

The Importance of Cell Division

Organisms are made of cells. For an organism to grow, new cells must be made because there is a limit to how large a cell can become.

For single-celled organisms, cell division is the process by which individuals reproduce, and the population gets larger.

You begin life as a single cell, as a fertilized egg cell. You grow because the cell divides to make two identical cells, these divide to make four, and so on. This is called cell division.

Adults are typically made of trillions of cells, i.e. they are multicellular. Therefore, cell division or replication must occur.

For multicellular organisms, cell division is the process by which a fertilized egg (a single cell) becomes eventually an adult with millions of cells.

Also in multicellular organisms, cell division is the process by which the organism replaces lost or damaged cells.

There are three important reasons for cell division: (i) reproduction, (ii) growth and (iii) repair.

1. Cell division for reproduction

All organisms use cell division to reproduce.

There are two types of reproduction: asexual and sexual.

Asexual reproduction is the process of producing offspring from only one parent, this results in the production of offspring that are genetically identical.

Genetically identical means that every cell that is produced has identical copies of a single, identical set of chromosomes. When cells in an organism undergo division, they all produce daughter cells, (two new cells), with exactly the same DNA.

In asexual reproduction, the offspring simply goes through cell division, forming two new daughter cells, each one genetically identical to the parent cell.

The process of producing offspring by the fusion of male and female gametes, (i.e. egg and sperm), the production of offspring that have genetic information from each parent is referred to as **sexual reproduction**.

Gametes: also referred to as 'half cells' are cells that contain only half of the DNA usually found in a cell. Gametes are produced when some of the parents' cells undergo a cell division process known as meiosis.

When two gamete cells combine, the offspring inherits characteristics from both parents.

Sexual reproduction results in offspring that receive a combination of genetic material from both parents. Hence, sexual reproduction has the advantage of creating variety in offspring, which may make for better adaptation to change.

Asexual reproduction occurs from division of the parent cell without meiosis, gamete formation, or fertilization. Hence, asexual reproduction uses less time and energy than sexual reproduction. Asexual reproduction is common in single celled organisms and plants.

Summary of Asexual and Sexual Reproduction

Reproduction	Number of parents	Division process	Resulting cell	Genetic makeup of offspring
Asexual	one	cell division	identical to parent	identical to parent
Sexual	two	meiosis	gamete has half the number of chromosomes as parent	offspring inherit characteristics from both parents

2. Cell division for growth

As all organisms grow, the number of cells increases. As multicellular organisms grow, their cells duplicate their genetic information and divide.

Cells undergo division rather than simply growing larger, this is because if the cell gets too large, it may not be able to transport materials in and wastes out efficiently, i.e. osmosis and diffusion are no longer efficient for transporting materials in and out.

Note: chemicals used during cell activity and growth enter across the cell membrane and travel through the cell where they are used via the process known as **diffusion**.

Diffusion is the process where substances cross the cell membrane from a region of high concentration to lower concentration until concentration of the substance is the same on both sides.

A cell membrane is referred to as **selectively permeable** because not all materials can cross it, some are kept out—or in.

(**Demo:** a drop of coloured dye in water, diffusion of coloured water across a coffee filter)

Whilst water enters and leaves the cell by a process called **osmosis**.

Diffusion is the fastest in gases and the slowest in solids. Because cells are made up of liquids/solvents, thus diffusion is relatively slow in cells.

As a cell becomes large, both its surface area (cell membrane) and its volume (cytoplasm and organelles) increase.

However, the volume increases at a greater rate than the surface area.

Cells can only bring things in and out through their surfaces, so a large surface to volume ratio is needed to get materials in and out quickly and efficiently, (i.e. the diffusion rate would be affected).

Since a cell depends on exchanging nutrients across the membrane, a large cell would need to transport more nutrients across the surface to take part in the cell's functions— this would require a greater surface area, thus the cell is less efficient at transporting materials.

Each cell maintains an efficient ratio of surface area to volume to sustain its life processes.

If a cell becomes too large to function efficiently, it will divide to produce two new cells.

3. Cell division for repair

When part of an organism is damaged, the remaining cells divide to repair the injury.

Cell division creates new cells that replace those in the wounded or broken area to close the wound and heal.

The time taken for the process of cell renewal changes as the individual's age changes, or with changes in hormone or vitamin levels.

A human body loses ~ 30 000 – 40 000 skin cells every minute.

Red blood cells in the human body are replaced every 120 days.

Human body sheds dead skin cells, and replaced by new ones. Every cut, blister needs new cells to fill in the gaps.

Assignment

1. Water enters and leaves the cell by a process called _____.
2. Each cell division produces two genetically identical cells called _____ cells.
3. Chemicals diffuse from an area of _____ concentration to an area of _____ concentration.
4. _____ reproduction involves only one parent.
5. What are the three reasons for cell division?
6. What happens as multicellular organisms grow?
7. A minor cut heals over time. Explain how this happens.
8. A household cleaner is advertised to kill 99.9 % of all bacteria in the kitchen. Explain if this advertisement is valid.
9. Explain why cells undergo cell division instead of just getting bigger, as an organism grows.
10. a. Define asexual reproduction and sexual reproduction in your own words.
b. Which method of reproduction produces a population with more genetic variety? Explain your answer.
11. When a cell divides to produce daughter cells, how similar are the daughters to the parent?
12. A Hollywood movie advertisement state “Giant Paramecium Threatens City”. Is this a logical and a rational possibility? Explain.