**What are genes, gene mutations and genetic testing?**

**Genetics** is the field of science that looks at how traits (such as eye color) are passed down from parents to their children through genes. **Genes** are pieces of DNA (deoxyribonucleic acid) inside our cells that tell the cell how to make the proteins the body needs to function. DNA is the genetic “blueprint” in each cell. Genes affect inherited traits passed on from a parent to a child, such as hair color, eye color, and height. They can also affect whether a person is likely to develop certain diseases, such as cancer.

Changes in genes, called **mutations**, play an important role in the development of cancer. Mutations can cause a cell to make (or not make) proteins that affect how the cell grows and divides into new cells. Certain mutations can cause cells to grow out of control, which can lead to cancer. Still, only about 5% to 10% of all cancers are thought to be strongly related to an**inherited** gene mutation. Usually several gene changes or mutations are needed before a cell becomes cancer.

Genetic testing, also known as DNA testing, is used to identify changes in DNA sequence or chromosome structure. The results of a genetic test can confirm or rule out a suspected genetic condition or help determine a person's chance of developing or passing on a genetic disorder.

**Predictive genetic testing** is the type of testing used to look for inherited gene mutations that might put a person at higher risk of getting certain kinds of cancer.For a person with a strong family history of certain types of cancer, to see if they carry a gene mutation that increases their risk. If they do have an inherited mutation, they might want to have tests to look for cancer early, or even take steps to lower their risk.

**What is Personalized Medicine?**

Personalized medicine, also referred to as precision medicine, is a medical model that separates people into different groups—with medical decisions, practices, interventions and/or products being tailored to the individual patient based on their predicted response or risk of disease. The terms personalized medicine, precision medicine, stratified medicine and P4 medicine are used interchangeably to describe this concept. Personalised medicine can also be used to predict a person's risk for a particular disease, based on one or even several genes. This approach uses the same sequencing technology to focus on the evaluation of disease risk, allowing the physician to initiate preventive treatment before the disease presents itself in their patient.

Becoming more accurate, precise, proactive, and impactful for each individual that comes under their care has always been the goal of all clinicians, no matter how basic the tools at their disposal.

**What Is Personalized Cancer Medicine?**

You may have heard the terms "personalized medicine." This means your medical care is based on your genes and your specific disease. Many cancers affect or involve specific genes. Learn more about cancer and your genes. This approach can also be called "precision medicine."

Personalized cancer medicine comes from studies of human genes and the genes in different cancers. These studies have helped researchers design more effective treatments. They have also used genetic information to develop tests for cancer and ways to prevent it.

Personalized cancer medicine can have fewer side effects than other types of treatment. This is because it is designed to be more specific. A personalized treatment may affect healthy cells less and cells involved in cancer more.

Your doctor may work with you on a personalized cancer screening or cancer treatment plan. This may include:

* Learning your chances of developing cancer and choosing screening tests to lower the risk.
* Matching the treatment to your genes and your cancer's genes. This may be more effective and cause fewer side effects.
* Predicting how likely the cancer is to come back. Doctors call this "risk of recurrence."

**How is personalized medicine different?**

Before personalized medicine, people with the same type of cancer usually got the same treatment. Over time, doctors noticed the treatments worked better for some people than others.

Then, researchers began finding genetic differences in people and their cancers. These differences explained a great deal about why cancers responded differently to the same treatment.

Today, you may still have the usual treatment for your type and stage of cancer. But your doctor may personalize it based on information about your genes and the cancer's genes. This is personalized cancer medicine.

**Examples of personalized cancer medicine**

**Targeted therapy**

A [targeted treatment](https://www.cancer.net/node/24729) targets specific genes and proteins that allow a certain cancer to grow and survive. Researchers find new targets for more cancers each year. Then, they create and test new drugs for these targets.

You may have targeted therapy if your cancer has the target that a treatment was designed for. Your doctor needs to test a sample of blood, bone marrow, or tumor tissue to learn this. The doctor will make treatment recommendations based on these results, as well as other factors.

**Pharmacogenomics**

Researchers can study how your genes affect your response to drugs. This is called pharmacogenomics. How your genes affect drugs in your body makes a difference. It determines how well a drug works for you and how safe it is.

For example, you may process a certain drug faster than most people do. So it goes through your system more quickly. This would mean you may need a higher dose for the drug to work as well as it does for most people.

**The future of personalized cancer medicine**

Personalized cancer medicine can make cancer treatment more effective, with fewer side effects. But there are still some challenges. These include:

* Personalized treatment is not available for all types and subtypes of cancer.
* Some personalized treatments are only available in clinical trials.
* Genetic testing can be expensive. Insurance plans do not always pay for it. Also, testing your genes and the genes in your tumor takes time. This can mean you wait longer to get the personalized treatment.
* Some personalized treatments, such as targeted treatments, can be expensive.

Researchers are still developing personalized medicine for cancer. They want to learn more about:

* The gene changes that happen in cancer cells.
* How personalized cancer treatments work.
* Why some targeted therapies stop working. Targeted therapy is a type of personalized cancer medicine.