Understanding Genetics in Primary Ciliary Dyskinesia

Frequently Asked Questions

How do genetics work in PCD?

Our bodies are built using instructions contained in **genes**. We inherit one copy of each gene from our mother and one copy from our father. Genes are made of DNA and tell our bodies how to grow, develop, and function.

Everyone has small differences in their genes, called **genetic variants**. Most genetic variants are harmless and simply make us unique. However, some variants can affect how the body works.

In primary ciliary dyskinesia (PCD), certain genetic variants affect the structure or function of a specific type of **cilia** known as motile cilia. Motile cilia are microscopic, hair-like structures that move in a coordinated way to help clear mucus and germs from the body. They are found in the lungs, sinuses, ears, reproductive system, and other parts of the body.

When motile cilia do not work properly:

- Mucus can build up in the lungs, sinuses, and ears.
- Infections may occur more often.
- Lung function and hearing may decline over time.
- Organ placement during fetal development may be affected, causing conditions such as situs inversus and cardiac defects.
- Subfertility problems can occur in both males and females with PCD.

Because PCD is genetic, motile cilia throughout the body are affected, so symptoms may develop in any organ system that relies on the function of motile cilia.

How does genetic testing help me understand my PCD?

Researchers have identified disease-causing variants in more than 50 genes that can cause PCD, and new genes continue to be discovered.

Genetic testing helps determine whether you have a known PCD-causing variant and can provide important information about your diagnosis. However, genetic testing is not always straightforward. Unlike a school test, there is no simple “pass” or “fail” result.

Some genetic results clearly confirm a diagnosis of PCD. Other results may be less clear and require additional testing or expert interpretation.

Genetic test results may show:

- **Disease-causing (pathogenic) variants:** When two pathogenic variants are found in the same PCD gene, and one has been inherited from each parent, the diagnosis of PCD can be confirmed.
- **Variants of uncertain significance (VUS):** These are genetic changes that may or may not cause disease. More information is often needed to understand their meaning.

Sometimes genetic testing results are inconclusive**. *It is important to remember that a ‘negative’ or ‘inconclusive’ genetic test for PCD does not mean you do not have PCD.*** We do not know all the genes associated with PCD yet, or all the variants on each gene that may be identified as pathogenic in the future.

Because genetic testing can be complex, it is important to work with healthcare providers who have expertise in PCD and genetics.

Why is it important to know the genetic cause of my symptoms?

Many conditions can cause symptoms that look similar to PCD, including other inherited disorders such as cystic fibrosis and certain immune system disorders.

Although these conditions may share some symptoms, their treatments, management, and research opportunities can be very different. Genetic testing helps ensure that you receive the most accurate diagnosis and the most appropriate care.

A geneticist and genetic counselor can help:

- Explain the benefits and limitations of testing.
- Recommend the most appropriate tests.
- Interpret complex results.
- Determine whether additional testing is needed.
- Help you understand what the results mean for your health.

Why might family testing be needed?

Sometimes genetic testing of parents or other family members is helpful in understanding a person's results.

Family testing can help determine whether genetic variants were inherited and whether they are likely to be causing disease. This information can improve the accuracy of the diagnosis and provide valuable information for other family members.

The genetics team will discuss whether family testing may be helpful in your situation.

How is PCD inherited?

The way PCD is inherited depends on the specific gene involved.

The most common inheritance pattern is called **autosomal recessive inheritance**, meaning a person typically inherits one disease-causing variant from each parent.

X-linked, and syndromic inheritance occurs in a small number of PCD genes.

In some cases, a genetic change can occur for the first time in an individual without being inherited from either parent. This is called a ***de novo* variant**. There are rare cases of PCD with dominant inheritance from *de novo* variants.

Because inheritance patterns can vary, a genetics specialist can help explain what your specific results mean for you and your family.

How is genetic testing performed?

Genetic testing for PCD is usually done using either:

- A cheek swab (buccal swab), or
- A blood sample.

The sample is sent to a specialized laboratory where genes known to be associated with PCD are analyzed.

Once the results are available, your healthcare provider or genetics specialist will review them with you and explain what they mean.

As new genes are discovered and scientific knowledge advances, additional testing may sometimes be recommended if earlier results were unclear.

Why is genetic testing important in PCD?

Genetic testing is an important part of PCD care because it can:

- Help confirm the diagnosis.
- Improve understanding of an individual's specific type of PCD.
- Guide treatment and management decisions.
- Help identify eligibility for research studies and clinical trials.
- Support the development of future therapies.

Researchers are actively developing gene-based therapies and other targeted treatments for PCD. Many of these approaches depend on knowing the specific gene responsible for a person's condition.

A confirmed genetic diagnosis also helps researchers better understand PCD and accelerate the development of new treatments for the entire PCD community.

How can a genetics specialist help?

A genetics specialist, such as a geneticist or genetic counselor, plays an important role in the diagnosis and management of PCD.

They can:

- Explain the benefits, risks, and limitations of genetic testing.
- Help choose the most appropriate testing.
- Interpret test results.
- Coordinate additional testing if needed.
- Explain what the results mean for you and your family.
- Discuss privacy protections and legal safeguards related to genetic information.

Genetics specialists work closely with your PCD care team to ensure that testing is accurate, cost-effective, and useful for guiding your care.

Common Concerns About Genetic Testing

Will my genetic information remain private?

Many people worry about how their genetic information will be stored and who can access it. Healthcare providers and laboratories follow strict privacy laws and security standards to protect personal health information. If you have questions about how your information will be stored or used, your healthcare team can explain the process.

Could genetic testing affect insurance or employment?

Some people worry that genetic test results could be used against them. In the United States, the **Genetic Information Nondiscrimination Act (GINA)** provides important protections against discrimination based on genetic information in health insurance and employment. Your genetics team can explain these protections and answer any questions you may have.

What if the results are emotionally difficult?

It is normal to feel anxious about genetic testing. Some people worry about what the results may reveal. Many patients find that having clear answers helps them better understand their condition and make informed healthcare decisions. Your healthcare team can provide support and resources throughout the process.

Are genetic test results accurate?

Modern genetic testing for PCD is highly reliable and continues to improve as new discoveries are made. However, no test is perfect. Sometimes results may be unclear or additional testing may be needed. This is one reason why expert interpretation is so important.

Is genetic testing affordable?

The cost of genetic testing varies depending on insurance coverage and the type of test ordered. Many testing programs are more affordable and accessible than they were in the past. Genetics professionals can help explain costs, insurance coverage, and available financial assistance programs.

I’ve already been diagnosed with PCD. Why should I have genetic testing?

Even if you already have a diagnosis of PCD, genetic testing can still provide valuable information.

Knowing your specific genetic cause may:

- Improve understanding of your condition.
- Help determine eligibility for research studies and clinical trials.
- Support the development of future targeted therapies.
- Contribute to research that may benefit the entire PCD community.

As new treatments become available, knowing your genetic diagnosis may become increasingly important.