

Cancer and Homeostasis

by Sophia



WHAT'S COVERED

In this lesson, you will learn to identify causes and treatments of cancer. Specifically, this lesson will cover:

1. Formation & Growth

Cancer is an uncontrolled cell division that can form a **tumor** and lead to **metastasis**. Normally, cells divide at a rate to replace old cells and maintain homeostasis; this rate of division is controlled by the cell's DNA. When DNA becomes mutated, it can cause these cells to divide uncontrollably. When a cell starts to divide uncontrollably, it will form this mass of abnormal cells called a tumor. Cells in a tumor can break off and float down the bloodstream, planting themselves somewhere else in the body. This process is called metastasis.

Causes of cancer include:

- Cancer can be hereditary. A person could have a higher risk of cancer if someone in their family has had it.
- Viruses
- Chemical **carcinogens** are cancer-causing agents, such as smoking.
- Radiation
- Suppression of the immune system

It's important to note that all of the above causes affect the DNA in some way, mutating it so that the signals that usually control cell division are lost or ignored.



TERMS TO KNOW

Cancer

A condition caused by the uncontrolled division of cells.

Tumor

A mass of abnormal cells formed from the uncontrolled division of cells in the area.

Metastasis

The spreading of cancerous cells from one site in the body to another.

Carcinogen

A substance that can cause cancer.

1a. Oncogenes & Tumor Suppressor Genes

An **oncogene** is a gene that, when mutated, increases the likelihood that a cell will become cancerous. Because there are a lot of mechanisms that control cell division, a cell must accumulate several mutations before it becomes cancerous. In order for cancer to develop, a cell requires the mutations of at least one **tumor suppressor gene**. Tumor suppressor genes help prevent cancer by slowing or stopping cell growth.

IN CONTEXT

So if a person has two controls to stop the growth of cancer, how do people still get it?

Let's say someone has an oncogene that's not responding to normal controls, and the cells are starting to divide very rapidly. Their tumor suppressor genes will normally help to stop that by slowing or stopping the cell growth or division. If this same person's tumor suppressor genes are mutated, it's not going to be able to do its job. It's not going to be able to stop or slow cell growth or division, causing the formation of tumors.



TERMS TO KNOW

Oncogene

A gene that, when mutated, increases the likelihood that a cell will become cancerous.

Tumor Suppressor Gene

A gene that acts to stop or slow abnormal cell growth.

1b. Angiogenin

Angiogenin is a growth factor secreted by cancer cells that causes more blood vessels to grow around the tumor. This supplies a tumor with oxygen and nutrients to grow.



TERM TO KNOW

Angiogenin

A substance secreted by cancerous cells that encourages blood vessels to grow around the tumor to provide necessary oxygen and nutrients for growth.

2. Cell-Mediated Responses

Cancer is difficult for our bodies to fight because cancer began as one of our normal cells. Often, cancerous cells appear to our immune system as a regular part of our bodies, and therefore, something that should not be attacked instead of appearing as diseased tissue.

However, the body has some defenses against cancer once it develops. Cell-mediated immune responses work to attack cancer cells. This is a part of the immune system that works on abnormal and compromised cells. The cell-mediated immune response involves invaders inside cells, cancerous cells, and other abnormal cells. Cytotoxic T cells and NK cells are a part of cell-mediated immune responses.

- Cytotoxic T cells will cause **apoptosis** of irregular cells, which is the programmed cell death. It will target

these cells, and those cells will eventually be killed.

- **NK cells** attack and kill irregular cells.



TERMS TO KNOW

Apoptosis

Programmed death of a cell; apoptosis can be caused by chemicals that T cells release.

NK Cells (Natural Killer Cells)

Lymphocytes that help kill abnormal cells of the body including cancerous cells.

3. Treatments

There are treatments for cancer that can help kill it when our body's own defenses are not enough. Treatment of cancer generally involves:

- **Chemotherapy**
- **Radiation**
- **Surgery**

There is research currently being done on angiogenin, the growth factor that's secreted by cancer cells that supplies blood vessels to the tumor. This research is being done to try and find a way to stop its production or secretion by those cancerous cells. If angiogenin wasn't secreted, then blood vessels wouldn't grow around the tumor, and the tumor would not be supplied with the nutrients it needed. Effectively, the tumor would end up starving.



TERMS TO KNOW

Chemotherapy

A form of treatment for cancer patients in which chemicals are used to try to kill cancerous cells.

Radiation Therapy

A form of treatment for cancer patients in which radiation is used to try to kill cancerous cells.

4. Common Types of Cancer

Melanoma is a form of skin cancer. Melanocytes are cells that are found in the deepest layer of the epidermis that can be affected by things like UV light. If they are exposed to UV light, the DNA within them can become mutated, causing cancer.

Other types of cancer can include:

- **Lymphoma:** Cancer of the lymphatic system.
- **Adenocarcinoma:** Cancer of gland tissues.
- **Leukemia:** Cancer of the bone marrow
- **Sarcoma:** Cancer of connective tissues

While these are some common types of cancers, there are many others.



SUMMARY

Cells naturally divide and reproduce to supply new cells when old cells die. This maintains homeostasis in our bodies. Sometimes, though, mutations occur that allow for the **formation and growth** of cancer. When there is a mutation in its DNA, a cell can start to divide uncontrollably. DNA in which a mutation is more likely to result in cancer is called an **oncogene**. When there is a mutation in the **tumor suppressor gene** as well, that is when cancer can form. **Angiogenin** is a growth factor that causes blood vessels to supply a tumor with the nutrients it needs to grow.

Our bodies do have a type of immune response to fight cancer: The **cell-mediated response** will seek out and destroy abnormal cells. There are also **treatments** such as chemotherapy, radiation, and surgery that can help treat cancer. New research is constantly being done on new treatments.

There are many **types of cancer**, but some common ones include melanoma, lymphoma, adenocarcinoma, leukemia, and sarcoma.

Keep up the learning and have a great day!

Source: THIS WORK IS ADAPTED FROM SOPHIA AUTHOR AMANDA SODERLIND



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