

DSG4 gene

desmoglein 4

Normal Function

The *DSG4* gene provides instructions for making a protein called desmoglein 4 (DSG4). This protein is found in specialized structures called desmosomes that are located in the membrane surrounding certain cells. Desmosomes help attach cells to one another and play a role in communication between cells. The DSG4 protein is found in cells in certain regions of hair follicles, including the inner compartment of the hair strand (shaft) known as the cortex. Hair growth occurs at the hair follicle when cells divide and the hair shaft is pushed upward and extends beyond the skin.

Desmosomes provide strength to the hair and are involved in signaling between neighboring cells within the hair shaft. The DSG4 protein may play a role in communicating the signals for cells to mature (differentiate) and form the hair shaft. In addition, the DSG4 protein is found in the upper layers of the skin where it provides strength and communicates signals for the skin cells to mature.

Health Conditions Related to Genetic Changes

Autosomal recessive hypotrichosis

At least 10 mutations in the *DSG4* gene have been found to cause autosomal recessive hypotrichosis, a condition that results in sparse hair growth (hypotrichosis) on the scalp, and less frequently, other parts of the body. A particular mutation that deletes a piece of genetic material in the *DSG4* gene (written as Ex5_8) is a common cause of the condition in individuals of Pakistani ancestry. This mutation impairs the protein's ability to help cells attach to one another. Other *DSG4* gene mutations result in the production of abnormal DSG4 proteins that cannot communicate signals between cells within hair follicles or skin. As a result, hair follicles are structurally abnormal and often underdeveloped. Irregular hair follicles alter the structure and growth of hair shafts, leading to fragile hair that breaks easily. A lack of normal DSG4 protein function may weaken the skin and contribute to the skin problems sometimes seen in individuals with autosomal recessive hypotrichosis.

Monilethrix

Mutations in the *DSG4* gene have been found in people with monilethrix, a hair

condition characterized by strands of hair with a beaded appearance. The hair is also short, brittle and breaks easily. The mutations associated with this condition can affect any part of the DSG4 protein, but these changes typically alter the extracellular domain, which is the region of the protein outside the cell that interacts with other cells. In people with monilethrix, the cortex of the affected hair shaft appears abnormal. However, it is unclear how mutations in the *DSG4* gene are related to the abnormality in the cortex or the beaded appearance of the hair.

It is unknown why some individuals with *DSG4* gene mutations develop monilethrix and others develop autosomal recessive hypotrichosis (described above). These conditions may represent different forms of the same disorder.

Other Names for This Gene

- cadherin family member 13
- CDGF13
- CDH family member 13
- CDHF13
- desmoglein-4
- DSG4_HUMAN
- LAH

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of DSG4 ([https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=147409\[geneid\]](https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=147409[geneid]))

Scientific Articles on PubMed

- PubMed (<https://pubmed.ncbi.nlm.nih.gov/?term=%28%28DSG4%5BTIAB%5D%29+OR+%28desmoglein+4%5BTIAB%5D%29%29+OR+%28desmoglein-4%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+%22ast+2520+days%22%5Bdp%5D>)

Catalog of Genes and Diseases from OMIM

- DESMOGLEIN 4; DSG4 (<https://omim.org/entry/607892>)

Gene and Variant Databases

- NCBI Gene (<https://www.ncbi.nlm.nih.gov/gene/147409>)

- ClinVar ([https://www.ncbi.nlm.nih.gov/clinvar?term=DSG4\[gene\]](https://www.ncbi.nlm.nih.gov/clinvar?term=DSG4[gene]))

References

- Bazzi H, Getz A, Mahoney MG, Ishida-Yamamoto A, Langbein L, Wahl JK 3rd, Christiano AM. Desmoglein 4 is expressed in highly differentiated keratinocytes and trichocytes in human epidermis and hair follicle. *Differentiation*. 2006 Mar;74(2-3):129-40. doi: 10.1111/j.1432-0436.2006.00061.x. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/16533311>)
- Farooq M, Ito M, Naito M, Shimomura Y. A case of monilethrix caused by novel compound heterozygous mutations in the desmoglein 4 (DSG4) gene. *Br J Dermatol*. 2011 Aug;165(2):425-31. doi: 10.1111/j.1365-2133.2011.10373.x. Epub 2011 Jul 19. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/21495994>)
- John P, Tariq M, Arshad Rafiq M, Amin-Ud-Din M, Muhammad D, Waheed I, Ansar M, Ahmad W. Recurrent intragenic deletion mutation in desmoglein 4 gene underlies autosomal recessive hypotrichosis in two Pakistani families of Balochi and Sindhi origins. *Arch Dermatol Res*. 2006 Aug;298(3):135-7. doi:10.1007/s00403-006-0671-3. Epub 2006 Jun 13. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/16770573>)
- Kljuic A, Bazzi H, Sundberg JP, Martinez-Mir A, Shaughnessy R, Mahoney MG, Levy M, Montagutelli X, Ahmad W, Aita VM, Gordon D, Uitto J, Whiting D, Ott J, Fischer S, Gilliam TC, Jahoda CA, Morris RJ, Panteleyev AA, Nguyen VT, Christiano AM. Desmoglein 4 in hair follicle differentiation and epidermal adhesion: evidence from inherited hypotrichosis and acquired pemphigus vulgaris. *Cell*. 2003 Apr 18;113(2):249-60. doi: 10.1016/s0092-8674(03)00273-3. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/12705872>)
- Messenger AG, Bazzi H, Parslew R, Shapiro L, Christiano AM. A missense mutation in the cadherin interaction site of the desmoglein 4 gene underlies localized autosomal recessive hypotrichosis. *J Invest Dermatol*. 2005 Nov;125(5):1077-9. doi: 10.1111/j.0022-202X.2005.23903.x. No abstract available. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/16297213>)
- Rafiq MA, Ansar M, Mahmood S, Haque S, Faiyaz-ul-Haque M, Leal SM, Ahmad W. A recurrent intragenic deletion mutation in DSG4 gene in three Pakistani families with autosomal recessive hypotrichosis. *J Invest Dermatol*. 2004 Jul;123(1):247-8. doi: 10.1111/j.0022-202X.2004.22715.x. No abstract available. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/15191570>)
- Shimomura Y, Sakamoto F, Kariya N, Matsunaga K, Ito M. Mutations in the desmoglein 4 gene are associated with monilethrix-like congenital hypotrichosis. *J Invest Dermatol*. 2006 Jun;126(6):1281-5. doi: 10.1038/sj.jid.5700113. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/16439973>)
- Wajid M, Bazzi H, Rockey J, Lubetkin J, Zlotogorski A, Christiano AM. Localized autosomal recessive hypotrichosis due to a frameshift mutation in the desmoglein 4 gene exhibits extensive phenotypic variability within a Pakistani family. *J Invest Dermatol*. 2007 Jul;127(7):1779-82. doi: 10.1038/sj.jid.5700791. Epub 2007 Mar 29.

No abstract available. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/17392831>)

- Zlotogorski A, Marek D, Horev L, Abu A, Ben-Amitai D, Gerad L, Ingber A, Frydman M, Reznik-Wolf H, Vardy DA, Pras E. An autosomal recessive form of monilethrix is caused by mutations in DSG4: clinical overlap with localized autosomal recessive hypotrichosis. *J Invest Dermatol.* 2006 Jun;126(6):1292-6. doi: 10.1038/sj.jid.5700251. Citation on PubMed (<https://pubmed.ncbi.nlm.nih.gov/16575393>)

Genomic Location

The *DSG4* gene is found on chromosome 18 (<https://medlineplus.gov/genetics/chromosome/18/>).

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