# Cell Structure And function

→ ## Cell : The Basic unit of life

★ ### Cell theory

Three pillars of cell theory

The classical cell theory was developed in the mid 1800s by scientists like Matthias Schleiden, Theodor Schwann and Rudolf Virchow. It consists of three main points.

1. All living organisms are composed of one or more cells. Whether it is a single celled bacteria or a trillion - celled human, life is cellular

2. The cell is the basic structural and functional unit of life. It is the smallest unit that can perform all the chemical processes necessary for an organism to stay alive.

3. All cells arise from pre existing cells. Cell don't just 'appear' out of now where (spontaneous generation) they are produced when a (parent) cell divides

Extensions

- As our technology improved, we added a few more 'modern' rule to the list.

- Energy flow (metabolism) occurs within cells.
- Cells contain hereditary information (DNA) which is passed from cell to cell during division
- All cells are basically the same in chemical composition in organisms of similar species.

☆ · Prokaryotic vs Eukaryotic

These are No membrane bounds nucleus
E.g y Bacteria

Eukaryotic :- has a defined nucleus and a membrane - bound organelles (e.g => Plants, Animals).

☆ Plant vs Animal Cells

Plant cells have a cell wall and Chloroplasts (plastids) animal cell have centrioles and lack rigid wall.

## ⇒ Cell organelles & Structure

• Endomembrane System

Includes the Endoplasmic Reticulum (protien / lipid) Synthesis, Golgi bodies (packaging), Lysosomes (waste disposal) and Vacuoles (storage)

- Powerhouse & Synthesis

Mitochondria (ATP/energy production) and ribosomes (protien Synthesis)

- The Control Center:-

Nucleus contains the nuclear membrane, chromatin (DNA), and the nucleus.

- Support & Movement

Cytoskeleton (structural frame), Cilia and flagella (movement)

## ⇒ Biomolecules

Just a small study about Proteins, carbs, Lipids, Nucleic Acids, Enzymes.

⇒ Proteins

Polymers of amino acids, vital for structure

Date
Page

## Carbohydrates

Sugars and starches used for energy and ~~membranes~~ structures.

## Lipids

Fats and oils used for long ~~term~~ term energy and membranes.

## Nucleic Acids

DNA and RNA · The genetic blueprint

## Enzymes

Biological catalysts that speed up reactions. Their action is often explained by lock and key model.

# ✱ Cell Division

## Cell cycle :-

The series of phases ($G_1$, $G_2$) a cell goes through divide

# Mitosis

Mitosis is a single division that results in two diploid (2n) daughter cells that are genetically identical to the parent.

## The 4 main stages

**Prophase** chromosomes condense and become visible. The nuclear envelope breaks down and spindle fibers form.

**Metaphase** chromosomes line up single file along the metaphase plate (the center of the cell)

**Anaphase** Sister chromatids are pulled apart by spindle fibers toward opposite poles of the cell.

**Telophase** Two new nuclear membranes form around the separated chromosomes The cell then physically split into cytokinesis.

# Meiosis

Meiosis involves two successive divisions (Meiosis 1 and 2) to produce four haploid daughter cells

These cells have half the number of chromosomes and are genetically unique.

Meiosis I (Reductional Division)

Prophase I

A critical step called crossing over occurs here. Homologous chromosomes pair up and exchange segments of DNA, creating genetic variety.

Metaphase I

Homologous pairs lines up in the center

Anaphase I

These pairs are separated, but Sister chromatids stay together.

Telophase I

Two haploid cells are formed

Meiosis II (Equational division)

This stage is very similar to meiosis. The two cells from meiosis I divide again. This time pulling sister chromatids apart. The result is four genetic haploid cells

Date
Page

## Prophase 2

The nuclear envelope breaks down again, and the spindle apparatus forms in the two ~~daughter~~ daughter cells. Produced in meiosis I. Unlike prophase I, no crossing over occurs here.

## Metaphase 2

The chromosomes line up in a single row along the metaphase plate (the center of the cell). Because of the crossing over that happened in meiosis I, the two sister chromatids are no longer genetically identical.

## Anaphase 2

The centromeres finally split. The spindle fibers pull the sister chromatids apart toward opposite poles of the cell. Once separated, each chromatid is considered an individual chromosome.

## Telophase 2 (cytokinesis)

Nuclear membranes form around the four sets of chromosomes. The cells divides (cytokinesis) resulting in four unique haploid daughter cells.

Date
Page

## Significance of Mitosis

Growth
Cell replacement and repair
Asexual reproduction
Maintenance of genetic stability

## Significance of Meiosis

Formation of gametes
Maintenance of Chromosome Number
Genetic variation
Evidence of Evolution