SMC1A gene

structural maintenance of chromosomes 1A

Normal Function

The *SMC1A* gene provides instructions for making a protein that is part of the structural maintenance of chromosomes (SMC) family. Within the nucleus, SMC proteins help regulate the structure and organization of chromosomes.

The protein produced from the *SMC1A* gene helps control chromosomes during cell division. Before cells divide, they must copy all of their chromosomes. The copied DNA from each chromosome is arranged into two identical structures, called sister chromatids, which are attached to one another during the early stages of cell division. The SMC1A protein is part of a protein group called the cohesin complex that holds the sister chromatids together.

Researchers believe that the SMC1A protein, as a structural component of the cohesin complex, also plays important roles in stabilizing cells' genetic information, repairing damaged DNA, and regulating the activity of certain genes that are essential for normal development.

Health Conditions Related to Genetic Changes

Cornelia de Lange syndrome

Variants (also called mutations) in the *SMC1A* gene have been identified in people with Cornelia de Lange syndrome, a developmental disorder that affects many parts of the body. Researchers estimate that variants in this gene account for about 5 percent of all cases of this condition.

Most of the *SMC1A* gene variants that cause Cornelia de Lange syndrome change single protein building blocks (amino acids) in the SMC1A protein. These variants alter the structure and function of the protein, which likely interferes with the activity of the cohesin complex and impairs its ability to regulate genes that are critical for normal development. Although researchers do not fully understand how these changes cause Cornelia de Lange syndrome, they suspect that altered gene regulation probably underlies many of the developmental problems characteristic of the condition.

Studies suggest that variants in the *SMC1A* gene tend to cause a form of Cornelia de Lange syndrome with relatively mild features. Compared to variants in the *NIPBL* gene,

which are the most common known cause of the disorder, *SMC1A* gene variants often cause less significant delays in development and growth and are less likely to cause major birth defects.

Other disorders

Variants in the *SMC1A* gene have also been identified in infants with a form of X-linked epilepsy. (X-linked refers to the fact that the *SMC1A* gene is on the X chromosome, one of the two sex chromosomes.) This condition, called developmental and epileptic encephalopathy-85 with or without midline brain defects (or DEE85), appears to affect only females. Affected individuals develop severe, recurrent seizures (epilepsy) by age 2 and have intellectual and developmental impairments. These individuals can also have distinctive facial features.

Most of the *SMC1A* gene variants that cause DEE85 result in an abnormally short blueprint for making protein. As a result, the blueprint is likely broken down, preventing SMC1A protein production. The gene variants that cause DEE85 severely reduce or eliminate SMC1A protein function in cells. A loss of SMC1A protein function likely interferes with the activity of the cohesin complex and impairs its ability to regulate genes that are critical for normal development. Although researchers do not fully understand how these changes cause DEE85, they suspect that altered gene regulation probably underlies many of the developmental problems characteristic of the condition. It is thought that variants that result in little or no SMC1A protein function cause the more severe signs and symptoms of DEE85, and variants that result in a partially functional version of the protein cause Cornelia de Lange syndrome.

Other Names for This Gene

- DXS423E
- KIAA0178
- segregation of mitotic chromosomes 1
- SMC1
- SMC1-alpha
- SMC1A_HUMAN
- SMC1L1
- SMCB

Additional Information & Resources

Tests Listed in the Genetic Testing Registry

- Tests of SMC1A (https://www.ncbi.nlm.nih.gov/gtr/all/tests/?term=8243[geneid])

Scientific Articles on PubMed

- PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=%28%28SMC1A%5BTIAB%5D%29+OR+%28SMC1L1%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+2160+days%22%5Bdp%5D)

Catalog of Genes and Diseases from OMIM

- STRUCTURAL MAINTENANCE OF CHROMOSOMES 1A; SMC1A (https://omim.org/entry/300040)

Gene and Variant Databases

- NCBI Gene (https://www.ncbi.nlm.nih.gov/gene/8243)
- ClinVar (https://www.ncbi.nlm.nih.gov/clinvar?term=SMC1A[gene])

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Genomic Location

The *SMC1A* gene is found on the X chromosome (https://medlineplus.gov/genetics/chromosome/x/).

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