

OFD1 gene

OFD1 centriole and centriolar satellite protein

Normal Function

The *OFD1* gene provides instructions for making a protein whose function is not fully understood. It appears to play a critical role in the early development of many parts of the body, including the brain, face, limbs, and kidneys.

The OFD1 protein is located at the base of cilia, which are finger-like projections that stick out from the surface of cells. Cilia are involved in cell movement and in many different chemical signaling pathways. They play important roles in the development and function of many parts of the body. Researchers suspect that the OFD1 protein is essential for the normal formation of cilia.

Studies suggest that the OFD1 protein may have additional functions. In the earliest stages of development, it appears to be involved in determining the left-right axis (the imaginary line that separates the left and right sides of the body). The OFD1 protein is also found in the nucleus, although its function in this cell structure is unknown.

Health Conditions Related to Genetic Changes

Oral-facial-digital syndrome

About 100 mutations in the *OFD1* gene have been found in people with oral-facial-digital syndrome type I, which is the most common form of the disorder. These mutations include changes in single DNA building blocks (base pairs) and larger deletions of genetic material from the *OFD1* gene. Most of these genetic changes lead to the production of an abnormally short, nonfunctional version of the OFD1 protein. It is unclear how a shortage of functional OFD1 protein leads to the specific features of oral-facial-digital syndrome type I. However, studies suggest that a lack of this protein prevents the normal formation of cilia, which affects the development of many tissues and organs.

Joubert syndrome

Mutations in the *OFD1* gene can also cause several other disorders with features that overlap with those of oral-facial-digital syndrome (described above), such as Joubert syndrome. This disorder is characterized by particular brain abnormalities, weak muscle

tone (hypotonia), delayed development, unusual eye movements, and breathing problems.

The *OFD1* mutations responsible for Joubert syndrome lead to the production of an abnormally short version of the OFD1 protein. However, studies suggest that these mutations result in a somewhat longer protein than the mutations that cause oral-facial-digital syndrome. This protein may retain some of its usual function in cilia. The abnormal protein probably disrupts the development or function of cilia in some way, although it is unclear how these changes result in the signs and symptoms of Joubert syndrome.

Primary ciliary dyskinesia

MedlinePlus Genetics provides information about Primary ciliary dyskinesia

Simpson-Golabi-Behmel syndrome

MedlinePlus Genetics provides information about Simpson-Golabi-Behmel syndrome

Other disorders

At least one *OFD1* gene mutation has been found in a family with a form of X-linked intellectual disability. Individuals with this condition have severe intellectual disability, an unusually large head size (macrocephaly), and breathing problems.

This *OFD1* gene mutation leads to the production of an abnormally short version of the OFD1 protein. However, the altered protein appears to be longer than the abnormal proteins involved in oral-facial-digital syndrome (described above). This protein may retain some of its usual function in cilia. The abnormal protein probably disrupts the development or function of cilia in some way, although it is unclear how these changes result in the signs and symptoms of X-linked intellectual disability.

Other Names for This Gene

- 71-7A
- CXorf5
- JBTS10
- MGC117039
- MGC117040
- OFD1_HUMAN
- oral-facial-digital syndrome 1
- SGBS2

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of OFD1 ([https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=8481\[geneid\]](https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=8481[geneid]))

Scientific Articles on PubMed

- PubMed (<https://pubmed.ncbi.nlm.nih.gov/?term=%28OFD1%5BTIAB%5D%29+OR+%28%28SGBS2%5BTIAB%5D%29+OR+%28CXorf5%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+3600+days%22%5Bdp%5D%29>)

Catalog of Genes and Diseases from OMIM

- OFD1 CENTRIOLE AND CENTRIOLAR SATELLITE PROTEIN; OFD1 (<https://omim.org/entry/300170>)
- JOUBERT SYNDROME 10; JBTS10 (<https://omim.org/entry/300804>)

Gene and Variant Databases

- NCBI Gene (<https://www.ncbi.nlm.nih.gov/gene/8481>)
- ClinVar ([https://www.ncbi.nlm.nih.gov/clinvar?term=OFD1\[gene\]](https://www.ncbi.nlm.nih.gov/clinvar?term=OFD1[gene]))

References

- Bisschoff IJ, Zeschnigk C, Horn D, Wellek B, Riess A, Wessels M, Willems P, Jensen P, Busche A, Bekkebraten J, Chopra M, Hove HD, Evers C, Heimdal K, Kaiser AS, Kunstmann E, Robinson KL, Linne M, Martin P, McGrath J, Pradel W, Prescott KE, Roesler B, Rudolf G, Siebers-Renelt U, Tyshchenko N, Wieczorek D, Wolff G, Dobyns WB, Morris-Rosendahl DJ. Novel mutations including deletions of the entire OFD1 gene in 30 families with type 1 orofaciodigital syndrome: a study of the extensive clinical variability. Hum Mutat. 2013 Jan;34(1):237-47. doi:10.1002/humu.22224. Epub 2012 Oct 17. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/23033313>) or Free article on PubMed Central (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5497464/>)
- Budny B, Chen W, Omran H, Fliegauf M, Tzschach A, Wisniewska M, Jensen LR, Raynaud M, Shoichet SA, Badura M, Lenzner S, Latos-Bielenska A, Ropers HH. A novel X-linked recessive mental retardation syndrome comprising macrocephaly and ciliary dysfunction is allelic to oral-facial-digital type I syndrome. Hum Genet. 2006 Sep;120(2):171-8. doi: 10.1007/s00439-006-0210-5. Epub 2006 Jun 17. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/16783569>)
- Coene KL, Roepman R, Doherty D, Afroze B, Kroes HY, Letteboer SJ, Ngu LH,

Budny B, van Wijk E, Gorden NT, Azhimi M, Thauvin-Robinet C, Veltman JA, Boink M, Kleefstra T, Cremers FP, van Bokhoven H, de Brouwer AP. OFD1 is mutated in X-linked Joubert syndrome and interacts with LCA5-encoded lebercilin. *Am J Hum Genet.* 2009 Oct;85(4):465-81. doi: 10.1016/j.ajhg.2009.09.002. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/19800048>) or Free article on PubMed Central (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2756557/>)

- Ferrante MI, Giorgio G, Feather SA, Bulfone A, Wright V, Ghiani M, Selicorni A, Gammara L, Scolari F, Woolf AS, Sylvie O, Bernard L, Malcolm S, Winter R, Ballabio A, Franco B. Identification of the gene for oral-facial-digital type I syndrome. *Am J Hum Genet.* 2001 Mar;68(3):569-76. doi: 10.1086/318802. Epub 2001 Feb 13. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/11179005>) or Free article on PubMed Central (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1274470/>)
- Ferrante MI, Zullo A, Barra A, Bimonte S, Messaddeq N, Studer M, Dolle P, Franco B. Oral-facial-digital type I protein is required for primary cilia formation and left-right axis specification. *Nat Genet.* 2006 Jan;38(1):112-7. doi: 10.1038/ng1684. Epub 2005 Nov 27. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/16311594>)
- Giorgio G, Alfieri M, Prattichizzo C, Zullo A, Cairo S, Franco B. Functional characterization of the OFD1 protein reveals a nuclear localization and physical interaction with subunits of a chromatin remodeling complex. *Mol Biol Cell.* 2007 Nov;18(11):4397-404. doi: 10.1091/mbc.e07-03-0198. Epub 2007 Aug 29. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/17761535>) or Free article on PubMed Central (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2043566/>)
- Macca M, Franco B. The molecular basis of oral-facial-digital syndrome, type 1. *Am J Med Genet C Semin Med Genet.* 2009 Nov 15;151C(4):318-25. doi: 10.1002/ajmg.c.30224. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/19876934>)
- Prattichizzo C, Macca M, Novelli V, Giorgio G, Barra A, Franco B; Oral-Facial-Digital Type I (OFDI) Collaborative Group. Mutational spectrum of the oral-facial-digital type I syndrome: a study on a large collection of patients. *Hum Mutat.* 2008 Oct;29(10):1237-46. doi: 10.1002/humu.20792. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/18546297>)
- Romio L, Fry AM, Winyard PJ, Malcolm S, Woolf AS, Feather SA. OFD1 is a centrosomal/basal body protein expressed during mesenchymal-epithelial transition in human nephrogenesis. *J Am Soc Nephrol.* 2004 Oct;15(10):2556-68. doi: 10.1097/01.ASN.0000140220.46477.5C. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/15466260>)
- Thauvin-Robinet C, Cossee M, Cormier-Daire V, Van Maldergem L, Toutain A, Alembik Y, Bieth E, Layet V, Parent P, David A, Goldenberg A, Mortier G, Heron D, Sagot P, Bouvier AM, Huet F, Cusin V, Donzel A, Devys D, Teyssier JR, Faivre L. Clinical, molecular, and genotype-phenotype correlation studies from 25 cases of oral-facial-digital syndrome type 1: a French and Belgian collaborative study. *J Med Genet.* 2006 Jan;43(1):54-61. doi: 10.1136/jmg.2004.027672. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/16397067>) or Free article on PubMed Central (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2564504/>)
- Thauvin-Robinet C, Franco B, Saugier-veber P, Aral B, Gigot N, Donzel A, Van Maldergem L, Bieth E, Layet V, Mathieu M, Teebi A, Lespinasse J, Callier P,

Mugneret F, Masurel-Paulet A, Gautier E, Huet F, Teyssier JR, Tosi M, Frebourg T, Faivre L. Genomic deletions of OFD1 account for 23% of oral-facial-digital type 1 syndrome after negative DNA sequencing. Hum Mutat. 2009 Feb;30(2):E320-9. doi: 10.1002/humu.20888. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/19023858>)

Genomic Location

The *OFD1* gene is found on the X chromosome (<https://medlineplus.gov/genetics/chromosome/x/>).

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