many bioinformatics databases. A system of evidence tracking ensures that all assertions are backed up by the primary literature. Reactome is used by clinicians, geneticists, genomics researchers, and molecular biologists to interpret the results of high-throughput experimental studies, by bioinformaticians seeking to develop novel algorithms for mining knowledge from genomic studies, and by systems biologists building predictive models of normal and disease variant pathways.

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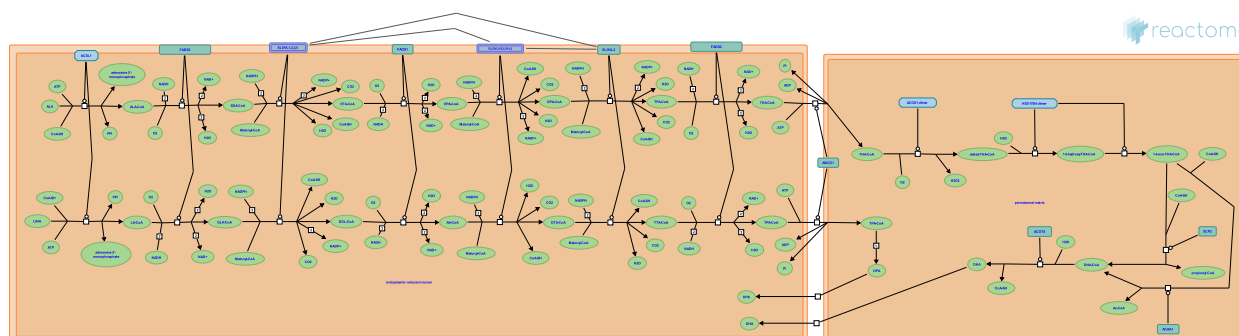
Reactome database release: 88

This document contains 3 pathways ([see Table of Contents](#))

alpha-linolenic (omega3) and linoleic (omega6) acid metabolism ↗

Stable identifier: R-HSA-2046104

Compartments: endoplasmic reticulum lumen, endoplasmic reticulum membrane, peroxisomal matrix, peroxisomal membrane



There are two major classes of polyunsaturated fatty acids (PUFAs): the omega-3 (n-3) and the omega-6 (n-6) fatty acids, where the number corresponds to the position of the first double bond proximate to the methyl end of the fatty acid. Omega-3 and omega-6 fatty acids are considered essential fatty acids. Humans cannot synthesize them, instead they are supplied through diet. Linoleic acid (LA, 18:2(n-6)), a major component of omega-6 fatty acids and alpha-linolenic acid (ALA, 18:2(n-3)) a major component of omega-3 fatty acids are the two main dietary essential fatty acids (EFAs) in humans. ALA and LA obtained from diet are converted in the body into their longer chain and more unsaturated omega-3 and omega-6 products by a series of desaturation and elongation steps. Metabolism of ALA and LA to their corresponding products is mediated via common enzyme systems. In humans ALA is finally converted to docosahexaenoic acid (DHA, C22:6(n-3)), and LA is converted to docosapentaenoic acid (DPA, C22:5(n-6)). The intermediary omega-3 and omega-6 series fatty acids play a significant role in health and disease by generating potent modulatory molecules for inflammatory responses, including eicosanoids (prostaglandins, and leukotrienes), and cytokines (interleukins) and affecting the gene expression of various bioactive molecules (Kapoor & Huang 2006, Sprecher 2002, Burdge 2006).

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Editions

2012-01-11

Authored, Edited

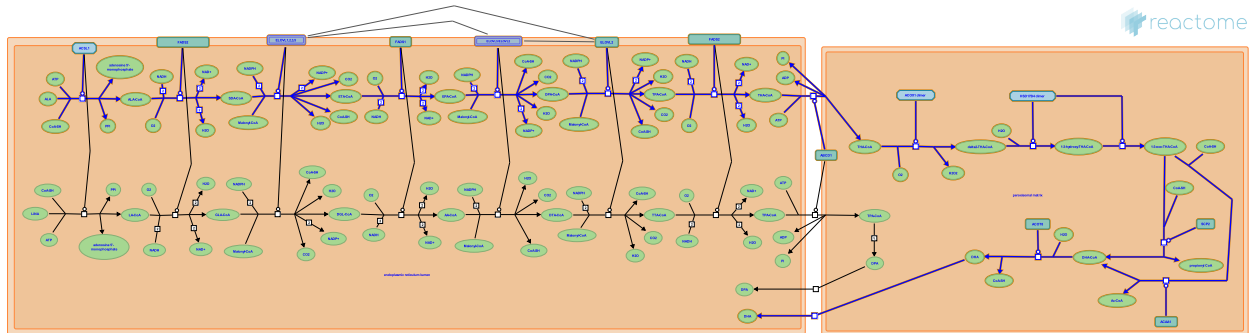
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alpha-linolenic acid (ALA) metabolism ↗

Location: [alpha-linolenic \(omega3\) and linoleic \(omega6\) acid metabolism](#)

Stable identifier: R-HSA-2046106

Compartments: peroxisomal matrix, endoplasmic reticulum membrane, peroxisomal membrane, endoplasmic reticulum lumen



Alpha-linolenic acid (ALA, 18:3(n-3)) is an omega-3 fatty acid, supplied through diet as it cannot be synthesized by humans. ALA has an important role in human health. It is converted to long chain more unsaturated n-3 fatty acids by a series of alternating desaturation and elongation reactions. Omega-3 products of ALA such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) reduce inflammation and may help lower risk of chronic diseases, such as heart disease and arthritis. All the desaturation and elongation steps occur in the endoplasmic reticulum (ER) except for the final step which requires translocation to peroxisomes for partial beta-oxidation.

The alpha-linolenic acid pathway involves the following steps: 18:3(n-3) → 18:4(n-3) → 20:4(n-3) → 20:5(n-3) → 22:5(n-3) → 24:5(n-3) → 24:6(n-3) → 22:6(n-3). Two desaturation enzymes are involved in this process: delta-6 desaturase that converts 18:3(n-3) to 18:4(n-3) and 24:5(n-3) to 24:6(n-3) respectively, delta-5 desaturase 20:4(n-3) to 20:5(n-3). (Sprecher 2002).

Literature references

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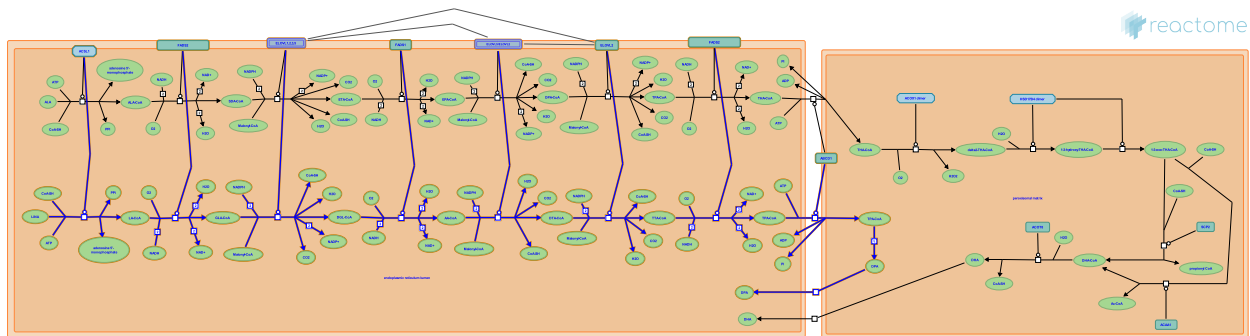
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Linoleic acid (LA) metabolism ↗

Location: [alpha-linolenic \(omega3\) and linoleic \(omega6\) acid metabolism](#)

Stable identifier: R-HSA-2046105

Compartments: peroxisomal matrix, endoplasmic reticulum membrane, peroxisomal membrane, endoplasmic reticulum lumen



Linoleic acid (LA, 18:2(n-6)) is an omega-6 fatty acid obtained through diet, mainly from vegetable oils. Omega-6 fatty acids help stimulate skin and hair growth, maintain bone health, regulate metabolism, and maintain the reproductive system. All the desaturation and elongation steps occur in the endoplasmic reticulum (ER) except for the final step which requires translocation to peroxisomes for partial beta-oxidation. The linoleic acid pathway involves the following steps: 18:2(n-6) → 18:3(n-6) → 20:3(n-6) → 20:4(n-6) → 22:4(n-6) → 24:4(n-6) → 24:5(n-6) → 22:5(n-6). Two desaturation enzymes are involved in this process: delta-6 desaturase which converts 18:2(n-6) to 18:3(n-6) and 24:4(n-6) to 24:5(n-6) respectively, and delta-5 desaturase which converts 20:3(n-6) to 20:4(n-6). (Sprecher 2002).

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