CBS gene

cystathionine-beta-synthase

Normal Function

The *CBS* gene provides instructions for making an enzyme called cystathionine beta-synthase. This enzyme acts in a chemical pathway and is responsible for using vitamin B6 to convert building block of proteins (amino acid) called homocysteine and serine to a molecule called cystathionine. Another enzyme then converts cystathionine to the amino acid cysteine, which is used to build proteins or is broken down and excreted in urine. Additionally, other amino acids, including methionine, are produced in this pathway.

Health Conditions Related to Genetic Changes

Homocystinuria

More than 150 mutations that cause homocystinuria have been identified in the *CBS* gene. Most of these mutations change single amino acids in cystathionine beta-synthase. The most common mutation substitutes the amino acid threonine for the amino acid isoleucine at position 278 in the enzyme (written as Ile278Thr or I278T). Another common mutation, which is the most frequent cause of homocystinuria in the Irish population, replaces the amino acid glycine with the amino acid serine at position 307 (written as Gly307Ser or G307S). These mutations disrupt the normal function of cystathionine beta-synthase. As a result, homocysteine and other potentially toxic compounds build up in the blood, and homocysteine is excreted in urine. Researchers have not determined how excess homocysteine leads to the signs and symptoms of homocystinuria.
**Chromosomal Location**

Cytogenetic Location: 21q22.3, which is the long (q) arm of chromosome 21 at position 22.3

Molecular Location: base pairs 43,053,190 to 43,076,861 on chromosome 21 (Homo sapiens Updated Annotation Release 109.20200228, GRCh38.p13) (NCBI)

Credit: Genome Decoration Page/NCBI

**Other Names for This Gene**

- beta-thionase
- CBS_HUMAN
- HIP4
- methylcysteine synthase
- serine sulphydrase

**Additional Information & Resources**

**Clinical Information from GeneReviews**

- Homocystinuria Caused by Cystathionine Beta-Synthase Deficiency
  https://www.ncbi.nlm.nih.gov/books/NBK1524

**Scientific Articles on PubMed**

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28CBS%5BTIAB%5D%29+OR+%28cystathionine-beta-synthase%5BTIAB%5D%29+AND+%28l-serine+hydro-lyase%28adding+homocysteine%29+OR+%28beta-thionase%5BMAJR%5D%29+OR+%28serine+sulphydrase%5BMAJR%5D%29+OR+%28cystathionine+synthetase%5BMAJR%5D%29+OR+%28beta-synthase%5BMAJR%5D%29+AND+%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1440+days%22%5Bdp%5D
Catalog of Genes and Diseases from OMIM

• CYSTATHIONINE BETA-SYNTHASE
  http://omim.org/entry/613381

Research Resources

• Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_CBS.html

• ClinVar

• HGNC Gene Symbol Report

• Kraus Lab at the University of Colorado Health Sciences Center
  http://www.ucdenver.edu/academics/colleges/medicalschool/programs/kraus/Pages/home.aspx

• Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:875

• NCBI Gene

• UniProt: CBS_HUMAN
  https://www.uniprot.org/uniprot/P35520

• UniProt: CBSL_HUMAN
  https://www.uniprot.org/uniprot/P0DN79

Sources for This Summary

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/15581573

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/20506325
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2966864/

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/10338090

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/12686134
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/15087459

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/14722927


Reviewed: July 2011
Published: May 26, 2020

Lister Hill National Center for Biomedical Communications
U.S. National Library of Medicine
National Institutes of Health
Department of Health & Human Services