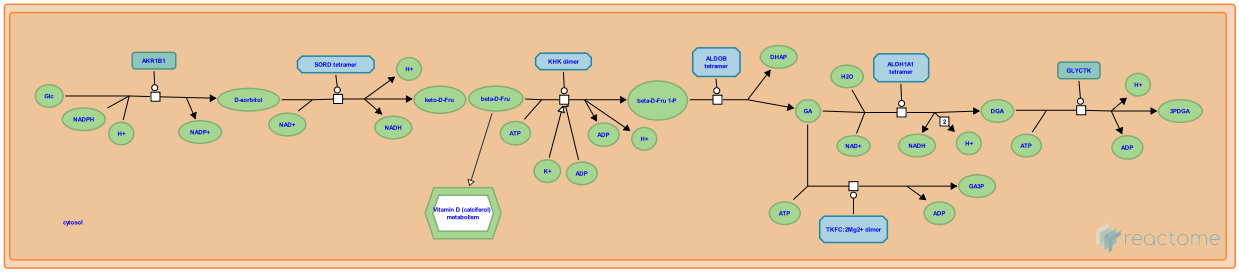
Fructose metabolism



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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. ↗

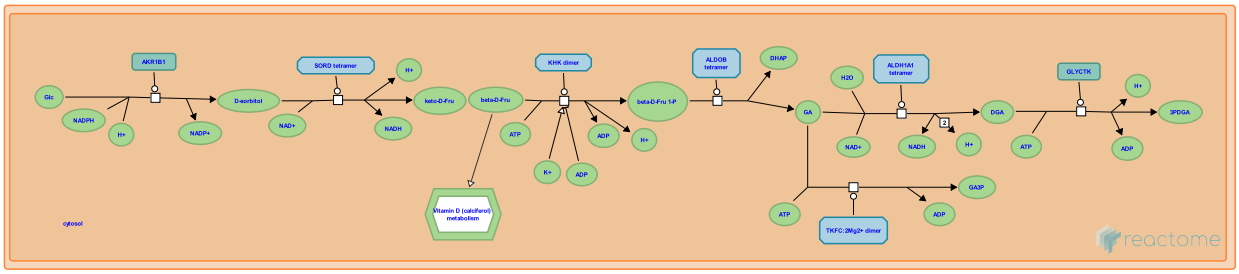
Reactome database release: 88

This document contains 3 pathways (see Table of Contents)

Fructose metabolism ↗

Stable identifier: R-HSA-5652084

Compartments: cytosol



Fructose is found in fruits, is one of the components of the disaccharide sucrose, and is a widely used sweetener in processed foods. Dietary fructose is catabolized in the liver via fructose 1-phosphate to yield dihydroxyacetone phosphate and glyceraldehyde 3-phosphate, which then are converted to pyruvate via steps of canonical glycolysis (Hers & Kusaka 1953; Sillero et al. 1969). Excessive dietary intake of fructose and its metabolism have been associated with major disease risks in humans, although this issue remains controversial (Kolderup & Svihus 2015; DiNicolantonio et al. 2015; Bray 2013; Mayes 1993; Rippe & Angelopoulos 2013; van Buul et al. 2013). Fructose can also be synthesized from glucose via the polyol pathway (Hers 1960; Oates 2008). This synthetic process provides the fructose found in seminal fluid and, in other tissues, can contribute to pathologies of diabetes.

Literature references

Rippe, JM., Angelopoulos, TJ. (2013). Sucrose, high-fructose corn syrup, and fructose, their metabolism and potential health effects: what do we really know?. *Adv Nutr, 4*, 236-45. ↗

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Svihus, B., Kolderup, A. (2015). Fructose Metabolism and Relation to Atherosclerosis, Type 2 Diabetes, and Obesity. *J Nutr Metab, 2015*, 823081. ↗

Brouns, FJ., Tappy, L., van Buul, VJ. (2014). Misconceptions about fructose-containing sugars and their role in the obesity epidemic. *Nutr Res Rev, 27*, 119-30. ↗

Hers, HG., Kusaka, T. (1953). [The metabolism of fructose-1-phosphate in the liver.]. *Biochim Biophys Acta, 11*, 427-37. ↗

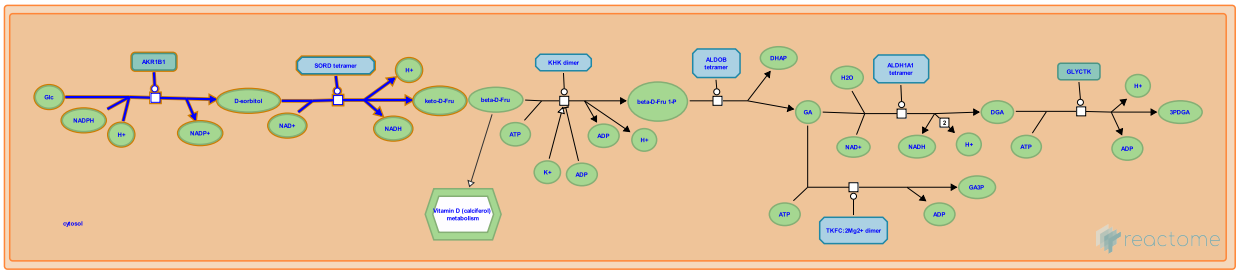
Editions

2014-11-27	Authored, Edited	D'Eustachio, P.
2015-08-28	Authored	Ribeiro, JM., Cameselle, JC.

Fructose biosynthesis ↗

Location: Fructose metabolism

Stable identifier: R-HSA-5652227



The conversion of glucose to fructose via sorbitol was demonstrated by Hers (1960) in the seminal vesicles of sheep, has since been demonstrated as well in human epidydimal tissue (Frenette et al. 2006), and appears to be the physiological source of the abundant fructose found in seminal fluid. The enzymes of the pathway are likewise abundant in the eye lens and in neurons, where their physiological role is less clear but where they appear to play a central role in diabetic tissue damage (Oates 2008).

Literature references

Oates, PJ. (2008). Aldose reductase, still a compelling target for diabetic neuropathy. *Curr Drug Targets, 9*, 14-36. ↗

Hers, HG. (1960). [The mechanism of the formation of seminal fructose and fetal fructose]. *Biochim. Biophys. Acta, 37* , 127-38. ↗

Sullivan, R., Thabet, M., Frenette, G. (2006). Polyol pathway in human epididymis and semen. *J. Androl., 27*, 233-9. ↗

Editions

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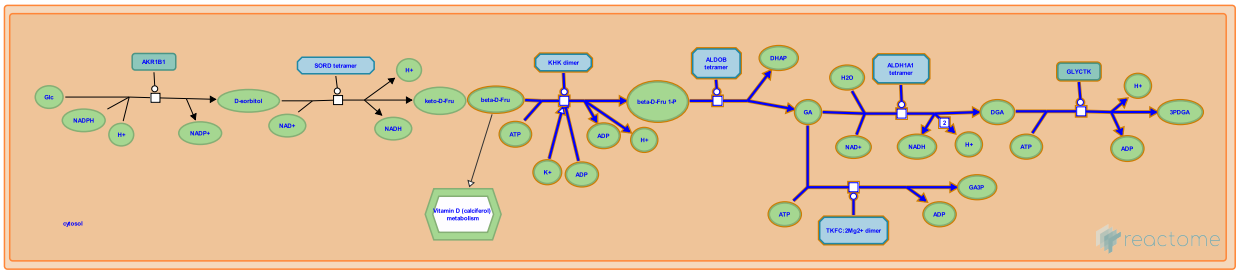
2015-08-28	Authored	Ribeiro, JM., Cameselle, JC.

Fructose catabolism ↗

Location: Fructose metabolism

Stable identifier: R-HSA-70350



Fructose occurs naturally in foods as a free monosaccharide and as a component of the disaccharide sucrose. It is also widely used as a sweetener. In the body, fructose catabolism occurs in the liver and to a lesser extent in the kidney and small intestine. In these tissues, it is converted to dihydroxyacetone phosphate and D-glyceraldehyde 3-phosphate, two intermediates in the glycolytic pathway, in a sequence of three reactions. It is phosphorylated to form fructose 1-phosphate, which is cleaved by aldolase to yield dihydroxyacetone phosphate and D-glyceraldehyde, and the latter compound is phosphorylated to yield D-glyceraldehyde 3-phosphate. Other pathways exist for the conversion of D-glyceraldehyde to intermediates of glycolysis, but these appear to play only a minor role in normal fructose metabolism (Sillero et al. 1969).

Literature references

Mayes, PA. (1993). Intermediary metabolism of fructose. *Am. J. Clin. Nutr., 58*, 754S-765S. ↗

Sillero, MA., Sillero, A., Sols, A. (1969). Enzymes involved in fructose metabolism in liver and the glyceraldehyde metabolic crossroads. *Eur. J. Biochem., 10*, 345-50. ↗

Editions

2003-06-24	Authored	D'Eustachio, P.
2010-01-25	Revised	D'Eustachio, P.
2015-01-29	Edited, Revised	D'Eustachio, P.
2015-01-29	Reviewed	Jassal, B.
2015-08-28	Authored	Ribeiro, JM., Cameselle, JC.

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