CYP17A1 gene

cytochrome P450 family 17 subfamily A member 1

Normal Function

The *CYP17A1* gene provides instructions for making a member of the cytochrome P450 enzyme family. Like other cytochrome P450 enzymes, CYP17A1 is involved in the formation (synthesis) of steroid hormones. This group of hormones includes sex hormones such as testosterone and estrogen, which are needed for normal sexual development and reproduction; mineralocorticoids, which help regulate the body's salt and water balance; and glucocorticoids, which are involved in maintaining blood sugar (glucose) levels and regulating the body's response to stress.

Steroid hormones are synthesized through a series of chemical reactions. The CYP17A1 enzyme performs two important reactions in this process. The enzyme has 17 alpha(α)-hydroxylase activity, converting pregnenalone to 17-hydroxypregnenolone and progesterone to 17-hydroxyprogesterone. These hormone precursors are further processed to produce glucocorticoids and sex hormones. CYP17A1 also has 17,20-lyase activity, which converts 17-hydroxypregnenolone to dehydroepiandrosterone (DHEA). This reaction is integral to the production of sex hormones.

Health Conditions Related to Genetic Changes

17 alpha-hydroxylase/17,20-lyase deficiency

Dozens of mutations in the *CYP17A1* gene have been found to cause 17α-hydroxylase/ 17,20-lyase deficiency. This condition affects the function of certain hormone-producing glands, leading to high blood pressure (hypertension) and abnormal sexual development. Mutations associated with this condition reduce or eliminate both 17α-hydroxylase and 17,20-lyase activity. Reduction of these activities leads to partial 17α-hydroxylase/17,20-lyase deficiency, while total loss of these activities leads to the more severe form of the disorder known as complete 17α-hydroxylase/17,20-lyase deficiency.

Without 17α-hydroxylase activity, pregnenolone and progesterone are not converted to 17-hydroxypregnenolone or 17-hydroxyprogesterone, impairing production of glucocorticoids. Instead pregnenolone and progesterone are processed to form mineralocorticoids. An excess of these salt-regulating hormones leads to hypertension and low levels of potassium in the blood (hypokalemia).

A loss of 17,20-lyase activity impairs sex hormone production. In females, a lack of female sex hormones disrupts development of internal reproductive organs (the ovaries and uterus) and secondary sex characteristics, such as breasts and menstrual periods. In chromosomal males (individuals with an X and a Y chromosome), a lack of male sex hormones leads to abnormal development of external genitalia. Depending on the severity of the condition, these affected individuals can have abnormal male genitalia, genitalia that do not look clearly male or clearly female, or female-typical genitalia.

Other disorders

A small number of *CYP17A1* gene mutations have been found to cause isolated 17,20-lyase deficiency, which is characterized by abnormal sexual development without hypertension or hypokalemia. These mutations alter a region of the CYP17A1 protein that plays a role in the enzyme's 17,20-lyase function but not its 17α-hydroxylase function. As a result, 17,20-lyase activity is severely reduced but 17α-hydroxylase activity is normal. As in 17α-hydroxylase/17,20-lyase deficiency (described above), impairment of 17,20-lyase activity disrupts sex hormone production, leading to abnormal development of internal or external reproductive organs and delayed or absent puberty in affected individuals.

Other Names for This Gene

- 17-alpha-hydroxyprogesterone aldolase
- CPT7
- CYP17
- CYPXVII
- cytochrome P450 17A1
- cytochrome p450 XVIIA1
- cytochrome P450, family 17, subfamily A, polypeptide 1
- cytochrome P450, subfamily XVII (steroid 17-alpha-hydroxylase), adrenal hyperplasia
- cytochrome P450-C17
- cytochrome P450c17
- P450C17
- S17AH
- steroid 17-alpha-hydroxylase/17,20 lyase precursor
- steroid 17-alpha-monooxygenase

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of CYP17A1 (https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=1586[geneid])

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=%28%28CYP17A1%5BTIAB%5D%29+OR+%28cytochrome+P450+family+17+subfamily+A+member+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+720+days%22%5Bdp%5D)

Catalog of Genes and Diseases from OMIM

- CYTOCHROME P450, FAMILY 17, SUBFAMILY A, POLYPEPTIDE 1; CYP17A1 (https://omim.org/entry/609300)

Gene and Variant Databases

- NCBI Gene (https://www.ncbi.nlm.nih.gov/gene/1586)
- ClinVar (https://www.ncbi.nlm.nih.gov/clinvar?term=CYP17A1[gene])

References

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Genomic Location

The *CYP17A1* gene is found on chromosome 10 (https://medlineplus.gov/genetics/chromosome/10/).

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