

CFTR Gene

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Cystic fibrosis transmembrane conductance regulator

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1. Normal Function

The *CFTR* gene provides instructions for making a protein called the cystic fibrosis transmembrane conductance regulator. This protein functions as a channel across the membrane of cells that produce mucus, sweat, saliva, tears, and digestive enzymes. The channel transports negatively charged particles called chloride ions into and out of cells. The transport of chloride ions helps control the movement of water in tissues, which is necessary for the production of thin, freely flowing mucus. Mucus is a slippery substance that lubricates and protects the lining of the airways, digestive system, reproductive system, and other organs and tissues.

The CFTR protein also regulates the function of other channels, such as those that transport positively charged particles called sodium ions across cell membranes. These channels are necessary for the normal function of organs such as the lungs and pancreas.

2. Health Conditions Related to Genetic Changes

2.1. Congenital bilateral absence of the vas deferens

About 80 *CFTR* mutations have been identified in males with congenital bilateral absence of the vas deferens. Most affected males have a mild mutation in at least one copy of the gene in each cell. These mutations allow the CFTR protein to retain some of its function. Some affected males have a mild mutation in one copy of the *CFTR* gene in each cell and a more severe, cystic fibrosis-causing mutation in the other copy of the gene.

Mutations in the *CFTR* gene disrupt the function of the chloride channel, preventing the usual flow of chloride ions and water into and out of cells. As a result, cells in the male genital tract produce mucus that is abnormally thick and sticky. This mucus clogs the tubes that carry sperm from the testes (the vas deferens) as they are forming, causing them to deteriorate before birth. Without the vas deferens, sperm cannot be transported from the testes to become part of semen. Men with congenital bilateral absence of the vas deferens are unable to father children (infertile) unless they use assisted reproductive technologies.

2.2. Cystic fibrosis

More than 1,000 mutations in the *CFTR* gene have been identified in people with cystic fibrosis. Most of these mutations change single protein building blocks (amino acids) in the CFTR protein or delete a small amount of DNA from the *CFTR* gene. The most common mutation, called delta F508, is a deletion of one amino acid at position 508 in the CFTR protein. The resulting abnormal channel breaks down shortly after it is made, so it never reaches the cell membrane to transport chloride ions.

Disease-causing mutations in the *CFTR* gene alter the production, structure, or stability of the chloride channel. All of these changes prevent the channel from functioning properly, which impairs the transport of chloride ions and the movement of water into and out of cells. As a result, cells that line the passageways of the lungs, pancreas, and other organs produce mucus that is abnormally thick and sticky. The abnormal mucus obstructs the airways and glands, leading to the characteristic signs and symptoms of cystic fibrosis.

2.3. Hereditary pancreatitis

2.4. Other disorders

A few mutations in the *CFTR* gene have been identified in people with isolated problems affecting the digestive or respiratory system. For example, *CFTR* mutations have been found in some cases of idiopathic pancreatitis, an inflammation of the pancreas that causes abdominal pain, nausea, vomiting, and fever. Although *CFTR* mutations may be a risk factor, the cause of idiopathic pancreatitis is unknown.

Changes in the *CFTR* gene also have been associated with rhinosinusitis, which is a chronic inflammation of the tissues that line the sinuses. This condition causes sinus pain and pressure, headache, fever, and nasal congestion or drainage. Other respiratory problems, including several conditions that partially block the airways and interfere with breathing, are also associated with *CFTR* mutations. These conditions include bronchiectasis, which damages the passages leading from the windpipe to the lungs (the bronchi), and allergic bronchopulmonary aspergillosis, which results from hypersensitivity to a certain type of fungal infection. Additional genetic and environmental factors likely play a part in determining the risk of these complex conditions.

3. Other Names for This Gene

- ABC35
- ABCC7
- cAMP-dependent chloride channel
- CF
- CFTR_HUMAN
- cystic fibrosis transmembrane conductance regulator (ATP-binding cassette sub-family C, member 7)
- cystic fibrosis transmembrane conductance regulator, ATP-binding cassette (sub-family C, member 7)
- MRP7

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