PHF21A gene

PHD finger protein 21A

Normal Function

The *PHF21A* gene (also known as *BHC80*) provides instructions for making a protein involved in a process called histone demethylation, which helps control (regulate) gene activity. Histones are structural proteins that attach (bind) to DNA and give chromosomes their shape. The removal of a molecule called a methyl group from histones (histone demethylation), helps turn off (repress) certain genes. The PHF21A protein binds to histones that have already been demethylated, which researchers speculate helps keep the histone demethylated and the genes turned off. The PHF21A protein appears to be particularly important in regulating genes involved in development of nerve cells in the brain and structures of the face.

Health Conditions Related to Genetic Changes

Potocki-Shaffer syndrome

A genetic change resulting in the deletion of the *PHF21A* gene causes a condition called Potocki-Shaffer syndrome. People with this condition have enlarged openings in two bones that make up much of the top and sides of the skull (enlarged parietal foramina) and multiple noncancerous bone tumors (osteochondromas). Other signs and symptoms seen in some people with Potocki-Shaffer syndrome include intellectual disability, developmental delay, distinctive facial features, vision problems, and defects in the heart, kidneys, and urinary tract.

Potocki-Shaffer syndrome (also called proximal 11p deletion syndrome) is caused by a deletion of genetic material from the short (p) arm of chromosome 11. In people with this condition, a loss of the *PHF21A* gene within this region is responsible for intellectual disability and distinctive facial features. The deletion likely leads to a reduction in the amount of PHF21A protein. It is thought that the resulting disruption of histone demethylation alters the activity of genes involved in neuronal and facial development, leading to intellectual disability and distinctive facial features. The loss of other genes in the same region of chromosome 11, *ALX4* and *EXT2*, underlie the enlarged parietal foramina and multiple osteochondromas, respectively. The loss of additional genes in the deleted region likely contributes to the other features of Potocki-Shaffer syndrome.

Other Names for This Gene

- BHC80
- BHC80a
- BM-006
- BRAF35-HDAC complex protein BHC80
- BRAF35/HDAC2 complex (80 kDa)
- KIAA1696

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of PHF21A (https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=51317[geneid])

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=%28%28PHF21A%5BTIAB%5D%29+OR+%28PHD+finger+protein+21A%5BTIAB%5D%29%29+OR+%28BHC80%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+3600+days%22%5Bdp%5D)

Catalog of Genes and Diseases from OMIM

- PHD FINGER PROTEIN 21A; PHF21A (https://omim.org/entry/608325)

Gene and Variant Databases

- NCBI Gene (https://www.ncbi.nlm.nih.gov/gene/51317)
- ClinVar (https://www.ncbi.nlm.nih.gov/clinvar?term=PHF21A[gene])

References

- Kim HG, Kim HT, Leach NT, Lan F, Ullmann R, Silahtaroglu A, Kurth I, Nowka A, Seong IS, Shen Y, Talkowski ME, Ruderfer D, Lee JH, Glotzbach C, Ha K, KjaergaardS, Levin AV, Romeike BF, Kleefstra T, Bartsch O, Elsea SH, Jabs EW, MacDonald ME,Harris DJ, Quade BJ, Ropers HH, Shaffer LG, Kutsche K, Layman LC, Tommerup N,Kalscheuer VM, Shi Y, Morton CC, Kim CH, Gusella JF. Translocations disruptingPHF21A in the Potocki-Shaffer-syndrome region are associated with intellectualdisability and craniofacial anomalies. Am J Hum Genet. 2012 Jul 13;91(1):56-72.doi: 10.1016/j.ajhg.2012.05.005. Epub 2012 Jul 5. Citation

on PubMed (https://pubmed.ncbi.nlm.nih.gov/22770980) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3397276/)

- Labonne JD, Vogt J, Reali L, Kong IK, Layman LC, Kim HG. A microdeletionencompassing PHF21A in an individual with global developmental delay andcraniofacial anomalies. Am J Med Genet A. 2015 Dec;167A(12):3011-8. doi:10.1002/ajmg.a.37344. Epub 2015 Sep 3. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/26333423)
- Lan F, Collins RE, De Cegli R, Alpatov R, Horton JR, Shi X, Gozani O, Cheng X,Shi Y. Recognition of unmethylated histone H3 lysine 4 links BHC80 toLSD1-mediated gene repression. Nature. 2007 Aug 9;448(7154):718-22. doi:10.1038/nature06034. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/17687328) or Free article on PubMed Central (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2702779/)
- Montgomery ND, Turcott CM, Tepperberg JH, McDonald MT, Aylsworth AS. A 137-kbdeletion within the Potocki-Shaffer syndrome interval on chromosome 11p11. 2associated with developmental delay and hypotonia. Am J Med Genet A. 2013Jan; 161A(1):198-202. doi: 10.1002/ajmg.a.35671. Epub 2012 Dec 13. Citation on PubMed (https://pubmed.ncbi.nlm.nih.gov/23239541)

Genomic Location

The *PHF21A* gene is found on chromosome 11 (https://medlineplus.gov/genetics/chromosome/11/).

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