Genetics Home Reference
Your Guide to Understanding Genetic Conditions

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Ehlers-Danlos syndrome

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What is Ehlers-Danlos syndrome?

Ehlers-Danlos syndrome is a group of disorders that affect connective tissues, which are tissues that support the skin, bones, blood vessels, and other organs. Defects in connective tissues cause the signs and symptoms of Ehlers-Danlos syndrome, which vary from mildly loose joints to life-threatening complications.

In the past, there were more than 10 recognized types of Ehlers-Danlos syndrome. In 1997, researchers proposed a simpler classification that reduced the number of major types to six and gave them descriptive names: the arthrochalasia type, the classic type, the dermatosparaxis type, the hypermobility type, the kyphoscoliosis type, and the vascular type. Other forms of the condition may exist, but they have been reported only in single families or are not well characterized.

Although all types of Ehlers-Danlos syndrome affect the joints and many also affect the skin, features vary by type. An unusually large range of joint movement (hypermobility) occurs with most forms of Ehlers-Danlos syndrome, particularly the hypermobility type. Infants with hypermobile joints often appear to have weak muscle tone, which can delay the development of motor skills such as sitting, standing, and walking. The loose joints are unstable and prone to dislocation, chronic pain, and early-onset arthritis. Dislocations involving both hips are a characteristic finding in infants with the arthrochalasia type of Ehlers-Danlos syndrome.

Many people with Ehlers-Danlos syndrome have soft, velvety skin that is highly elastic (stretchy) and fragile. Affected individuals tend to bruise easily, and some types of the condition also cause abnormal scarring. People with the classic form of Ehlers-Danlos syndrome experience wounds that split open with little bleeding and leave scars that widen over time to create characteristic shallow "cigarette paper" scars. The dermatosparaxis type of the disorder is characterized by skin that sags and wrinkles. Extra (redundant) folds of skin may be present as affected children get older.

Some forms of Ehlers-Danlos syndrome, notably the vascular and kyphoscoliosis types, can involve serious and potentially life-threatening complications. Blood vessels can tear (rupture) unpredictably, causing internal bleeding, stroke, and shock. The vascular type of Ehlers-Danlos syndrome is also associated with an increased risk of organ rupture, including tearing of the intestine and rupture of the uterus (womb) during pregnancy. People with the kyphoscoliosis form of Ehlers-Danlos syndrome experience severe, progressive curvature of the spine that can interfere with breathing.

How common is Ehlers-Danlos syndrome?

Although it is difficult to estimate the overall frequency of Ehlers-Danlos syndrome, the combined prevalence of all types of this condition may be about 1 in 5,000 individuals worldwide. The hypermobility and classic forms are most common; the hypermobility type may affect as many as 1 in 10,000 to 15,000 people, while the classic type probably occurs in 1 in 20,000 to 40,000 people.

Other forms of Ehlers-Danlos syndrome are very rare. About 30 cases of the arthrochalasia type and fewer than 60 cases of the kyphoscoliosis type have been reported worldwide. About a dozen infants and children with the dermatosparaxis type have been described. The vascular type is also rare; estimates vary widely, but the condition may affect about 1 in 250,000 people.

What genes are related to Ehlers-Danlos syndrome?

Mutations in the *ADAMTS2*, *COL1A1*, *COL1A2*, *COL3A1*, *COL5A1*, *COL5A2*, *PLOD1*, and *TNXB* genes cause Ehlers-Danlos syndrome.

Some of these genes (*COL1A1*, *COL1A2*, *COL3A1*, *COL5A1*, and *COL5A2*) provide instructions for making proteins that are used to assemble different types of collagen. Collagens are molecules that give structure and strength to connective tissues throughout the body. Other genes (*ADAMTS2*, *PLOD1*, and *TNXB*) provide instructions for making proteins that process or interact with collagen. Mutations that cause the different forms of Ehlers-Danlos syndrome disrupt the structure, production, or processing of collagen, preventing these molecules from being assembled properly. These defects weaken connective tissues in the skin, bones, and other parts of the body, resulting in the characteristic features of this condition.

Related Gene(s)

Changes in these genes are associated with Ehlers-Danlos syndrome.

- ADAMTS2
- COL1A1
- COL1A2
- COL3A1
- COL5A1
- COL5A2
- PLOD1
- TNXB

How do people inherit Ehlers-Danlos syndrome?

The inheritance pattern of Ehlers-Danlos syndrome varies by type. The arthrochalasia, classic, hypermobility, and vascular forms of the disorder usually have an autosomal dominant pattern of inheritance. Autosomal dominant inheritance means that one copy of the altered gene in each cell is sufficient to cause the disorder. In some cases, an affected person inherits the mutation from one affected parent. Other cases result from new (sporadic) gene mutations. These cases occur in people with no history of the disorder in their family.

The dermatosparaxis and kyphoscoliosis types of Ehlers-Danlos syndrome, and some cases of the classic and hypermobility forms, are inherited in an autosomal recessive pattern. In autosomal recessive inheritance, two copies of the gene in each cell are altered. Most often, the parents of an individual with an autosomal recessive disorder are carriers of one copy of the altered gene but do not show signs and symptoms of the disorder.

Where can I find information about diagnosis or management of Ehlers-Danlos syndrome?

These resources address the diagnosis or management of Ehlers-Danlos syndrome and may include treatment providers.

- Gene Review: Ehlers-Danlos Syndrome, Classic Type (http://www.ncbi.nlm.nih.gov/books/NBK1244)
- Gene Review: Ehlers-Danlos Syndrome, Hypermobility Type (http://www.ncbi.nlm.nih.gov/books/NBK1279)

- Gene Review: Ehlers-Danlos Syndrome, Kyphoscoliotic Form (http://www.ncbi.nlm.nih.gov/books/NBK1462)
- Gene Review: Ehlers-Danlos Syndrome Type IV (http://www.ncbi.nlm.nih.gov/books/NBK1494)
- Genetic Testing Registry: Dermatosparaxis (http://www.ncbi.nlm.nih.gov/gtr/conditions/C2700425)
- Genetic Testing Registry: Ehlers-Danlos syndrome (http://www.ncbi.nlm.nih.gov/gtr/conditions/C0013720)
- Genetic Testing Registry: Ehlers-Danlos syndrome, hydroxylysine-deficient (http://www.ncbi.nlm.nih.gov/gtr/conditions/C0268342)
- Genetic Testing Registry: Ehlers-Danlos syndrome, procollagen proteinase deficient (http://www.ncbi.nlm.nih.gov/gtr/conditions/C0268345)
- Genetic Testing Registry: Ehlers-Danlos syndrome, type 1 (http://www.ncbi.nlm.nih.gov/gtr/conditions/C0268335)
- Genetic Testing Registry: Ehlers-Danlos syndrome, type 2 (http://www.ncbi.nlm.nih.gov/gtr/conditions/C0268336)
- Genetic Testing Registry: Ehlers-Danlos syndrome, type 3 (http://www.ncbi.nlm.nih.gov/gtr/conditions/C0268337)
- Genetic Testing Registry: Ehlers-Danlos syndrome, type 4 (http://www.ncbi.nlm.nih.gov/gtr/conditions/C0268338)
- MedlinePlus Encyclopedia: Ehlers-Danlos Syndrome (http://www.nlm.nih.gov/medlineplus/ency/article/001468.htm)
- MedlinePlus Encyclopedia: Hyperelastic Skin (http://www.nlm.nih.gov/medlineplus/ency/article/003280.htm)
- MedlinePlus Encyclopedia: Hypermobile Joints (http://www.nlm.nih.gov/medlineplus/ency/article/003295.htm)

You might also find information on the diagnosis or management of Ehlers-Danlos syndrome in Educational resources (http://ghr.nlm.nih.gov/condition/ehlers-danlos-syndrome/show/Educational+resources) and Patient support (http://ghr.nlm.nih.gov/condition/ehlers-danlos-syndrome/show/Patient+support).

General information about the diagnosis (http://ghr.nlm.nih.gov/handbook/consult/diagnosis) and management (http://ghr.nlm.nih.gov/handbook/consult/treatment) of genetic conditions is available in the Handbook. Read more about genetic testing (http://ghr.nlm.nih.gov/handbook/testing), particularly the difference between clinical tests and research tests (http://ghr.nlm.nih.gov/handbook/testing/researchtesting).

To locate a healthcare provider, see How can I find a genetics professional in my area? (http://ghr.nlm.nih.gov/handbook/consult/findingprofessional) in the Handbook.

Where can I find additional information about Ehlers-Danlos syndrome?

You may find the following resources about Ehlers-Danlos syndrome helpful. These materials are written for the general public.

- **MedlinePlus - Health information**
    - Encyclopedia: Ehlers-Danlos Syndrome (http://www.nlm.nih.gov/medlineplus/ency/article/

001468.htm)

- Encyclopedia: Hyperelastic Skin (http://www.nlm.nih.gov/medlineplus/ency/article/003280.htm)
- Encyclopedia: Hypermobile Joints (http://www.nlm.nih.gov/medlineplus/ency/article/003295.htm)
- Health Topic: Ehlers-Danlos Syndrome (http://www.nlm.nih.gov/medlineplus/ehlersdanlossyndrome.html)

- **Genetic and Rare Diseases Information Center - Information about genetic conditions and rare diseases**
  - Genetic and Rare Diseases Information Center: Ehlers-Danlos syndrome (http://rarediseases.info.nih.gov/gard/6322/ehlers-danlos-syndrome/resources/1)
  - Genetic and Rare Diseases Information Center: Ehlers-Danlos syndrome, classic type (http://rarediseases.info.nih.gov/gard/2088/ehlers-danlos-syndrome-classic-type/resources/1)
  - Genetic and Rare Diseases Information Center: Ehlers-Danlos syndrome hypermobility type (http://rarediseases.info.nih.gov/gard/2081/ehlers-danlos-syndrome-hypermobility-type/resources/1)
  - Genetic and Rare Diseases Information Center: Ehlers-Danlos syndrome progeroid type (http://rarediseases.info.nih.gov/gard/9991/ehlers-danlos-syndrome-progeroid-type/resources/1)
  - Genetic and Rare Diseases Information Center: Ehlers-Danlos syndrome vascular type (http://rarediseases.info.nih.gov/gard/2082/ehlers-danlos-syndrome-vascular-type/resources/1)
- Additional NIH Resources - National Institutes of Health
  Questions and Answers About Heritable Disorders of Connective Tissue (National Institute of Arthritis and Musculoskeletal and Skin Diseases) (http://www.niams.nih.gov/Health_Info/Connective_Tissue/default.asp)

- **Educational resources - Information pages**
  - Madisons Foundation (http://www.madisonsfoundation.org/index.php?option=com_mpower&task=disease&diseaseID=339)
  - Merck Manual of Medical Information, Second Home Edition (http://www.merckmanuals.com/home/childrens_health_issues/hereditary_connective_tissue_disorders/ehlers-danlos_syndrome.html)
  - My46 Trait Profile (https://www.my46.org/trait-document?trait=Ehlers-Danlos%20syndrome%20-%20Vascular%20type&type=profile)
  - Orphanet: Ehlers-Danlos syndrome, arthrochalasic type (http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=1899)
  - Orphanet: Ehlers-Danlos syndrome, classic type (http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=287)
  - Orphanet: Ehlers-Danlos syndrome, dermatosparaxis type (http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=1901)
  - Orphanet: Ehlers-Danlos syndrome, hypermobility type (http://www.orpha.net/consor/cgi-

bin/OC_Exp.php?Lng=EN&Expert=285)

- Orphanet: Ehlers-Danlos syndrome, kyphoscoliotic type (http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=1900)
- Orphanet: Ehlers-Danlos syndrome, vascular type (http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=286)

- **Patient support - For patients and families**
  - Ehlers-Danlos Support Group (UK) (http://www.ehlers-danlos.org/)
  - National Organization for Rare Disorders (https://www.rarediseases.org/rare-disease-information/rare-diseases/byID/240/viewAbstract)
  - RareConnect (https://www.rareconnect.org/en/community/ehlers-danlos-syndrome)
  - Resource list from the University of Kansas Medical Center (http://www.kumc.edu/gec/support/ehlers.html)
  - The Hypermobility Syndrome Association (UK) (http://hypermobility.org/)

You may also be interested in these resources, which are designed for healthcare professionals and researchers.

- **Gene Reviews - Clinical summary**
  - Gene Review: Ehlers-Danlos Syndrome, Classic Type (http://www.ncbi.nlm.nih.gov/books/NBK1244)
  - Gene Review: Ehlers-Danlos Syndrome, Hypermobility Type (http://www.ncbi.nlm.nih.gov/books/NBK1279)
  - Gene Review: Ehlers-Danlos Syndrome, Kyphoscoliotic Form (http://www.ncbi.nlm.nih.gov/books/NBK1462)
  - Gene Review: Ehlers-Danlos Syndrome Type IV (http://www.ncbi.nlm.nih.gov/books/NBK1494)

- **Genetic Testing Registry - Repository of genetic test information**
  - Genetic Testing Registry: Dermatosparaxis (http://www.ncbi.nlm.nih.gov/gtr/conditions/C2700425)
  - Genetic Testing Registry: Ehlers-Danlos syndrome (http://www.ncbi.nlm.nih.gov/gtr/conditions/C0013720)
  - Genetic Testing Registry: Ehlers-Danlos syndrome, hydroxylysine-deficient (http://www.ncbi.nlm.nih.gov/gtr/conditions/C0268342)
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  - Genetic Testing Registry: Ehlers-Danlos syndrome, type 2 (http://www.ncbi.nlm.nih.gov/gtr/conditions/C0268336)
  - Genetic Testing Registry: Ehlers-Danlos syndrome, type 3 (http://www.ncbi.nlm.nih.gov/gtr/conditions/C0268337)

    - Genetic Testing Registry: Ehlers-Danlos syndrome, type 4 (http://www.ncbi.nlm.nih.gov/gtr/conditions/C0268338)
  - ClinicalTrials.gov - Linking patients to medical research (http://clinicaltrials.gov/ct2/results?cond=%22ehlers-danlos%20syndrome%22)
  - **OMIM - Genetic disorder catalog**
    - EHLERS-DANLOS SYNDROME, TYPE I (http://omim.org/entry/130000)
    - EHLERS-DANLOS SYNDROME, TYPE II (http://omim.org/entry/130010)
    - EHLERS-DANLOS SYNDROME, TYPE III (http://omim.org/entry/130020)
    - EHLERS-DANLOS SYNDROME, TYPE IV, AUTOSOMAL DOMINANT (http://omim.org/entry/130050)
    - EHLERS-DANLOS SYNDROME, TYPE VI (http://omim.org/entry/225400)
    - EHLERS-DANLOS SYNDROME, TYPE VII, AUTOSOMAL DOMINANT (http://omim.org/entry/130060)
    - EHLERS-DANLOS SYNDROME, TYPE VII, AUTOSOMAL RECESSIVE (http://omim.org/entry/225410)

What other names do people use for Ehlers-Danlos syndrome?

- EDS
- Ehlers Danlos disease

For more information about naming genetic conditions, see the Genetics Home Reference Condition Naming Guidelines (http://ghr.nlm.nih.gov/ConditionNameGuide) and How are genetic conditions and genes named? (http://ghr.nlm.nih.gov/handbook/mutationsanddisorders/naming) in the Handbook.

What if I still have specific questions about Ehlers-Danlos syndrome?

Ask the Genetic and Rare Diseases Information Center (http://rarediseases.info.nih.gov/GARD/).

What glossary definitions help with understanding Ehlers-Danlos syndrome?

arthritis ; autosomal ; autosomal dominant ; autosomal recessive ; cell ; chronic ; collagen ; deficiency ; dislocation ; elastic ; gene ; hypermobility ; inheritance ; inheritance pattern ; inherited ; intestine ; joint ; kyphoscoliosis ; motor ; muscle tone ; mutation ; pattern of inheritance ; prevalence ; recessive ; rupture ; shock ; sporadic ; syndrome ; vascular

You may find definitions for these and many other terms in the Genetics Home Reference Glossary (http://ghr.nlm.nih.gov/glossary).

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The resources on this site should not be used as a substitute for professional medical care or advice. Users seeking information about a personal genetic disease, syndrome, or condition should consult with a qualified healthcare professional. See How can I find a genetics professional in my area? (http://ghr.nlm.nih.gov/handbook/consult/findingprofessional) in the Handbook.

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