Unit 5 Notes: Cellular Reproduction (Ch. 9 & 10.1)

Cells - are the basic unit of life.

Average human cell is approximately 50 μm (micrometers) in diameter. Bacteria ≈ 1 μm

1000 μm = 1 mm (millimeter)

Most cells are less than 100 μm in diameter, which is smaller than the period at the end of this sentence.

Cell reproduction (division)- process that creates more cells

Growth - an increase in size or mass of a cell or organism.

Ex. 

Development - Changes a cell/organism undergoes to become specialized. Stem Cell → muscle cell, red blood cell, nerve cell

The most efficient cells are small in size.

What limits cell size and why are cells small?

(1) Transport of substances: To move nutrients into the cell and Wastes out of the cell faster.

(2) Intercellular / Intracellular communication: To communicate more efficiently.

(3) Small cells require less energy.

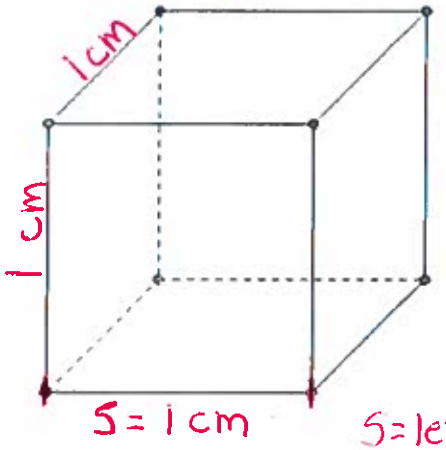
Cell Surface Area to Volume Ratio

↑ SA

A cell functions best when it has a high surface area (SA) and a low volume (V). ↓ V

Surface Area to Volume Ratio in Cubic Cells

Cell #1 = smaller cell



s = length of a side

$SA = 6s^2$

$SA = 6(1cm)^2$

$SA = 6(1cm)(1cm)$

$SA = 6\,cm^2$

$V = s^3$

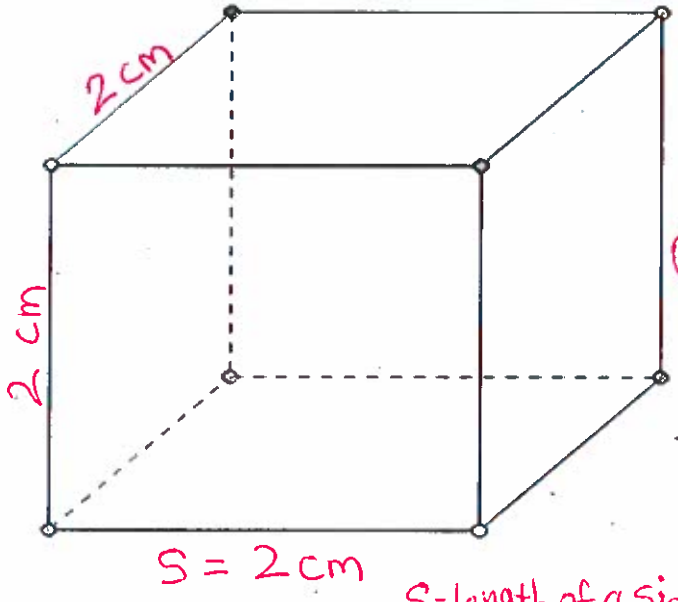
$V = (1cm)^3$

$V = (1cm)(1cm)(1cm)$

$V = 1\,cm^3$

$$\frac{SA}{V} = \frac{6\,cm^2}{1\,cm^3} = 6 \text{ or } 6:1$$

Cell #2 = larger cell



s = length of a side

$SA = 6s^2$

$SA = 6(2cm)^2$

$SA = 6(2cm)(2cm)$

$SA = 24\,cm^2$

$V = s^3$

$V = (2cm)^3$

$V = (2cm)(2cm)(2cm)$

$V = 8\,cm^3$

$$\frac{SA}{V} = \frac{24\,cm^2}{8\,cm^3} = 3 \text{ or } 3:1$$

As a cell increases in size, the Volume increases at a much faster rate than the surface area.

Conclusion

★ Larger $\frac{SA}{V}$ makes for a more efficient cell, so cell #1 the smaller cell is better than cell #2 the larger cell.

What does a cell do when it becomes too large?

1. The cell Stops growing.
2. The cell divides.
3. The cell dies.

Two Types of Cell Reproduction (Cell Division):

1. Mitosis **- reproduction of body cells** (somatic cells)

- Parent cell: 1 diploid (2n) body cell

- Daughter cells: 2 genetically identical diploid (2n) body cells

Examples: red blood cell, white blood cell, nerve cell, skeletal muscle cell, cardiac muscle cell, fat cell, epithelial skin cell.

2. Meiosis **- formation of sex cells (** gametes **)**

- Parent cell: 1 diploid (2n) body cell

- Daughter cells: 4 different haploid (n) sex cells

Examples: Gametes (sex cells) = males **sperm cell and** females **egg cell**

Cell Cycle = process of cellular reproduction in 3 main parts

3 Main Parts:

(1) Interphase = 1st stage of the cell cycle in which the cell grows, matures, and replicates its DNA and cell structures.

- growing stage in which a cell spends most of its life

- **G_1 (Growth 1) – cell grows in size; organelles double in #**
- **S (Synthesis) – DNA replication occurs in nucleus of cell**
- **G_2 (Growth 2) – cell continues to grow in size in preparation for cell division**

(2) Mitosis or Meiosis =2nd stage of the cell cycle in which the cell's nuclear material divides and moves to opposite ends of the cell.

Mitosis (1 division): 1 cell → 2 cells

- Prophase
- Metaphase
- Anaphase
- Telophase

Meiosis (2 divisions): 1 cell → 2 cells → 4 cells

- Prophase I
- Metaphase I
- Anaphase I
- Telophase I
- Prophase II
- Metaphase II
- Anaphase II
- Telophase II

Events Similar to Stages of Mitosis

(3) Cytokinesis = 3rd stage of the cell cycle in which the cell's cytoplasm divides creating new cells.