GALC gene

galactosylceramidase

Normal Function

The *GALC* gene provides instructions for making an enzyme called galactosylceramidase. Through a process called hydrolysis, this enzyme uses water molecules to break down certain fats called galactolipids, which are found primarily in the brain and kidneys.

Within cells, galactosylceramidase is found in enzyme-filled sacs called lysosomes where it hydrolyzes specific galactolipids, including galactosylceramide and psychosine. Galactosylceramide is an important component of myelin, the protective covering around certain nerve cells that ensures the rapid transmission of nerve impulses. Psychosine forms during the production of myelin, and then it breaks down with help of galactosylceramidase. Under normal conditions, tissues contain very little psychosine.

Health Conditions Related to Genetic Changes

Krabbe disease

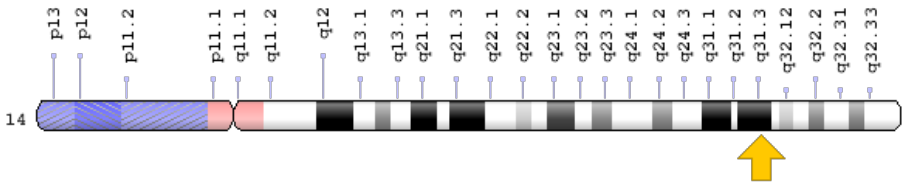
More than 70 *GALC* gene mutations that cause Krabbe disease have been identified. The most common mutation in affected individuals of European ancestry deletes a large segment of the *GALC* gene (written as 30-kb del). Other mutations insert additional DNA building blocks (base pairs) into the *GALC* gene, delete a small number of base pairs from the gene, or replace a single base pair with an incorrect base pair. These mutations severely reduce the activity of the galactosylceramidase enzyme. As a result, certain galactolipids such as galactosylceramide and psychosine cannot be broken down and accumulate in cells that make myelin. Research suggests that psychosine accumulation is toxic and damages myelin-producing cells, causing the loss of myelin. Without myelin, nerves in the brain and other parts of the body cannot function properly, leading to the signs and symptoms of Krabbe disease.

Some individuals with late-onset Krabbe disease have a particular mutation in one of the two copies of the *GALC* gene in each cell. This mutation replaces one of the building blocks (amino acids) used to make the galactosylceramidase enzyme. Specifically, the amino acid glycine is replaced with the amino acid aspartic acid at position 270 in the enzyme (written as Gly270Asp or G270D). The second copy of the *GALC* gene usually has a different mutation, such as the large 30-kb deletion. The Gly270Asp mutation probably allows some activity of the galactosylceramidase enzyme, which delays onset of the disease.

Chromosomal Location

Cytogenetic Location: 14q31.3, which is the long (q) arm of chromosome 14 at position 31.3

Molecular Location: base pairs 87,933,014 to 87,993,665 on chromosome 14 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- galactocerebrosidase
- Galactosylceramide beta-Galactosidase
- GALC_HUMAN
- GALCERase

Additional Information & Resources

GeneReviews

- Krabbe Disease
  https://www.ncbi.nlm.nih.gov/books/NBK1238

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28GALC%5BTIAB%5D%29+OR+%28galactosylceramidase%5BTIAB%5D%29%29+OR+%28%28galactocerebrosidase%5BTIAB%5D%29+OR+%28Galactosylceramide+beta-Galactosidase%5BTIAB%5D%29+OR+%28GALCERase%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+2880+days%22%5Bdp%5D

OMIM

- GALACTOSYLCERAMIDASE
  http://omim.org/entry/606890

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_GALC.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=GALC%5Bgene%5D
- HGNC Gene Symbol Report
  https://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=4115
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/2581
- UniProt
  http://www.uniprot.org/uniprot/P54803

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