

What Is Cancer? How It Starts and Spreads

Cancer is a disease in which some of the body's cells grow out of control and can spread to other parts of the body. It starts when changes to genes make cells grow and divide when they shouldn't. There are more than 100 types of cancer, usually named for where they start.

The simple version

Cancer is a disease in which some of the body's cells grow uncontrollably and spread to other parts of the body.

Cancer can start almost anywhere in the human body, which is made up of trillions of cells. Normally, human cells grow and multiply through a process called cell division to form new cells as the body needs them. When cells grow old or become damaged, they die, and new cells take their place.

Sometimes this orderly process breaks down. Abnormal or damaged cells grow and multiply when they shouldn't. These cells may form tumors, which are lumps of tissue. Tumors can be cancerous or not cancerous (benign).

Cancer, at its heart, is normal cell growth gone out of control.

Cancerous and benign tumors

Cancerous tumors spread into, or invade, nearby tissues. They can also travel to distant places in the body to form new tumors, a process called metastasis. Cancerous tumors may also be called malignant tumors. Many cancers form solid tumors, but cancers of the blood, such as leukemias, generally do not.

Benign tumors do not spread into or invade nearby tissues. When removed, benign tumors usually don't grow back, while cancerous tumors sometimes do. Benign tumors can sometimes be quite large, though. Some can cause serious symptoms or be life threatening, such as benign tumors in the brain.

How cancer cells are different

Cancer cells differ from normal cells in many ways. For instance, cancer cells:

- grow without the signals that normally tell cells to grow. Normal cells only grow when they receive such signals.

- ignore signals that normally tell cells to stop dividing or to die (a process known as programmed cell death, or apoptosis).
- invade nearby areas and spread to other parts of the body. Most normal cells stop growing when they meet other cells and do not move around the body.
- tell blood vessels to grow toward tumors. These blood vessels bring oxygen and nutrients and remove waste.
- hide from the immune system, which normally removes damaged or abnormal cells.
- trick the immune system into helping cancer cells stay alive and grow.
- build up multiple changes in their chromosomes, such as extra or missing pieces.
- rely on different nutrients and make energy in a different way, which can let them grow more quickly.

Cancer cells often rely so heavily on these abnormal behaviors that they can't survive without them. Researchers have used this fact to develop treatments that target the abnormal features of cancer cells. For example, some therapies keep blood vessels from growing toward tumors, essentially starving the tumor of nutrients it needs.

How cancer develops

Cancer is a genetic disease. That means it is caused by changes to genes, which control the way our cells work, especially how they grow and divide.

Genetic changes that cause cancer can happen because:

- of errors that occur as cells divide.
- of damage to DNA caused by harmful substances in the environment, such as chemicals in tobacco smoke and ultraviolet rays from the sun.
- they were inherited from our parents.

The body normally removes cells with damaged DNA before they turn cancerous. But the body's ability to do this goes down as we age. This is part of the reason there is a higher risk of cancer later in life.

Each person's cancer has a unique combination of genetic changes. As the cancer keeps growing, more changes happen. Even within the same tumor, different cells may have different genetic changes.

The genes involved in cancer

The genetic changes that contribute to cancer tend to affect three main types of genes: proto-oncogenes, tumor suppressor genes, and DNA repair genes. These changes are sometimes called "drivers" of cancer.

- **Proto-oncogenes** are involved in normal cell growth and division. When these genes are altered in certain ways or are more active than normal, they may become cancer-causing genes (called oncogenes) that let cells grow and survive when they should not.
- **Tumor suppressor genes** are also involved in controlling cell growth and division. Cells with certain changes in these genes may divide in an uncontrolled way.
- **DNA repair genes** fix damaged DNA. Cells with changes in these genes tend to build up more changes in other genes, which together may make the cells cancerous.

As scientists have learned more, they have found that certain gene changes are common across many types of cancer. There are now many treatments that target gene changes found in cancer. A few can be used for any cancer that has the targeted change, no matter where the cancer started.

When cancer spreads

A cancer that has spread from where it first formed to another place in the body is called metastatic cancer. The process by which this happens is called metastasis.

Metastatic cancer has the same name and the same type of cancer cells as the original, or primary, cancer. For example, breast cancer that forms a tumor in the lung is metastatic breast cancer, not lung cancer. Under a microscope, metastatic cancer cells generally look like cells of the original cancer and share molecular features with it.

In some cases, treatment may help people with metastatic cancer live longer. In other cases, the main goal is to control the cancer's growth or relieve symptoms. Metastatic tumors can cause severe damage to how the body works, and most people who die of cancer die of metastatic disease.

Tissue changes that are not cancer

Not every change in the body's tissues is cancer. Some tissue changes may develop into cancer if they are not treated. Here are some examples that are not cancer but are sometimes monitored:

- **Hyperplasia** happens when cells within a tissue multiply faster than normal and extra cells build up. The cells and the way the tissue is organized still look normal under a microscope.
- **Dysplasia** is more advanced. There is a buildup of extra cells, but the cells look abnormal and the tissue is organized differently. In general, the more abnormal the cells look, the greater the chance that cancer will form. An abnormal mole (a dysplastic nevus) is one example; it can turn into melanoma, although most do not.
- **Carcinoma in situ** is more advanced still. It is sometimes called stage 0 cancer, but it is not cancer because the abnormal cells do not invade nearby tissue the way cancer cells do. Because some cases may become cancer, carcinoma in situ is usually treated.

Types of cancer

There are more than 100 types of cancer. Types are usually named for the organs or tissues where they form. For example, lung cancer starts in the lung and brain cancer starts in the brain. Cancers may also be described by the type of cell that formed them.

Some broad categories, based on the type of cell where they begin, include:

- **Carcinoma** — the most common type of cancer, formed by epithelial cells that cover the inside and outside surfaces of the body. Adenocarcinoma, basal cell carcinoma, squamous cell carcinoma, and transitional cell carcinoma are types of carcinoma.
- **Sarcoma** — cancers that form in bone and soft tissues, including muscle, fat, blood vessels, lymph vessels, and fibrous tissue such as tendons and ligaments.
- **Leukemia** — cancers that begin in the blood-forming tissue of the bone marrow. These do not form solid tumors; instead, abnormal white blood cells build up and crowd out normal blood cells.
- **Lymphoma** — cancer that begins in lymphocytes (T cells or B cells), which are disease-fighting white blood cells. The two main types are Hodgkin lymphoma and non-Hodgkin lymphoma.
- **Multiple myeloma** — cancer that begins in plasma cells, another type of immune cell, and builds up in the bone marrow.
- **Melanoma** — cancer that begins in cells that become melanocytes, the cells that make the pigment that gives skin its color.
- **Brain and spinal cord tumors** — named for the type of cell they formed in and where they started. They can be benign or malignant.

There are also other types, such as germ cell tumors, neuroendocrine tumors, and carcinoid tumors.

Knowing exactly which type of cancer someone has is the first step toward understanding it and planning care.

Source: National Cancer Institute (cancer.gov/about-cancer/understanding/what-is-cancer)

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