Ch 7 Life is Cellular

The Cell Theory

These discoveries are summarized in the cell theory, a fundamental concept of biology.

The cell theory states:

1. All living things are made up of cells.
2. Cells are the basic units of structure and function in living things.
3. New cells are produced from existing cells.

Prokaryotes and Eukaryotes

Prokaryotic cells do not separate their genetic material within a nucleus.

In eukaryotic cells, the nucleus separates the genetic material from the rest of the cell.

Eukaryotic cells also contain membrane bound organelles.

Cell Transport Overview

I. Passive Transport
   A. Diffusion
      1. Facilitated Diffusion
         a. Osmosis

II. Active Transport
   A. Endocytosis
   B. Endocytosis

Passive Transport

The movement of materials across the cell membrane *without* using cellular energy is called passive transport.

Cell membrane –important function- to keep the cell's internal conditions relatively constant; regulates the movement of molecules in/out

Diffusion

The cytoplasm of a cell is a solution of many different substances dissolved in water.

The process by which particles move from an area of high concentration to an area of lower concentration is known as diffusion.

Diffusion is the driving force behind the movement of many substances across the cell membrane.

Down the concentration gradient…..with the current…downriver

If the substance can cross the cell membrane, its particles will tend to move toward the area where it is less concentrated until it is evenly distributed.

Facilitated Diffusion

Cell membranes have proteins that act as carriers (channels), making it easy for molecules to cross.

Molecules that cannot directly diffuse across the membrane pass through special protein channels in a process known as facilitated diffusion.

The movement of molecules by facilitated diffusion does not require use of the cell's energy.

Osmosis: An Example of Facilitated Diffusion

Osmosis is the diffusion of water through a selectively permeable membrane; from an area of higher concentration to an area of lower concentration.

The inside of a cell's lipid bilayer is hydrophobic—or "water-hating." Because of this, water molecules have a tough time passing through the cell membrane.

Many cells contain water channel proteins, known as aquaporins, that allow water to pass right through them. Without aquaporins, water would diffuse in and out of cells very slowly.

How Osmosis Works

In the experimental setup below, the barrier is permeable to water but not to sugar. This means that water molecules can pass through the barrier, but the solute, sugar, cannot.

How Osmosis Works

When the concentration is the same on both sides of the membrane, the two solutions will be isotonic, which means “same strength.”

The more concentrated sugar solution at the start of the experiment was hypertonic, or “above strength,” compared to the dilute sugar solution.

The dilute sugar solution was hypotonic, or “below strength.”

Osmotic Pressure

The net movement of water out of or into a cell exerts a force known as osmotic pressure. (aka turgor pressure in plants)

Because the cell is filled with salts, sugars, proteins, and other molecules, it is almost always hypertonic to fresh water.

Water tends to move quickly into a cell surrounded by fresh water, causing it to swell. Eventually, the cell may burst.

In plants, the movement of water into the cell causes the central vacuole to swell, pushing cell contents out against the cell wall.

Cells of plants and some bacteria are surrounded by tough cell walls that prevent the cells from expanding, even under tremendous osmotic pressure.

Animal cells will burst like a balloon.

In a hypertonic solution, water rushes out of the cell, causing animal cells to shrink and plant cell vacuoles to collapse.

Why do supermarkets spray down their produce with water?

Think – Pair - Share

Active Transport

The movement of materials against a concentration gradient is known as active transport. Active transport requires energy.

Against the concentration gradient… ..against the current…upriver

Molecular Transport

Small molecules and ions are carried across membranes by proteins in the membrane that act like pumps.

Many cells use such proteins to move calcium, potassium, and sodium ions across cell membranes.

Bulk Transport - Endocytosis

Large molecules, clumps of food, and even whole cells can be taken up by endocytosis.

Two examples of endocytosis are phagocytosis (take in food particle) and pinocytosis (take in liquid).

Bulk Transport - Exocytosis

Many cells also release large amounts of material from the cell, a process known as exocytosis.

During exocytosis, the membrane of the vacuole surrounding the material fuses with the cell membrane, forcing the contents out of the cell.

Cell Transport Overview

I. Passive Transport

A. Diffusion, Facilitated Diffusion, Osmosis

B. NO ENERGY – with the current – gradient…. downstream

II. Active Transport

A. Endocytosis & Endocytosis

B. ENERGY NEEDED- paddling upstream against the current /gradient