

ATP1A1 gene

ATPase Na⁺/K⁺ transporting subunit alpha 1

Normal Function

The *ATP1A1* gene provides instructions for making one part (the alpha-1 subunit) of a protein pump known as a Na⁺/K⁺ ATPase. This protein uses energy from a molecule called adenosine triphosphate (ATP) to transport charged atoms (ions) into and out of cells. Specifically, the protein pumps sodium ions (Na⁺) out of cells and potassium ions (K⁺) into cells.

Na⁺/K⁺ ATPases that include the alpha-1 subunit are found in many types of cells, although the pumps appear to play a particularly important role in the adrenal glands, which are small hormone-producing glands located on top of each kidney. In the adrenal glands, the flow of sodium and potassium ions helps regulate the production of the hormone aldosterone, which controls blood pressure by maintaining proper salt and fluid levels in the body.

Health Conditions Related to Genetic Changes

Aldosterone-producing adenoma

Mutations in the *ATP1A1* gene have been found to cause aldosterone-producing adenomas, which are noncancerous (benign) tumors that form in the adrenal glands. The genetic changes involved in these tumors, called somatic mutations, are acquired during a person's lifetime and are present only in adrenal gland cells that give rise to the tumor. Changes in the *ATP1A1* gene account for approximately six percent of cases of aldosterone-producing adenoma.

ATP1A1 gene mutations impair the Na⁺/K⁺ ATPase's normal function. The abnormal pumps allow sodium or hydrogen (H⁺) ions to enter the cell. The abnormal flow of these ions increases aldosterone production, resulting in excess aldosterone and leading to high blood pressure (hypertension) and an increased risk of heart attack and stroke. Changes in adrenal gland cells due to impaired Na⁺/K⁺ ATPase function also increase cell growth and division (proliferation), which promotes adenoma formation.

Charcot-Marie-Tooth disease

MedlinePlus Genetics provides information about Charcot-Marie-Tooth disease

Other Names for This Gene

- ATPase, Na⁺/K⁺ transporting, alpha 1 polypeptide
- Na(+)/K(+) ATPase alpha-1 subunit
- Na⁺/K⁺ ATPase 1
- Na, K-ATPase, alpha-A catalytic polypeptide
- Na,K-ATPase alpha-1 subunit
- Na,K-ATPase catalytic subunit alpha-A protein
- sodium pump subunit alpha-1
- sodium-potassium ATPase catalytic subunit alpha-1
- sodium-potassium-ATPase, alpha 1 polypeptide

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of ATP1A1 ([https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=476\[geneid\]](https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=476[geneid]))

Scientific Articles on PubMed

- PubMed (<https://pubmed.ncbi.nlm.nih.gov/?term=%28%28ATP1A1%5BTIAB%5D%29+OR+%28ATPase+Na+/K++transporting+subunit+alpha+1%5BTIAB%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+1800+days%22%5Bdp%5D%29>)

Catalog of Genes and Diseases from OMIM

- ATPase, Na⁺/K⁺ TRANSPORTING, ALPHA-1 POLYPEPTIDE; ATP1A1 (<https://omim.org/entry/182310>)

Gene and Variant Databases

- NCBI Gene (<https://www.ncbi.nlm.nih.gov/gene/476>)
- ClinVar ([https://www.ncbi.nlm.nih.gov/clinvar?term=ATP1A1\[gene\]](https://www.ncbi.nlm.nih.gov/clinvar?term=ATP1A1[gene]))

References

- Azizan EA, Poulsen H, Tuluc P, Zhou J, Clausen MV, Lieb A, Maniero C, Garg S, Bochukova EG, Zhao W, Shaikh LH, Brighton CA, Teo AE, Davenport AP, Dekkers T, Tops B, Kusters B, Ceral J, Yeo GS, Neogi SG, McFarlane I, Rosenfeld N, Marass

F, Hadfield J, Margas W, Chaggar K, Solar M, Deinum J, Dolphin AC, Farooqi IS, Striessnig J, Nissen P, Brown MJ. Somatic mutations in *ATP1A1* and *CACNA1D* underlie a common subtype of adrenal hypertension. *Nat Genet.* 2013 Sep; 45(9):1055-60. doi: 10.1038/ng.2716. Epub 2013 Aug 4. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/23913004>)

- Beuschlein F, Boulkroun S, Osswald A, Wieland T, Nielsen HN, Lichtenauer UD, Penton D, Schack VR, Amar L, Fischer E, Walther A, Tauber P, Schwarzmayer T, Diener S, Graf E, Allolio B, Samson-Couterie B, Benecke A, Quinkler M, Fallo F, Plouin PF, Mantero F, Meitinger T, Mulatero P, Jeunemaitre X, Warth R, Vilsen B, Zennaro MC, Strom TM, Reincke M. Somatic mutations in *ATP1A1* and *ATP2B3* lead to aldosterone-producing adenomas and secondary hypertension. *Nat Genet.* 2013 Apr; 45(4):440-4, 444e1-2. doi: 10.1038/ng.2550. Epub 2013 Feb 17. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/23416519>)
- Kitamoto T, Suematsu S, Yamazaki Y, Nakamura Y, Sasano H, Matsuzawa Y, Saito J, Omura M, Nishikawa T. Clinical and Steroidogenic Characteristics of Aldosterone-Producing Adenomas With ATPase or *CACNA1D* Gene Mutations. *J Clin Endocrinol Metab.* 2016 Feb; 101(2):494-503. doi: 10.1210/jc.2015-3284. Epub 2015 Nov 25. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/26606680>)
- Stindl J, Tauber P, Sterner C, Tegtmeier I, Warth R, Bandulik S. Pathogenesis of Adrenal Aldosterone-Producing Adenomas Carrying Mutations of the Na(+)/K(+)-ATPase. *Endocrinology.* 2015 Dec; 156(12):4582-91. doi:10.1210/en.2015-1466. Epub 2015 Sep 29. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/26418325>)

Genomic Location

The *ATP1A1* gene is found on chromosome 1 (<https://medlineplus.gov/genetics/chromosome/1/>).

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