DNMT1 gene

DNA methyltransferase 1

Normal Function

The *DNMT1* gene provides instructions for making an enzyme called DNA methyltransferase 1. This enzyme is involved in DNA methylation, which is the addition of methyl groups, consisting of one carbon atom and three hydrogen atoms (methylation), to DNA molecules. In particular, the enzyme helps add methyl groups to DNA building blocks (nucleotides) called cytosines.

DNA methylation is important in many cellular functions. These include determining whether the instructions in a particular segment of DNA are carried out or suppressed (gene silencing), regulating reactions involving proteins and fats (lipids), and controlling the processing of chemicals that relay signals in the nervous system (neurotransmitters). DNA methyltransferase 1 is active in the adult nervous system. Although its specific function is not well understood, the enzyme may help regulate nerve cell (neuron) maturation and specialization (differentiation), the ability of neurons to migrate where needed and connect with each other, and neuron survival.

Health Conditions Related to Genetic Changes

hereditary sensory and autonomic neuropathy type IE

At least three *DNMT1* gene mutations have been identified in people with hereditary sensory and autonomic neuropathy (HSAN IE), a disorder characterized by a gradual loss of intellectual functions (dementia), deafness, and sensory problems in the feet. The mutations, which are in a region of the gene called exon 20, reduce or eliminate the DNA methyltransferase 1 enzyme's methylation function. As a result, maintenance of the neurons that make up the nervous system is impaired. However, it is not known how the mutations cause the specific signs and symptoms of HSAN IE.

cancers

Several normal variations (polymorphisms) in the *DNMT1* gene have been associated with an increased risk of cancer, including cancers of the breast and stomach. These variations, which can be passed on from parent to child, may affect the activity of the DNA methyltransferase 1 enzyme and the way it regulates other genes. Changes in the regulation of these genes can lead to abnormal cell growth and division and increase the risk of cancer.

In addition, increased activity (overexpression) of the *DNMT1* gene has been identified in certain brain cancers called gliomas. The genetic changes involved in this overexpression are somatic, which means that they occur only in the tumor cells and are not inherited. Researchers suggest that overexpression of the *DNMT1* gene may result in methylation and silencing of genes called tumor suppressors. When tumor suppressor genes are silenced, cells can grow and divide unchecked, which can lead to cancer.

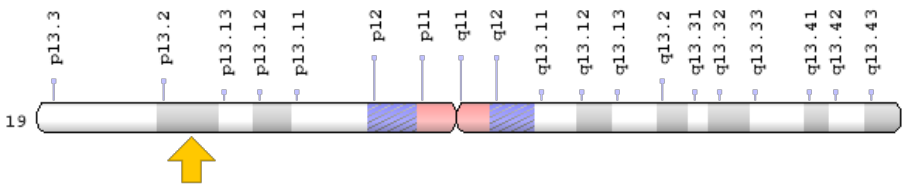
other disorders

At least three *DNMT1* gene mutations have been identified in people with another nervous system disorder called autosomal dominant cerebellar ataxia, deafness, and narcolepsy. Features of this disorder include difficulty coordinating movements (ataxia), hearing loss, and excessive daytime sleepiness (narcolepsy). The mutations associated with this disorder are in a region of the *DNMT1* gene known as exon 21, distinct from the mutations that cause HSAN IE (described above) which are in exon 20. Mutations in different locations within the gene may affect the DNA methyltransferase 1 enzyme differently, which can lead to particular combinations of signs and symptoms.

Chromosomal Location

Cytogenetic Location: 19p13.2, which is the short (p) arm of chromosome 19 at position 13.2

Molecular Location: base pairs 10,133,344 to 10,195,135 on chromosome 19 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- AIM
- CXXC finger protein 9
- CXXC-type zinc finger protein 9
- CXXC9

- DNA (cytosine-5-)-methyltransferase 1
- DNA (cytosine-5)-methyltransferase 1
- DNA methyltransferase HsaI
- DNA MTase HsaI
- DNMT
- DNMT1_HUMAN
- HSN1E
- m.HsaI
- MCMT

Additional Information & Resources

Educational Resources

- Madame Curie Bioscience Database: DNA Methylation
  http://www.ncbi.nlm.nih.gov/books/NBK45032/#ch4689.s5

GeneReviews

- DNMT1-Related Dementia, Deafness, and Sensory Neuropathy
  http://www.ncbi.nlm.nih.gov/books/NBK84112

Genetic Testing Registry

- GTR: Genetic tests for DNMT1
  http://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=1786%5Bgeneid%5D

Scientific articles on PubMed

- PubMed
  http://www.ncbi.nlm.nih.gov/pubmed?term=%28%28DNMT1%5BTI%5D%29+OR+%28DNA++-methyltransferase+1%5BTI%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+720+days%22%5Bdp%5D

OMIM

- CEREBELLAR ATAXIA, DEAFNESS, AND NARCOLEPSY, AUTOSOMAL DOMINANT
  http://omim.org/entry/604121
- DNA METHYLTRANSFERASE 1
  http://omim.org/entry/126375

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/DNMT1ID40347ch19p13.html
- HGNC Gene Family: Zinc fingers CXXC-type
  http://www.genenames.org/cgi-bin/genefamilies/set/136
- HGNC Gene Symbol Report
  http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=2976
- NCBI Gene
  http://www.ncbi.nlm.nih.gov/gene/1786
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