CHD7 gene

chromodomain helicase DNA binding protein 7

Normal Function

The *CHD7* gene provides instructions for making a protein called chromodomain helicase DNA binding protein 7. This protein is found in many parts of the body before birth, including the eye, the inner ear, and the brain. In the brain, the CHD7 protein is active in several areas, including a bundle of nerve cells (neurons) called the olfactory bulb that is critical for the perception of odors.

The CHD7 protein belongs to a family of proteins that are thought to play a role in the organization of chromatin. Chromatin is the complex of DNA and protein that packages DNA into chromosomes. The CHD7 protein regulates the activity (expression) of several other genes through a process known as chromatin remodeling. The structure of chromatin can be changed (remodeled) to alter how tightly DNA is packaged. When DNA is tightly packed, gene expression is lower than when DNA is loosely packed. Researchers are working to determine which genes the CHD7 protein regulates.

Health Conditions Related to Genetic Changes

CHARGE syndrome

Mutations in the *CHD7* gene cause CHARGE syndrome, a disorder that affects many areas of the body. CHARGE is an abbreviation for several of the features common in the disorder: coloboma, heart defect, atresia choanae (also known as choanal atresia), growth retardation, genital abnormality, and ear abnormality. More than 600 mutations that can cause CHARGE syndrome have been identified, and they occur throughout the *CHD7* gene. Most of these mutations lead to the production of an abnormal CHD7 protein that is broken down prematurely. Shortage of this protein is thought to disrupt chromatin remodeling and the regulation of gene expression. Changes in gene expression during embryonic development likely cause the signs and symptoms of CHARGE syndrome.

Kallmann syndrome

More than 50 mutations in the *CHD7* gene have been identified in people with Kallmann syndrome, a disorder characterized by the combination of hypogonadotropic hypogonadism (a condition affecting the production of hormones that direct sexual

development) and an impaired sense of smell. Mutations in this gene account for 5 to 10 percent of all cases of Kallmann syndrome.

Many people with Kallmann syndrome caused by a *CHD7* gene mutation have some of the features of CHARGE syndrome (described above), such as abnormally shaped ears and hearing loss. However, the signs and symptoms tend to be much less severe. Researchers suspect that Kallmann syndrome resulting from a *CHD7* gene mutation may actually represent a mild form of CHARGE syndrome.

Most of the *CHD7* gene mutations that cause Kallmann syndrome alter single protein building blocks (amino acids) in the CHD7 protein. Studies suggest that these mutations have a less severe effect on protein function than those that cause CHARGE syndrome. The altered protein affects the development of the olfactory bulb, which impairs the sense of smell. It also disrupts the development of certain neurons needed for the production of sex hormones, which interferes with normal sexual development.

Coloboma

MedlinePlus Genetics provides information about Coloboma

Other Names for This Gene

- CHD7_HUMAN
- FLJ20357
- FLJ20361
- IS3
- KIAA1416

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of CHD7 (https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=55636[geneid])

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=%28%28CHD7%5BTI%5D%29+OR+%28chromodomain+helicase+DNA+binding+protein+7%5BTI%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

- CHROMODOMAIN HELICASE DNA-BINDING PROTEIN 7; CHD7 (https://omim.org/entry/608892)

Gene and Variant Databases

- NCBI Gene (https://www.ncbi.nlm.nih.gov/gene/55636)
- ClinVar (https://www.ncbi.nlm.nih.gov/clinvar?term=CHD7[gene])

References

- Balasubramanian R, Choi JH, Francescatto L, Willer J, Horton ER, AsimacopoulosEP, Stankovic KM, Plummer L, Buck CL, Quinton R, Nebesio TD, Mericq V, Merino PM,Meyer BF, Monies D, Gusella JF, Al Tassan N, Katsanis N, Crowley WF Jr.Functionally compromised CHD7 alleles in patients with isolated GnRH deficiency.Proc Natl Acad Sci U S A. 2014 Dec 16;111(50):17953-8. doi:10.1073/pnas.1417438111. Epub 2014 Dec 3. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/25472840) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4273325/)
- Balasubramanian R, Crowley WF Jr. Isolated Gonadotropin-Releasing Hormone(GnRH) Deficiency. 2007 May 23 [updated 2022 May 12]. In: Adam MP, Feldman J, Mirzaa GM, Pagon RA, Wallace SE, Bean LJH, Gripp KW, Amemiya A, editors. GeneReviews(R) [Internet]. Seattle (WA): University of Washington,Seattle; 1993-2024. Available from http://www.ncbi.nlm.nih.gov/books/NBK1334/ Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/20301509)
- Bergman JE, de Ronde W, Jongmans MC, Wolffenbuttel BH, Drop SL, Hermus A, Bocca G, Hoefsloot LH, van Ravenswaaij-Arts CM. The results of CHD7 analysis inclinically well-characterized patients with Kallmann syndrome. J Clin EndocrinolMetab. 2012 May;97(5):E858-62. doi: 10.1210/jc.2011-2652. Epub 2012 Mar 7. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/22399515)
- Bergman JE, Janssen N, Hoefsloot LH, Jongmans MC, Hofstra RM, vanRavenswaaij-Arts CM. CHD7 mutations and CHARGE syndrome: the clinicalimplications of an expanding phenotype. J Med Genet. 2011 May;48(5):334-42. doi:10.1136/jmg.2010.087106. Epub 2011 Mar 4. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/21378379)
- Bouazoune K, Kingston RE. Chromatin remodeling by the CHD7 protein is impairedby mutations that cause human developmental disorders. Proc Natl Acad Sci U S A.2012 Nov 20;109(47):19238-43. doi: 10.1073/pnas.1213825109. Epub 2012 Nov 7. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/23134727) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3511097/)
- Jongmans MC, van Ravenswaaij-Arts CM, Pitteloud N, Ogata T, Sato N,Claahsen-van der Grinten HL, van der Donk K, Seminara S, Bergman JE, Brunner HG, Crowley WF Jr, Hoefsloot LH. CHD7 mutations in patients initially diagnosed withKallmann syndrome--the clinical overlap with CHARGE syndrome. Clin Genet. 2009Jan;75(1):65-71. doi: 10.1111/j.1399-0004.2008.01107.x. Epub 2008 Nov 17. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/19021638) or Free article on

PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2854009/)

- Kim HG, Kurth I, Lan F, Meliciani I, Wenzel W, Eom SH, Kang GB, Rosenberger G, Tekin M, Ozata M, Bick DP, Sherins RJ, Walker SL, Shi Y, Gusella JF, Layman LC. Mutations in CHD7, encoding a chromatin-remodeling protein, cause idiopathichypogonadotropic hypogonadism and Kallmann syndrome. Am J Hum Genet. 2008Oct;83(4):511-9. doi: 10.1016/j.ajhg.2008.09.005. Epub 2008 Oct 2. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/18834967) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2561938/)
- Lalani SR, Safiullah AM, Fernbach SD, Harutyunyan KG, Thaller C, Peterson LE, McPherson JD, Gibbs RA, White LD, Hefner M, Davenport SL, Graham JM, Bacino CA,Glass NL, Towbin JA, Craigen WJ, Neish SR, Lin AE, Belmont JW. Spectrum of CHD7mutations in 110 individuals with CHARGE syndrome and genotype-phenotypecorrelation. Am J Hum Genet. 2006 Feb;78(2):303-14. doi: 10.1086/500273. Epub2005 Dec 29. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/16400610) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1380237/)
- Marcos S, Sarfati J, Leroy C, Fouveaut C, Parent P, Metz C, Wolczynski S,Gerard M, Bieth E, Kurtz F, Verier-Mine O, Perrin L, Archambeaud F, Cabrol S,Rodien P, Hove H, Prescott T, Lacombe D, Christin-Maitre S, Touraine P,Hieronimus S, Dewailly D, Young J, Pugeat M, Hardelin JP, Dode C. The prevalenceof CHD7 missense versus truncating mutations is higher in patients with Kallmannsyndrome than in typical CHARGE patients. J Clin Endocrinol Metab. 2014Oct;99(10):E2138-43. doi: 10.1210/jc.2014-2110. Epub 2014 Jul 31. Erratum In: JClin Endocrinol Metab. 2015 Jan;100(1):317. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/25077900)
- Schulz Y, Wehner P, Opitz L, Salinas-Riester G, Bongers EM, vanRavenswaaij-Arts CM, Wincent J, Schoumans J, Kohlhase J, Borchers A, Pauli S.CHD7, the gene mutated in CHARGE syndrome, regulates genes involved in neuralcrest cell guidance. Hum Genet. 2014 Aug;133(8):997-1009. doi:10.1007/s00439-014-1444-2. Epub 2014 Apr 13. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/24728844)
- van Ravenswaaij-Arts CM, Hefner M, Blake K, Martin DM. CHD7 Disorder.2006 Oct 2 [updated 2022 Sep 29]. In: Adam MP, Feldman J, Mirzaa GM, Pagon RA,Wallace SE, Bean LJH, Gripp KW, Amemiya A, editors. GeneReviews(R)[Internet]. Seattle (WA): University of Washington, Seattle; 1993-2024. Availablefrom http://www.ncbi.nlm.nih.gov/books/NBK1117/ Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/20301296)
- Vissers LE, van Ravenswaaij CM, Admiraal R, Hurst JA, de Vries BB, Janssen IM, van der Vliet WA, Huys EH, de Jong PJ, Hamel BC, Schoenmakers EF, Brunner HG, Veltman JA, van Kessel AG. Mutations in a new member of the chromodomain genefamily cause CHARGE syndrome. Nat Genet. 2004 Sep;36(9):955-7. doi:10.1038/ng1407. Epub 2004 Aug 8. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/15300250)

Genomic Location

The *CHD7* gene is found on chromosome 8 (https://medlineplus.gov/genetics/chromosome/8/).

Last updated February 1, 2017