

Curing Cancer



What is Cancer?



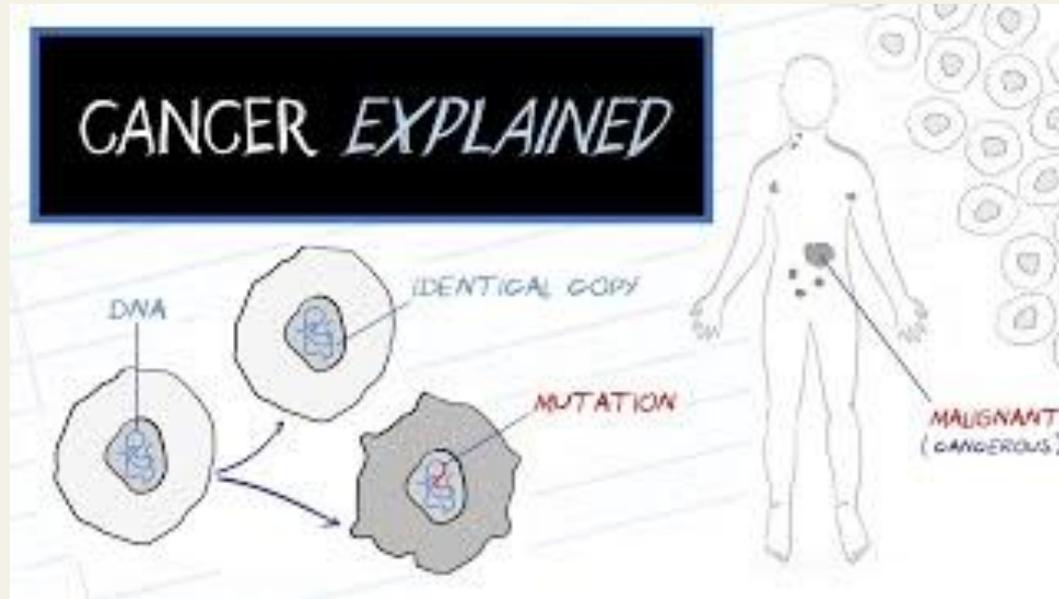
Chemotherapy



Curing Cancer



What is Cancer?



Cancer

- Cancer is caused by uncontrolled cell growth
-

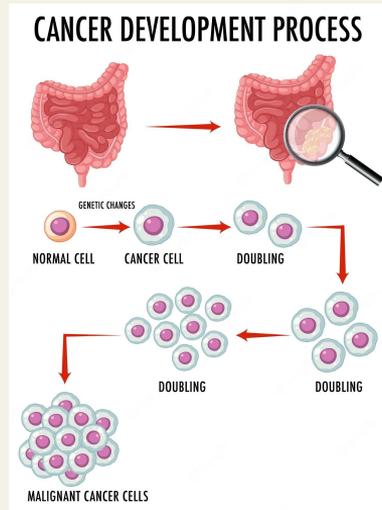
Cells are constantly dividing, making copies of themselves and dying



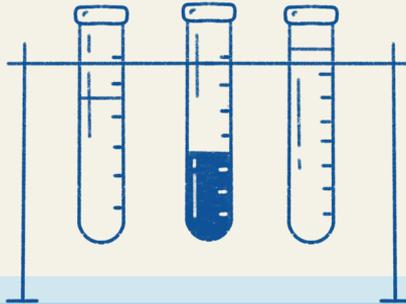
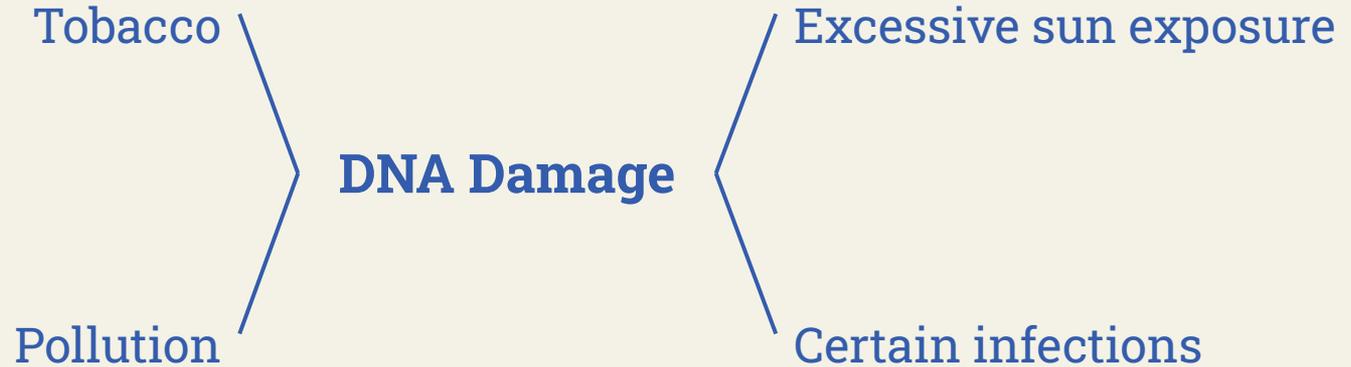
This process is controlled by instructions coded into our DNA



Mutations in DNA lead to uncontrolled cell growth



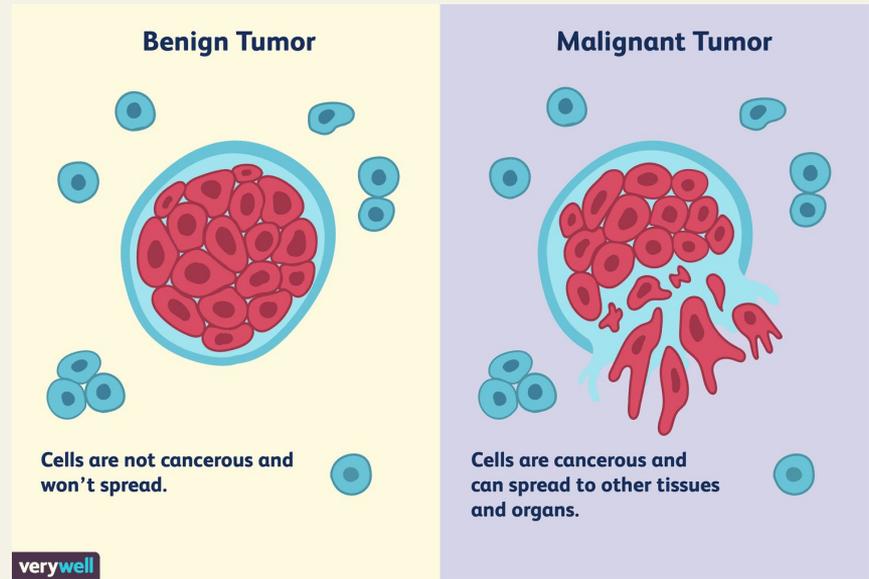
What Causes DNA Damage?



Malignant Tumors

Malignant tumors can grow and spread to other parts of the body

It is important to detect cancer at its earliest stages before it has spread to other parts of the body



Cancer Treatment

Cancer treatment aims to destroy cancerous cells without damaging healthy cells

Surgery: removes tumors

Radiation: targeted to destroy cancer cells



Chemotherapy: medication is used to kill cancer cells



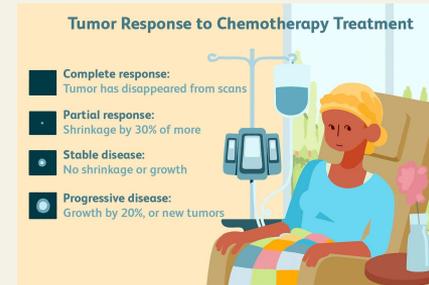
Cancer Treatment

The goal of cancer treatment is to destroy cancerous cells without damaging healthy cells



However, sometimes healthy cells are impacted by treatment

Particularly fast growing cells like hair and gut cells can be impacted leading to hair loss, nausea and other side effects



Scientists have made major advances in treating cancer and mortality rates have dropped significantly

Curing Cancer

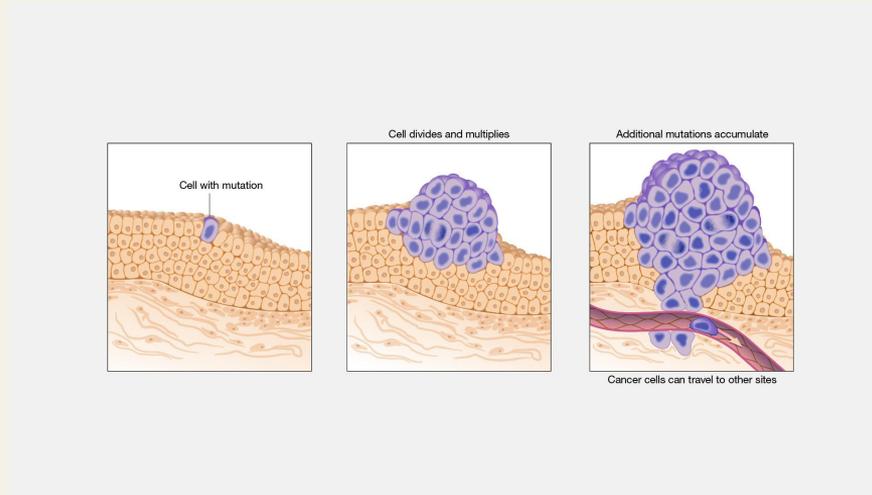


1. Elimination Phase

One cell is no longer able to repair DNA damage and the cell starts rapidly multiplying

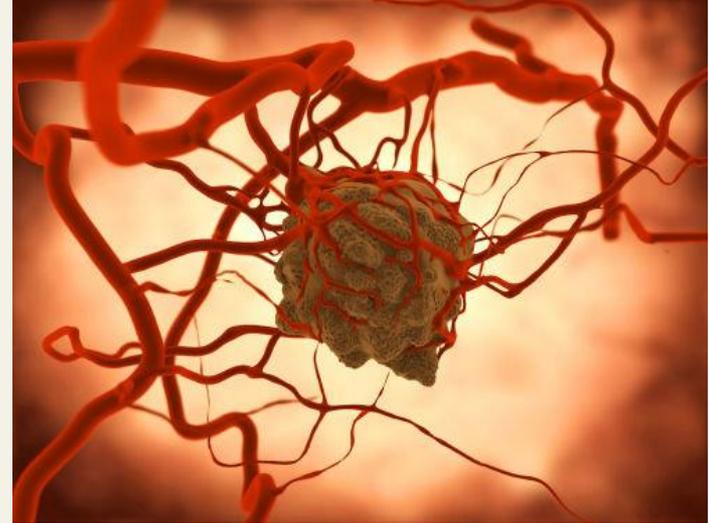


The cell continues to multiply mutated copies of itself that can eventually form a tumor



Tumors

- Tumors consist of multiple lineages of mutated cells
-
- Cancer cells continue to mutate so they can survive
- Tumors need oxygen/ blood flow from the body to survive
- The tumor can eventually start to destroy healthy cells in the neighboring areas



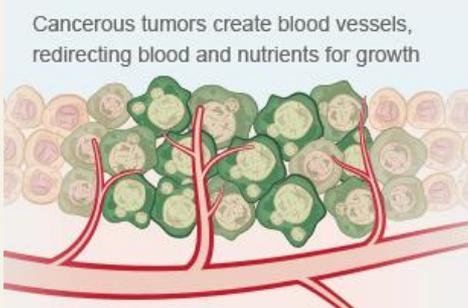
Immune System

Your body tries to fight the tumor by activating the immune system

Tumors rely on blood vessels to get the oxygen/ blood flow they need to survive



Immune **T cells** block the growth of new blood vessels so tumor cells can no longer survive



2. Equilibrium Phase

Just one cancer cell survives the elimination phase



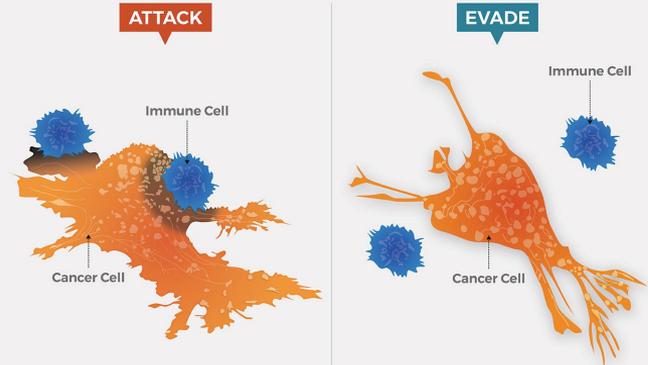
This one surviving cancer cell can continue to make copies of itself until a new tumor forms

Sometimes, the surviving cancer cell is very strong and can survive with less oxygen, can grow faster, etc making it even harder for the immune system to attack

Immune System

Mutated tumor cells can find a way to switch off or deactivate immune cells before they have a chance to fight the cancer cells

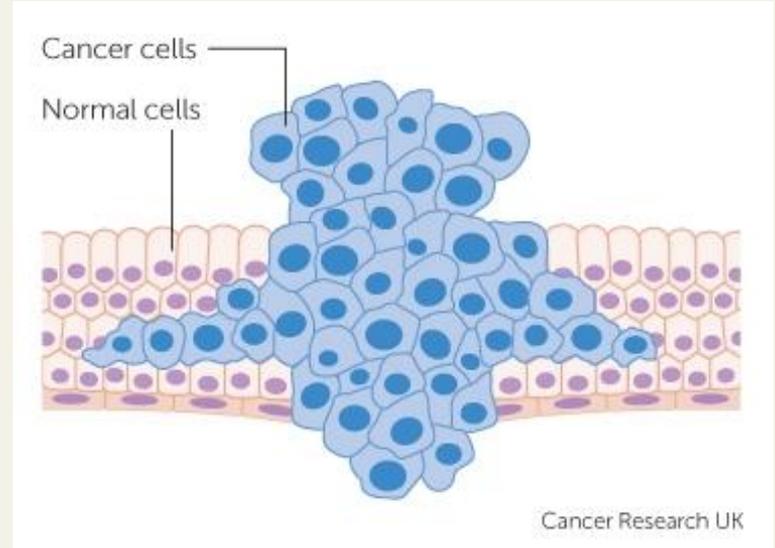
How Does the Immune System Interact with Cancer?



3. Escape Phase

During this phase the cancer cells are able to shut down the immune system and prevent it from attacking cancer cells

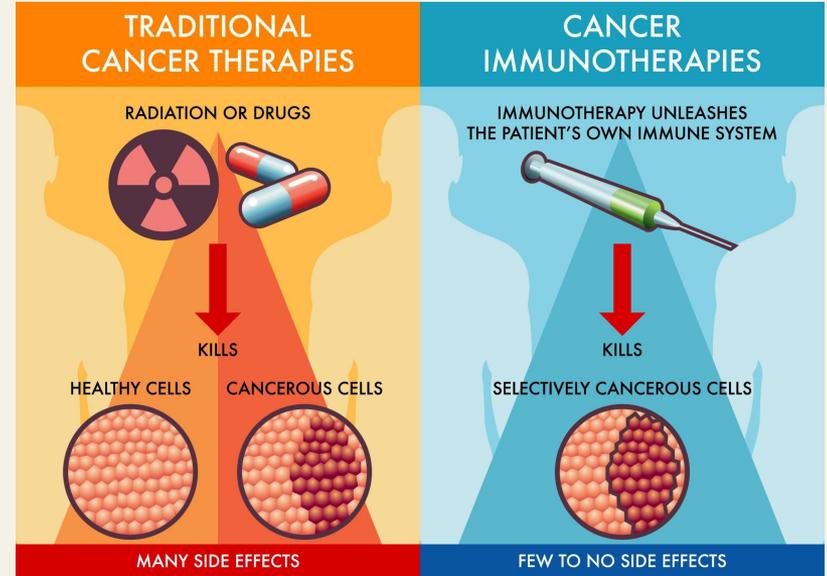
Without the immune system, the cancer microenvironment becomes favorable for cancer growth and allows the tumor to grow uncontrollably



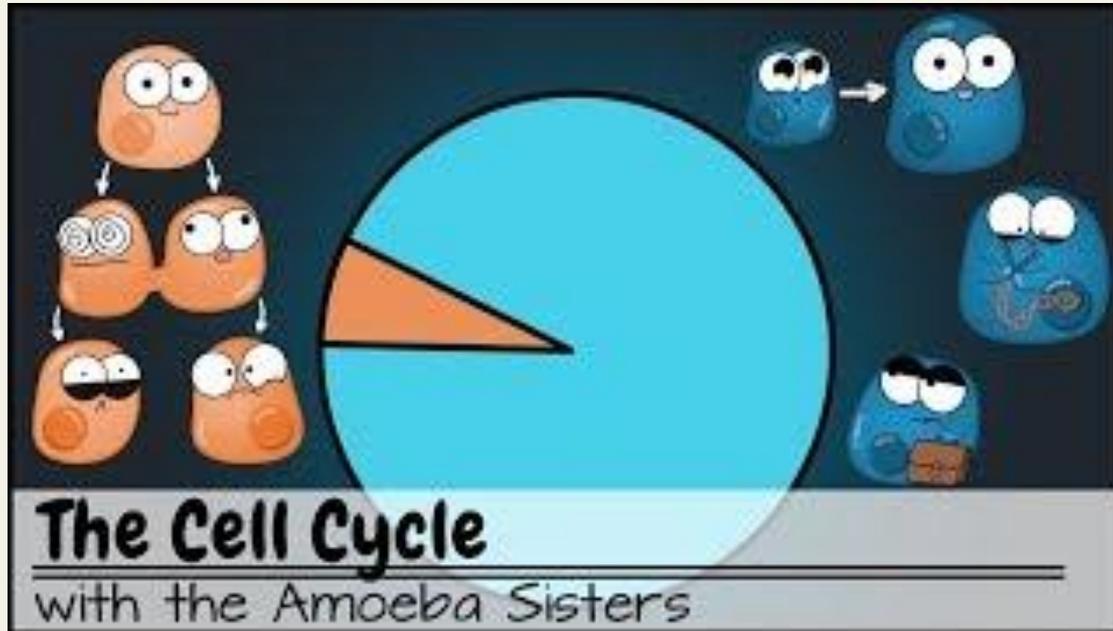
Cancer microenvironment: the area surrounding the tumor that determines its growth

Curing Cancer

- Scientists have made a lot of progress developing cancer treatments and cancer mortality rates have dropped significantly
- **Immunotherapy:** your own immune cells are modified so they can kill cancer more effectively

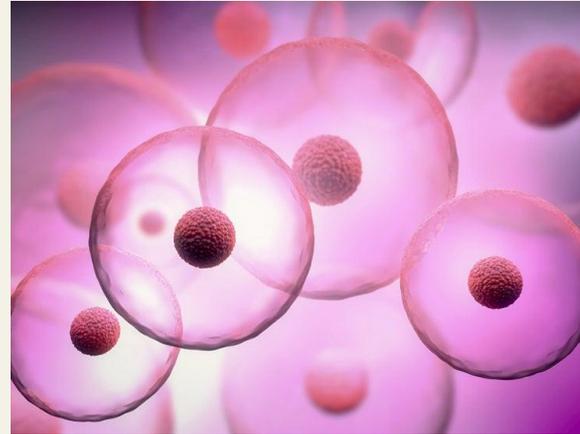


Cell Cycle and Cancer



Cells

- All living things are made of cells
- Cells are specialized
 - Skin cells
 - Stomach cells
 - Muscle cells



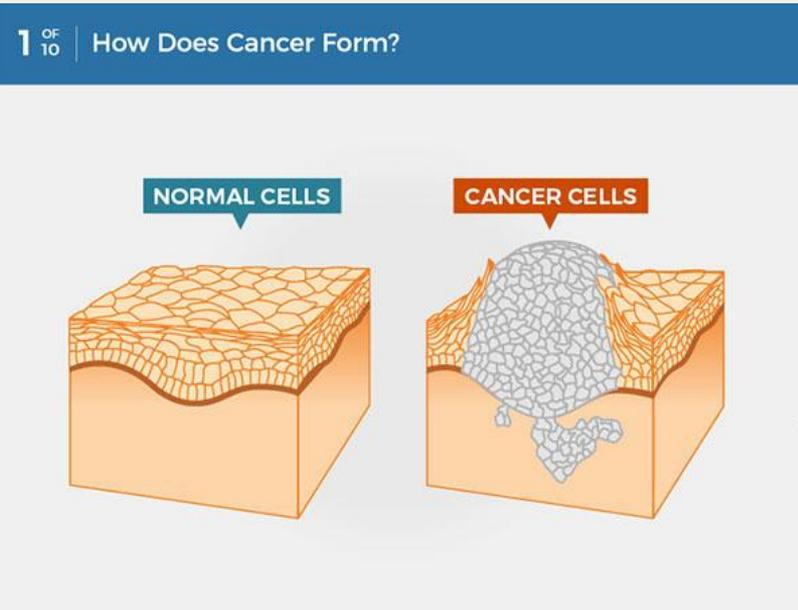
Cell Cycle

Cells are constantly dividing and producing new copies of themselves

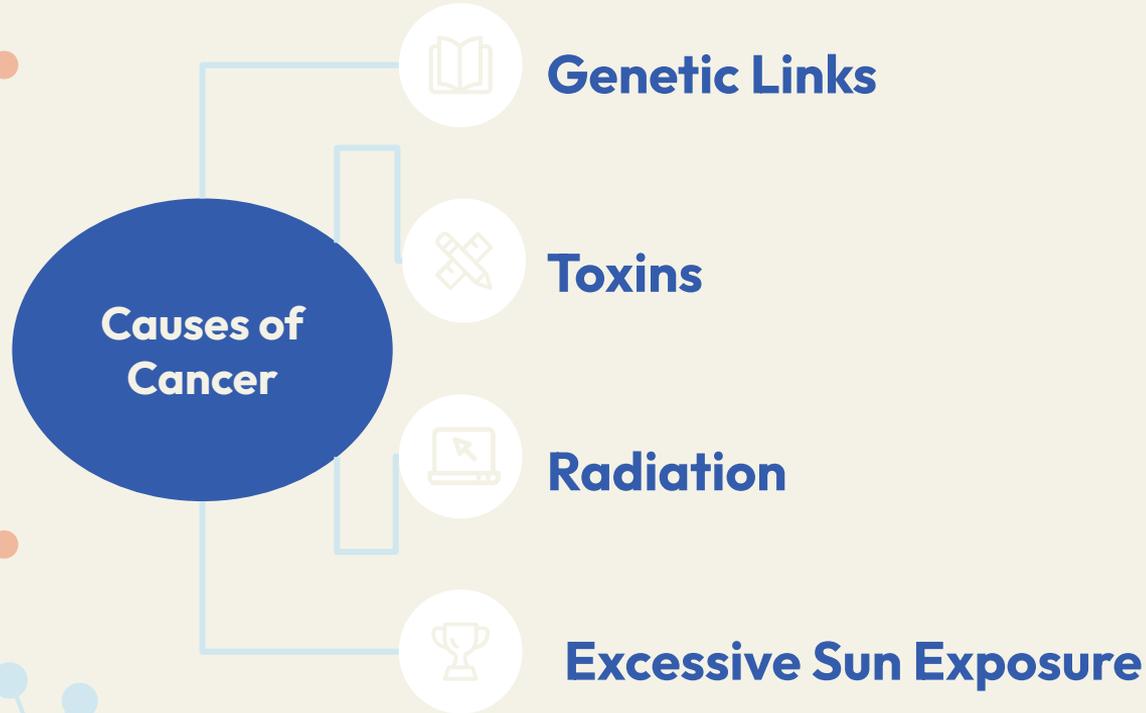
Cancer can occur when cells start dividing uncontrollably



Uncontrollable cell growth leads to tumors which can sometimes spread to other parts of the body



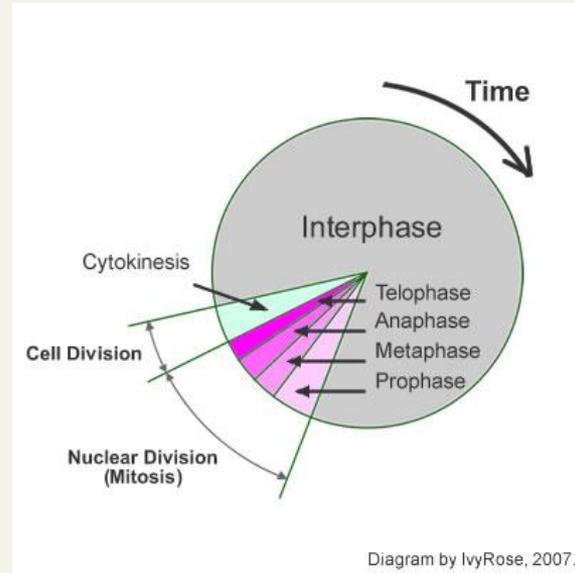
What Causes Cancer?



Cell Cycle

- Interphase: cells are performing their normal functions
- M phase (mitosis): cells are dividing to make new cells

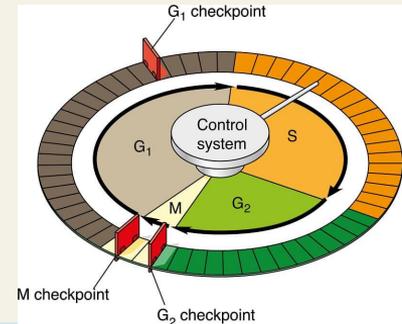
Cells spend most of their time in interphase



Checkpoints

- There are checkpoints along the cell cycle to ensure that DNA is replicating correctly and the cell is growing as it should
- These checkpoints help to stop mutated cells from replicating
- If the cell fails to pass these checkpoints, it will either attempt to fix the issue or it will self destruct
- Different types of proteins regulate the checkpoints of the cell cycle

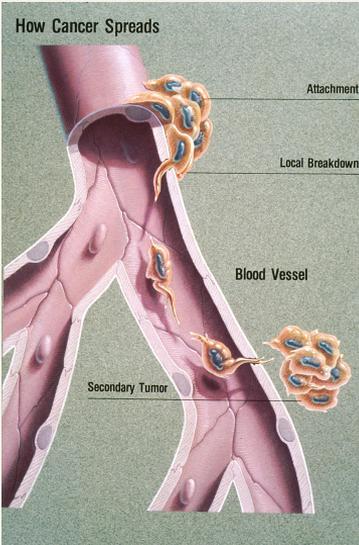
Cancer can occur if these checkpoints fail and allow mutated cancer cells to replicate uncontrollably



How Does Cancer Spread?



How Does Cancer Spread?



1

Localized Tumor

One tumor in one area of the body



No treatment

2

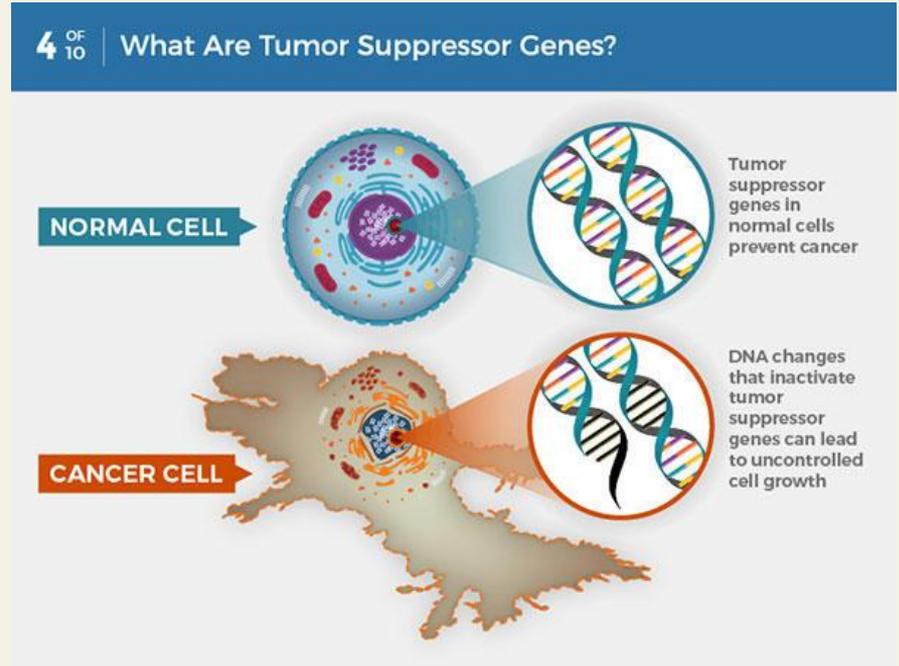
Metastatic Cancer

Tumor spreads to nearby organs



Genes

- **Tumor Suppressor Gene:** genes that are designed to prevent cancer from growing by preventing cells from growing out of control
- **Oncogene:** genes that can promote the development of cancer



3 Ways that Cancer Spreads

Transcoelomic

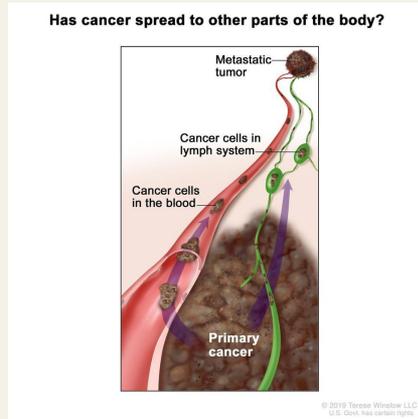
Tumor spreads across body cavity

Hematogenous

Cancer cells invade blood vessels

Lymphatic

Cancer cells invade the lymph nodes



The lymphatic system is a large network of vessels that can allow cancer cells to reach distant areas of the body

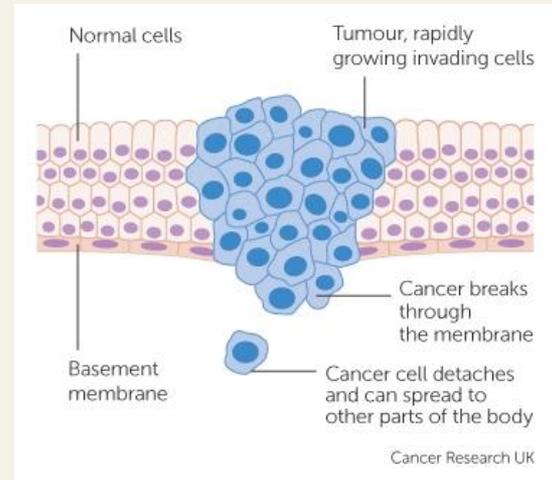
Metastatic Cancer

Cancer cells die easily if they are in the wrong microenvironment



This is why tumors spread to areas with similar environments that allow them to keep growing

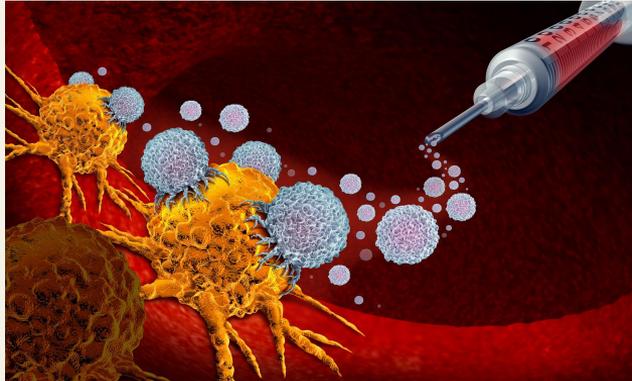
Cancer also spreads based on its location and proximity to certain lymphatic channels that can drain the tumor and allow it to spread



Immunotherapy

Immunotherapy is a new treatment that helps your body's immune system fight off cancer cells

Cancer vaccine: trains your immune system to recognize cancer cells and fight them



Other treatments can increase the growth and activity of immune cells by injecting chemicals called **interleukins** which boost immune cells

Health Disparities in Cancer



Health Disparities in Cancer

People of color are more likely to be diagnosed with many types of cancer and often face worse outcomes

This could be a result of many factors:

- Bias in the medical system
- Inequitable access to healthcare
- Health insurance
- Exposure to air pollutants
- Access to cancer screening
- **Other ideas?**

