

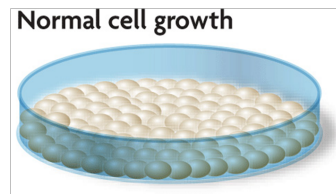
Section 5.3 Regulation of the Cell Cycle

I. Internal and external factors regulate cell division.

A. **External factors** include physical and chemical signals from outside the cell.

1. An example of **physical** - single layer of mammal cells in a culture dish *will stop dividing once they touch other cells* - leaving a single layer of cells
2. A **chemical** example is *Growth factors* are proteins that *stimulate cell division by attaching to receptors* that activate genes to start cell growth.

Ex: hormones, platelets



External factors trigger internal factors, which affect the cell cycle

- Two of the most important internal factors are *kinases* and *cyclins*.

I. Normal Control of the Cell Cycle

*Some cells divide rapidly, while others divide slowly.

A. Proteins and Enzymes Control the Cell Cycle.

1. Proteins called *cyclins* and a set of enzymes attach to points in the cell cycle to control it.
2. The cyclins activate the enzymes called *kinases*, which increase energy to a target molecule or change its shape.

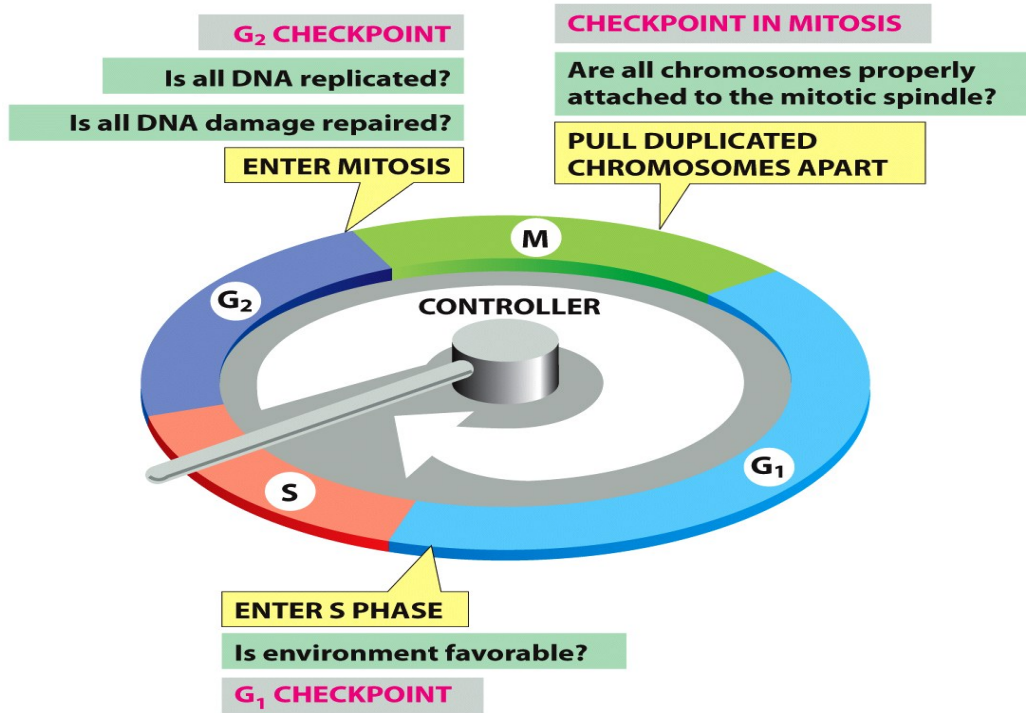
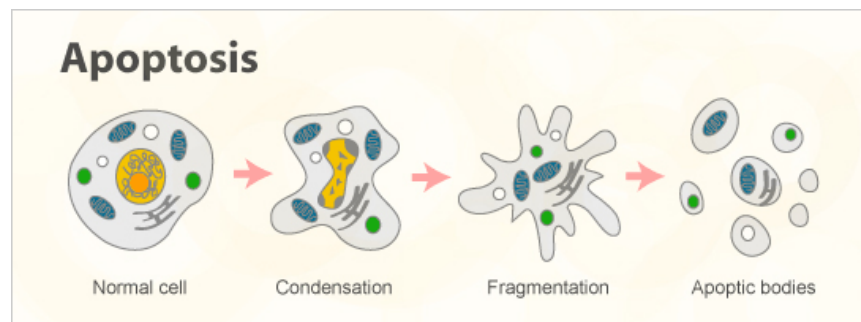


Figure 18-3 Essential Cell Biology 3/e (© Garland Science 2010)

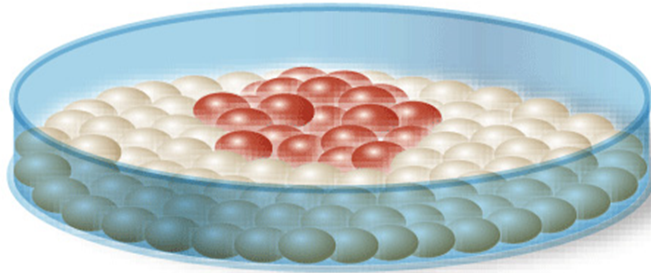
B. Apoptosis is programmed cell death.

- a normal feature of healthy organisms
 - caused by a cell's production of self-destructive enzymes
 - occurs in development of infants
- ex: webbed feet & hands before birth

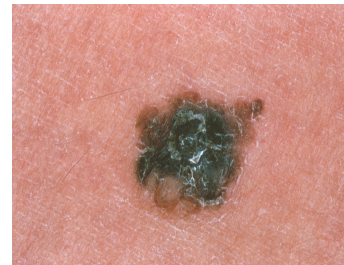


C. Cancer = *is a result of uncontrolled cell division.*

- The loss of control may be caused by *environment factors or by changes in enzyme production.*
- Enzyme production is directed by *genes*, which are segments of DNA.

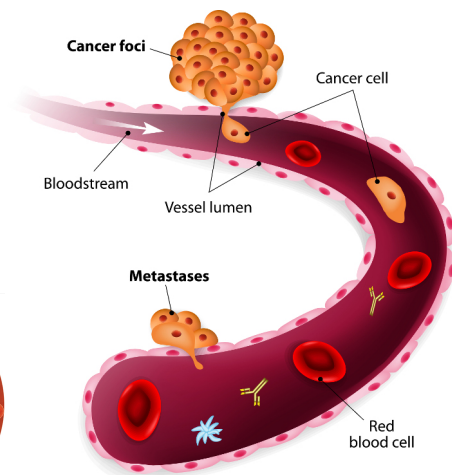
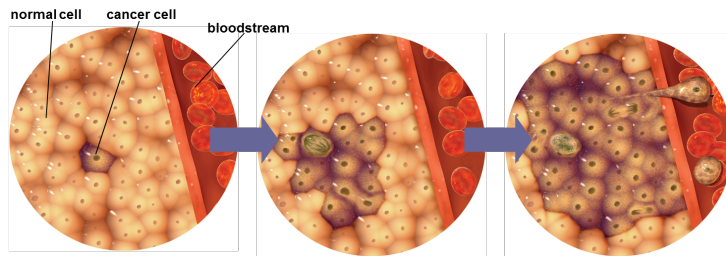
Cancerous cell growth**D. Cancer: A Mistake in the Cell Cycle**

1. Currently, scientists consider cancer to be a result of changes in *one or more of the genes* that aid in controlling the cell cycle.
2. These changes are *expressed* as cancer when something prompts the damaged genes into *action*.
3. Cancerous cells *form masses of tissue called tumors*. If the cancer remains in one location and doesn't spread, it is *benign*.



4. In later stages, cancer cells enter the ***circulatory system*** and spread throughout the body forming new tumors. This is when cancer is considered ***malignant***.

5. ***Metastasis*** is the process by which cancer spreads, from the place at which it first arose, to distant locations in the body.



E. The Cause of Cancer

*It is difficult to pinpoint the cause of cancer because ***both genetic and environmental*** factors are involved.

- Genetic factors include ***oncogenes and mutations***.

- ***Carcinogens*** are environment factors include cigarette smoke, air and water pollution, and exposure to ultraviolet radiation.

- ***Mutagens*** are physical or chemical agents that ***change the genetic material***, usually DNA, of an organism and thus increases the frequency of mutations

F. Standard cancer **treatments** typically kill both cancerous and healthy cells. ex: *radiation & chemotherapy*

G. Cancer Prevention

**Healthy diet and not using tobacco* are recommended to reduce the risk of cancer.

***Research** includes studying a group of tumor cells from Henrietta Lacks (who died in 1951 of cervical cancer)- *HeLa cells*

FYI - They were the first human cells grown in a lab that were "immortal," meaning that **they do not die after a few cell divisions**, and they could be used for conducting many experiments. This represented an enormous boon to medical and biological research

