

Lesson Overview Regulating the Cell Cycle

THINK ABOUT IT

How do cells know when to divide?

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Controls on Cell Division

How is the cell cycle regulated?

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Controls on Cell Division

How is the cell cycle regulated?

The cell cycle is controlled by regulatory proteins both inside and outside the cell.

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The controls on cell growth and division can be turned on and off.

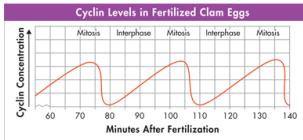
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For example, when an injury such as a broken bone occurs, cells are stimulated to divide rapidly and start the healing process. The rate of cell division slows when the healing process nears completion.

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The Discovery of Cyclins

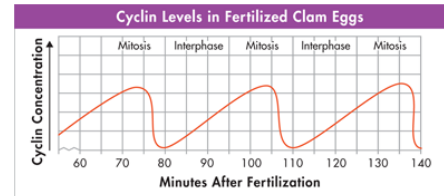
Cyclins are a family of proteins that regulate the timing of the cell cycle in eukaryotic cells.



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The Discovery of Cyclins

This graph shows how cyclin levels change throughout the cell cycle in fertilized clam eggs.



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Regulatory Proteins

Internal regulators are proteins that respond to events inside a cell. They allow the cell cycle to proceed only once certain processes have happened inside the cell.

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Regulatory Proteins

External regulators are proteins that respond to events outside the cell. They direct cells to speed up or slow down the cell cycle.

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Regulatory Proteins

Growth factors are external regulators that stimulate the growth and division of cells. They are important during embryonic development and wound healing.

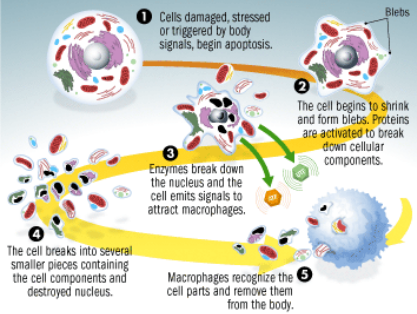
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Apoptosis

- **Apoptosis** is a process of programmed cell death.
- Apoptosis plays a role in development by shaping the structure of tissues and organs in plants and animals. For example, the foot of a mouse is shaped the way it is partly because the toes undergo apoptosis during tissue development.

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Apoptosis Process



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Apoptosis



Image 1: The development of the foot begins at week 4 as a limb bud and is dependent on a number of genes and signals to develop and grow normally.

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Cancer: Uncontrolled Cell Growth

How do cancer cells differ from other cells?

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Cancer: Uncontrolled Cell Growth

How do cancer cells differ from other cells?

Cancer cells do not respond to the signals that regulate the growth of most cells. As a result, the cells divide uncontrollably.

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- **Cancer** is a disorder in which body cells lose the ability to control cell growth.
- Cancer cells divide uncontrollably to form a mass of cells called a **tumor**.

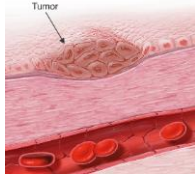
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A benign tumor is noncancerous. It does not spread to surrounding healthy tissue.



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A malignant tumor is cancerous. It invades and destroys surrounding healthy tissue and can spread to other parts of the body. The spread of cancer cells is called metastasis. Cancer cells absorb nutrients needed by other cells, block nerve connections, and prevent organs from functioning.



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What Causes Cancer?

- **Cancers** are caused by defects in genes that regulate cell growth and division.
- Some sources of gene defects are smoking tobacco, radiation exposure, defective genes, and viral infection.
- A damaged or defective p53 gene is common in cancer cells. It causes cells to lose the information needed to respond to growth signals.

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Treatments for Cancer

- Some localized tumors can be removed by surgery.
- Many tumors can be treated with targeted radiation.
- Chemotherapy is the use of compounds that kill or slow the growth of cancer cells.