CYP11B1 gene

cytochrome P450 family 11 subfamily B member 1

Normal Function

The *CYP11B1* gene provides instructions for making an enzyme called 11-beta-hydroxylase. This enzyme is found in the adrenal glands, which are located on top of the kidneys. The 11-beta-hydroxylase enzyme is a member of the cytochrome P450 family of enzymes. These enzymes are involved in the formation and breakdown of various molecules within cells.

The 11-beta-hydroxylase enzyme helps produce hormones called cortisol and corticosterone. Specifically, the enzyme helps convert a molecule called 11-deoxycortisol to cortisol, and helps convert another molecule called 11-deoxycorticosterone to corticosterone. These processes are triggered by the release of a hormone called adrenocorticotropic hormone (ACTH) by the pituitary gland, located at the base of the brain.

Cortisol helps maintain blood sugar (glucose) levels, protects the body from physical stress, and suppresses inflammation. Corticosterone is converted to the hormone aldosterone by the aldosterone synthase enzyme, which is produced from the nearby *CYP11B2* gene. Aldosterone helps control blood pressure by maintaining proper salt and fluid levels in the body.

Health Conditions Related to Genetic Changes

Congenital adrenal hyperplasia due to 11-beta-hydroxylase deficiency

More than 80 mutations in the *CYP11B1* gene have been found to cause congenital adrenal hyperplasia (CAH) due to 11-beta-hydroxylase deficiency, a disorder in which the adrenal glands produce excess male sex hormones (androgens). Most of these mutations change single protein building blocks (amino acids) in the 11-beta-hydroxylase enzyme and decrease the function of the enzyme. *CYP11B1* gene mutations that severely reduce or eliminate the function of the enzyme typically result in the classic form of CAH due to 11-beta-hydroxylase deficiency. Mutations that allow for some enzyme function usually result in the non-classic form of the disorder.

Some mutations that cause the classic form of CAH due to 11-beta-hydroxylase deficiency fuse sections of the *CYP11B1* gene with sections of a nearby gene called

CYP11B2. The added part of the *CYP11B2* gene contains a section called a promoter region, which normally controls (regulates) production of the protein made by the *CYP11B2* gene. As a result, the *CYP11B1* gene is regulated by the *CYP11B2* gene promoter region rather than its own promoter region. In addition, the fusion typically deletes parts of the *CYP11B1* gene. These changes in the gene's regulation and structure diminish production of 11-beta-hydroxylase.

Both types of CAH due to 11-beta-hydroxylase deficiency interfere with the production of cortisol and corticosterone. The molecules that are used to form these hormones instead build up in the adrenal gland and are converted to androgens. The excess production of androgens leads to abnormalities of sexual development in people with CAH due to 11-beta-hydroxylase deficiency. A buildup of the molecule 11-deoxycorticosterone, the substance that 11-beta-hydroxylase converts to form corticosterone, increases salt retention, leading to high blood pressure (hypertension) in individuals with the classic form of CAH due to 11-beta-hydroxylase deficiency.

Familial hyperaldosteronism

A genetic change affecting the *CYP11B1* gene causes familial hyperaldosteronism type I, a disorder that leads to hypertension. This change joins (fuses) a section of the *CYP11B1* gene called a promoter region, which normally helps start the production of the 11-beta-hydroxylase enzyme, to the section of the *CYP11B2* gene that provides instructions for making aldosterone synthase.

By binding to the *CYP11B1* gene's promoter region, ACTH normally triggers production of the 11-beta-hydroxylase enzyme. In the fusion gene, ACTH binding abnormally triggers production of aldosterone synthase. High levels of aldosterone synthase result in excessive aldosterone production, which leads to the hypertension associated with familial hyperaldosteronism type I.

Other Names for This Gene

- C11B1_HUMAN
- CPN1
- CYP11B
- CYPXIB1
- cytochrome P-450c11
- cytochrome P450 11B1, mitochondrial
- cytochrome P450 11B1, mitochondrial isoform 1 precursor
- cytochrome P450 11B1, mitochondrial isoform 2 precursor
- cytochrome p450 XIB1
- cytochrome P450, family 11, subfamily B, polypeptide 1
- cytochrome P450, subfamily XIB (steroid 11-beta-hydroxylase), polypeptide 1
- cytochrome P450C11
- DKFZp686B05283

- FHI
- FLJ36771
- P450C11
- steroid 11-beta-hydroxylase
- steroid 11-beta-monooxygenase

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of CYP11B1 (https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=1584[geneid])

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=%28CYP11B1%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)

Catalog of Genes and Diseases from OMIM

- CYTOCHROME P450, SUBFAMILY XIB, POLYPEPTIDE 1; CYP11B1 (https://omim.org/entry/610613)

Gene and Variant Databases

- NCBI Gene (https://www.ncbi.nlm.nih.gov/gene/1584)
- ClinVar (https://www.ncbi.nlm.nih.gov/clinvar?term=CYP11B1[gene])

References

- Martinez-Aguayo A, Fardella C. Genetics of hypertensive syndrome. Horm Res. 2009;71(5):253-9. doi: 10.1159/000208798. Epub 2009 Apr 1. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/19339789)
- Moraitis AG, Rainey WE, Auchus RJ. Gene mutations that promote adrenalaldosterone production, sodium retention, and hypertension. Appl Clin Genet. 2013Dec 24;7:1-13. doi: 10.2147/TACG.S35571. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/24399884) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3882136/)
- Nimkarn S, New MI. Steroid 11beta- hydroxylase deficiency congenital adrenalhyperplasia. Trends Endocrinol Metab. 2008 Apr;19(3):96-9. doi:10.1016/j.tem.2008.01.002. Epub 2008 Feb 21. Citation on PubMed (https://pubmed.ncbi.nlm.

nih.gov/18294861)

- Parajes S, Loidi L, Reisch N, Dhir V, Rose IT, Hampel R, Quinkler M, ConwayGS, Castro-Feijoo L, Araujo-Vilar D, Pombo M, Dominguez F, Williams EL, Cole TR,Kirk JM, Kaminsky E, Rumsby G, Arlt W, Krone N. Functional consequences of sevennovel mutations in the CYP11B1 gene: four mutations associated with nonclassicand three mutations causing classic 11beta-hydroxylase deficiency. J ClinEndocrinol Metab. 2010 Feb;95(2):779-88. doi: 10.1210/jc.2009-0651. Epub 2010 Jan20. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/20089618) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2846960/)
- Peter M. Congenital adrenal hyperplasia: 11beta-hydroxylase deficiency. SeminReprod Med. 2002 Aug;20(3):249-54. doi: 10.1055/s-2002-35389. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/12428205)
- Quack I, Vonend O, Rump LC. Familial hyperaldosteronism I-III. Horm Metab Res. 2010 Jun;42(6):424-8. doi: 10.1055/s-0029-1246187. Epub 2010 Feb 3. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/20131203)
- Stowasser M, Gordon RD. Familial hyperaldosteronism. J Steroid Biochem MolBiol. 2001 Sep;78(3):215-29. doi: 10.1016/s0960-0760(01)00097-8. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/11595502)
- Stowasser M, Gordon RD. Monogenic mineralocorticoid hypertension. Best PractRes Clin Endocrinol Metab. 2006 Sep;20(3):401-20. doi:10.1016/j.beem.2006.07.008. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/16980202)
- Stowasser M, Gunasekera TG, Gordon RD. Familial varieties of primaryaldosteronism. Clin Exp Pharmacol Physiol. 2001 Dec;28(12):1087-90. doi: 10.1046/j.1440-1681.2001.03574.x. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/11903322)
- Williams SS. Advances in genetic hypertension. Curr Opin Pediatr. 2007Apr;19(2):192-8. doi: 10.1097/MOP.0b013e32801e217c. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/17496764)

Genomic Location

The *CYP11B1* gene is found on chromosome 8 (https://medlineplus.gov/genetics/chromosome/8/).

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