TH gene

tyrosine hydroxylase

Normal Function

The *TH* gene provides instructions for making the enzyme tyrosine hydroxylase, which is important for normal functioning of the nervous system. Tyrosine hydroxylase takes part in the first step of the pathway that produces a group of hormones called catecholamines. This enzyme helps convert the protein building block (amino acid) tyrosine to a catecholamine called dopamine. Dopamine is also known as a neurotransmitter because it transmits signals between nerve cells in the brain to help control physical movement and emotional behavior. Other catecholamines called norepinephrine and epinephrine are produced from dopamine. Norepinephrine and epinephrine are involved in the autonomic nervous system, which controls involuntary body processes such as the regulation of blood pressure and body temperature.

Health Conditions Related to Genetic Changes

Dopa-responsive dystonia

More than two dozen mutations in the *TH* gene have been found to cause dopa-responsive dystonia. This condition is characterized by a pattern of involuntary muscle contractions (dystonia), tremors, and other uncontrolled movements and usually responds to treatment with a medication called L-Dopa. Most *TH* gene mutations that cause this condition change single protein building blocks (amino acids) in the tyrosine hydroxylase enzyme, resulting in a decrease in functional enzyme. A reduction in normal tyrosine hydroxylase enzyme leads to a decrease in the production of dopamine, which causes the movement problems characteristic of dopa-responsive dystonia. The amount of functional enzyme that is produced is associated with the severity of the signs and symptoms. Less functional enzyme leads to more severe symptoms.

Tyrosine hydroxylase deficiency

More than 20 mutations in the *TH* gene have been identified in people with tyrosine hydroxylase (TH) deficiency. These mutations result in reduced activity of the tyrosine hydroxylase enzyme. As a result, the body produces less dopamine, norepinephrine, and epinephrine. These catecholamines are necessary for normal nervous system function, and changes in their levels contribute to the abnormal movements, nervous system dysfunction, and other neurological problems seen in people with TH deficiency.

Dopa-responsive dystonia (described above) is sometimes considered a mild form of tyrosine hydroxylase deficiency. It is uncertain whether they are two separate disorders or part of the same disease spectrum.

Other disorders

Certain common *TH* variations (polymorphisms) modify catecholamine production, which affects the risk of developing conditions associated with regulation of the autonomic nervous system. These *TH* gene polymorphisms affect the extent to which blood pressure increases with stress and may increase the risk of high blood pressure (hypertension).

One *TH* gene polymorphism has been associated with sudden infant death syndrome (SIDS). SIDS is a major cause of death in babies younger than 1 year. It is characterized by sudden and unexplained death, usually during sleep. The polymorphism, called allele *9.3, is the most common *TH* gene polymorphism among people of European descent and has been identified in a larger percentage of babies who die from SIDS than in other babies. This version of the gene may affect the regulation of breathing or awakening in infants.

Other Names for This Gene

- DYT5b
- TY3H_HUMAN
- TYH
- tyrosine 3-monooxygenase

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of TH (https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=7054[geneid])

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=%28tyrosine+hydroxylase%5BTIAB%5D%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+720+days%22%5Bdp%5D)

Catalog of Genes and Diseases from OMIM

- TYROSINE HYDROXYLASE; TH (https://omim.org/entry/191290)

Gene and Variant Databases

- NCBI Gene (https://www.ncbi.nlm.nih.gov/gene/7054)
- ClinVar (https://www.ncbi.nlm.nih.gov/clinvar?term=TH[gene])

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Genomic Location

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

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