ASS1 gene

argininosuccinate synthase 1

Normal Function

The *ASS1* gene provides instructions for making an enzyme called argininosuccinate synthase 1. This enzyme participates in the urea cycle, which is a sequence of chemical reactions that takes place in liver cells. The urea cycle processes excess nitrogen that is generated as the body breaks down proteins. The excess nitrogen is used to make a compound called urea, which is excreted from the body in urine.

Argininosuccinate synthase 1 is involved in the third step of the urea cycle. This step combines two protein building blocks (amino acids), citrulline and aspartate, to form a molecule called argininosuccinic acid. A series of additional chemical reactions uses argininosuccinic acid to form urea.

Health Conditions Related to Genetic Changes

Citrullinemia

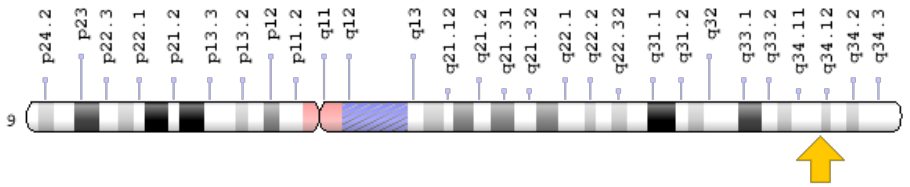
At least 118 mutations that cause type I citrullinemia have been identified in the *ASS1* gene. Type I citrullinemia is a serious condition that usually appears in the first few days of life. It causes life-threatening health problems, including poor feeding, vomiting, seizures, and loss of consciousness. Most of the mutations involved in type I citrullinemia change single amino acids in the argininosuccinate synthase 1 enzyme. These genetic changes likely alter the structure of the enzyme, impairing its ability to attach to molecules such as citrulline and aspartate. A few mutations lead to the production of an abnormally short version of the enzyme that cannot effectively play its role in the urea cycle.

Defects in argininosuccinate synthase 1 disrupt the third step of the urea cycle, preventing the liver from processing excess nitrogen into urea. As a result, nitrogen (in the form of ammonia) and other byproducts of the urea cycle (such as citrulline) build up in the bloodstream. Ammonia is toxic, particularly to the nervous system. An accumulation of ammonia during the first few days of life leads to poor feeding, vomiting, seizures, and the other signs and symptoms of type I citrullinemia.

Chromosomal Location

Cytogenetic Location: 9q34.11, which is the long (q) arm of chromosome 9 at position 34.11

Molecular Location: base pairs 130,444,707 to 130,501,274 on chromosome 9 (Homo sapiens Updated Annotation Release 109.20190607, GRCh38.p13) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- argininosuccinate synthetase 1
- ASS
- ASSY_HUMAN
- Citrulline-aspartate ligase
- CTLN1

Additional Information & Resources

Educational Resources

- Chapter 23.4: Ammonium Ion Is Converted Into Urea in Most Terrestrial Vertebrates (Biochemistry, fifth edition, 2002)
  https://www.ncbi.nlm.nih.gov/books/NBK22450/

Clinical Information from GeneReviews

- Citrullinemia Type I
  https://www.ncbi.nlm.nih.gov/books/NBK1458
- Urea Cycle Disorders Overview
  https://www.ncbi.nlm.nih.gov/books/NBK1217

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28ASS%5BTIAB%5D%29+OR+%28argininosuccinate+synthetase%5BTIAB%5D%29%29+OR+%28%28ASS1%5BTIAB%5D%29+OR+%28CTLN1%5BTIAB%5D%29+OR+%28Citrulline-aspartate+ligase%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+1440+days%22%5Bdp%5D

Catalog of Genes and Diseases from OMIM

- ARGININOSUCCINATE SYNTHETASE 1
  http://omim.org/entry/603470

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_ASS1.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=ASS1%5Bgene%5D
- HGNC Gene Symbol Report
  https://www.genenames.org/data/gene-symbol-report/#!/hgnc_id/HGNC:758
- Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:445
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/445
- UniProt
  https://www.uniprot.org/uniprot/P00966

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