ATP7A gene

ATPase copper transporting alpha

Normal Function

The *ATP7A* gene provides instructions for making a protein that is important for regulating copper levels in the body. Copper is necessary for many cellular functions, but it is toxic when present in excessive amounts. The ATP7A protein is found throughout the body, except in liver cells. In the small intestine, this protein helps control the absorption of copper from food. In other cells, the ATP7A protein has a dual role and shuttles between two cellular locations. The protein normally resides in a cell structure called the Golgi apparatus, which modifies newly produced proteins, including enzymes. In the Golgi apparatus, the ATP7A protein supplies copper to certain enzymes that are critical for the structure and function of bone, skin, hair, blood vessels, and the nervous system. If copper levels in the cell environment are elevated, however, the ATP7A protein moves to the cell membrane and eliminates excess copper from the cell.

Health Conditions Related to Genetic Changes

Cutis laxa

Several mutations in the *ATP7A* gene are responsible for a condition called occipital horn syndrome or X-linked cutis laxa, which is considered a mild form of Menkes syndrome. Occipital horn syndrome is characterized by loose and sagging skin, wedge-shaped calcium deposits in a bone at the base of the skull (the occipital bone), coarse hair, and loose joints.

Most of the mutations that cause occipital horn syndrome reduce but do not eliminate the production of the ATP7A protein. A shortage of this protein impairs the absorption of copper from food and prevents its normal distribution to cells throughout the body. The decreased supply of copper can reduce the activity of numerous copper-containing enzymes, affecting the structure and function of bone, skin, hair, blood vessels, and the nervous system. The reduced activity of these enzymes underlies the characteristic features of occipital horn syndrome.

Menkes syndrome

Researchers have identified more than 150 mutations in the *ATP7A* gene that cause Menkes syndrome. Many of these mutations delete part of the gene and likely result in a shortened ATP7A protein. Other mutations insert additional DNA building blocks (nucleotides) into the gene or change single nucleotides. All of these mutations

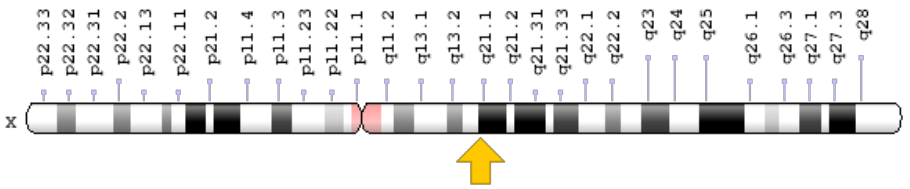
prevent the production of functional ATP7A protein. As a result, the absorption of copper from food is impaired, and copper is not supplied to certain enzymes. The abnormal protein may get stuck in the cell membrane and become unable to shuttle back and forth from the Golgi apparatus.

The disrupted activity of the ATP7A protein causes copper to be poorly distributed to cells in the body. Copper accumulates in some tissues, such as the small intestine and kidneys, while the brain and other tissues have unusually low levels. The decreased supply of copper can reduce the activity of numerous copper-containing enzymes, affecting the structure and function of bone, skin, hair, blood vessels, and the nervous system. The signs and symptoms of Menkes syndrome are caused by the reduced activity of these copper-containing enzymes.

Chromosomal Location

Cytogenetic Location: Xq21.1, which is the long (q) arm of the X chromosome at position 21.1

Molecular Location: base pairs 77,910,656 to 78,050,395 on the X chromosome (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- ATP7A_HUMAN
- ATPase, Cu++ transporting, alpha polypeptide
- ATPase, Cu++ transporting, alpha polypeptide (Menkes syndrome)
- ATPP1
- copper pump 1
- MC1
- MK
- MNK
- OHS

Additional Information & Resources

Educational Resources

- Basic Neurochemistry: Molecular, Cellular, and Medical Aspects (sixth edition, 1999): Linkage of Copper and Iron Metabolism in Basal Ganglia Disorders
  https://www.ncbi.nlm.nih.gov/books/NBK28009/?rendertype=box&id=A3234

GeneReviews

- ATP7A-Related Copper Transport Disorders
  https://www.ncbi.nlm.nih.gov/books/NBK1413

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28ATP7A%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+1800+days%22%5Bdp%5D

OMIM

- ATPase, Cu(2+)-TRANSPORTING, ALPHA POLYPEPTIDE
  http://omim.org/entry/300011

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_ATP7A.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=ATP7A%5Bgene%5D
- HGNC Gene Family: ATPase copper transporting
  https://www.genenames.org/cgi-bin/genefamilies/set/1212
- HGNC Gene Symbol Report
  https://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=869
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/538
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  http://www.uniprot.org/uniprot/Q04656

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https://ghr.nlm.nih.gov/gene/ATP7A

Reviewed: June 2009
Published: February 20, 2018

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