PCBD1 gene
pterin-4 alpha-carbinolamine dehydratase 1

Normal Function

The PCBD1 gene provides instructions for making an enzyme called pterin-4 alpha-carbinolamine dehydratase. This enzyme helps carry out one step in the chemical pathway that recycles a molecule called tetrahydrobiopterin (BH4).

Tetrahydrobiopterin plays a critical role in processing several protein building blocks (amino acids) in the body. For example, it works with the enzyme phenylalanine hydroxylase to convert an amino acid called phenylalanine into another amino acid, tyrosine. Tetrahydrobiopterin is also involved in reactions that produce chemicals called neurotransmitters, which transmit signals between nerve cells in the brain. Because it helps enzymes carry out chemical reactions, tetrahydrobiopterin is known as a cofactor.

When tetrahydrobiopterin interacts with enzymes during chemical reactions, the cofactor is altered and must be recycled to a usable form. Pterin-4 alpha-carbinolamine dehydratase is one of two enzymes that help recycle tetrahydrobiopterin in the body.

Health Conditions Related to Genetic Changes

Tetrahydrobiopterin deficiency

At least nine mutations in the PCBD1 gene have been found to cause tetrahydrobiopterin deficiency. When this condition results from PCBD1 gene mutations, it is known as pterin-4 alpha-carbinolamine dehydratase (PCD) deficiency. PCD deficiency accounts for about 5 percent of all cases of tetrahydrobiopterin deficiency.

Some mutations in the PCBD1 gene change single amino acids in pterin-4 alpha-carbinolamine dehydratase, while other mutations introduce a premature stop signal in the instructions for making this enzyme. Changes in pterin-4 alpha-carbinolamine dehydratase reduce the enzyme’s activity, which affects the body's ability to recycle tetrahydrobiopterin. As a result, less of this cofactor is available to participate in chemical reactions such as the conversion of phenylalanine to tyrosine. If phenylalanine is not converted to tyrosine, the excess can build up in the bloodstream and other tissues.

Although people with PCD deficiency usually have elevated levels of phenylalanine in the blood, this form of tetrahydrobiopterin deficiency rarely causes significant medical problems. Researchers believe that other enzymes may compensate for the reduced activity of pterin-4 alpha-carbinolamine dehydratase in people with PCBD1 gene mutations.
Chromosomal Location

Cytogenetic Location: 10q22.1, which is the long (q) arm of chromosome 10 at position 22.1

Molecular Location: base pairs 70,882,280 to 70,888,565 on chromosome 10 (Homo sapiens Updated Annotation Release 109.20200228, GRCh38.p13) (NCBI)

Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- 4-alpha-hydroxy-tetrahydropterin dehydratase
- 6-pyruvyl-tetrahydropterin synthase/dimerization cofactor of hepatocyte nuclear factor 1 alpha (TCF1)
- Carbinolamine-4a-dehydratase
- DCOH
- Dimerization cofactor of hepatocyte nuclear factor 1-alpha
- Dimerization cofactor of HNF1
- PCBD
- PCD
- Phenylalanine hydroxylase-stimulating protein
- PHS_HUMAN
- Pterin-4-alpha-carbinolamine dehydratase
- pterin-4 alpha-carbinolamine dehydratase/dimerization cofactor of hepatocyte nuclear factor 1 alpha
- pterin-4 alpha-carbinolamine dehydratase/dimerization cofactor of hepatocyte nuclear factor 1 alpha (TCF1)
- Pterin-4a-carbinolamine dehydratase (dimerization cofactor of hepatic nuclear factor 1-alpha)
- Pterin carbinolamine dehydratase
Additional Information & Resources

Scientific Articles on PubMed

• PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28pterin-4+alpha-carbinolamine+dehydratase%5BTIAB%5D%29+OR+%28carbinolamine-4a-dehydratase%5BTIAB%5D%29+OR+%28PCBD+NOT+bile%5BTIAB%5D%29+OR+%28PCBD1%29%29+AND+english%5Blanguage%5D+AND+human%5Bspecies%5D

Catalog of Genes and Diseases from OMIM

• PTERIN-4-ALPHA-CARBINOLAMINE DEHYDRATASE 1
  http://omim.org/entry/126090

Research Resources

• ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=PCBD1%5Bgene%5D

• HGNC Gene Symbol Report

• Monarch Initiative
  https://monarchinitiative.org/gene/NCBIGene:5092

• NCBI Gene

• UniProt
  https://www.uniprot.org/uniprot/P61457

Sources for This Summary

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/8352282
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1682436/

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/19234759

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• Thöny B, Blau N. Mutations in the BH4-metabolizing genes GTP cyclohydrolase I, 6-pyruvoyl-tetrahydropterin synthase, sepiapterin reductase, carbinolamine-4a-dehydratase, and dihydropteridine reductase. Hum Mutat. 2006 Sep;27(9):870-8. 
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  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/9760199

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