

10-1 Cell Growth

What problems does growth cause for cells?

Limits to Cell Growth



The larger a cell becomes, the more demands the cell places on its DNA. In addition, the cell has more trouble moving enough nutrients and wastes across the cell membrane.

What problems does growth cause for cells?



Molecules such as DNA generally occur in the same amount in small and large cells

If a large cell needs to utilize the same amount of DNA to accomplish MORE tasks (like protein synthesis, DNA replication, and organelle development), it can cause too much stress on the cell.

The rate at which food, oxygen, water, and wastes are moved in and out of the cell is dependent on the surface area of the cell.

The rate at which food, oxygen, and water are used and waste is produced depends on the cell's volume.


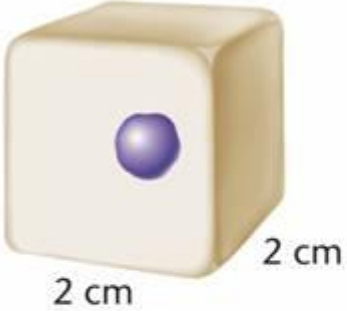
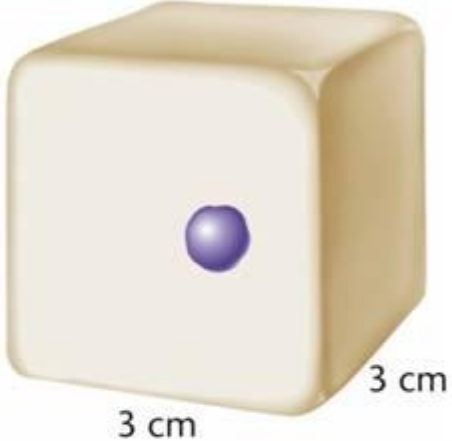
Ratio of Surface Area to Volume

As the length of a cell increases, its volume increases faster than the surface area.

The decrease in the cell's ratio of surface area to volume makes it more difficult for the cell to move needed materials in and waste products out quickly enough for the cell to survive.

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Ratio of Surface Area to Volume in Cells

Cell Size	 <p>1 cm 1 cm 1 cm</p>	 <p>2 cm 2 cm 2 cm</p>	 <p>3 cm 3 cm 3 cm</p>
Surface Area (length x width x 6)	$1\text{ cm} \times 1\text{ cm} \times 6 = 6\text{ cm}^2$	$2\text{ cm} \times 2\text{ cm} \times 6 = 24\text{ cm}^2$	$3\text{ cm} \times 3\text{ cm} \times 6 = 54\text{ cm}^2$
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	$6 / 1 = 6 : 1$	$24 / 8 = 3 : 1$	$54 / 27 = 2 : 1$

Division of the Cell

Before it becomes too large, a growing cell divides forming two “daughter” cells.

The process by which a cell divides into two new daughter cells is called cell division.

Cells of young organisms are not smaller in size, just smaller in number

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1 As a cell increases in size, which of the following increases most rapidly?

a. surface area

b. volume

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2 If an imaginary cube-shaped cell has a length of 6 cm, its ratio of surface area to volume is

a. 1 : 1.

b. 6 : 1.

c. 36 : 1.

d. 1 : 6.

3 The process by which a cell divides into two new daughter cells is called

- a. cell growth.
- b. cell division.
- c. DNA replication.
- d. cell multiplication.

- 4 When one cell divides in two, what happens to the surface area to volume ratios in the new cells?
- a. There is no change in the amount of material exchanged.
 - b. Each new cell can exchange more material than the original cell.
 - c. Each new cell can exchange less material than the original cell.
 - d. The two new cells cannot be compared to the original cell.

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- 5** When a growing cell undergoes cell division, each new cell gets
- a. half the DNA from the original cell.
 - b. twice as much DNA as the original cell.
 - c. a random sample of the DNA in the original cell.
 - d. a full copy of all the DNA in the original cell.