

**Lesson Overview**  
10.1 Cell Growth, Division,  
and Reproduction

**Lesson Overview** Cell Growth, Division, and Reproduction

**THINK ABOUT IT**

When a living thing grows, what happens to its cells?

What is there about growth that requires cells to divide and reproduce themselves?

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**Limits to Cell Size**

What are some of the difficulties a cell faces as it increases in size?

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**Limits to Cell Size**

What are some of the difficulties a cell faces as it increases in size?

The larger a cell becomes, the more demands the cell places on its DNA. In addition, a larger cell is less efficient in moving nutrients and waste materials across its cell membrane.

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**Information “Overload”**

- Living cells store critical information in DNA.
- As a cell grows, that information is used to build the molecules needed for cell growth.
- As size increases, the demands on that information grow as well. If a cell were to grow without limit, an “information crisis” would occur.

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**Information “Overload”**


Compare a cell to a growing town. The town library has a limited number of books. As the town grows, these limited number of books are in greater demand, which limits access.



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### Information "Overload"

A growing cell makes greater demands on its genetic "library." If the cell gets too big, the DNA would not be able to serve the needs of the growing cell.



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### Exchanging Materials

- Food, oxygen, and water enter a cell through the cell membrane. Waste products leave in the same way.
- The rate at which this exchange takes place depends on the surface area of a cell.
- The rate at which food and oxygen are used up and waste products are produced depends on the cell's volume.
- The ratio of surface area to volume is key to understanding why cells must divide as they grow.

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### Ratio of Surface Area to Volume

Imagine a cell shaped like a cube. As the length of the sides of a cube increases, its volume increases faster than its surface area, decreasing the ratio of surface area to volume.

**Ratio of Surface Area to Volume in Cells**

	1 cm	2 cm	3 cm
Surface Area (length x width) x 6 sides	$1\text{ cm} \times 1\text{ cm} \times 6 = 6\text{ cm}^2$	$2\text{ cm} \times 2\text{ cm} \times 6 = 24\text{ cm}^2$	$3\text{ cm} \times 3\text{ cm} \times 6 = 54\text{ cm}^2$
Volume (length x width x height)	$1\text{ cm} \times 1\text{ cm} \times 1\text{ cm} = 1\text{ cm}^3$	$2\text{ cm} \times 2\text{ cm} \times 2\text{ cm} = 8\text{ cm}^3$	$3\text{ cm} \times 3\text{ cm} \times 3\text{ cm} = 27\text{ cm}^3$
Ratio of Surface Area to Volume	$6 / 1 = 6 : 1$	$24 / 8 = 3 : 1$	$54 / 27 = 2 : 1$

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### Ratio of Surface Area to Volume

If a cell gets too large, the surface area of the cell is not large enough to get enough oxygen and nutrients in and waste out.

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### Traffic Problems

To use the town analogy again, as the town grows, more and more traffic clogs the main street. It becomes difficult to get information across town and goods in and out.



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**Traffic Problems**

Similarly, a cell that continues to grow would experience “traffic” problems. If the cell got too large, it would be more difficult to get oxygen and nutrients in and waste out.



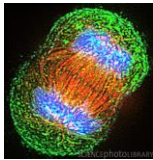
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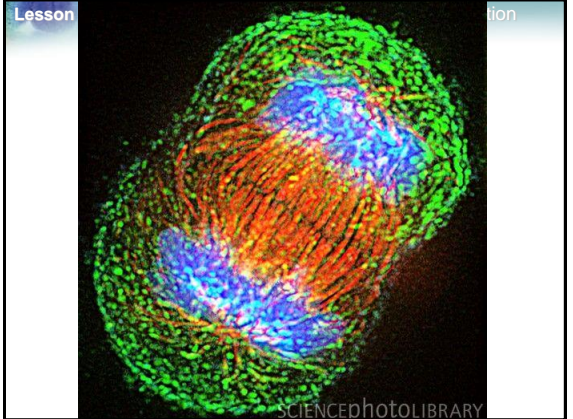
**Division of the Cell**

Before a cell grows too large, it divides into two new “daughter” cells in a process called **cell division**.

Before cell division, the cell copies all of its DNA.



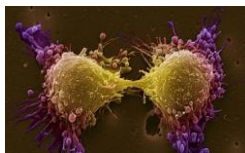
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**Division of the Cell**

- It then divides into two “daughter” cells. Each daughter cell receives a complete set of DNA.
- Cell division reduces cell volume. It also results in an increased ratio of surface area to volume, for each daughter cell.



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### Cell Division and Reproduction

- How do asexual and sexual reproduction compare?

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- The production of genetically identical offspring from a single parent is known as asexual reproduction.

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### Cell Division and Reproduction

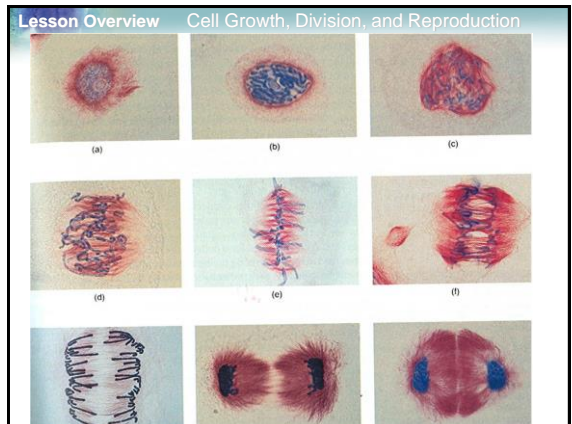
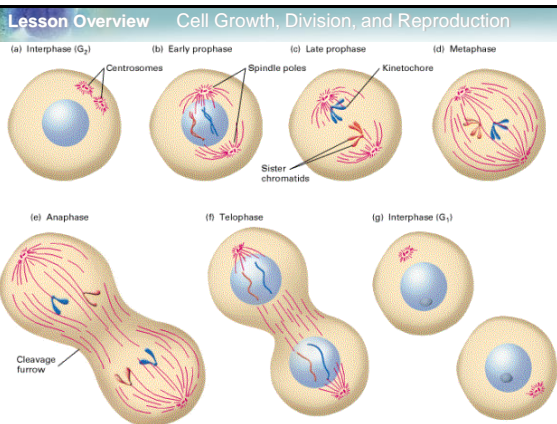
- How do asexual and sexual reproduction compare?
- The production of genetically identical offspring from a single parent is known as asexual reproduction.
- Offspring produced by sexual reproduction inherit some of their genetic information from each parent.

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### Asexual Reproduction

In multicellular organisms, cell division leads to growth. It also enables an organism to repair and maintain its body.

In single-celled organisms, cell division is a form of reproduction.



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## Asexual Reproduction

**Asexual reproduction** is reproduction that involves a single parent producing an offspring. The offspring produced are, in most cases, genetically identical to the single cell that produced them.

Asexual reproduction is a simple, efficient, and effective way for an organism to produce a large number of offspring.

Both prokaryotic and eukaryotic single-celled organisms and many multicellular organisms can reproduce asexually.

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## Examples of Asexual Reproduction

Bacteria reproduce by binary fission.

Kalanchoe plants form plantlets.

Hydras reproduce by budding.

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## Sexual Reproduction

In **sexual reproduction**, offspring are produced by the fusion of two sex cells – one from each of two parents. These fuse into a single cell before the offspring can grow.

The offspring produced inherit some genetic information from both parents.

Most animals and plants, and many single-celled organisms, reproduce sexually.

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## Comparing Sexual and Asexual Reproduction

Asexual	Sexual
Produces genetically identical offspring	Produces genetically diverse offspring
Reproduction is quick and produces large number of offspring	Genetic diversity helps ensure survival of species when environment changes