CELL BEHAVIOR

Cell behavior refers to the various activities and functions that cells perform within living organisms.

Cells are the basic structural and functional units of life, and their behavior is crucial for the overall functioning and maintenance of an organism.
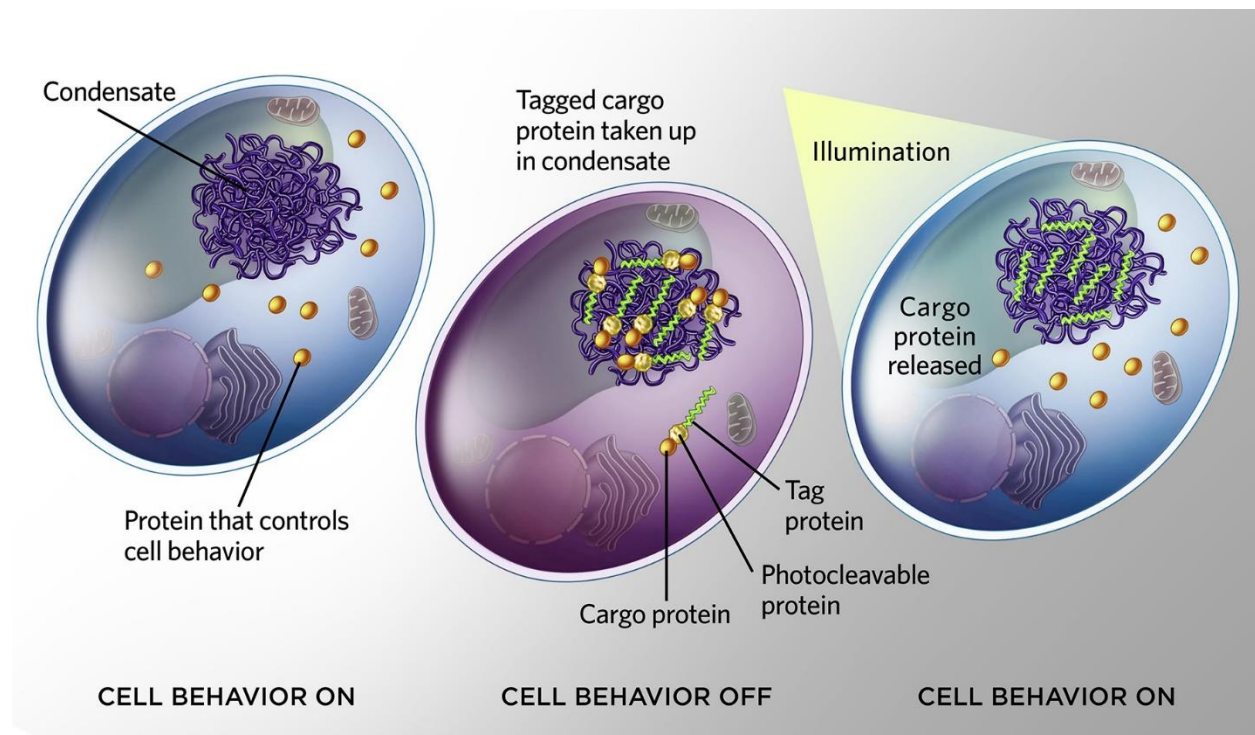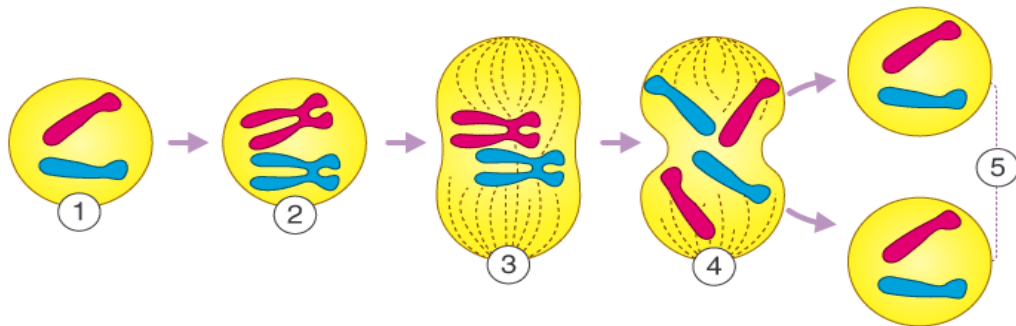

**Here are some key aspects of cell behavior:**

- ➤ **Cell Division:**

- • **Mitosis**: Most cells divide through mitosis, producing two genetically identical daughter cells. This process is crucial for growth, development, and tissue repair.

1 Interphase | 2 Prophase | 3 Metaphase | 4 Anaphase | 5 Telophase

- **Meiosis**: Occurs in specialized cells (gametes) and leads to the production of cells with half the normal chromosome number, essential for sexual reproduction.

Prophase II
(n = 2)

Metaphase II

Anaphase II

Telophase II

Cytokinesis
(n = 2)
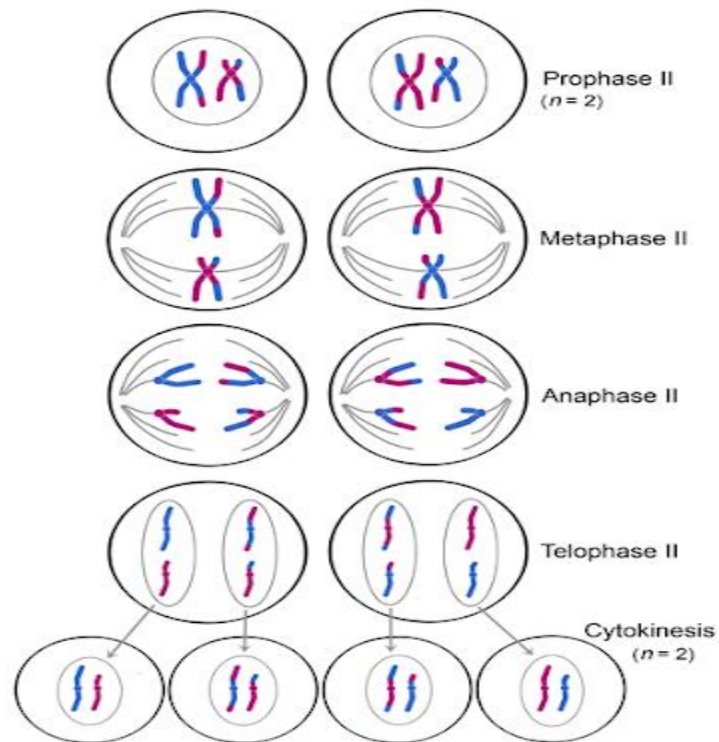
➢ **Cell Growth:**

- Cells grow by increasing in size and mass. Growth is regulated by various factors, including hormones, nutrients, and environmental signals.

➢ **Metabolism:**
- Cells carry out metabolic processes to obtain energy from nutrients and perform essential functions. Metabolism includes catabolic processes that break down molecules for energy and anabolic processes that build complex molecules.

➢ **Cellular Communication:**

Cells communicate with each other through signaling pathways. This involves the release of signaling molecules (such as hormones) and the reception of these signals by target cells.
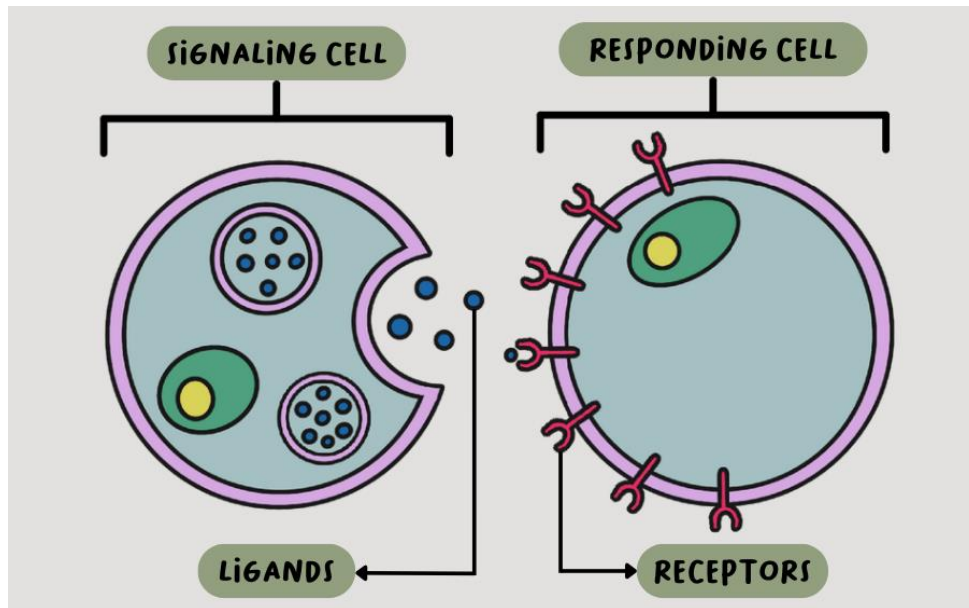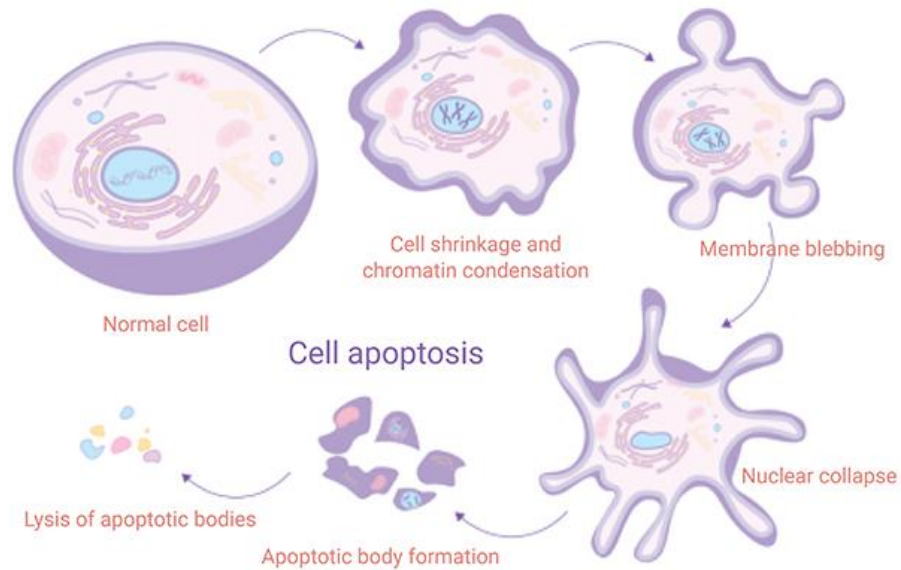

➢ **Differentiation:**
- During development, cells differentiate into specialized cell types with specific functions. This process is crucial for the formation of tissues and organs.

➢ **Apoptosis:**

Apoptosis, or programmed cell death, is a controlled process that eliminates damaged or unwanted cells. It plays a vital role in development, tissue homeostasis, and the elimination of potentially harmful cells.

Cell shrinkage and chromatin condensation

Membrane blebbing

Normal cell

Cell apoptosis

Nuclear collapse

Lysis of apoptotic bodies

Apoptotic body formation

➢ **Adhesion and Migration:**

Cells adhere to each other and to extracellular matrix components. This is essential for maintaining tissue structure. Cells also migrate to specific locations during development, wound healing, and immune responses.

➢ **Homeostasis:**

Cells work to maintain a stable internal environment, responding to changes in the external environment and adjusting their activities to ensure optimal conditions for survival.

➢ **Response to Stimuli:**

Cells respond to various stimuli, such as changes in temperature, pH, and the presence of specific molecules. This responsiveness is crucial for adapting to the environment.

➢ **Cell Cycle Regulation:**

The cell cycle is tightly regulated to ensure accurate DNA replication and cell division. Checkpoints exist to monitor the integrity of the DNA and ensure that the cell is ready to progress through each phase of the cycle.
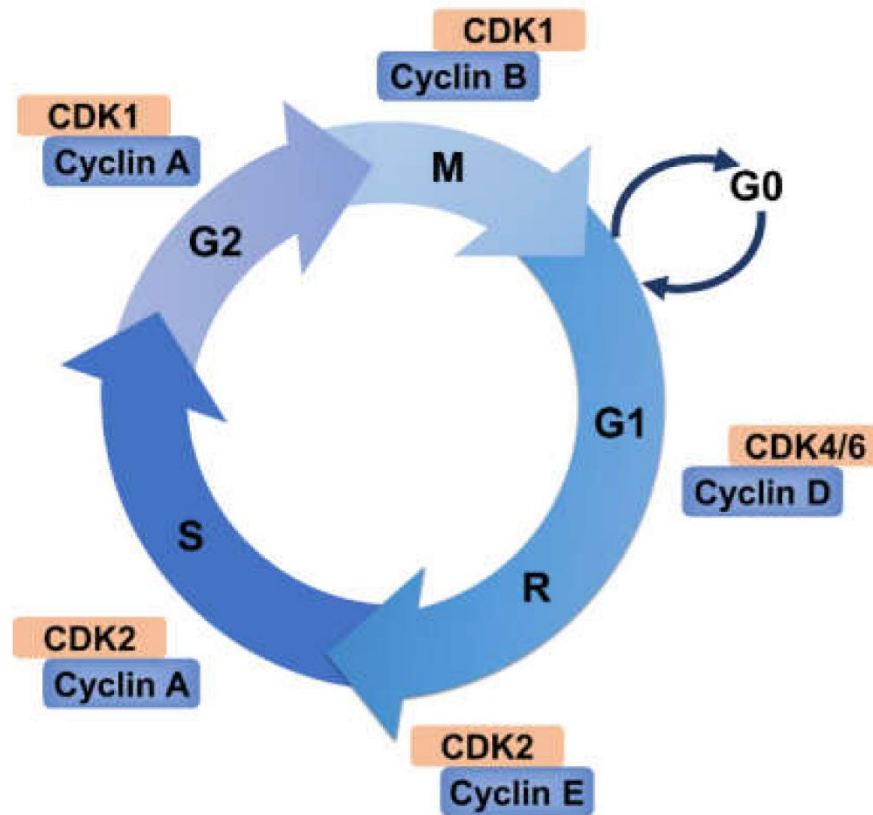
Understanding cell behavior is fundamental to various fields, including biology, medicine, and biotechnology, as it provides insights into normal physiological processes, disease mechanisms, and potential therapeutic interventions.

Cell Movement

Cells have structures to help them move:

◆ **<u>Cilia</u>** – short hair-like extensions that occur in large numbers

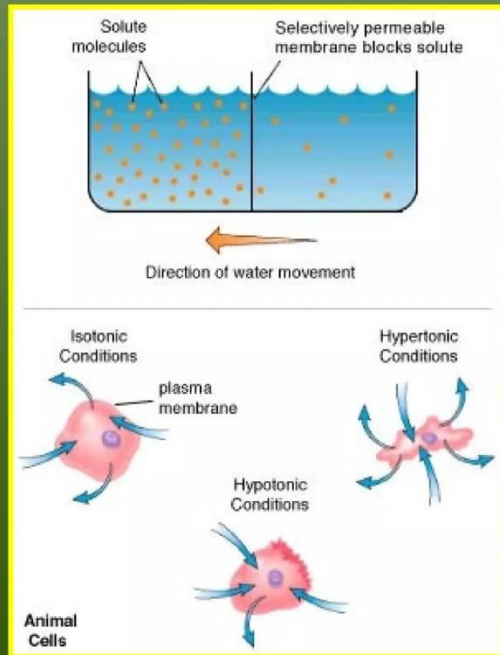◆ **<u>Flagella</u>** – long, whip-like extensions that occur singly or in pairs.

Movement through the membrane

- **<u>Diffusion</u>** – particles move from areas of greater concentration to areas of lesser concentration.
- Continues until *equilibrium* is reached
- No energy required by the cell

Movement through the membrane

Solute molecules

Selectively permeable membrane blocks solute

Direction of water movement

Isotonic Conditions

plasma membrane

Hypertonic Conditions

Hypotonic Conditions

Animal Cells

- **<u>Osmosis</u>** – the movement of water through a selectively permeable membrane.
- Continues until both solutions are *isotonic*
- No energy required by cell
- Osmotic pressure:
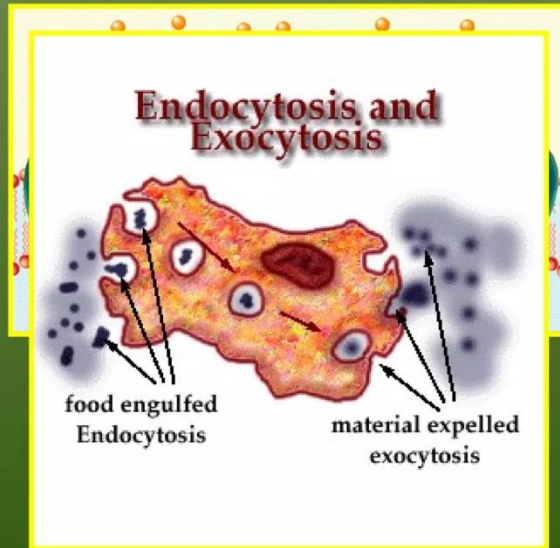   1. *Hypotonic*: below strength
    2. *Hypertonic*: above strength

Movement through the membrane

- **<u>Facilitated diffusion</u>** - small *protein channels* in the membrane allow specific molecules to flow through

- No energy required by the cell
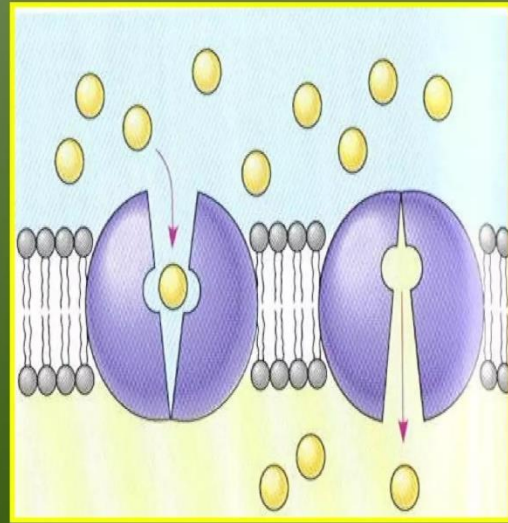
Movements that require Energy

Endocytosis and Exocytosis

food engulfed
Endocytosis

material expelled
exocytosis

- **Active Transport** uses *protein channels* to move specific molecules against the gradient
- **Endocytosis** – engulfs "big stuff"
- **Exocytosis** – expelling pockets of "big wastes"