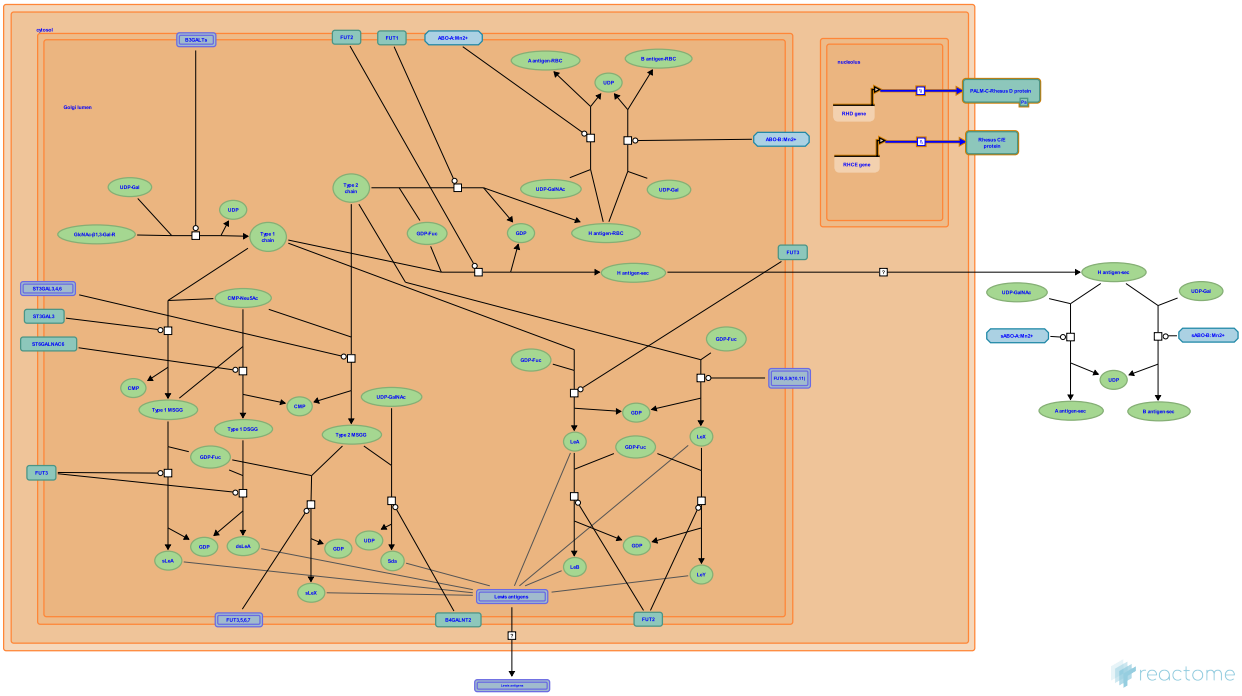
Rhesus blood group biosynthesis



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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.
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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. ↗

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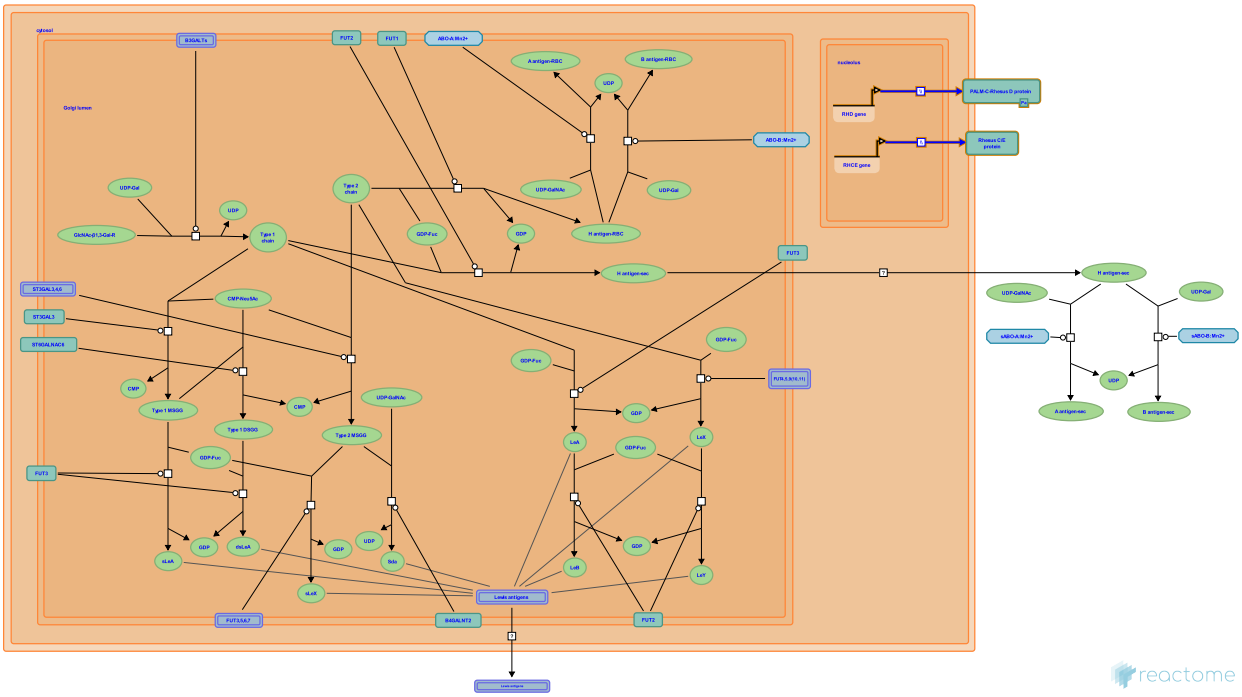
Rhesus blood group biosynthesis ↗

Stable identifier: R-HSA-9037628



The Rhesus (Rh) blood group system (including the Rh factor) is the second most important blood group system after the ABO blood group system. The Rh blood type was first discovered in 1937 by Karl Landsteiner and Alexander S. Wiener who named it after the rhesus macaque whose RBCs were used to generate the rabbit immune serum that first detected the human blood group system. Subsequent studies by them and Philip Levine and Rufus Stetson identified the antigen that induced this immunization as the "Rh factor" and also its association with hemolytic disease of the newborn (Levine & Stetson 1984, Landsteiner & Wiener 1941). Of the 50 defined Rh blood group antigens, five (D, C/c and E/e) are the major types expressed by the *RHD* and *RHCE* genes in the *RH* gene complex. Rh antigens are expressed on red cell (RBC) membranes in association with other membrane proteins and this whole complex interacts with the spectrin-based skeleton and contributes to the maintenance of the mechanical properties of the RBC membrane (Van Kim et al. 2006).

The *RHD* gene produces the D antigen, the most immunogenic Rh antigen. The term "Rh factor" refers only to the D antigen; Rh positive (Rh+) individuals have the D antigen on their RBC membranes whereas Rh negative (Rh-) individuals don't. Humans are not born with antibodies towards the D antigen in their blood, they have to be exposed to it (through blood transfusion or placental exposure during pregnancy) at some point in their lives before antibodies are made against it. Once exposed, however, Rh+ individuals remain sensitive for the rest of their lives. Importantly, if individuals are Rh+ and are exposed to Rh- blood, no immune response is mounted. Anti-D antibodies are only seen if an individual is lacking the D antigen (Rh-) and is exposed to Rh+ blood. The *RHCE* gene produces polypeptides with C/c and E/e antigens.

These polypeptides are the core components of their respective antigens but by themselves are devoid of the immunoreactivity which defines the Rh antigens. The remaining antigens are produced by partial deletion, recombination, mutation, or polymorphisms of one or both *RHD* and *RHCE* genes (Cartron 1999). Together, these antigens form the most complex and polymorphic blood group system based on the multitude of phenotypes that can be expressed on the RBC surface. The Fisher-Race system, the nomenclature used most commonly, uses the CDE system to depict the notation of Rh genotypes (Race 1948). The most common group of 3 genes inherited is CDe with ce (D negative) being the second most common. Rh genotyping is used in blood transfusion, paternity testing and to determine the risk of hemolytic disease of the newborn.

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Editions

2018-02-20	Authored, Edited	Jassal, B.
2018-12-17	Reviewed	Matsui, T.

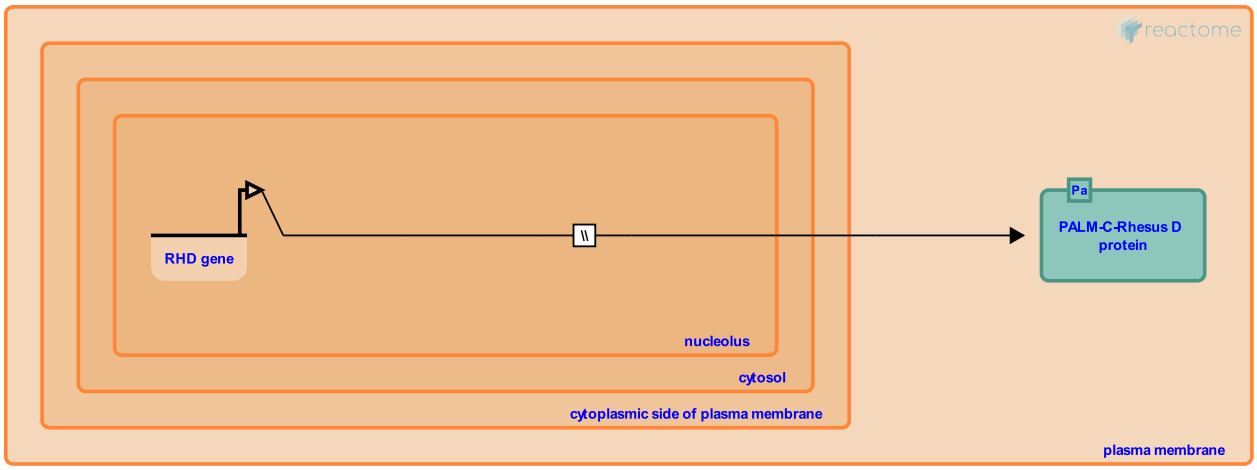
RHD gene produces PALM-C-Rhesus D protein ↗

Location: Rhesus blood group biosynthesis

Stable identifier: R-HSA-9038658

Type: omitted

Compartments: nucleolus, plasma membrane



The *RHD* gene encodes the blood group Rh(D) polypeptide (Rhesus D protein, D antigen) (Bloy et al. 1988, Saboori et al. 1988, Avent et al. 1988). It is present only on the erythrocyte membrane as a post-translationally-modified palmitoylated protein (de Vetten & Agre 1988, Hartel-Schenk & Agre 1992).

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Editions

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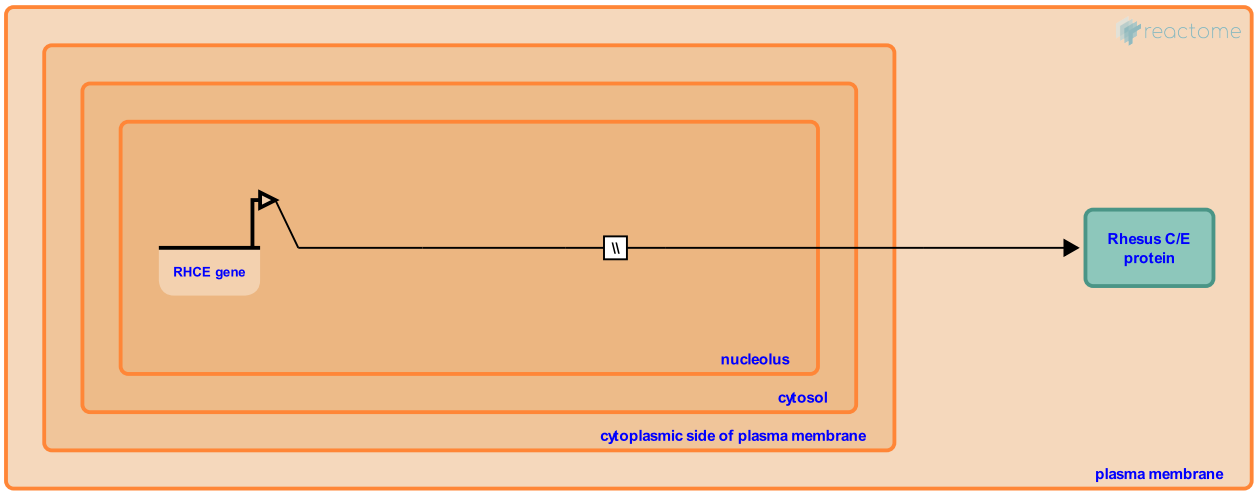
RHCE gene produces Rhesus C or E proteins ↗

Location: Rhesus blood group biosynthesis

Stable identifier: R-HSA-9038653

Type: omitted

Compartments: nucleolus, plasma membrane



The *RHCE* gene encodes the C/c and E/e proteins, presumably by alternative splicing of a pre messenger RNA (Bloy et al. 1998, Le Van Kim et al. 1992).

Literature references

Lopez, M., Mouro, I., Raynal, V., Colin, Y., Le Van Kim, C., Cherif-Zahar, B. et al. (1992). Multiple Rh messenger RNA isoforms are produced by alternative splicing. *Blood, 80*, 1074-8. ↗

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