GCDH gene

glutaryl-CoA dehydrogenase

Normal Function

The *GCDH* gene provides instructions for making the enzyme glutaryl-CoA dehydrogenase. This enzyme is found in mitochondria, the energy-producing centers of cells. The GCDH enzyme is involved in the breakdown of the amino acids lysine, hydroxylysine, and tryptophan, which are building blocks of proteins.

Health Conditions Related to Genetic Changes

Glutaric acidemia type I

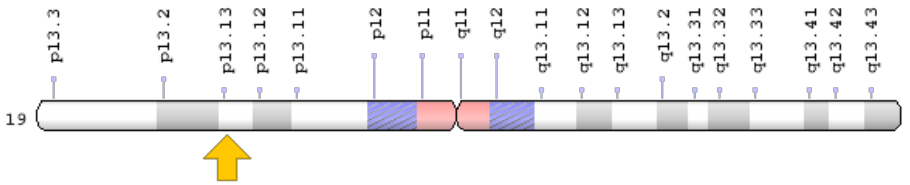
Mutations in the *GCDH* gene prevent production of the glutaryl-CoA enzyme, or result in the production of a defective enzyme that cannot fulfill its role in the breakdown of lysine, hydroxylysine, and tryptophan. This enzyme deficiency allows these amino acids and their intermediate breakdown products to build up to abnormal levels, which damages the nervous system, especially when the body is under stress.

More than 150 *GCDH* gene mutations that cause glutaric acidemia type I have been reported in populations around the world. Most of these mutations result in the substitution of one amino acid for another amino acid in the enzyme. In the Old Order Amish community, all known glutaric acidemia type I cases derive from the replacement of the amino acid alanine with the amino acid valine at position 421 (written as Ala421Val or A421V). A few specific mutations have been seen in certain Native American populations. Individuals with glutaric acidemia type I who belong to the Lumbee community of North Carolina have been found to have a mutation in which the amino acid glutamic acid is replaced with the amino acid lysine at position 414, written as Glu414Lys or E414K. A mutation that replaces a particular DNA building block (nucleotide) called guanine with the nucleotide thymine (written as IVS1, G-T, +5) is prevalent in the Ojibwa population of Canada. As a result of this mutation, an abnormally shortened version of the enzyme is produced. Many different mutations occur in other populations.

Chromosomal Location

Cytogenetic Location: 19p13.13, which is the short (p) arm of chromosome 19 at position 13.13

Molecular Location: base pairs 12,891,129 to 12,915,345 on chromosome 19 (Homo sapiens Updated Annotation Release 109.20190607, GRCh38.p13) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- ACAD5
- GCD
- GCDH_HUMAN
- glutaryl-CoA dehydrogenase, mitochondrial
- glutaryl-Coenzyme A dehydrogenase isoform a precursor
- glutaryl-Coenzyme A dehydrogenase isoform b precursor

Additional Information & Resources

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28GCDH%5BTIAB%5D%29+OR+%28glutaryl-Coenzyme+A+dehydrogenase%5BTIAB%5D%29%29+OR+%28%28glutaryl-Coenzyme+A+dehydrogenase+isoform+a+precursor%5BTIAB%5D%29+OR+%28glutaryl-Coenzyme+A+dehydrogenase+isoform+b+precursor%5BTIAB%5D%29+OR+%28GCD%5BTIAB%5D%29+OR+%28ACAD5%5BTIAB%5D%29+OR+%28glutaryl-CoA+dehydrogenase,+mitochondrial%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

- GLUTARYL-CoA DEHYDROGENASE
  http://omim.org/entry/608801

Research Resources

- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=GCDH%5Bgene%5D
- HGNC Gene Symbol Report
  https://www.genenames.org/data/gene-symbol-report/#!/hgnc_id/HGNC:4189
- Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:2639
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/2639
- UniProt
  https://www.uniprot.org/uniprot/Q92947

Sources for This Summary

- Basinger AA, Booker JK, Frazier DM, Koeberl DD, Sullivan JA, Muenzer J. Glutaric acidemia type 1 in patients of Lumbee heritage from North Carolina. Mol Genet Metab. 2006 May;88(1):90-2. Epub 2006 Feb 8.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16466958
- Busquets C, Soriano M, de Almeida IT, Garavaglia B, Rimoldi M, Rivera I, Uziel G, Cabral A, Coll MJ, Ribes A. Mutation analysis of the GCDH gene in Italian and Portuguese patients with glutaric aciduria type I. Mol Genet Metab. 2000 Nov;71(3):535-7.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/11073722
- OMIM: GLUTARYL-CoA DEHYDROGENASE
  http://omim.org/entry/608801
- Goodman SI, Stein DE, Schlesinger S, Christensen E, Schwartz M, Greenberg CR, Elpeleg ON. Glutaryl-CoA dehydrogenase mutations in glutaric acidemia (type I): review and report of thirty novel mutations. Hum Mutat. 1998;12(3):141-4. Review.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/9711871
- Greenberg CR, Prasad AN, Dilling LA, Thompson JR, Haworth JC, Martin B, Wood-Steiman P, Seargeant LE, Seifert B, Booth FA, Prasad C. Outcome of the first 3-years of a DNA-based neonatal screening program for glutaric acidemia type 1 in Manitoba and northwestern Ontario, Canada. Mol Genet Metab. 2002 Jan;75(1):70-8.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/11825066
- Hedlund GL, Longo N, Pasquali M. Glutaric acidemia type 1. Am J Med Genet C Semin Med Genet. 2006 May 15;142C(2):86-94. Review.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16602100
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2556991/
- Kölker S, Garbade SF, Greenberg CR, Leonard JV, Saudubray JM, Ribes A, Kalkanoglu HS, Lund AM, Merinero B, Wajner M, Troncoso M, Williams M, Walter JH, Campistol J, Martí-Herrero M, Caswill M, Burlina AB, Lagler F, Maier EM, Schwahn B, Tokatli A, Dursun A, Coskun T, Chalmers RA, Koeller DM, Zschocke J, Christensen E, Burgard P, Hoffmann GF. Natural history, outcome, and treatment efficacy in children and adults with glutaryl-CoA dehydrogenase deficiency. Pediatr Res. 2006 Jun;59(6):840-7. Epub 2006 Apr 26.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16641220

- Kölker S, Hoffmann GF, Schor DS, Feyh P, Wagner L, Jeffrey I, Pourfarzam M, Okun JG, Zschocke J, Baric I, Bain MD, Jakobs C, Chalmers RA. Glutaryl-CoA dehydrogenase deficiency: region-specific analysis of organic acids and acylcarnitines in post mortem brain predicts vulnerability of the putamen. Neuropediatrics. 2003 Jun;34(5):253-60.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/14598231
- Tang NL, Hui J, Law LK, Lam YY, Chan KY, Yeung WL, Chan AY, Cheung KL, Fok TF. Recurrent and novel mutations of GCDH gene in Chinese glutaric acidemia type I families. Hum Mutat. 2000 Nov;16(5):446.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/11058907

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