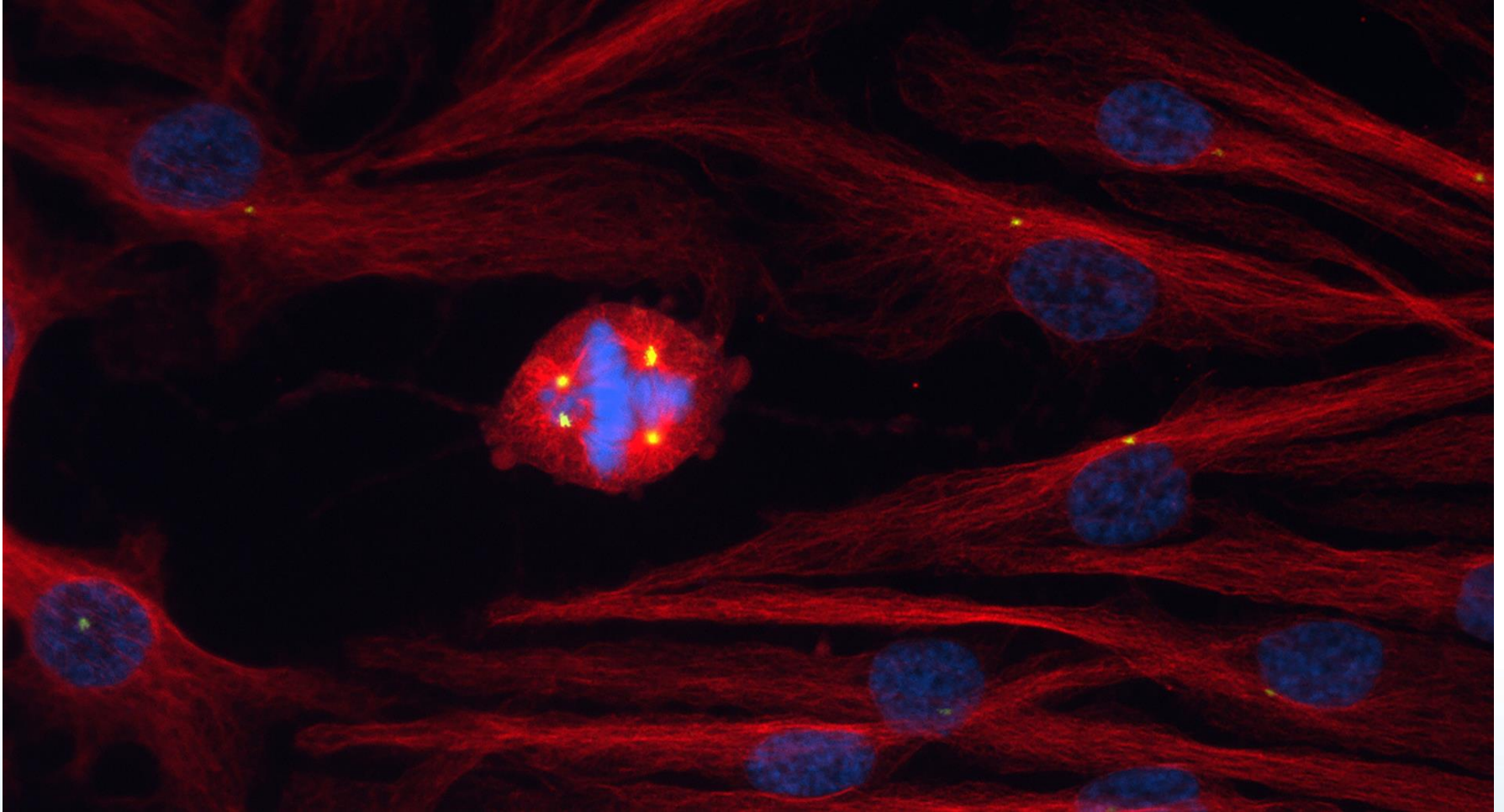


Regulating the Cell Cycle

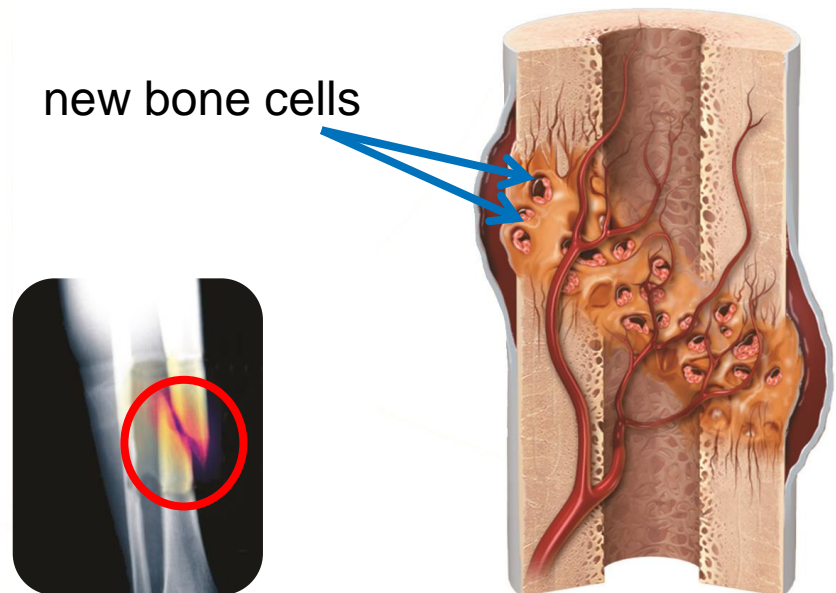


Regulating the cell cycle

- Cells in multicellular organisms are carefully controlled in how it grows and divides.
 - Essential for orderly growth and development
 - If not, serious diseases such as cancer can result.
- Most muscle and nerve cells do not divide once they have developed.
- While, blood-producing cells (bone marrow), skin cells, and digestive tract cells grow and divide regularly.

Cell Division and Repair

- When an injury occurs, cells at the edges of the injury are stimulated to divide rapidly. This starts the healing process. When it nears completion, the rate of cell division slows, controls on growth are restored, and normal activities return.



Regulatory proteins

- Scientists have identified dozens of proteins that help to regulate the cell cycle both inside and outside the cell.
 - These proteins “tell” the cell when to divide, duplicate chromosomes, or enter another phase in the cycle.

Internal regulators proteins act as checkpoints inside the cell

- One set doesn't let the cell enter mitosis until the chromosomes have replicated
- Another set prevents a cell from entering anaphase until spindle fibers have attached to the chromosomes

Regulatory Proteins

External regulatory proteins respond to events outside the cell

- Speed up or slow down the cell cycle
- **Growth factors:** stimulate the growth and division of cells
 - These are important during embryonic development and wound healing
- Others cause the cells to slow down or stop – this prevents excessive growth and keeps tissues from disrupting others

The Discovery of Cyclins

- Scientists found a protein in a cell undergoing mitosis in the early 1980s.
 - They injected the protein into a non-dividing cell.
 - A mitotic spindle started to form.
 - They named this protein cyclin.
 - **Cyclins:** proteins that regulate the cell cycle
- Scientists have since discovered a family of proteins known as cyclins that regulate the timing of the cell cycle in eukaryotic cells

Apoptosis

- Just as new cells are produced every day, many other cells die.
- Some cells die by accident due to damage or injury
- **Apoptosis:** a process of programmed cell death
 - Series of controlled steps leading to self-destruction
 - First, the cell and chromatin shrink
 - Then parts of the cell membrane break off
 - Neighboring cells quickly clean up the remains
- When it doesn't occur as it should, a number of diseases can result
 - Cell loss in AIDS and Parkinson's disease
 - Too much apoptosis occurs

Cancer: Uncontrolled Cell Growth

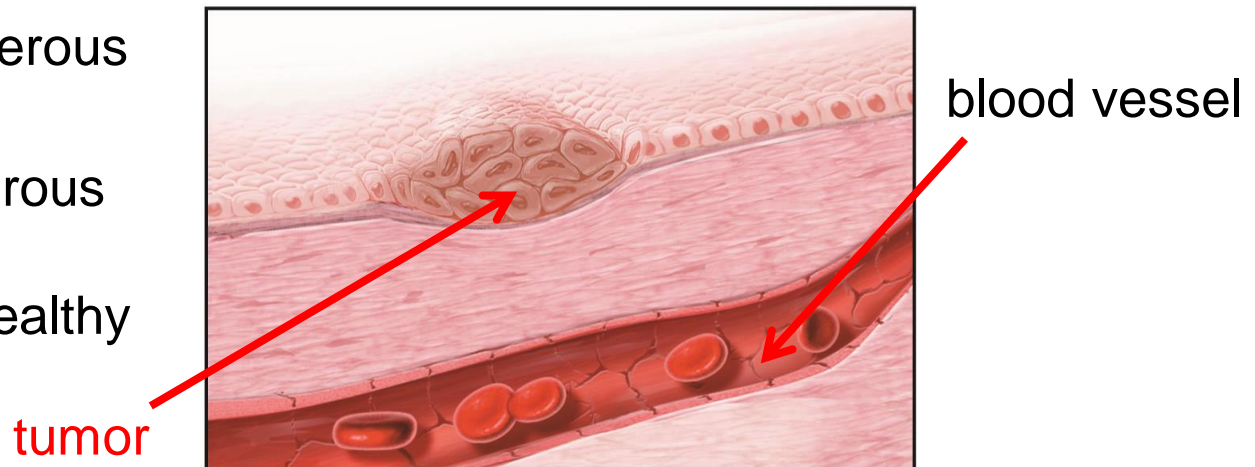
Cancer: a disorder in which body cells lose the ability to control growth

- Cancer cells don't respond to normal regulatory signals.
- Cell cycle is disrupted.
- Cells grow and divide uncontrollably.

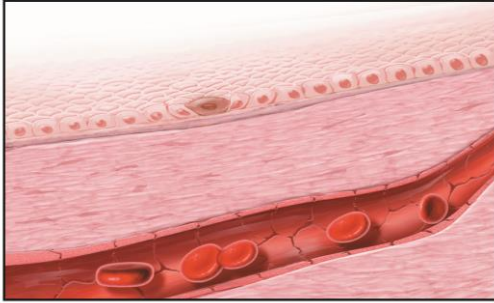
Tumor: a mass of cells formed from cancer cells

Benign tumor: noncancerous

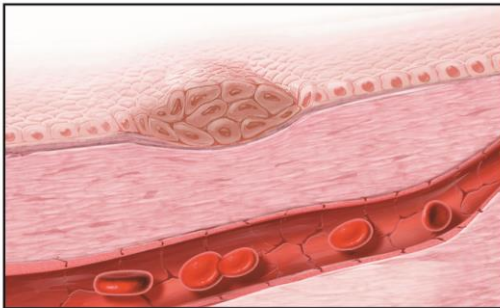
Malignant tumor: cancerous tumor that invades and destroys surrounding healthy tissue



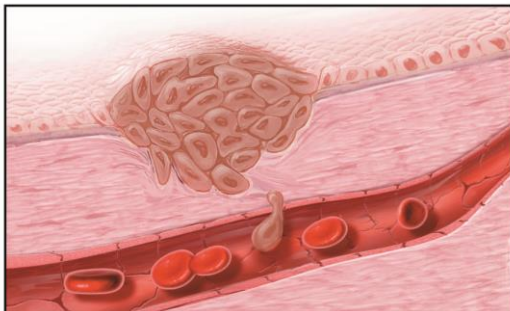
Cancer Formation: A Closer Look



1. A cell begins to divide abnormally.



2. Cells produce a tumor and start to displace normal cells and tissues.



3. Cancer cells move to other parts of the body and are particularly dangerous as they travel in the bloodstream or lymph vessels.

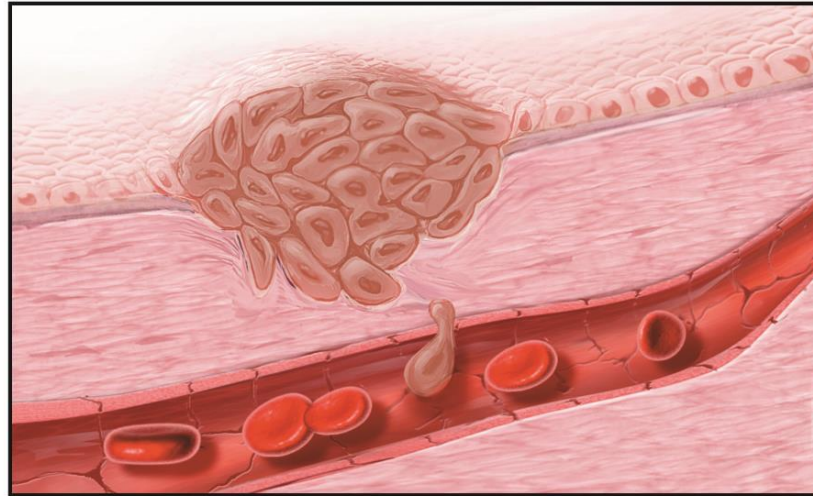
What Causes Cancer?

Cancer results from a **defect in genes** that control cell growth and division.

- Sources include smoking, chewing tobacco, radiation exposure, or viral infections

All cancers have one thing in common: The control over the cell cycle is broken down

- No longer respond to external or internal regulators



Treatments for Cancer

- Surgery to remove localized tumor
 - Skin cancer, most common form of the disease, can usually be treated this way – has to be found early
- Radiation to destroy cancer cell DNA
- Chemotherapy to kill cancer cells or slow their growth
 - Fairly newer procedure
 - Can cure some forms of cancer
 - Can interfere with cell division in normal, healthy cells

Cancer is a serious disease and remains a major scientific challenge.