Biology Cells Notes Samhitha Bodangi 8B

Definitions:

cell = basic unit of all forms of life

cell membrane = thin, flexible barrier that surrounds all cells; regulates what enters and leaves the cell

nucleus = in cells, structure that contains the cells genetic material in the form of DNA

Eukaryote = organism whose cells contain a nucleus

Prokaryote = unicellular organism that lacks a nucleus

Discovery of Cells:

Anton van Leeuwenhoek - discovered bacteria (animacules)

Robert Hooke - termed the cell

Schleiden and Schwan - came up with the first 2 of the cell theory

Virchow - stole research from Remak → 3rd cell theory

Cell theory - a fundamental concept of biology:

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

Light microscopes:

- allows light to pass through a specimen and uses 2 lenses to form an image
- can only produce clear magnification of about 1000 times

Electron microscopes:

- use beams of electrons that are focused by magnetic fields

Transmission Electron Molecules:

- make it possible to explore cell structures and large protein molecules
- cells and tissues must be cut into ultrathin slices before they can be examined → causes images to be flat or 2D

Scanning Electron Microscopes:
- does not need thin samples
- produces 3D images of the specimen's surface

All cells contain DNA, the molecule that carries biological info.

Prokaryotes:
- Smaller and simpler than Eukaryotic cells
- DNA is not in nucleus. It swims around
- Prokaryotes have no nucleus in cells
- Still carry out every activity associated with living things
    - they grow, reproduce, and respond to environment
- Living things called bacteria = prokaryote
- no membrane bound organelles
- circular chromosomes

Eukaryotes:
- larger and more complex than prokaryote cells
- have dozens of structures and internal membranes
    - structures have special jobs
- Nucleus seperates DNA from cell
- Eukaryotes can be different from each other
    - protists = live solitary lives as unicellular organisms
    - others form large multicellular organisms (plants, fungai, animals)
- Have linear chromosomes

Definitions:
cytoplasm = fluid portion of the cell outside the nucleus
organelle: specialized structure that performs important cellular functions within a eukaryotic cell (little organs)
vacuole: cell organelle that stores materials such as water, salts, proteins, and carbohydrates

lysosome = cell organelle that breaks down lipids, carbohydrates, and proteins into small molecules that the rest of cell uses

cytoskeleton = network of protein filaments (string) in a eukaryotic cell that gives the cell its shape and internal organization and is involved in movement

centriole = structure in an animal cell that helps to organize cell division

ribosome = cell organelle consisting of RNA and protein found throughout the cytoplasm in a cell; the site of protein synthesis

endoplasmic reticulum = internal membrane system found in eukaryotic cells; place where lipid components of the cell membrane are assembled

Golgi apparatus = organelle in cells that modifies, sorts, and packages proteins and other materials from the endoplasmic reticulum for storage in cell or release out the cell

chloroplast = organelle found in plant cells and some other organisms that captures the energy from sunlight and converts it into chemical energy

mitochondrion = cell organelle that converts the chemical energy stored in food into compounds that are more convenient for the cell to use

cell wall = strong, supporting layer around the cell membrane in some cells

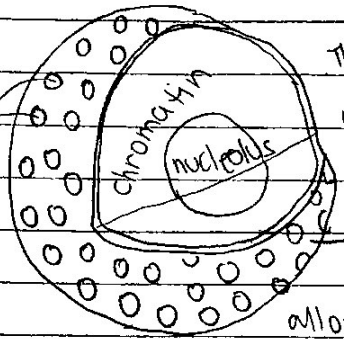
lipid bilayer = flexible double-layered sheet that makes up the cell membrane and forms a barrier between the cell and its surroundings

selectively permeable = property of biological membranes that allow some substances to pass across it while others cannot; also called semipermeable membrane

The nucleus and cytoplasm work together in the business of life

Prokaryotic cells have cytoplasm too, even if they don't have nucleus

nucleus contains nearly all the cell's DNA and, with it, the coded instructions for making proteins and other important molecules



The nucleus is surrounded by a nuclear envelope which is composed of two membranes

The nuclear envelope is dotted with thousands of nuclear pores, which allow things to move in and out from nucleus (proteins, RNA, and other molecules move in and out of nucleus)

chromosomes, which carry the cell's genetic information, are also found in the nucleus

The threadlike chromosomes are spread throughout the nucleus in the form of chromatin - a complex of DNA bound to proteins

When cells divide, its chromosomes condense

Most nuclei also have a small dense region known as the nucleolus

The nucleolus is where the assembly of ribosomes begins

In many plant cells, there is a single large central vacuole filled with liquid

The pressure of the central vacuole in these cells increases their rigidity, making it possible for plants to support heavy structures, such as leaves and flowers.

Nearly all eukaryotic cells contains smaller membrane-enclosed structures called vesicles.

Vesicles store and move materials between cell organelles, as well as well as to and from the cell structure

Lysosomes are small organelles filled with enzymes

Lysosomes remove "junk" that might clutter up the cell

Lysosomes are found in animal and few specialized plant cells

Eukaryotic cells are given their shape and internal organization by a network of protein strings known as cytoskeleton

Certain parts of cytoskeleton also help deliver materials between different parts of the cell

Microfilaments are threadlike structures made up of a protein (actin)

Microfilaments form extensive networks in some cells and produce a tough flexible framework that supports the cell

They help the cells move. And microfilament assembly and disassembly are responsible for the cytoplasmic movements that allow amoebas and other cells to crawl along surfaces

Microtubules are hollow structures made up of proteins known as tubulin

They play critical roles in maintaining cell shape

Important in cell division, where they form a structure known as the mitotic spindle, which helps to seperate chromosomes

In animal cells, centrioles are organelles formed from tubulin

Centrioles are not found in plant cells and are located near the nucleus and help with cell division.

Microtubules also help build projections from the cell surface known a cilia and flagella that enable cells to swim rapidly through liquid.

Ribosomes are small particles of RNA and protein found throughout the cytoplasm in all cells

Ribosomes produce proteins by following coded instructions from DNA

Endoplasmic reticulum is where lipid components of the cell membrane are assembled, along with proteins and other materials that are exported from the cell.

Newly made proteins leave ribosomes found on the surface and are inserted into the rough ER (portion of ER involved in the synthesis of proteins) where they may be chemically modified

Proteins made on the rough ER include those that will be released or secreted from the cell as well as many membrane proteins and proteins destined for lysosomes and other specialized locations within the cell.

The other portion of the ER is known as smooth endoplasmic reticulum (smooth ER) because ribosomes are not found on its surface.

The smooth ER contains collections of enzymes that perform specialized tasks, including the synthesis of membrane lipids and the detoxification of drugs

Eukaryotic cells, proteins produced in the rough ER move next into an organelle called the golgi apparatus, which appears as a stack of flattened membranes.

As proteins leave the rough ER, molecular "adress tags" get them to the right destinations.

As these tags are "read" by the cell, the proteins are bundled into tiny vesicles that bud from the ER and carry them to the Golgi apparatus.

The Golgi apparatus "ship" the proteins to their final destination inside or outside the cell.

Two membranes surround chloroplasts. Inside the organelle are large stacks of other membranes, which contain the green pigment chlorophyll

Mitochondria are the power plants of the cell

Two membranes, an outer membrane and an inner membrane, enclose the mitochondria - The inner membrane is folded up inside the organelle

All of our mitochondria come from the cytoplasm of the egg cell

Animal cells do not have cell walls

Cell walls lie outside the cell membrane. Most cell walls are porous enough to allow water, oxygen, carbon dioxide, and certain other substances to pass through easily.

Cell walls provide much of the strength needed for plants to stand against the force of gravity

The layered structure of cell membranes reflects the chemical properties of the lipids that make them up.

When fatty acids with a hydrophobic and hydrophilic end phospholipids mix with water, the hydrophobic fatty acid "tails" cluster together while their hydrophilic "heads" are attracted to water. A lipid bilayer is the result.

Embedded in the lipid bilayer of most cell membranes are protein molecules. Carbohydrate molecules are attached to many of these proteins.

Because the proteins embedded in the lipid layer can move around and float among the lipids, and because so many different kinds of molecules make up the cell membrane, it is considered as a fluid mosiac.

Some of the proteins form channels and pumps that help to move material across the cell membrane

Some proteins attach directly to the cytoskeleton, enabling cells to respond to their environment by using their membranes to help move or change shape

Definitions:

diffusion = process by which particles tend to move from an area where they are more concentrated to an area where they are less concentrated

facilitated diffusion = process of diffusion in which molecules pass across the membrane through cell membrane channels

aquaporin: water channel protein in a cell (allow water to pass)
osmosis: diffusion of water through a selectively permeable membrane
isotonic: when the concentration of two solutions is the same
hypertonic when compairing two solutions, the solution with the greater concentration of solutes
hypotonic: when compaining two solutions, the solution with the lesser concentration of solutes
osmotic pressure = pressure that must be applied to prevent osmotic movement across a selectively permeable membrane

Cellular cytoplasm consists of many different substances dissolved in water. The solute particles move constantly.

The particles collide with one another and tend to spread out randomly. The particles tend to move from an area where they are more concentrated to an area where they are less concentrated.

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

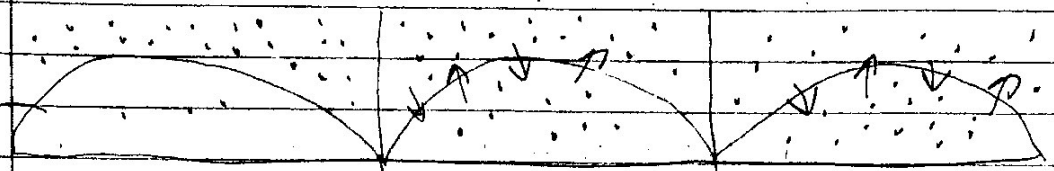
If a substance is present in unequal concentrations on either side of a cell membrane, and if the substance can cross the cell membrane, its particles will tend to move toward the area where it is less concentrated until it is evenly distributed.

Once the concentration of the substance on both sides of the cell membrane is the same equilibrium is reached.

Even when equilibrium is reached, particles of a solution continue to move across the membrane in both directions. But because almost equal numbers of particles move in each direction, the concentration does not further change

Diffusion depends on random particle movements. Thus, substances diffuse across membranes without requiring the cell to use additional energy.

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



The outside has more concentration of solute than the inside of membrane	The solute particles move sides so the concentration on both sides are equal	Even if it is equal, the particles move, but they all move at equal rats so concentration is same

Since cell membranes are built around lipid bilayers, the molecules that pass through them most easily are small and uncharged These properties allow them to dissolve in the membranes lipid environment

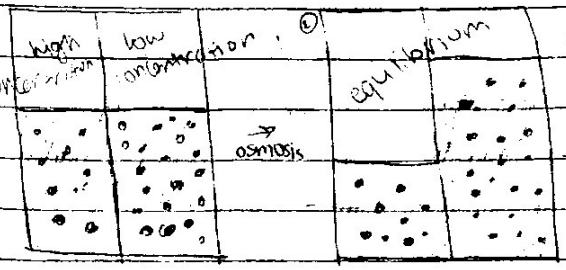
There are proteins in the cell membrane that act as carriers, or channels, which make it easy for certain molecules to pass

Facilitated diffusion is when molecules that cannot directly diffuse across the membrane pass through special protein channels

facilitated diffusion does not require any additional use of the cells energy

In osmosis, molecules move from an area of higher concentration to an area of lower concentration. BA, the molecules that move are water molecules and not solute molecules

concentration is referring to water concentration



In the first beaker, there was a higher concentration of water in the first side. This is because there is less solvent molecules than the 2nd side. This means that there is more water on the first side and less water on the second side because they have same volume. To balance the amount of water on both sides, water molecules move to the side with more solvent molecules.

If a solution is hypertonic, a net movement of water molecules out of the cell causes it to shrink

If a solution is hypotonic, a net movement of water molecules into the cell causes it to swell.

The net movement of water out of or into a cell produces a force known as osmotic pressure.

Cells contain salts, sugars, proteins, and other dissolved so they are almost hypotonic to fresh water. As a result, water tends to move quickly into a cell, causing it to swell and burst

That is why, cells are usually bathed in isotonic fluids. The concentration of dissolved materials in these isotonic fluids are roughly equal to those in the cells themselves.

Some cells such as bacteria and plant cells have cell walls that prevent the cells from expanding even under osmotic pressure.

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

The active transport of small molecules or ions across a cell membrane is generally carried out by transport proteins (proten pumps) that are found in the membrane itself.

Larger molecules and clumps of material can also be actively transported across the cell membrane by processes known as endocytosis and exocytosis. called bulk transport

The transport of the larger materials sometimes involves changes in the shape of the cell membrane.

Many cells use protein pumps to move calcium, potassium, and sodium ions across cell membranes

A considerable portion of the energy used by cells in their daily activities is spent providing the energy to keep this form of active transport working.

The use of energy in these systems enables cells to concentrate substances in a particular location, even when the forces of difussion might tend to move these substances in the opposite direction.

Endocytosis is the process of taking material into the cell by means by infoldings, or pockets, of the cell membrane. The pocket that results breaks loose from the outer portion of the cell membrane and forms a vesicle or vacuole within the cytoplasm. Large molecules, clumps of food, even whole cells can be taken up this way.

Phagocytosis is a type of endocytosis, in which extensions of cytoplasm surround a particle and

package it within a food vacuole. The cell then engulfs it.

Engulfing materials in this way conserves energy and is considered a form of active transport.

Pinocytosis is when many cells take up liquid from the surrounding environment. Tiny pockets form along the cell membrane, fill with liquid, and pinch off to form vacuoles within the cell.

Exocytosis is when many cells release large amounts of material.

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

Definitions:

homeostasis: the relatively constant internal physical and chemical conditions that organisms maintain

tissue: a group of similar cells that perform a particular function

organ: a group of tissues that work together to perform closely related function

organ system: a group of organs that work together to perform a specific function

There are many uni-cellular organisms. More than multicellular.

To stay in homeostasis, uni-cellulars grow, respond to the environment, change food or sunlight into useful energy, and reproduce.

Single-celled organisms include both prokaryotes and eukaryotes

Prokaryotes (especially bacteria) are very adaptable. They live almost everywhere: soil, leaves, ocean, air, and humans.

Many eukaryotes are single-celled too.

Cells in a multicellular organism become specialized for certain jobs. They communicate with one another to maintain homeostasis.

Each specialized cell helps the organism maintain homeostasis

Levels of organisation:
cell → tissue → organ → organ system
basic unit of life — group of cells — group of tissues — group of organs

Levels of organization example:
muscle cell → smooth muscle tissue → stomach → digestive system

Difference of equilibrium and isotonic = equilibrium

solvent = something that solutes dissolve in. Ex = water
solute = something that dissolves in a solute Ex = salt

Cells in a large organism communicate by means of chemical signals that are passed from one cell to another.

These cellular signals can speed up or slow down the activities of the cells that receive them and can even cause the cell to change what it is doing in a most dramatic way

certain cells form connections, or cellular junctions to neighboring cells. Some of these junctions, hold cells together firmly

others allow small molecules carrying chemical messages or signals to pass directly from one cell to the next

To respond to one of these chemical signals, a cell must have a receptor to which the signaling molecule can bind

Some receptors are on the cell membrane; receptors for other types of signals are inside the cytoplasm

the chemical signals sent by various types of cells can cause important changes in cellular activity.