

SERPINA1 gene

serpin family A member 1

Normal Function

The *SERPINA1* gene provides instructions for making a protein called alpha-1 antitrypsin, which is a type of serine protease inhibitor (serpin). Serpins help control several types of chemical reactions by blocking (inhibiting) the activity of certain enzymes. The first identified role for alpha-1 antitrypsin was to control the activity of the digestive enzyme trypsin. Alpha-1 antitrypsin also inhibits other enzymes, including a powerful enzyme called neutrophil elastase that is released from white blood cells to fight infection.

Alpha-1 antitrypsin is produced in the liver and then transported throughout the body via the blood. Alpha-1 antitrypsin protects the lungs from neutrophil elastase, which can damage lung tissue if not properly controlled.

Health Conditions Related to Genetic Changes

Alpha-1 antitrypsin deficiency

More than 100 variants (also known as mutations) in the *SERPINA1* gene have been associated with a condition called alpha-1 antitrypsin deficiency. This condition is characterized by a shortage (deficiency) of the alpha-1 antitrypsin protein, which increases a person's risk of developing lung disease, liver disease, and other abnormalities.

Many *SERPINA1* gene variants change single protein building blocks (amino acids) in alpha-1 antitrypsin, which can alter the protein's structure. The most common variant that causes alpha-1 antitrypsin deficiency replaces the amino acid glutamic acid with the amino acid lysine at protein position 342 (written as Glu342Lys or E342K). This genetic change creates a version of the *SERPINA1* gene called the Z allele. Another common variant creates a version of the gene called the S allele. This variant replaces the amino acid glutamic acid with the amino acid valine at protein position 264 (written as Glu264Val or E264V). (The unaltered version of the *SERPINA1* gene is known as the M allele.)

Abnormal alpha-1 antitrypsin proteins, including those produced from the Z allele, may bind together to form a large molecule, or polymer, that cannot leave the liver. The

accumulation of these polymers results in liver damage. In addition, lung tissue is destroyed because there is not enough alpha-1 antitrypsin available to protect against neutrophil elastase. Polymers of alpha-1 antitrypsin may also contribute to excessive inflammation, which may explain some of the other features of alpha-1 antitrypsin deficiency, such as a skin condition called panniculitis.

The S allele and some other *SERPINA1* gene variants lead to the production of an abnormal form of alpha-1 antitrypsin that is quickly broken down in the liver. Still other gene variants prevent the production of any alpha-1 antitrypsin protein. As a result, little or no alpha-1 antitrypsin is available in the lungs. While the liver remains healthy in individuals with these variants, the lungs are left unprotected from neutrophil elastase.

Other Names for This Gene

- A1A
- A1AT
- A1AT_HUMAN
- AAT
- alpha-1 antiproteinase
- alpha-1 antitrypsin
- alpha-1 proteinase inhibitor
- alpha1AT
- PI
- PI1
- protease inhibitor 1 (anti-elastase)
- serine protease inhibitor, clade A (alpha-1 antiproteinase, antitrypsin), member 1
- serpin peptidase inhibitor, clade A (alpha-1 antiproteinase, antitrypsin), member 1

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of SERPINA1 ([https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=5265\[geneid\]](https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=5265[geneid]))

Scientific Articles on PubMed

- PubMed (<https://pubmed.ncbi.nlm.nih.gov/?term=%28%28SERPINA1%5BALL%5D%29+OR+%28AIAT%5BALL%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D>)

Catalog of Genes and Diseases from OMIM

- SERPIN PEPTIDASE INHIBITOR, CLADE A, MEMBER 1; SERPINA1 (<https://omim.org/entry/107400>)

Gene and Variant Databases

- NCBI Gene (<https://www.ncbi.nlm.nih.gov/gene/5265>)
- ClinVar ([https://www.ncbi.nlm.nih.gov/clinvar?term=SERPINA1\[gene\]](https://www.ncbi.nlm.nih.gov/clinvar?term=SERPINA1[gene]))

References

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Genomic Location

The *SERPINA1* gene is found on chromosome 14 (<https://medlineplus.gov/genetics/chromosome/14/>).

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