Chondroitin sulfate/dermatan sulfate metabolism

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11/06/2020
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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Literature references


Reactome database release: 72

This document contains 5 pathways (see Table of Contents)

https://reactome.org
Chondroitin sulfate/dermatan sulfate metabolism

Stable identifier: R-HSA-1793185

Chondroitin sulfate (CS) is a sulfated glycosaminoglycan (GAG). CS chains are unbranched polysaccharides of varying length containing two alternating monosaccharides: D-glucuronic acid (GlcA) and N-acetyl-D-galactosamine (GalNAc). The chains are usually attached to proteins forming a proteoglycan. CS is an important structural component of cartilage due to its ability to withstand compression. It is also a widely used dietary supplement for osteoarthritis. When some of the GlcA residues are epimerized into L-iduronic acid (IdoA) the resulting disaccharide is then referred to as dermatan sulfate (DS) (Silbert & Sugumaran 2002). DS is the most predominant GAG in skin but is also found in blood vessels, heart valves, tendons, and the lungs. It may play roles in cardiovascular disease, tumorigenesis, infection, wound repair and fibrosis (Trowbridge & Gallo 2002).

Literature references


Editions

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https://reactome.org
A tetrasaccharide linker sequence is required for GAG synthesis

**Location:** Chondroitin sulfate/dermatan sulfate metabolism

**Stable identifier:** R-HSA-1971475

The biosynthesis of dermatan sulfate/chondroitin sulfate and heparin/heparan sulfate glycosaminoglycans (GAGs) starts with the formation of a tetrasaccharide linker sequence to the core protein. The first step is the addition of xylose to the hydroxy group of specific serine residues on the core protein. Subsequent additions of two galactoses and a glucuronide moiety completes the linker sequence. From here, the next hexosamine addition is critical as it determines which GAG is formed (Lamberg & Stoolmiller 1974, Pavao et al. 2006).

**Literature references**


**Editions**

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Chondroitin sulfate biosynthesis

Location: Chondroitin sulfate/dermatan sulfate metabolism

Stable identifier: R-HSA-2022870

Chondroitin sulfate (CS) glycosaminoglycan consists of N-acetylgalactosamine (GalNAc) residues alternating in glycosidic linkages with glucuronic acid (GlcA). GalNAc residues are sulfated to varying degrees on 4- and/or 6- positions. The steps below describe the biosynthesis of a simple CS molecule (Pavao et al. 2006, Silbert & Sugumaran 2002).

Literature references


Editions

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Dermatan sulfate biosynthesis

Location: Chondroitin sulfate/dermatan sulfate metabolism

Stable identifier: R-HSA-2022923

Dermatan sulfate (DS) consists of N-acetylgalactosamine (GalNAc) residues alternating in glycosidic linkages with glucuronic acid (GlcA) or iduronic acid (IdoA) residues. As with CS, GalNAc residues can be sulfated in CS chains but also the uronic acid residues may be substituted with sulfate at the 2- and 4- positions. The steps below outline the synthesis of a simple DS chain (Silbert & Sugumaran 2002).

Literature references


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CS/DS degradation

Location: Chondroitin sulfate/dermatan sulfate metabolism

Stable identifier: R-HSA-2024101

Lysosomal degradation of glycoproteins is part of the cellular homeostasis of glycosylation (Winchester 2005). The steps outlined below describe the degradation of chondroitin sulfate and dermatan sulfate. Complete degradation of glycoproteins is required to avoid build up of glycosaminoglycan fragments which can cause lysosomal storage diseases. Complete degradation steps are not shown as they are repetitions of the main ones described here. The proteolysis of the core protein of the glycoprotein is not shown here.

Literature references


Editions

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