

PTS gene

6-pyruvoyltetrahydropterin synthase

Normal Function

The *PTS* gene provides instructions for making an enzyme called 6-pyruvoyltetrahydropterin synthase. This enzyme is involved in the second of three steps in the production of a molecule called tetrahydrobiopterin (BH₄). Other enzymes help carry out the first and third steps in this process.

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.

Health Conditions Related to Genetic Changes

Tetrahydrobiopterin deficiency

More than 45 mutations in the *PTS* gene have been found to cause tetrahydrobiopterin deficiency. When this condition is caused by *PTS* gene mutations, it is known as 6-pyruvoyltetrahydropterin synthase (PTS) deficiency. PTS deficiency accounts for more than half of all cases of tetrahydrobiopterin deficiency.

Most *PTS* gene mutations change single amino acids in 6-pyruvoyltetrahydropterin synthase, although some mutations insert or delete small amounts of DNA in the *PTS* gene or disrupt the way the gene's instructions are used to make the enzyme. Changes in 6-pyruvoyltetrahydropterin synthase greatly reduce or eliminate the enzyme's activity. Without enough of this enzyme, little or no tetrahydrobiopterin is produced. As a result, this cofactor is not available to participate in chemical reactions such as the conversion of phenylalanine to tyrosine. If phenylalanine is not converted to tyrosine, it can build up to toxic levels in the blood and other tissues. Nerve cells in the brain are particularly sensitive to phenylalanine levels, which is why excessive amounts of this substance can cause brain damage.

Additionally, a reduction in 6-pyruvoyltetrahydropterin synthase activity disrupts the production of certain neurotransmitters in the brain. Because neurotransmitters are

necessary for normal brain function, changes in the levels of these chemicals contribute to intellectual disability in people with PTS deficiency.

Other Names for This Gene

- 6-pyruvoyl-H4-pterin synthase
- 6-pyruvoyl-tetrahydropterin synthase
- PTP synthase
- PTPS
- PTPS_HUMAN
- sepiapterin synthase A
- sepiapterin synthesizing enzyme 1

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of PTS ([https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=5805\[geneid\]](https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=5805[geneid]))

Scientific Articles on PubMed

- PubMed (<https://pubmed.ncbi.nlm.nih.gov/?term=%28%286-pyruvoyltetrahydropterin+synthase%5BTIAB%5D%29+OR+%28PTS+gene%5BTIAB%5D%29+OR+%28sepiapterin+synthase+A%5BTIAB%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D%29>)

Catalog of Genes and Diseases from OMIM

- 6-PYRUVOYL-TETRAHYDROPTERIN SYNTHASE; PTS (<https://omim.org/entry/612719>)

Gene and Variant Databases

- NCBI Gene (<https://www.ncbi.nlm.nih.gov/gene/5805>)
- ClinVar ([https://www.ncbi.nlm.nih.gov/clinvar?term=PTS\[gene\]](https://www.ncbi.nlm.nih.gov/clinvar?term=PTS[gene]))

References

- Auerbach G, Nar H. The pathway from GTP to tetrahydrobiopterin: three-dimensional structures of GTP cyclohydrolase I and 6-pyruvoyltetrahydropterin synthase. *Biol Chem.* 1997 Mar-Apr;378(3-4):185-92. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/9165069>)

- Dudesek A, Roschinger W, Muntau AC, Seidel J, Leupold D, Thony B, Blau N. Molecular analysis and long-term follow-up of patients with different forms of 6-pyruvoyl-tetrahydropterin synthase deficiency. *Eur J Pediatr*. 2001 May;160(5):267-76. doi: 10.1007/s004310000722. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/11388593>)
- Kao CD, Niu DM, Chen JT, Shan DE, Lin YY, Wu ZA, Liao KK. Subtle brain dysfunction in treated 6-pyruvoyl-tetrahydropterin synthase deficiency: relationship to motor tasks and neurophysiological tests. *Brain Dev*. 2004 Mar;26(2):93-8. doi: 10.1016/S0387-7604(03)00098-6. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/15036427>)
- Leuzzi V, Carducci CA, Carducci CL, Pozzessere S, Burlina A, Cerone R, Concolino D, Donati MA, Fiori L, Meli C, Ponzzone A, Porta F, Strisciuglio P, Antonozzi I, Blau N. Phenotypic variability, neurological outcome and genetics background of 6-pyruvoyl-tetrahydropterin synthase deficiency. *Clin Genet*. 2010 Mar;77(3):249-57. doi: 10.1111/j.1399-0004.2009.01306.x. Epub 2009 Jan 3. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/20059486>)
- Liu TT, Chiang SH, Wu SJ, Hsiao KJ. Tetrahydrobiopterin-deficient hyperphenylalaninemia in the Chinese. *Clin Chim Acta*. 2001 Nov;313(1-2):157-69. doi: 10.1016/S0009-8981(01)00669-6. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/11694255>)
- Longo N. Disorders of biopterin metabolism. *J Inherit Metab Dis*. 2009 Jun;32(3):333-42. doi: 10.1007/s10545-009-1067-2. Epub 2009 Feb 9. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/19234759>)
- Shintaku H. Disorders of tetrahydrobiopterin metabolism and their treatment. *Curr Drug Metab*. 2002 Apr;3(2):123-31. doi: 10.2174/1389200024605145. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/12003346>)
- Thony B, Auerbach G, Blau N. Tetrahydrobiopterin biosynthesis, regeneration and functions. *Biochem J*. 2000 Apr 1;347 Pt 1(Pt 1):1-16. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/10727395>) or Free article on PubMed Central (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1220924/>)
- Thony 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. doi: 10.1002/humu.20366. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/16917893>)
- Wang L, Yu WM, He C, Chang M, Shen M, Zhou Z, Zhang Z, Shen S, Liu TT, Hsiao KJ. Long-term outcome and neuroradiological findings of 31 patients with 6-pyruvoyl-tetrahydropterin synthase deficiency. *J Inherit Metab Dis*. 2006 Feb;29(1):127-34. doi: 10.1007/s10545-006-0080-y. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/16601879>)

Genomic Location

The *PTS* gene is found on chromosome 11 (<https://medlineplus.gov/genetics/chromosome>)

me/11/).

Last updated July 1, 2011