



## ALAD gene

aminolevulinate dehydratase

### Normal Function

The *ALAD* gene provides instructions for making an enzyme known as delta-aminolevulinate dehydratase. This enzyme is involved in the production of a molecule called heme. Heme is vital for all of the body's organs, although it is found mostly in the blood, bone marrow, and liver. Heme is an essential component of several iron-containing proteins called hemoproteins, including hemoglobin (the protein that carries oxygen in the blood).

The production of heme is a multi-step process that requires eight different enzymes. Delta-aminolevulinate dehydratase is responsible for the second step in this process, which combines two molecules of delta-aminolevulinic acid (the product of the first step) to form a compound called porphobilinogen. In subsequent steps, four molecules of porphobilinogen are combined and then modified to produce heme.

### Health Conditions Related to Genetic Changes

#### Porphyria

At least 10 mutations in the *ALAD* gene can cause a rare form of porphyria called ALAD deficiency porphyria. Most of these mutations change single protein building blocks (amino acids) in delta-aminolevulinate dehydratase. These changes reduce the activity of the enzyme, allowing delta-aminolevulinic acid to build up to toxic levels in the body. This compound is formed during the normal process of heme production, but reduced activity of delta-aminolevulinate dehydratase allows it to accumulate to toxic levels. Very high levels of this compound can cause attacks of abdominal pain, vomiting, and other signs and symptoms of ALAD deficiency porphyria.

#### Other disorders

A common variation (polymorphism) in the *ALAD* gene may affect the risk of developing lead poisoning in people exposed to environmental lead. Lead is a heavy metal that is toxic when inhaled or ingested. Lead poisoning can cause significant health problems involving the nervous system, blood, kidneys, and reproductive system.

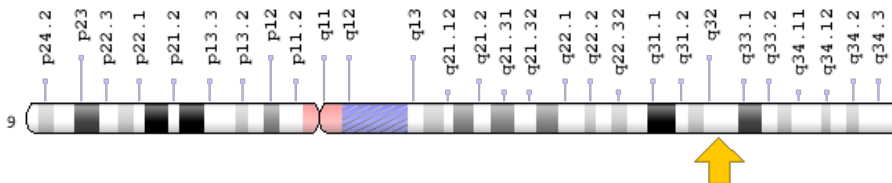
The *ALAD* variation that has been studied most extensively replaces the amino acid glycine with the amino acid cysteine at position 177 in delta-aminolevulinate dehydratase (written as Gly177Cys or G177C). This variation may influence the amount of lead in a person's blood and bones. Although some studies suggest that

this variation increases the risk of lead poisoning, other studies have not found such an association.

### Chromosomal Location

Cytogenetic Location: 9q32, which is the long (q) arm of chromosome 9 at position 32

Molecular Location: base pairs 113,386,312 to 113,401,338 on chromosome 9 (Homo sapiens Updated Annotation Release 109.20190905, GRCh38.p13) (NCBI)



Credit: Genome Decoration Page/NCBI

### Other Names for This Gene

- 5-aminolevulinate dehydratase
- 5-Aminolevulinate hydro-lyase (adding 5-aminolevulinate and cyclizing)
- ALA-Dehydrase
- ALADH
- Aminolevulinate Hydro-Lyase
- aminolevulinate, delta-, dehydratase
- Aminolevulinic Acid Dehydratase
- delta-Aminolevulinate Dehydratase
- delta-Aminolevulinic Acid Dehydratase
- HEM2\_HUMAN
- PBGS
- Porphobilinogen Synthase

### Additional Information & Resources

#### Educational Resources

- Biochemistry (fifth edition, 2002): Mammalian Porphyrins Are Synthesized from Glycine and Succinyl Coenzyme A  
<https://www.ncbi.nlm.nih.gov/books/NBK22446/#A3395>

## Scientific Articles on PubMed

- PubMed  
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28ALAD+AND+gene%5BTIAB%5D%29+AND+%28%285-aminolevulinate+hydro-lyase%5BTIAB%5D%29+OR+%28ala-dehydrase%5BTIAB%5D%29+OR+%28aminolevulinic+acid+dehydratase%5BTIAB%5D%29+OR+%28delta-aminolevulinate+dehydratase%5BTIAB%5D%29+OR+%28porphobilinogen+synthase%5BTIAB%5D%29+OR+%28delta-aminolevulinic+acid+dehydratase%5BTIAB%5D%29+OR+%28aminolevulinate+hydro-lyase%5BTIAB%5D%29+OR+%28ALA+dehydratase+porphyria%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

- DELTA-AMINOLEVULINATE DEHYDRATASE  
<http://omim.org/entry/125270>

## Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology  
[http://atlasgeneticsoncology.org/Genes/GC\\_ALAD.html](http://atlasgeneticsoncology.org/Genes/GC_ALAD.html)
- ClinVar  
<https://www.ncbi.nlm.nih.gov/clinvar?term=ALAD%5Bgene%5D>
- HGNC Gene Symbol Report  
[https://www.genenames.org/data/gene-symbol-report/#!/hgnc\\_id/HGNC:395](https://www.genenames.org/data/gene-symbol-report/#!/hgnc_id/HGNC:395)
- Monarch Initiative  
<https://monarchinitiative.org/gene/NCBIGene:210>
- NCBI Gene  
<https://www.ncbi.nlm.nih.gov/gene/210>
- UniProt  
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Reprinted from Genetics Home Reference:  
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