SLC2A9 gene
solute carrier family 2 member 9

Normal Function

The *SLC2A9* gene provides instructions for making a protein called glucose transporter 9 (GLUT9). This protein is found mainly in the kidneys, specifically in structures called proximal tubules. These structures help to reabsorb needed nutrients, water, and other materials into the blood and excrete unneeded substances into the urine. Within the proximal tubules, the GLUT9 protein helps reabsorb or excrete a substance called urate. Urate is a byproduct of certain normal biochemical reactions in the body. In the bloodstream it acts as an antioxidant, protecting cells from the damaging effects of unstable molecules called free radicals. When more urate is needed in the body, the GLUT9 protein helps reabsorb it into the bloodstream. Most urate that is filtered through the kidneys is reabsorbed into the bloodstream; about 10 percent is released into urine. The GLUT9 protein also plays a role in reabsorbing and excreting the simple sugar glucose.

Health Conditions Related to Genetic Changes

**Renal hypouricemia**

At least 17 mutations in the *SLC2A9* gene have been found to cause renal hypouricemia. This condition results in a reduced amount of urate in the blood. Renal hypouricemia often does not cause any health problems but can lead to kidney stones, blood in the urine (hematuria), or pain and nausea after exercise. Most of the mutations that cause renal hypouricemia replace single protein building blocks (amino acids) in the GLUT9 protein and severely reduce or eliminate the protein's ability to reabsorb urate into the bloodstream. As a result, an excessive amount of urate is lost through the urine. While it is not clear how these changes in urate levels lead to the signs and symptoms of renal hypouricemia, it is likely that the loss of urate's antioxidant properties in combination with the increase in urate passing through the kidneys to be released in the urine contribute to the characteristic features of this condition.

**Gout**

Genetic changes in the *SLC2A9* gene are associated with a condition called gout, which is a form of arthritis. Gout develops when elevated urate levels in the blood (hyperuricemia) lead to the formation of urate crystals in joints, triggering an inflammatory response from the immune system.
SLC2A9 gene changes associated with gout likely increase the production of a form of the GLUT9 protein that is 28 amino acids shorter than the full-length version. This shorter version of GLUT9 reabsorbs urate into the bloodstream more readily than the full length version. An increase in the short GLUT9 protein raises the levels of urate in the blood and reduces its release into the urine. As a result, urate can accumulate in the body's joints in the form of crystals, leading to painful arthritis.

While changes in the SLC2A9 gene can alter urate levels in the body, they are likely not enough to cause gout by themselves. A combination of dietary, genetic, and other environmental factors play a part in determining the risk of developing this complex disorder.

Chromosomal Location

Cytogenetic Location: 4p16.1, which is the short (p) arm of chromosome 4 at position 16.1

Molecular Location: base pairs 9,771,125 to 10,040,248 on chromosome 4 (Homo sapiens Updated Annotation Release 109.20190905, GRCh38.p13) (NCBI)

Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- glucose transporter type 9
- GLUT-9
- GLUT9
- GLUTX
- human glucose transporter-like protein-9
- solute carrier family 2 (facilitated glucose transporter), member 9
- solute carrier family 2, facilitated glucose transporter member 9
- UAQTL2
- urate voltage-driven efflux transporter 1
- URATv1
Additional Information & Resources

Educational Resources

• Biochemistry (fifth edition, 2002): Purines Are Degraded to Urate in Human Beings
  https://www.ncbi.nlm.nih.gov/books/NBK22372/#A3526

• Informed Health Online: Gout: Overview
  https://www.ncbi.nlm.nih.gov/books/NBK284934/

Scientific Articles on PubMed

• PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28SLC2A9%5BTIAB%5D%29+OR+%28GLUT9%5BTIAB%5D%29+OR+%28glucose+transporter+type+9%5BTIAB%5D%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

• SOLUTE CARRIER FAMILY 2 (FACILITATED GLUCOSE TRANSPORTER), MEMBER 9
  http://omim.org/entry/606142

Research Resources

• Atlas of Genetics and Cytogenetics in Oncology and Haematology

• ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=SLC2A9%5Bgene%5D

• HGNC Gene Symbol Report

• Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:56606

• NCBI Gene

• UniProt
  https://www.uniprot.org/uniprot/Q9NRM0
Sources for This Summary

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/24107611

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/22132964

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/23263486 
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3663712/

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• OMIM: SOLUTE CARRIER FAMILY 2 (FACILITATED GLUCOSE TRANSPORTER), MEMBER 9
  http://omim.org/entry/606142

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  interactions in the 4p16.1 region suggest functional mechanisms underlyinng SLC2A9
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  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4159153/

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