

# ATP7B Gene

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Contributor: Vicky Zhou

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## 1. Normal Function

The *ATP7B* gene provides instructions for making a protein called copper-transporting ATPase 2. This protein is part of the P-type ATPase family, a group of proteins that transport metals into and out of cells by using energy stored in the molecule adenosine triphosphate (ATP). Copper-transporting ATPase 2 is found primarily in the liver, with smaller amounts in the kidneys and brain. It plays a role in the transport of copper from the liver to other parts of the body. Copper is an important part of certain enzymes that maintain normal cell functions. Copper-transporting ATPase 2 is also important for the removal of excess copper from the body.

Within liver cells, copper-transporting ATPase 2 is found in a structure called the Golgi apparatus, which modifies newly produced enzymes and other proteins. Here, copper-transporting ATPase 2 supplies copper to a protein called ceruloplasmin, which transports copper to other parts of the body via the blood. If copper levels in the liver get too high, copper-transporting ATPase 2 leaves the Golgi and transfers copper to small sacs (vesicles) for elimination through bile. Bile is a substance produced by the liver that is important for digestion and the removal of waste products.

## 2. Health Conditions Related to Genetic Changes

### Wilson Disease

Researchers have identified more than 250 *ATP7B* gene mutations that cause Wilson disease. About half the mutations change one of the protein building blocks (amino acids) used to make copper-transporting ATPase 2. This type of mutation alters the 3-dimensional structure of the protein or its stability, preventing copper-transporting ATPase 2 from functioning properly. A common amino acid substitution replaces the amino acid histidine with the amino acid glutamine at position 1069 in the protein (written as His1069Gln or H1069Q). This particular mutation occurs in nearly 40 percent of affected individuals with a Northern or Eastern European ancestry. Approximately one-third of Asians with Wilson disease have a mutation that replaces the amino acid arginine with the amino acid leucine at position 778 (written as Arg778Leu or R778L). In the Costa Rican population, more than 60 percent of affected individuals have a mutation that replaces the amino acid aspartic acid with the amino acid serine at position 1270 (written as Asp1270Ser or D1270S).

Other types of mutations delete or insert small segments of DNA within the *ATP7B* gene or introduce a stop signal in the gene's instructions for making copper-transporting ATPase 2. As a result, no protein is produced, or an abnormally small protein is made. These types of mutations usually result in symptoms that are more severe than those caused by mutations that change a single amino acid.

With a shortage of functional protein, removal of excess copper from the body is impaired. As a result, copper accumulates to toxic levels that can damage tissues and organs, particularly the liver and brain.

## 3. Other Names for This Gene

- ATP7B\_HUMAN
- ATPase, Cu<sup>++</sup> transporting, beta polypeptide
- ATPase, Cu<sup>++</sup> transporting, beta polypeptide (Wilson disease)
- Copper pump 2
- PWD
- WC1

- Wilson disease-associated protein
  - WND
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## References

1. Cater MA, Forbes J, La Fontaine S, Cox D, Mercer JF. Intracellular trafficking of the human Wilson protein: the role of the six N-terminal metal-binding sites. *Biochem J*. 2004 Jun 15;380(Pt 3):805-13.
  2. Fatemi N, Sarkar B. Molecular mechanism of copper transport in Wilson disease. *Environ Health Perspect*. 2002 Oct;110 Suppl 5:695-8. Review.
  3. Ferenci P. Regional distribution of mutations of the ATP7B gene in patients with Wilson disease: impact on genetic testing. *Hum Genet*. 2006 Sep;120(2):151-9.
  4. Huster D, Hoppert M, Lutsenko S, Zinke J, Lehmann C, Mössner J, Berr F, Caca K. Defective cellular localization of mutant ATP7B in Wilson's disease patients and hepatoma cell lines. *Gastroenterology*. 2003 Feb;124(2):335-45.
  5. Kitzberger R, Madl C, Ferenci P. Wilson disease. *Metab Brain Dis*. 2005 Dec;20(4):295-302. Review.
  6. Langner C, Denk H. Wilson disease. *Virchows Arch*. 2004 Aug;445(2):111-8.
  7. Panagiotakaki E, Tzetis M, Manolaki N, Loudianos G, Papatheodorou A, Manesis E, Nousia-Arvanitakis S, Syriopoulou V, Kanavakis E. Genotype-phenotype correlations for a wide spectrum of mutations in the Wilson disease gene (ATP7B). *Am J Med Genet A*. 2004 Dec 1;131(2):168-73.
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