

Difference between Mitosis and Meiosis

Introduction

Mitosis and meiosis are fundamental processes of cell division that facilitate the growth, development, and reproduction of organisms. Mitosis is a process of nuclear division that results in the formation of two genetically identical daughter cells from a single parent cell, primarily for growth and tissue repair in multicellular organisms. Meiosis, on the other hand, is a specialized form of cell division that reduces the chromosome number by half, producing four genetically distinct gametes or spores, essential for sexual reproduction in eukaryotes. Here we discuss the similarities and difference between mitosis and meiosis with a comparison table. You can download the notes as PDF from the download link provided below.

Difference between Mitosis and Meiosis

Aspect	Mitosis	Meiosis
Purpose	Growth, repair, and asexual reproduction	Sexual reproduction – production of gametes
Number of Divisions	One division	Two sequential divisions (Meiosis I and Meiosis II)
Phases	Prophase, Metaphase, Anaphase, Telophase	Meiosis-I: Prophase I, Metaphase I, Anaphase I, Telophase I Meiosis-II: Prophase II, Metaphase II, Anaphase II, Telophase II
Number of Daughter Cells	Two daughter cells are formed	Four daughter cells are formed
Genetic Composition of Daughter Cells	Genetically identical to the parent cell	Genetically diverse, each with half the chromosome number
Chromosome Number	Maintains the same chromosome number as the parent cell (diploid)	Reduces the chromosome number by half (haploid)
Occurrence	Occurs in somatic cells	Occurs in germ cells (gametes)
Homologous Chromosome Pairing	No pairing of homologous chromosomes occurs	Homologous chromosomes pair and undergo synapsis
Crossing Over	No crossing over occurs	Crossing over occurs during Prophase I, leading to genetic recombination
Centromere Division	Centromeres divide during anaphase	Centromeres do not divide during Meiosis I but do during Meiosis II
Synapsis of Homologs	Does not occur	Occurs during Prophase I

Spindle Formation	Occurs once	Occurs twice (one in meiosis I and another in meiosis II)
Daughter Cell Chromosome Number	Diploid (2n)	Haploid (n)
Genetic Variation	No genetic variation introduced	Genetic variation introduced through crossing over and independent assortment
Cytokinesis	Occurs once after mitosis	Occurs twice, once after each meiotic division
Chromosome Behavior	Chromosomes line up individually on the metaphase plate	Homologous chromosomes line up as tetrads on the metaphase plate during Meiosis I
Disjunction	Sister chromatids separate during anaphase	Homologous chromosomes separate during Anaphase I; sister chromatids separate during Anaphase II

Similarities Between Mitosis and Meiosis

- **Basic Process of Division:** Both mitosis and meiosis involve the division of a parent cell into daughter cells through stages that include prophase, metaphase, anaphase, and telophase.
- **Requirement of DNA Replication:** Both processes are preceded by a single round of DNA replication during the S phase of the cell cycle.
- **Role of Spindle Apparatus:** In both processes, the spindle apparatus is crucial for the separation of chromosomes and their movement to opposite poles of the cell.



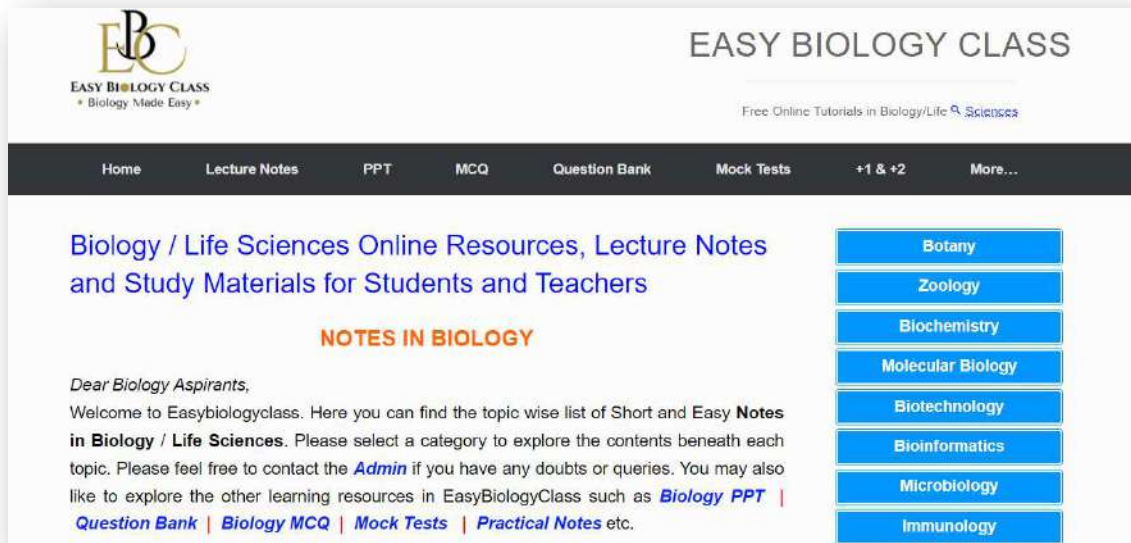
- **Involvement of Cytokinesis:** Both processes conclude with cytokinesis, where the cytoplasm divides, resulting in separate daughter cells.
- **Phases of Division:** Both mitosis and meiosis include similar phases, albeit in meiosis the sequence is repeated with modifications during meiosis I and II.

Summary

Mitosis and meiosis are critical cellular processes with distinct roles in growth, development, and reproduction. Mitosis ensures the maintenance of genetic consistency across somatic cells, facilitating organismal growth and repair. In contrast, meiosis introduces genetic diversity through the production of haploid gametes, essential for sexual reproduction and evolution.

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