POMT1 gene
protein O-mannosyltransferase 1

Normal Function

The POMT1 gene provides instructions for making one piece of the protein O-mannosyltransferase (POMT) enzyme complex. The other piece is produced from the POMT2 gene. This enzyme complex is present in many different tissues in the body but is particularly abundant in the muscles used for movement (skeletal muscles), fetal brain, and testes.

The POMT complex helps modify a protein called alpha (α)-dystroglycan. Specifically, this complex adds a sugar molecule called mannose to α-dystroglycan through a process called glycosylation. Glycosylation is critical for the normal function of α-dystroglycan.

The α-dystroglycan protein helps anchor the structural framework inside each cell (cytoskeleton) to the lattice of proteins and other molecules outside the cell (extracellular matrix). In skeletal muscles, glycosylated α-dystroglycan helps stabilize and protect muscle fibers. In the brain, it helps direct the movement (migration) of nerve cells (neurons) during early development.

Health Conditions Related to Genetic Changes

Walker-Warburg syndrome

At least 24 mutations in the POMT1 gene have been found to cause Walker-Warburg syndrome, the most severe form of a group of disorders known as congenital muscular dystrophies. Individuals with Walker-Warburg syndrome have skeletal muscle weakness and abnormalities of the brain and eyes. Because of the severity of the problems caused by this condition, affected individuals usually do not survive past early childhood.

POMT1 gene mutations that cause Walker-Warburg syndrome lead to the formation of nonfunctional POMT enzyme complexes that cannot transfer mannose to α-dystroglycan, preventing its normal glycosylation. As a result, α-dystroglycan can no longer effectively anchor cells to the proteins and other molecules that surround them. Without functional α-dystroglycan to stabilize the muscle fibers, they become damaged as they repeatedly contract and relax with use. The damaged fibers weaken and die over time, which affects the development, structure, and function of skeletal muscles in people with Walker-Warburg syndrome.
Defective α-dystroglycan also affects the migration of neurons during the early development of the brain. Instead of stopping when they reach their intended destinations, some neurons migrate past the surface of the brain into the fluid-filled space that surrounds it. Researchers believe that this problem with neuronal migration causes a brain abnormality called cobblestone lissencephaly, in which the surface of the brain lacks the normal folds and grooves and instead appears bumpy and irregular. Less is known about the effects of POMT1 gene mutations in other parts of the body.

Limb-girdle muscular dystrophy

Other disorders

Mutations in the POMT1 gene are also involved in less severe forms of muscular dystrophy, including muscle-eye-brain disease and POMT1-related congenital muscular dystrophy (also known as MDDGB1). Muscle-eye-brain disease is similar to Walker-Warburg syndrome (described above), although affected individuals usually survive into childhood or adolescence. POMT1-related congenital muscular dystrophy causes muscle weakness, brain abnormalities, and intellectual disability, but usually does not affect the eyes.

POMT1 gene mutations that cause these conditions result in POMT enzyme complexes with reduced function. As a result, glycosylation of α-dystroglycan is impaired. The severity of the resulting condition appears to be related to the level of α-dystroglycan glycosylation; the less glycosylation, the more severe the condition.

Chromosomal Location

Cytogenetic Location: 9q34.13, which is the long (q) arm of chromosome 9 at position 34.13

Molecular Location: base pairs 131,502,902 to 131,523,806 on chromosome 9 (Homo sapiens Updated Annotation Release 109.20190905, GRCh38.p13) (NCBI)

Credit: Genome Decoration Page/NCBI
Other Names for This Gene

- dolichyl-phosphate-mannose-protein mannosyltransferase
- dolichyl-phosphate-mannose--protein mannosyltransferase 1
- LGMD2K
- MDDGA1
- MDDGB1
- MDDGC1
- POMT1_HUMAN
- protein O-mannosyl-transferase 1
- protein-O-mannosyltransferase 1
- RT

Additional Information & Resources

Educational Resources

- Molecular Cell Biology (fourth edition, 2000): Protein Glycosylation in the ER and Golgi Complex
  https://www.ncbi.nlm.nih.gov/books/NBK21744/
- Washington University Neuromuscular Disease Center
  https://neuromuscular.wustl.edu/syncm.html#pomt1ww

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28POMT1%5BTIAB%5D%29+OR+%28protein-O-mannosyltransferase%3B%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D

Catalog of Genes and Diseases from OMIM

- MUSCULAR DYSTROPHY-DYSTROGLYCANOPATHY (CONGENITAL WITH MENTAL RETARDATION), TYPE B, 1
  http://omim.org/entry/613155
- PROTEIN O-MANNOSYLTRANSFERASE 1
  http://omim.org/entry/607423
Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_POMT1.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=POMT1%5Bgene%5D
- HGNC Gene Symbol Report
- Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:10585
- NCBI Gene
- UniProt
  https://www.uniprot.org/uniprot/Q9Y6A1

Sources for This Summary

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• OMIM: PROTEIN O-MANNOSYLTRANSFERASE 1 http://omim.org/entry/607423


Reviewed: January 2017
Published: November 26, 2019

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