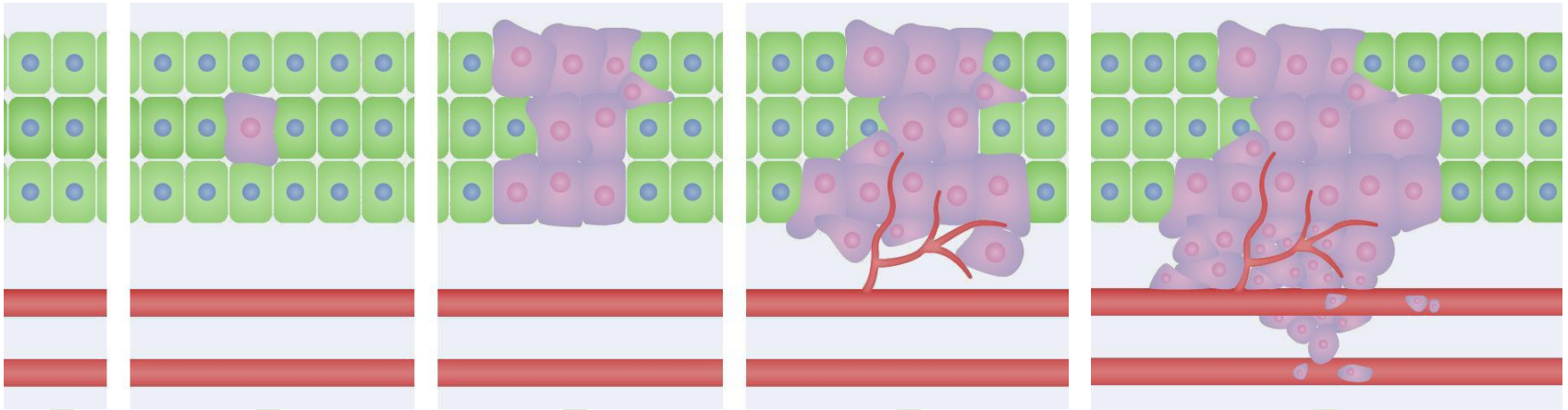
Overview of Cancer

10 Most Important Concepts

1. Definition of cancer
2. Cancer cells vs. non-cancer cells
3. Malignant tumors vs. benign tumors
4. Cancer cells as bullies
5. Evasion abilities of cancer cells
6. 3 ways cancer: genetic
7. 3 gene drivers of cancer
8. Metastasis cancer and its naming
9. Tissue changes of non-cancer and potential cancer
10. 8 commonly used names of cancer

What Is Cancer?

Collection of related diseases



Normal

Division cleanup of damaged cells

Mutation

Breakdown of orderly cell processes

Cell divides

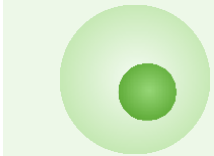
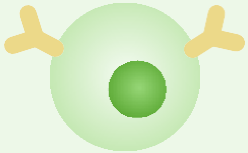
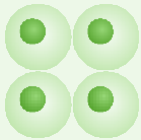
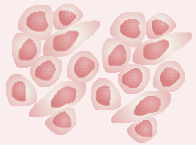
Movement into surrounding tissues

Invasive tumor

Mutated cells spread via blood and lymph vessels

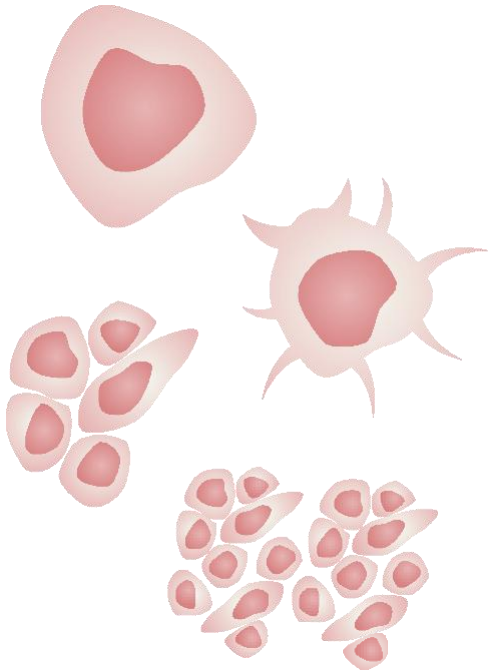
Metastasis

Cancer vs. Non-cancer Cells

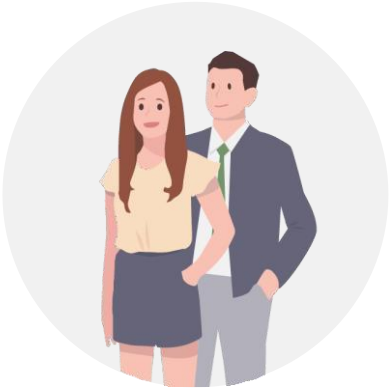
Non-cancer		Cancer	
Small, uniformly shaped nuclei with a relatively large cytoplasmic volume			Large, variable-shaped nuclei with a relatively small cytoplasmic volume
May have differentiated cell structures; normal presentation of cell surface markers			Loss of normalized, specialized features; elevated expression of certain cell makers
Conform in cell size and shape; cells arranged into discrete tissue			Variation in cell size and shape; disorganized arrangement
Lower levels of dividing cells; cell's tissue clearly demarcated			Large number of dividing cells; poorly defined tumor boundaries

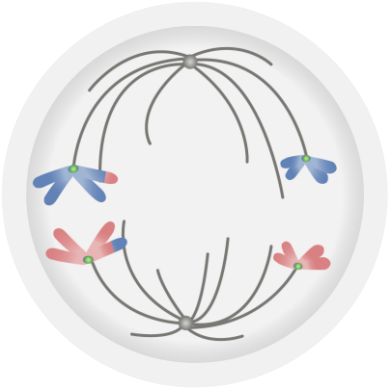
What Makes Cancer Cells Different?

- Less specialized
- Less distinct cell types and functions
- Unrestricted division and programmed cell death
- Influence on other cells
- Development of tumor blood supply
- Immune system defenses
  - Evasion
  - Suppression



Cancer Is a Genetic Disease





Changes in DNA can result from:

Inheritance from parents	Error in DNA during cell division	Environmental exposure

Drivers of Cancer

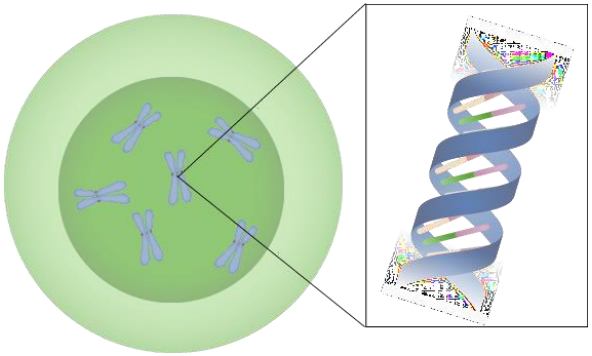
3 main types of genes (that are involved in normal cell growth, division, and programmed death) experience DNA changes:

Proto-oncogenes (become oncogenes)	Tumor suppressor genes	DNA repair genes

Drivers of Cancer

Proto-oncogenes:

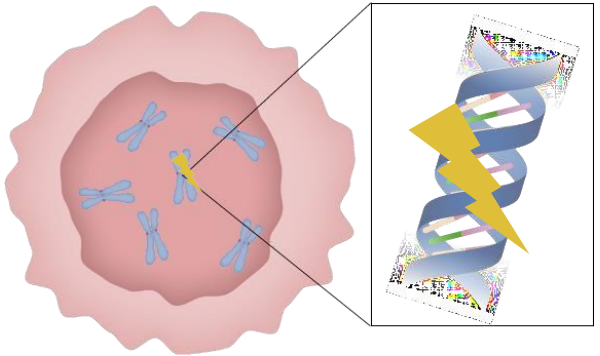
genes that could lead to unregulated cell growth/reproduction if damaged



Normal cell

Oncogenes:

damaged proto-oncogenes



Cancer cell

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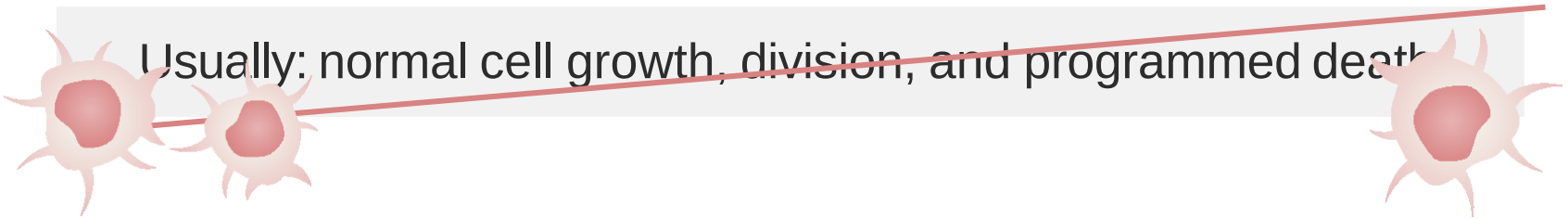
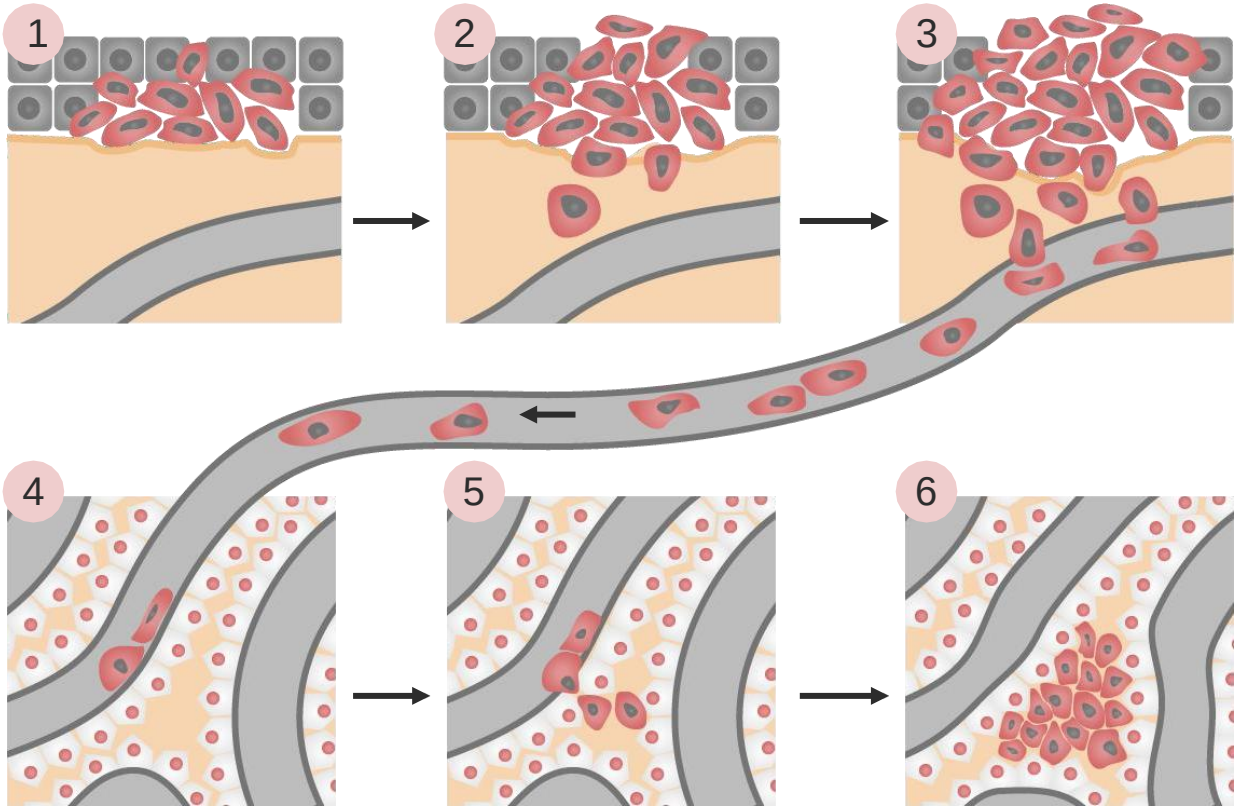
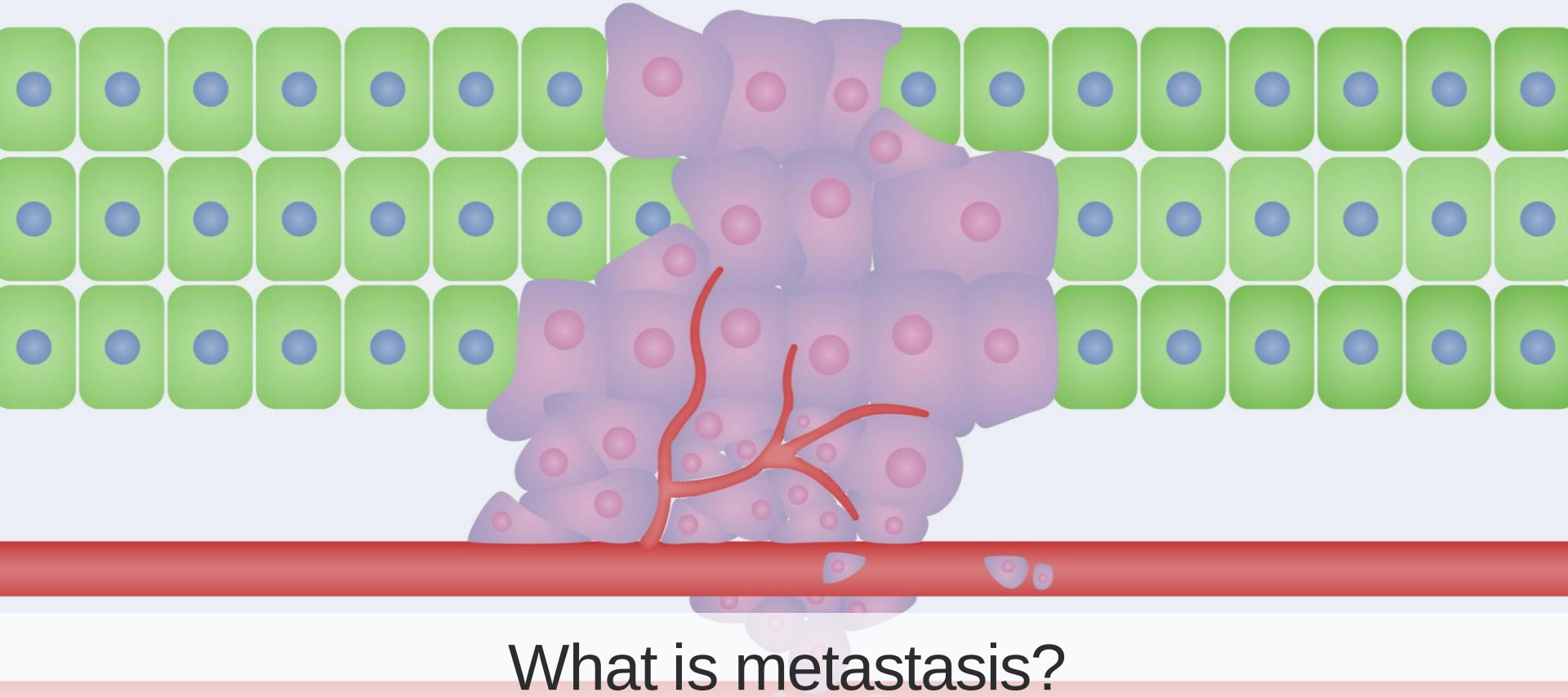


Metastasis Process

1. Benign tumor in epithelium
2. Tumor breaks through basal lamina
3. Invades capillary
4. Adheres to blood vessel wall in the liver
5. Extravascation occurs
6. Proliferates to form metastases





What is metastasis?

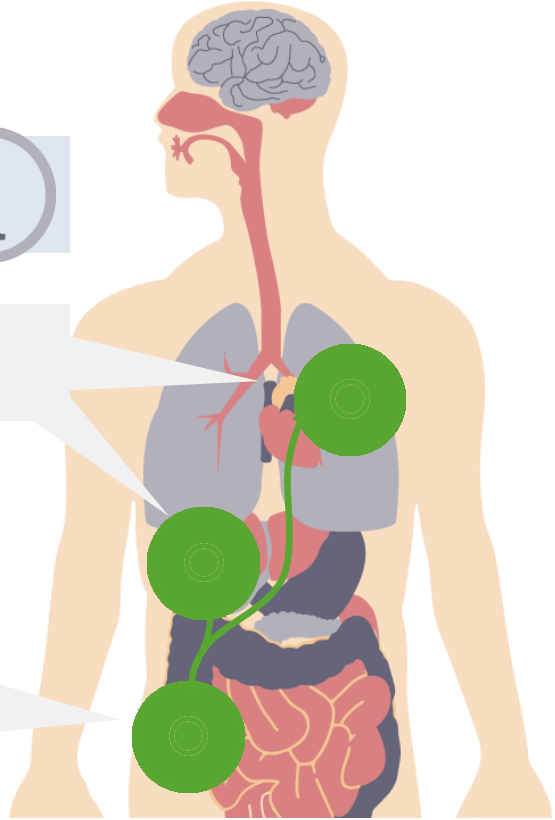
What Is Metastasis?

The metastatic tumor is the same type of cancer as the primary tumor.

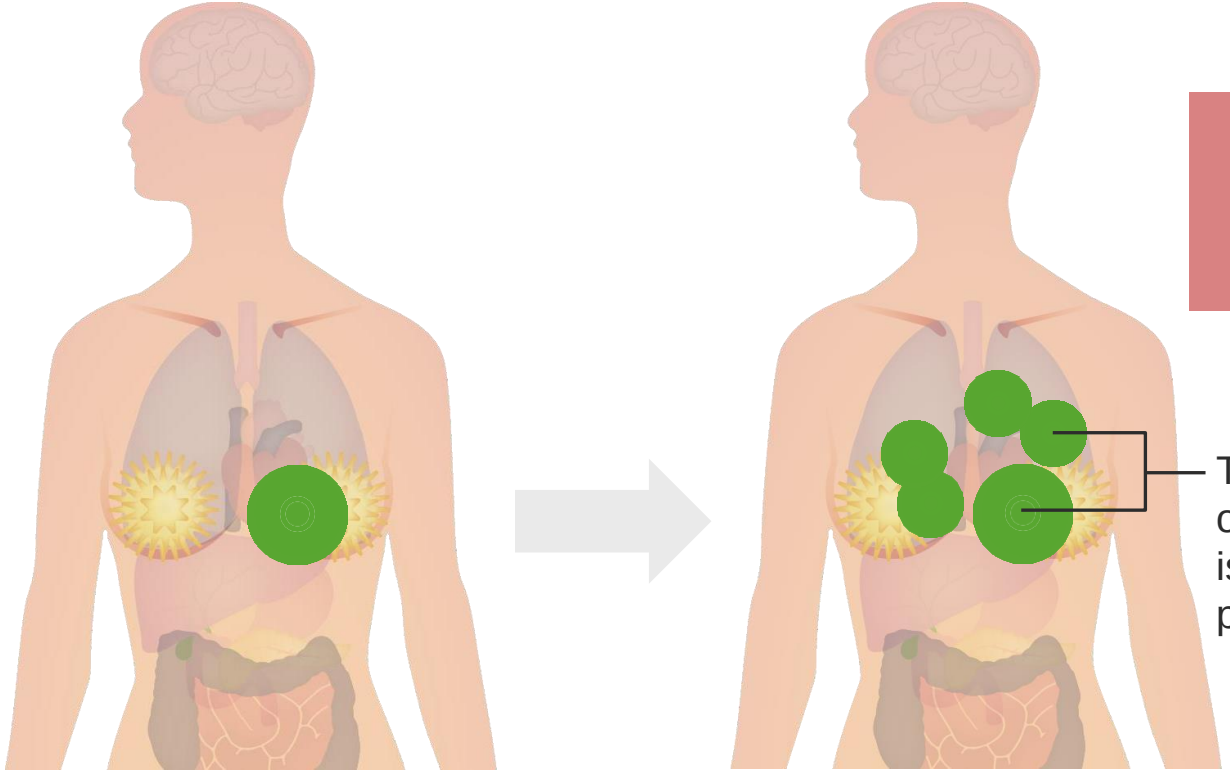
It forms new tumors (metastatic tumors) in other parts of the body.

It travels through the **blood** or **lymph system.**

Cancer cells break away from where they first formed (primary cancer).



Naming Metastases



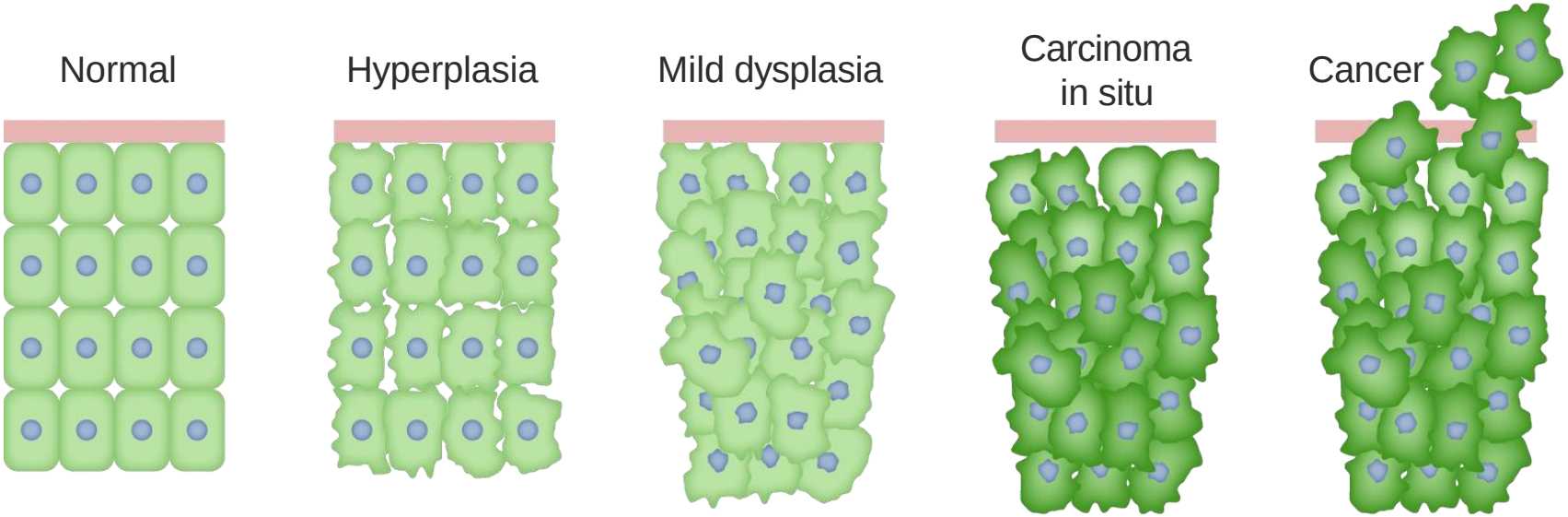
Naming: Primary breast cancer that spreads to the lungs is metastatic breast cancer, **not** lung cancer!

The microscopic view of metastatic cells is similar to that of primary cancer cells.

Primary Goal of Treatment

The primary goal of treatment is to slow the growth of the cancer and treat symptoms caused by the metastases.

Tissue Changes



Not every tissue change is cancer!

Hyperplasia	Dysplasia	Carcinoma in situ

Categories of Cancer

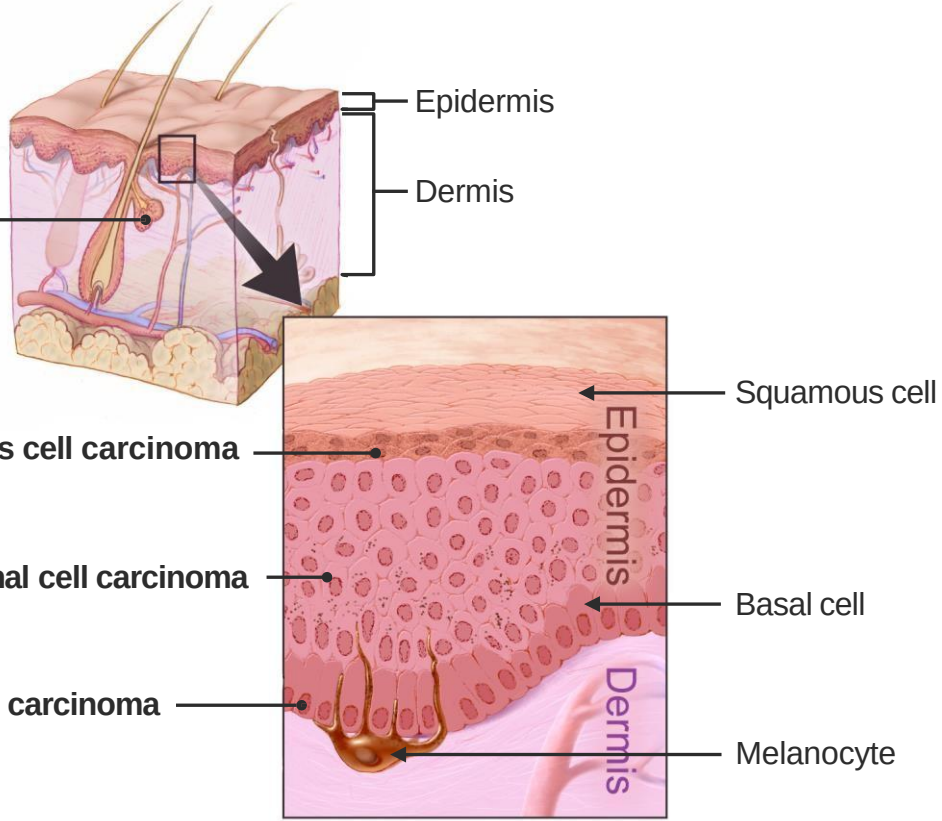
Begin in certain types of cells:

- Carcinoma
- Sarcoma
- Leukemia
- Lymphoma
- Multiple myeloma
- Melanoma
- Brain and spinal cord

Carcinoma

Carcinoma is the most common form of cancer. It is formed by epithelial cells.

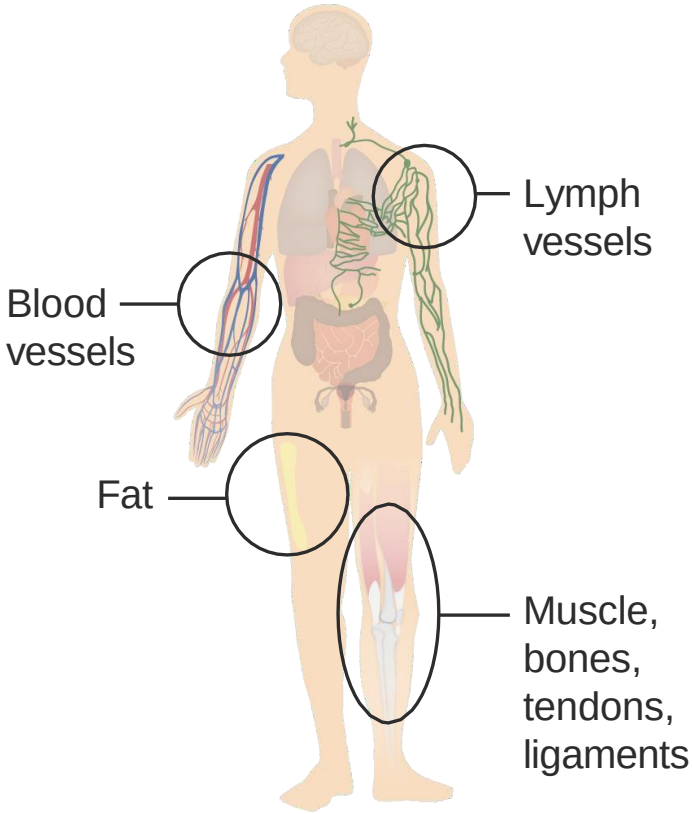
Carcinoma – 4 Different Epithelial Cell Types



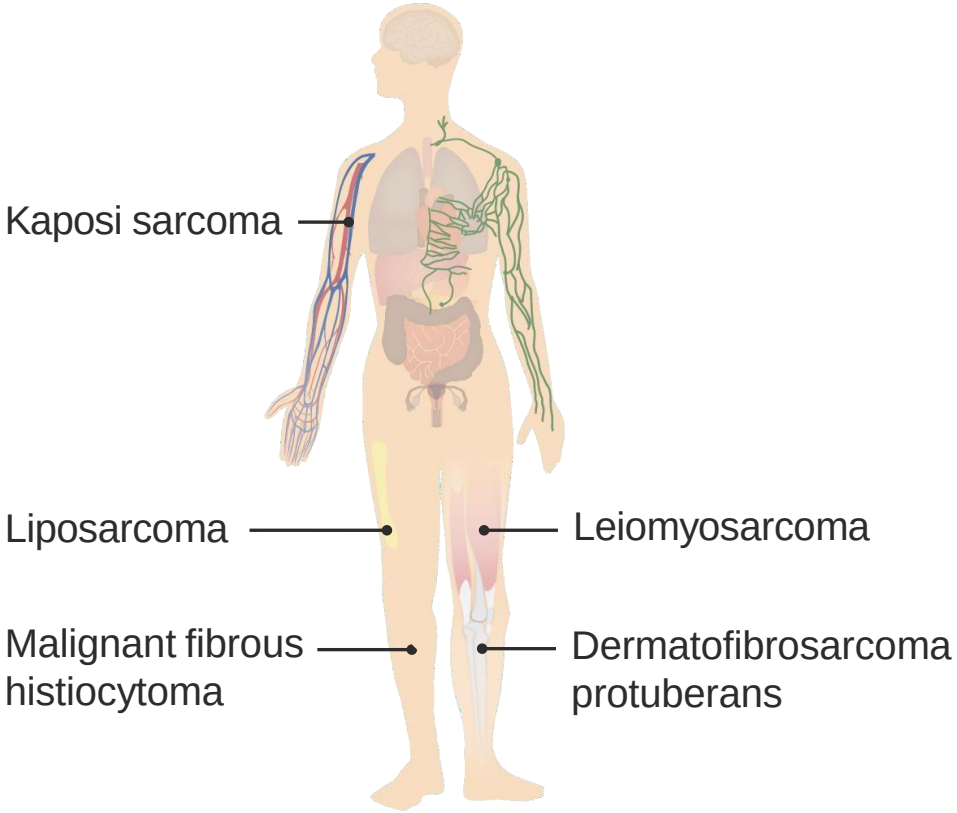
Sarcoma

Formed in:
soft tissue and bone

Most common cancer of bone:
osteosarcoma

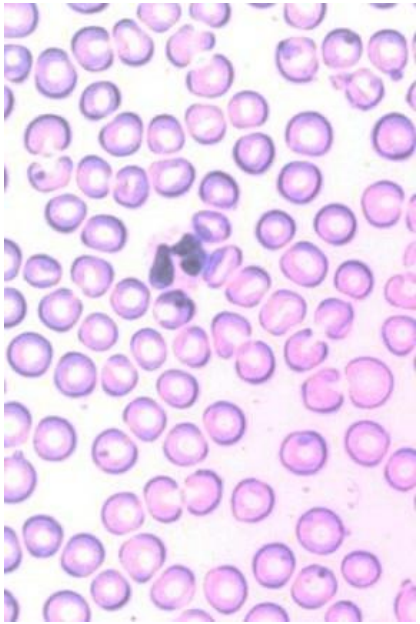


Most Common Types of Soft Tissue Sarcoma



Leukemia

- Begins in the blood-forming tissue of the bone marrow
- Does not form solid tumors
- Large numbers of abnormal white blood cells (leukemia cells and leukemic blast cells) build up in the blood and bone marrow
- Inadequate normal cells cause poor oxygenation, bleeding risk, and inability to fight off infection



Normal

Leukemia

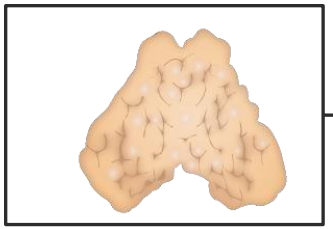
Lymphoma

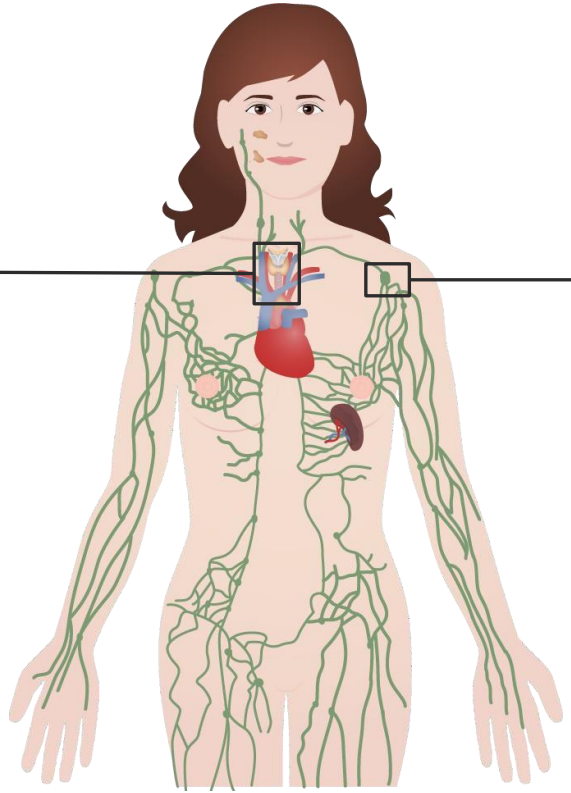
Lymphoma begins in lymphocytes (T cells or B cells).

Abnormal lymphocytes build up in the lymph nodes, lymph vessels, and organs.

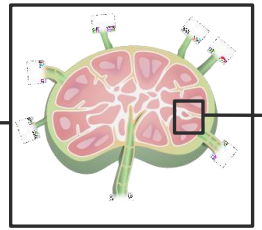
Lymphoma

Thymus (makes B cells and T cells)

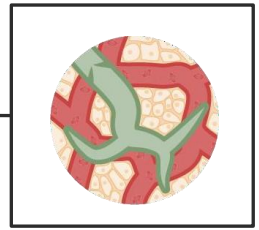




Lymph node



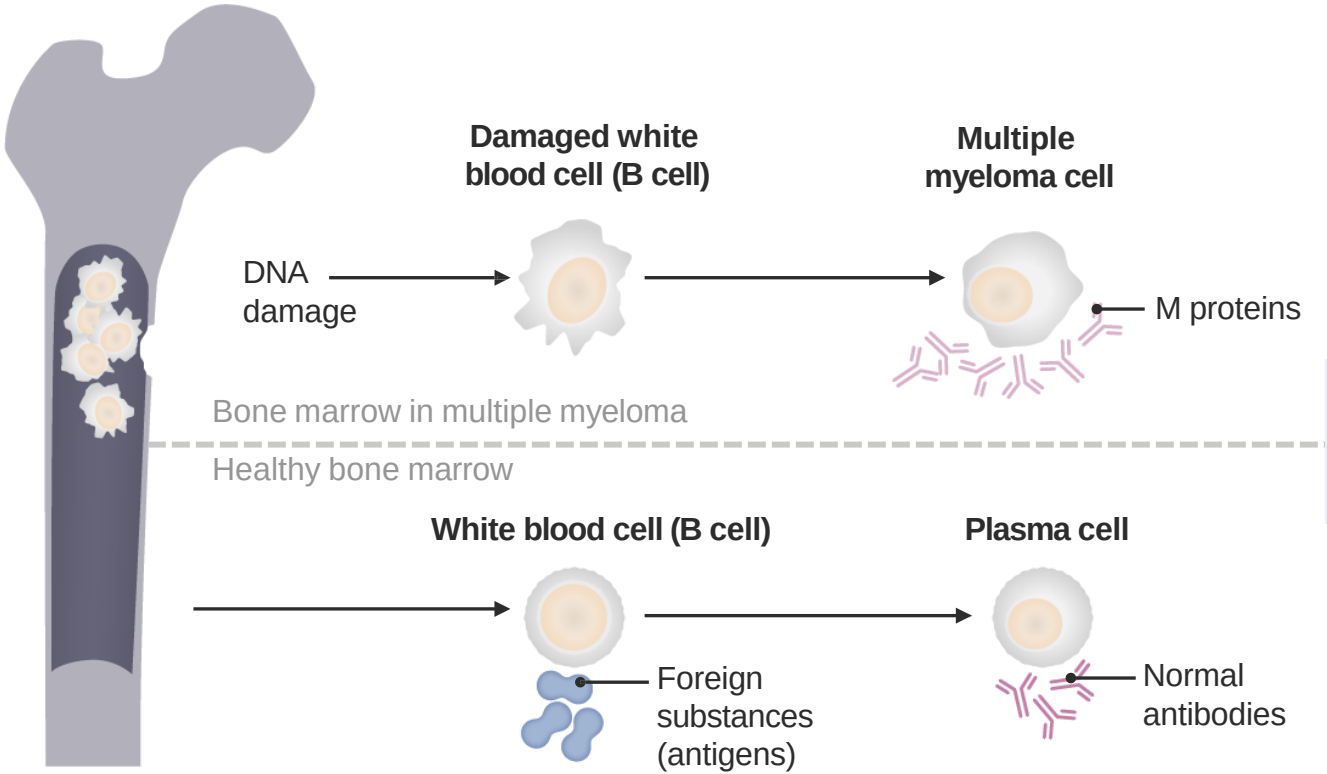
Lymphocytes



Hodgkin lymphoma
Reed-Sternberg cells usually form from B cells.

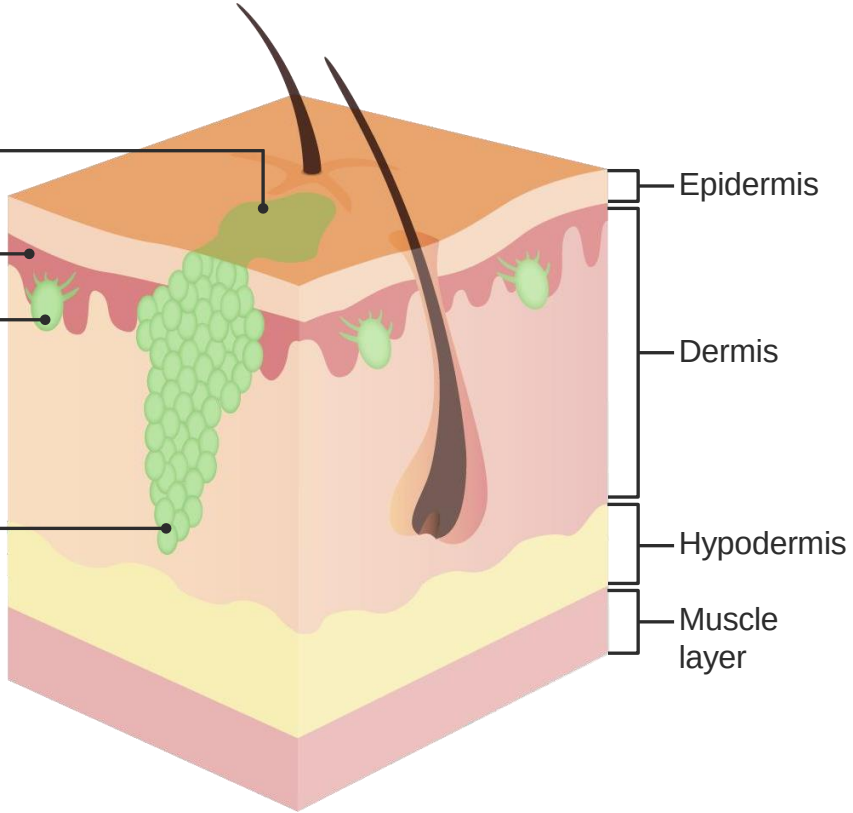
Non-Hodgkin lymphoma
Starts in lymphocytes.
Grows quickly or slowly.
Forms from B cells or T cells.

Multiple Myeloma



Also called plasma cell myeloma and Kahler disease

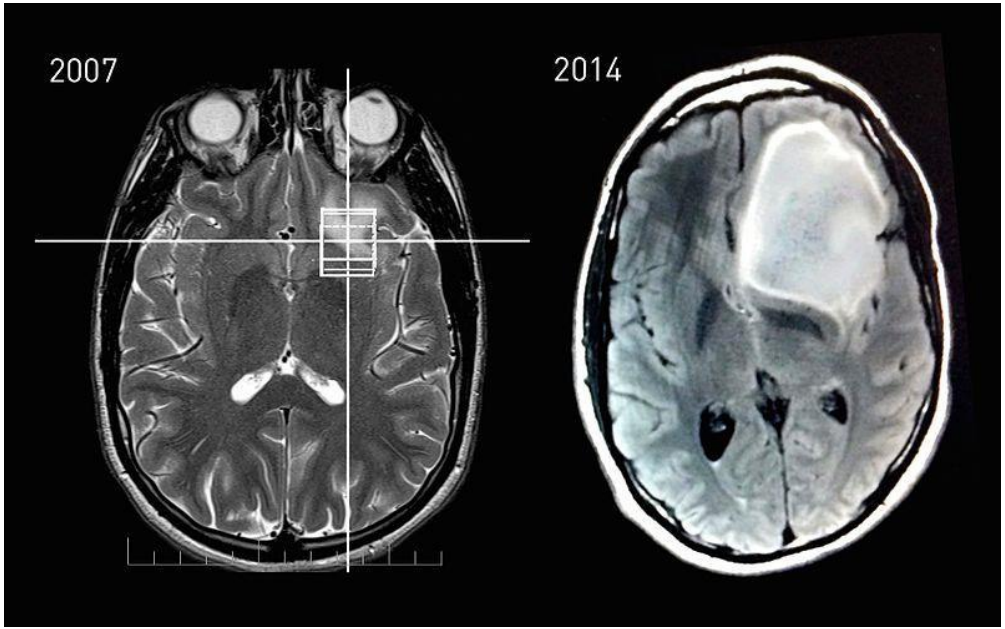
Melanoma



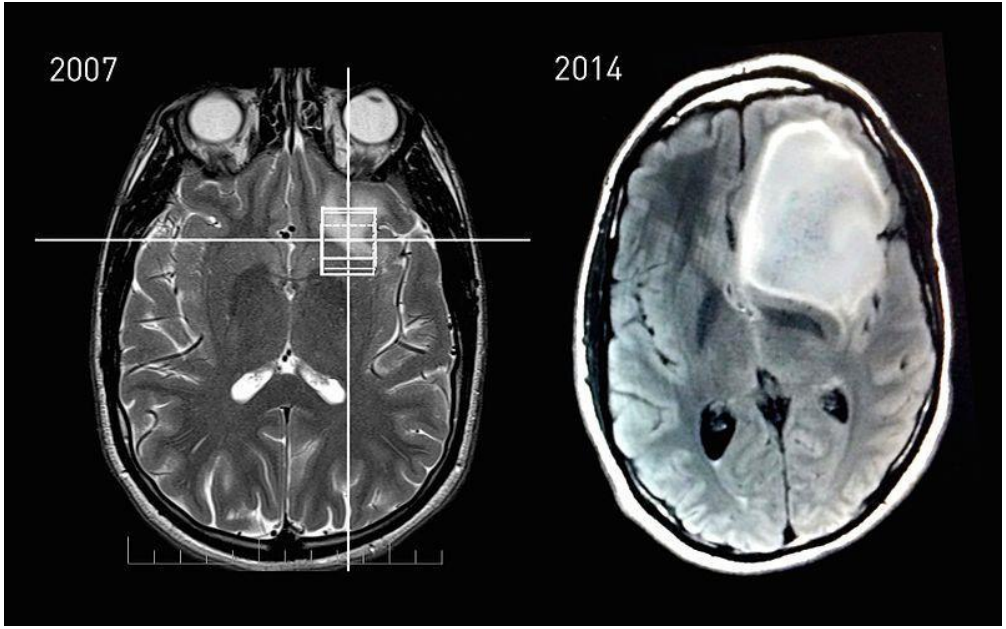
The most common form occurs in the skin, but melanoma can also form in other pigmented tissue (eye).

Brain and Spinal Cord Tumors

- Many different types of brain and spinal cord tumors
- Named based on the type of cell in which they are formed



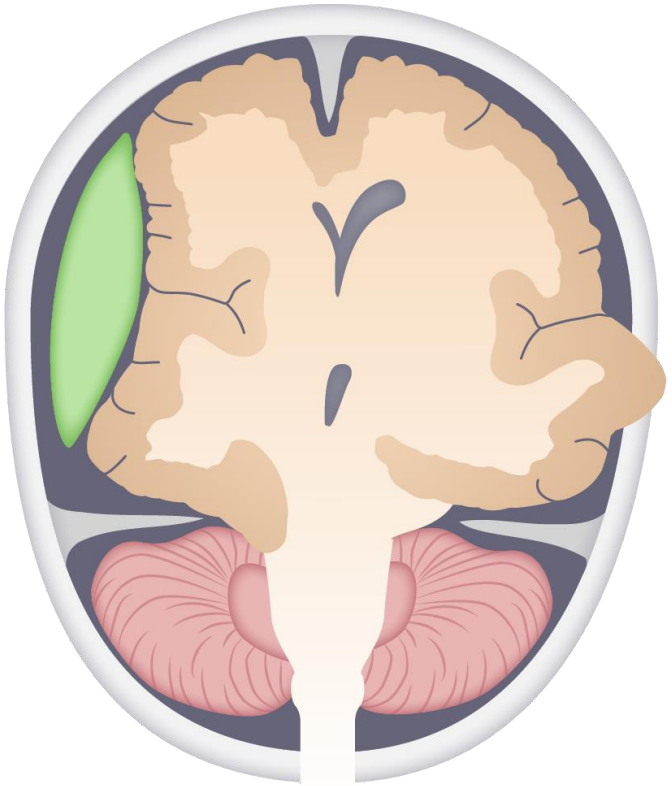
Brain and Spinal Cord Tumors



Example:
An astrocytic tumor starts in the astrocytes (star-shaped brain cells).

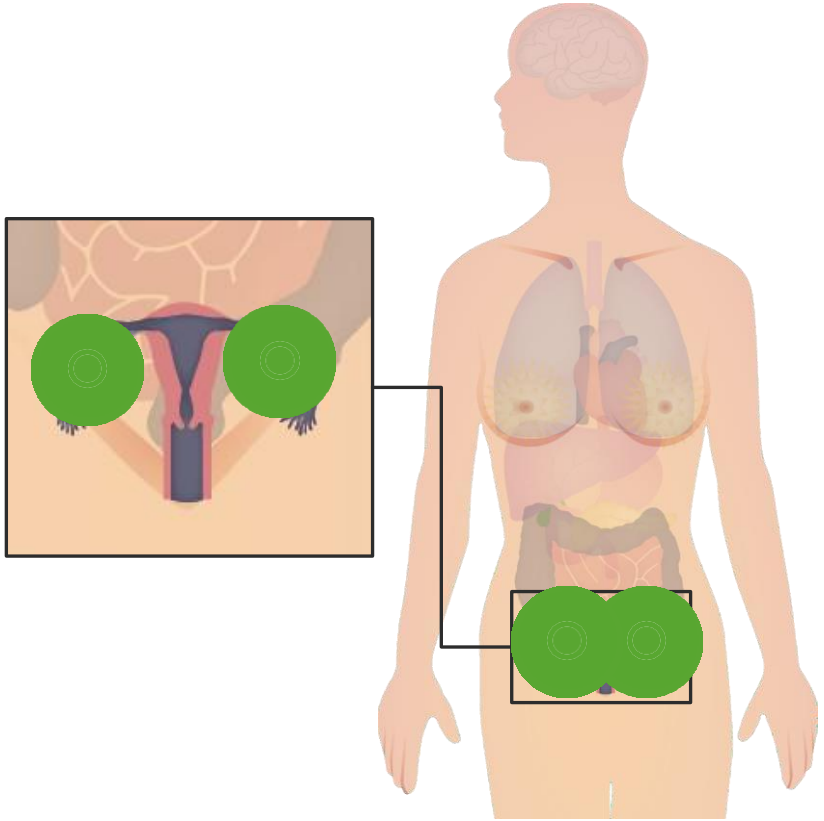
Brain and Spinal Cord Tumors

- Brain tumors can be benign or malignant
- Even benign brain tumors are dangerous



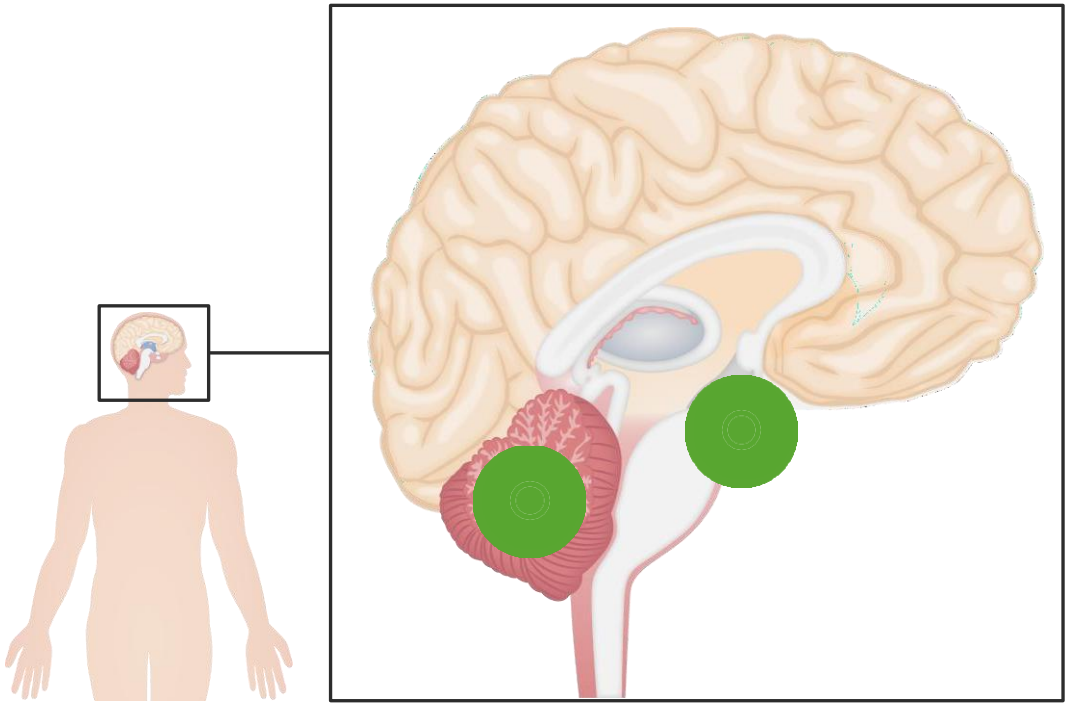
Germ Cell Tumors

- Begin in the cells that become sperm or eggs
- Can occur almost anywhere in the body and can be benign or malignant



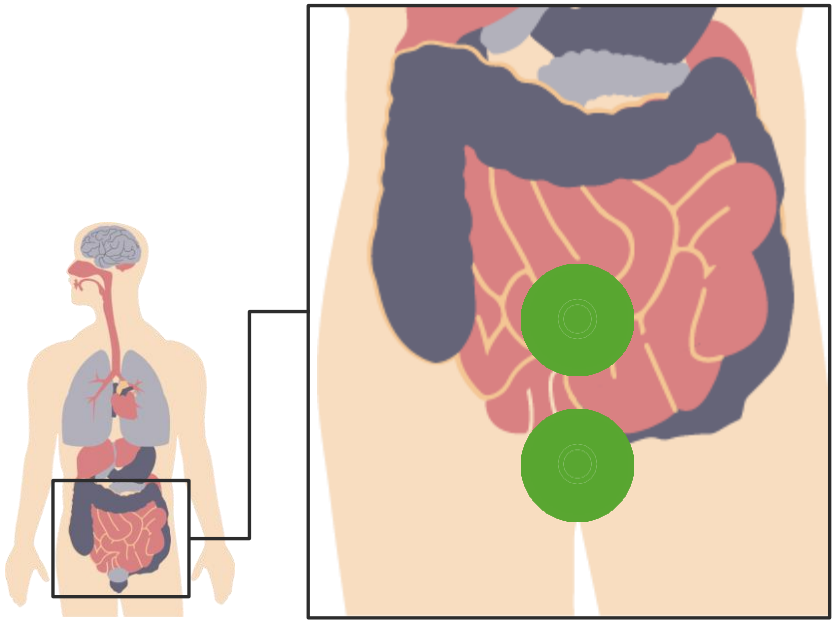
Neuroendocrine Tumors

- Form from cells that release hormones into the blood
- Higher levels of hormones due to tumors
- May be benign or malignant



Carcinoid Tumors

- Are a type of neuroendocrine tumor
- Slow-growing tumors usually found in the GI system (often rectum and the small intestine)
- May spread to the liver or other sites
- May secrete serotonin or prostaglandins, causing carcinoid syndrome



In a Nutshell

- ✓ Cancer is a collection of related diseases where there is a breakdown of orderly cell processes.
- ✓ In metastasis, cancer cells break away from where they first formed (the primary cancer), travel through the blood or lymph system, and form new tumors (metastatic tumors) in other parts of the body.
- ✓ Cancer can be categorized based on the type of cell where it begins: carcinoma, sarcoma, leukemia, lymphoma, multiple myeloma, melanoma, on the brain and spinal cord.