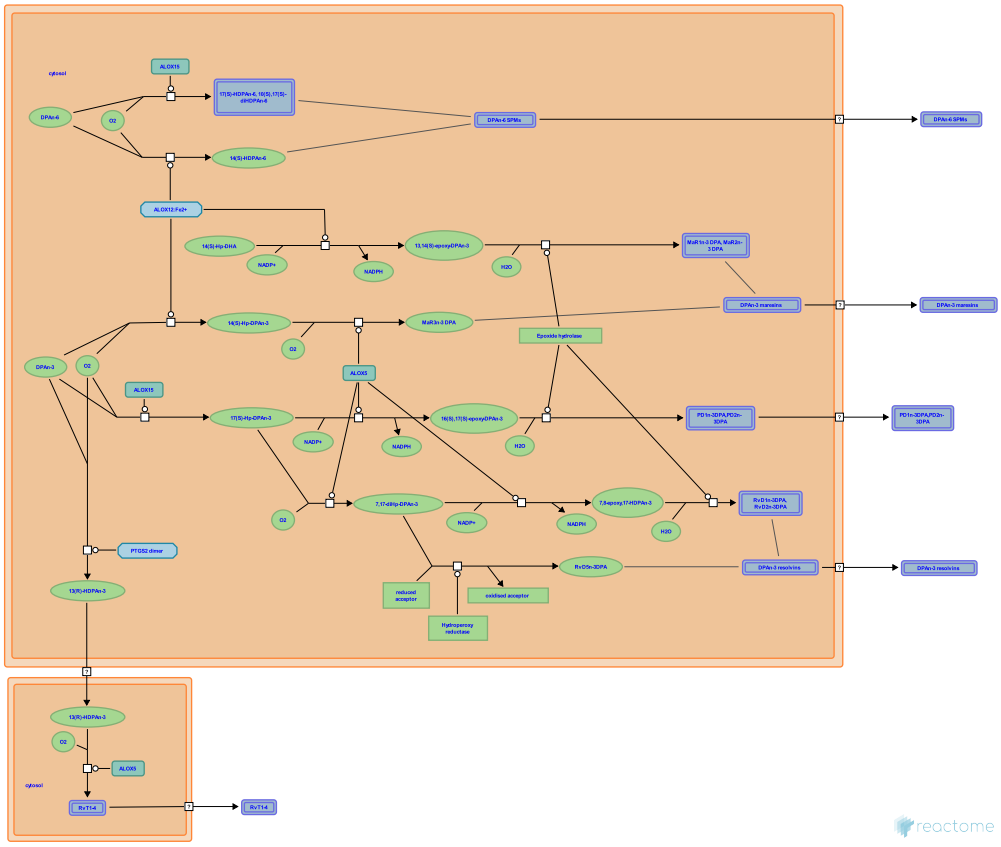
Biosynthesis of DPA-derived SPMs



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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.

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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.
The development of Reactome is supported by grants from the US National Institutes of Health (P41 HG003751), University of Toronto (CFREF Medicine by Design), European Union (EU STRP, EMI-CD), and the European Molecular Biology Laboratory (EBI Industry program).

Literature references

Fabregat, A., Sidiropoulos, K., Viteri, G., Forner, O., Marin-Garcia, P., Arnau, V. et al. (2017). Reactome pathway analysis: a high-performance in-memory approach. *BMC bioinformatics, 18*, 142. ↗

Sidiropoulos, K., Viteri, G., Sevilla, C., Jupe, S., Webber, M., Orlic-Milacic, M. et al. (2017). Reactome enhanced pathway visualization. *Bioinformatics, 33*, 3461-3467. ↗

Fabregat, A., Jupe, S., Matthews, L., Sidiropoulos, K., Gillespie, M., Garapati, P. et al. (2018). The Reactome Pathway Knowledgebase. *Nucleic Acids Res, 46*, D649-D655. ↗

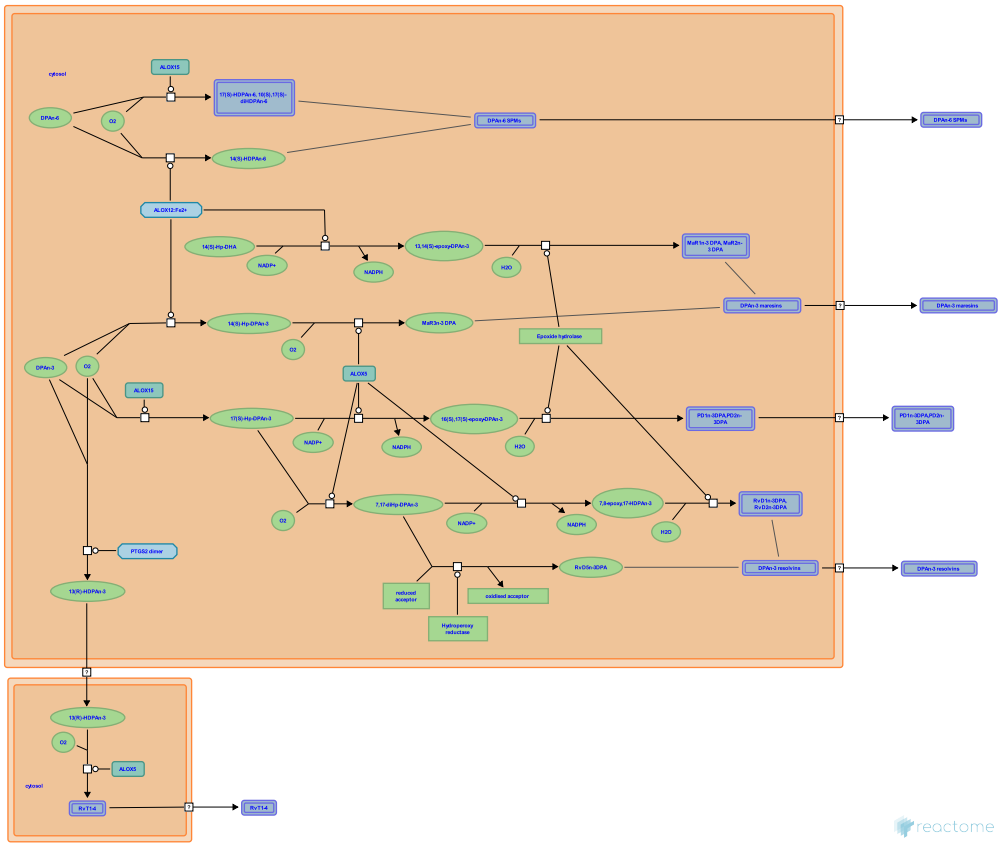
Fabregat, A., Korninger, F., Viteri, G., Sidiropoulos, K., Marin-Garcia, P., Ping, P. et al. (2018). Reactome graph database: Efficient access to complex pathway data. *PLoS computational biology, 14*, e1005968. ↗

Reactome database release: 88

This document contains 3 pathways (see Table of Contents)

Biosynthesis of DPA-derived SPMs ↗

Stable identifier: R-HSA-9018683



Docosapentaenoic acid (DPA), a C22:5 long-chain ω3 or ω6 polyunsaturated fatty acid (PUFA), is found in algal and fish oils, created via linoleic acid metabolism and is a metabolite in DHA metabolism. It can be acted upon by lipoxygenases to produce mono-, di- and tri-hydroxy derivatives in neutrophils and macrophages. These DPA derivatives are another branch of the specialised proresolving mediators (SPMs) produced from long-chain fatty acids which have anti-inflammatory properties, even though mechanisms of their anti-inflammatory action have not been fully elucidated (Bannenberg & Serhan 2010, Dangi et al. 2010, Vik et al. 2017, Hansen et al. 2017).

The biosynthesis of SPMs derived from the two isomers of DPA, DPAn-6 (cis-4,7,10,13,16-docosapentaenoic acid) and DPAn-3 (cis-7,10,13,16,19-docosapentaenoic acid), is described here. The only difference between the two isomers is the position of the first double bond; ω-3 for DPAn-3 and ω-6 for DPAn-6. The products of these isomers were characterised by analogy in structure and action to docosahexaenoic acid (DHA)-derived and eicosapentaenoic acid (EPA)-derived resolvins, protectins and maresins (Serhan et al. 2002, Bannenberg & Serhan 2010, Serhan et al. 2015).

Literature references

Serhan, CN., Bannenberg, G. (2010). Specialized pro-resolving lipid mediators in the inflammatory response: An update. *Biochim. Biophys. Acta, 1801*, 1260-73. ↗

Serhan, CN., Hansen, TV., Dalli, J. (2017). The novel lipid mediator PD1n-3 DPA: An overview of the structural elucidation, synthesis, biosynthesis and bioactions. *Prostaglandins Other Lipid Mediat.*. ↗

Hansen, TV., Vik, A., Dalli, J. (2017). Recent advances in the chemistry and biology of anti-inflammatory and specialized pro-resolving mediators biosynthesized from n-3 docosapentaenoic acid. *Bioorg. Med. Chem. Lett., 27*, 2259-2266. ↗

Arterburn, LM., Hallenbeck, T., Chung, G., Nauroth, JM., Obeng, M., Dangi, B. et al. (2010). Metabolism and biological production of resolvins derived from docosapentaenoic acid (DPAn-6). *Biochem. Pharmacol., 79*, 251-60. ↗

Editions

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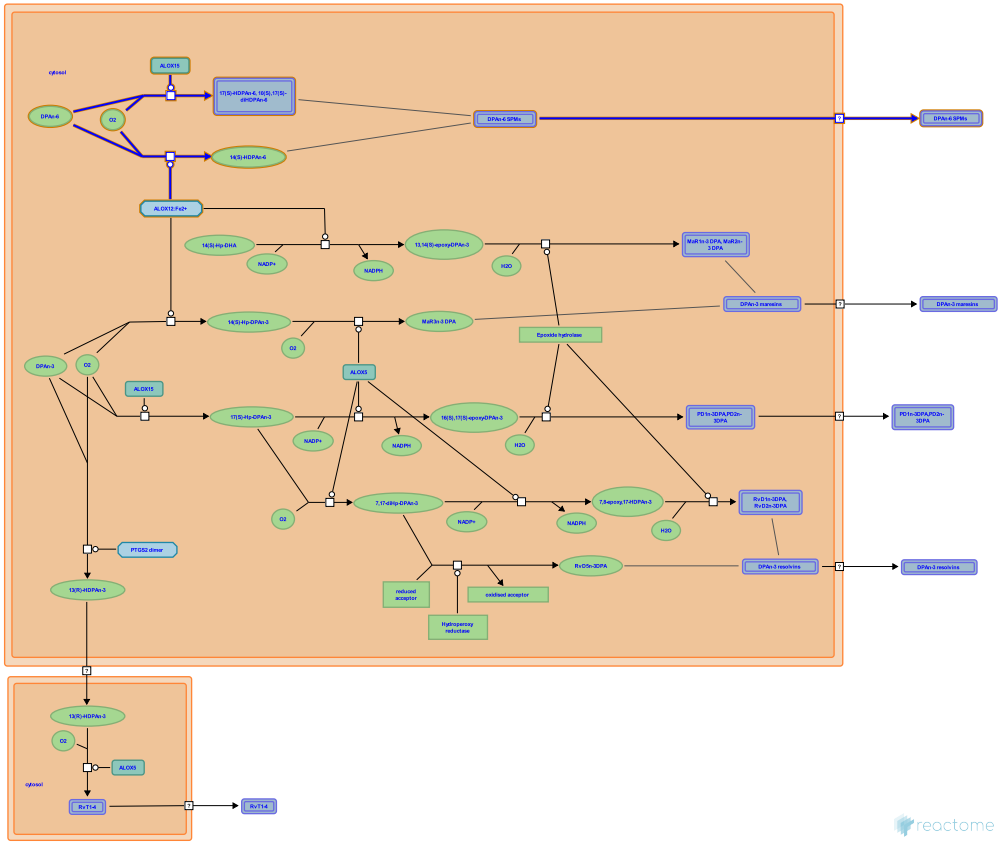
Biosynthesis of DPAn-6 SPMs ↗

Location: Biosynthesis of DPA-derived SPMs

Stable identifier: R-HSA-9025106



The biosynthesis of specialised proresolving mediators (SPMs) derived from the ω-6 isomer of DPA, DPAn-6 (cis-4,7,10,13,16-docosapentaenoic acid) is described here (Dangi et al. 2010). The products of the ω-6 isomer were characterised by analogy in structure and action to docosahexaenoic acid (DHA)-derived and eicosapentaenoic acid (EPA)-derived resolvins (Serhan et al. 2002, Bannenberg & Serhan 2010).

Literature references

Weylandt, KH. (2016). Docosapentaenoic acid derived metabolites and mediators - The new world of lipid mediator medicine in a nutshell. *Eur. J. Pharmacol., 785*, 108-115. ↗

Arterburn, LM., Hallenbeck, T., Chung, G., Nauroth, JM., Obeng, M., Dangi, B. et al. (2010). Metabolism and biological production of resolvins derived from docosapentaenoic acid (DPAn-6). *Biochem. Pharmacol., 79*, 251-60. ↗

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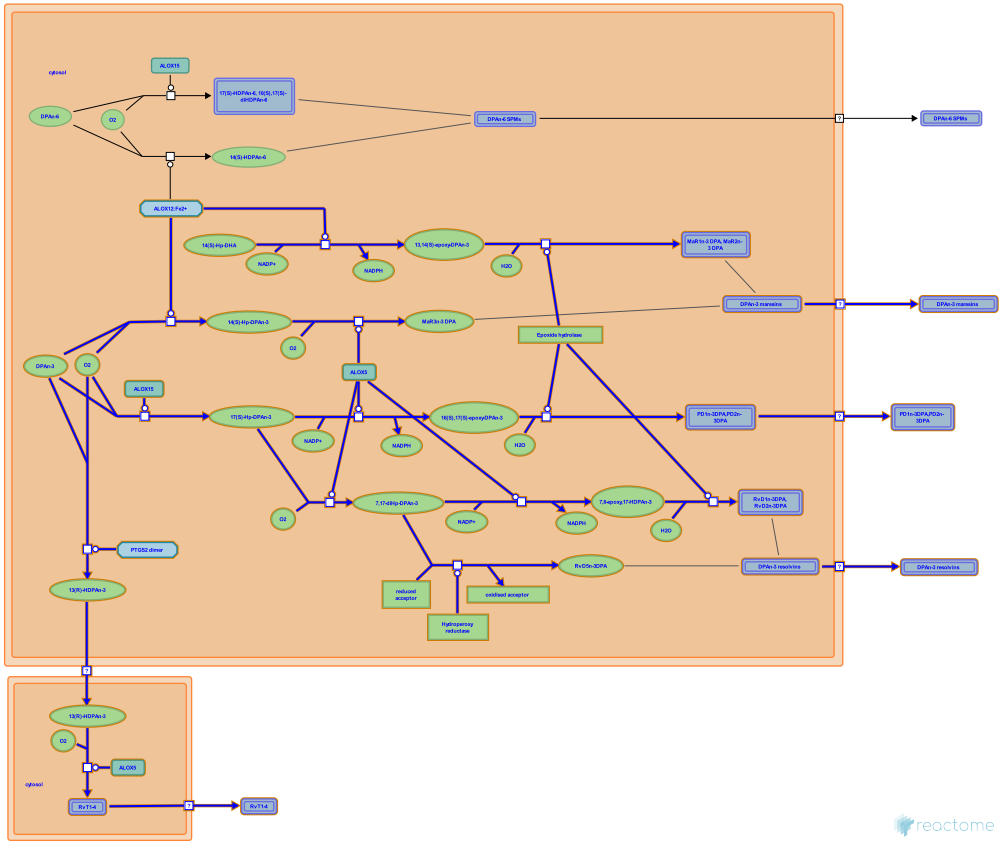
Biosynthesis of DPAn-3 SPMs ↗

Location: Biosynthesis of DPA-derived SPMs

Stable identifier: R-HSA-9025094



The polyunsaturated fatty acid (PUFA) ω-3 cis-7,10,13,16,19-docosapentaenoic acid (DPAn-3) is an intermediate in the biosynthesis of docosahexaenoic acid (DHA) from eicosapentaenoic acid (EPA) and is also a precursor for the production of novel bioactive mediators. The proposed biosynthesis of specialised proresolving mediators (SPMs) derived from DPAn-3 is described here (Dalli et al. 2013, Hansen et al. 2017, Vik et al. 2017). The products of the ω-3 isomer were characterised based on DHA (docosahexaenoic acid) derived resolvins, protectins and maresins (Serhan et al. 2002, Bannenberg & Serhan 2010). The same biosynthetic route as DHA-derived SPMs is probably how DPAn-3 products are also formed (Dalli et al. 2013).

Literature references

Serhan, CN., Colas, RA., Dalli, J. (2013). Novel n-3 immunoresolvents: structures and actions. *Sci Rep, 3*, 1940. ↗

Serhan, CN., Hansen, TV., Dalli, J. (2017). The novel lipid mediator PD1n-3 DPA: An overview of the structural elucidation, synthesis, biosynthesis and bioactions. *Prostaglandins Other Lipid Mediat.*. ↗

Hansen, TV., Vik, A., Dalli, J. (2017). Recent advances in the chemistry and biology of anti-inflammatory and specialized pro-resolving mediators biosynthesized from n-3 docosapentaenoic acid. *Bioorg. Med. Chem. Lett., 27*, 2259-2266. ↗

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