



Cell

Structure and Function

Overview

- Basic unit of life
- Vary in size, shape and function
- Microscopic – only the ovum is visible to the naked eye
- Cells show all characteristics of life

Characteristics of Life

- Organization
- Growth
- Metabolism
- Responsiveness
- Reproduction
- Homeostasis

Common cell characteristics

- Plasma Membrane
 - Separates the cell from the external environment
- Cytoplasm
 - Mainly water - cytosol
- Organelles
 - Little organs
- Inclusions
 - Other molecules: fats, proteins, etc.

Plasma Membrane

- Selectively or semi-permeable
- Divides fluid into extracellular/intracellular
- Hydrophilic vs. hydrophobic
- Receptor for hormones and neurotransmitters
- Acts in cell to cell recognition

Cell membrane composition

- Fluid Mosaic Model
 - Creates flexibility
 - Double layer
- Phospholipids
 - Allows materials to enter/leave the cell
- Cholesterol
 - Creates rigidity and stability
 - Up to 20% of the membrane by volume

Cell membrane proteins

- Transporters
 - Assist substances in entering/leaving cell
- Receptor sites
 - Attachment points
- Antigens
 - Cell markers identifying particular cell as “self”
- Carbohydrates
 - Assist with cell recognition and cells sticking together

Membrane Extensions

- **Microvilli**
 - Increase surface area
 - Absorptive ability
- **Cilia**
 - Look like hair
 - Found in the mucus membrane and nervous system
- **Flagellum**
 - Whip like tail
 - Creates movement of whole cell - sperm

Cellular Junctions

- Hold cells together to create tissues
- Tight Junctions
 - Waterproof barriers
 - Found in skin and digestive tracts
- Desmosomes
 - Large and protect against friction
 - Skin, mouth, esophagus, vagina
- Gap Junctions
 - Circular proteins between cells
 - Only in heart and unborn's nervous system

Cell Organelles

- Suspended in cytoplasm
- Possess their own membranes – except proteins
- Table 3.1 in book

Cell organelles

- Control center
- Contains the DNA (chromatin)
- Enclosed by nuclear envelope
- Not all cells contain a nucleus
- Prokaryotes – bacteria

- Contains **NUCLEOLUS**
 - Composed of DNA, RNA, and proteins
 - Important manufacturer of ribosomes

Cell organelles

- Ribosomes – site of protein synthesis
- ER
- Two Types
- Rough
 - Ribosomes on surface
 - Synthesizes protein
 - Produces proteins, enzymes, hormones
- Smooth
 - No ribosomes
 - Synthesizes lipids
 - Detoxify drugs ingested by a person

Organelles cont....

- Mitochondria
 - Powerhouse
 - Produce ATP
- Golgi Apparatus
 - Post office of the cell
 - Packages substances for secretion from cell
- Lysosomes
 - Contain digestive enzymes which destroy
 - Worn out cell parts
 - Dead cells
 - Foreign substances, bacteria, etc.

Cell organelles

- Peroxisomes
 - Filled with oxidase enzymes that neutralize free radicals
 - Prevent mutations and cell death
 - Self replicating
- Centrioles
 - Star shaped organelles
 - Used during cell division

Cell Functions

- Protein Synthesis
 - DNA and RNA
 - Site-ribosomes
- Cell Division
 - Mitosis
 - Meiosis
- Movement of substances across the cell membrane
 - Passive and active transport

Cell Transport

- **Passive**

- Does not require energy
- Diffusion
- Osmosis
- Filtration
- Facilitated diffusion

- **Active**

- Required for large molecules
- Uses ATP
- Phagocytosis
- Pinocytosis
- Exocytosis
- Endocytosis

Diffusion

- Molecules move through a membrane in either direction
- No energy
- High concentration to low concentration
- Examples
 - Sugar in water
 - Food coloring in water
 - Perfume odor
 - O₂ and CO₂ exchange

Osmosis

- Diffusion of WATER through a SELECTIVELY PERMEABLE membrane
- No energy
- Moves because of osmotic pressure

Facilitated Diffusion

- Help molecules move through membrane
- No energy
- Uses a carrier enzyme to bring the molecule across
- High to low concentration
- Glucose is an example

Filtration

- Particles move from a place of high water pressure to a place of low water pressure
- Requires mechanical energy – blood pressure
- Examples:
 - Movement of blood/fluid through the kidney, liver, or spleen

Bulk Transport

- Exocytosis
- Large molecules move out of the cell
 - Hormones
 - Mucus secretions
- Endocytosis
- Cell eating
 - Glucose
 - Phagocytosis
 - Only seen in WBC eating bacteria or dead cells
 - Pinocytosis
 - Cellular drinking

Mitosis

- Interphase
 - Normal growth of the cell
 - DNA and centrioles copy
- Prophase
 - Chromosomes and spindles form
 - Nucleus disappears
- Metaphase
 - Chromosomes line up at the equator
- Anaphase
 - Chromosomes separate and migrate to opposite poles
- Telophase
 - New nucleus reforms around each set of DNA

Mitosis

- Most frequently takes place:
 - Epidermis of skin
 - Stomach lining
 - Red bone marrow – 2million new cells/second
- Does not take place
 - Cardiac muscle
 - Central nervous system
 - Muscle cells

Mitosis

- Cytokinesis
 - Division of cytoplasm
 - 2 cells
- Mutation
 - Heredity, viruses, radiation, chemicals
- Atrophy
 - shrink
- Hyperplasia
 - enlarge
- Necrosis
 - Cell death

Meiosis

- Formation of gametes – sex cells
- 4 haploid cells
- Oogenesis = ovum
- Spermatogenesis = sperms
- Fertilization forms diploid zygote
- 8 phases

DNA

- 2 strands
- Bases
 - Adenine
 - Thymine
 - Cytosine
 - Guanine
- Nucleotides = base, sugar and phosphate

RNA

- One strand
- Bases
 - Adenine
 - Uracil
 - Cytosine
 - Guanine
- 3 types
 - tRNA
 - mRNA
 - rRNA