

Chapter Eleven: Cell Growth and Division

Lesson 11.1: Cell Growth, Division, and Reproduction

Most living things grow by producing more cells

- You begin life as a single cell.
- That single cell has grown and divided so many times that the average human body contains nearly 40 trillion cells

Main reason for cell division:

1. The larger a cell becomes, the less efficient it is in moving nutrients and waste materials across its cell membrane.
2. As a cell grows, it places increasing demands on its own DNA.

All cells are connected to the outside world through the cell membrane.

- Cells must allow food, oxygen, and water to enter and waste products to leave.
- The rate at which this exchange takes place depends on the surface area of the cell which is the total area of the cell membrane.
- The rate at which food and oxygen are used and waste produced depends on the cell's volume.
- Volume and surface area do not increase at the same rate as this is the reason cells divide rather than continue to grow.

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	$6 / 1 = 6 : 1$	$24 / 8 = 3 : 1$	$54 / 27 = 2 : 1$

- Surface area does not increase as fast as volume does.
- This creates serious problems with the relative amount of cell membrane available.
- Compare a growing cell to a small town with a 2-lane street
 - As the town grows, more traffic clogs the streets
 - Businesses have more demands
 - Garbage piles up because of traffic jams
- There are too many demands placed on DNA and an information crisis/overload occurs
 - Cell division occurs

Cell division: the process by which a cell divides into two new daughter cells

- First thing that happens is the DNA is copied, or replicated
 - Prevents the overload of information because each cell gets one complete copy of genetic information
- Cell division solves the problem of increasing size by reducing volume
- This allows for a more efficient change of material

Cell division and reproduction

- **Asexual reproduction:** process of reproduction involving a single parent that results in offspring that are genetically identical to the parent
 - single-celled organisms such as bacteria
 - populations increase in number very quickly and short time
 - genetically identical to the cell that produced them and thrive in stable environments
 - when conditions change, offspring are not well adapted
- **Sexual reproduction:** type of reproduction in which cells from two parents unite to form the first cell of a new organism
 - offspring inherit some of their genetic information from each parent
 - relatively fewer offspring and growth takes more time
 - need to find a mate
 - in changing environments, genetic diversity can be beneficial
 - ensure the population contains the right combination of characteristics needed to survive