SIGNIFICANCE OF MEIOSIS

Meiosis holds considerable biological significance, contributing to various aspects of sexual reproduction and genetic diversity.

- **Formation of Gametes:** Meiosis is pivotal for the production of gametes, the specialized reproductive cells essential for sexual reproduction. Gametes, such as sperm and egg cells, are instrumental in the formation of a new organism through fertilization, where the fusion of two gametes leads to the creation of a zygote.
- **Maintenance of Chromosome Number:** A crucial role of meiosis is the reduction of the chromosome number in gametes. By halving the chromosome count during meiosis, the resulting gametes possess half the diploid chromosome number. This reduction ensures that during fertilization, when two gametes fuse, the original diploid chromosome number is restored in the zygote. This intricate process creates a paradoxical interplay of reducing and restoring chromosome numbers.
- **Introduction of Variations:** Meiosis introduces genetic variability through the formation of new combinations of chromosomes. The exchange of genetic material during crossing over in Prophase I and the independent assortment of chromosomes during metaphase I contribute to the creation of genetically distinct gametes. These variations play a crucial role in enhancing genetic diversity within a population, ultimately influencing the adaptability and evolution of species. The variability introduced by meiosis is fundamental to the evolutionary success of sexually reproducing organisms.

Difference between Mitosis and Meiosis			
	Mitosis		**Meiosis**
1	The cells undergoing mitosis may be haploid or diploid.	1	The cells undergoing meiosis are always diploid.
2	It is a single division which produces two cells.	2	Meiosis is a double division. It gives rise to four cells.
3	Subsequent mitotic divisions are similar to earlier ones.	3	The two divisions of meiosis are not similar. The first one is the heterotypic or reductional while the second one is homo typic or equational like mitosis.
4	Each chromosome replicates in the interphase before every division.	4	The chromosomes replicate only once, prior to meiosis.
5	The number of chromosomes remains the same after mitosis.	5	The number of chromosomes is reduced to one half after Meiosis.
Prophase			
6	Prophase is of shorter duration.	6	Prophase I is of longer duration while prophase II is very brief.
7	Each chromosome has two distinct chromatids.	7	Chromosomes of prophase I do not show distinct chromatids.
8	No bouquet stage is recorded.	8	Chromosomes of animals and some plants show convergence towards one side during early prophase I. It is known as bouquet stage.
9	Pairing of chromosomes does not occur in mitosis	9	Pairing or synapsis of homologous chromosomes takes place during zygotene of prophase I and continues up to metaphase-I

10	A synaptonemal complex is absent.	**10**	Synapsed homologous chromosome develop a synaptonemal complex.
11	Crossing over is absent.	**11**	Crossing over or exchange of similar segments between nonsister chromatids of homologous chromosomes usually takes place during pachytene stage.
12	Chiasmata are absent.	**12**	Chiasmata or visible connections between homologous chromosomes of bivalents are observed during diplotene, diakinesis
Metaphase			
13	Centromeres produce a single metaphasic plate.	**13**	A double metaphasic plate is formed by centromeres in metaphase I but only one in metaphase II.
14	Only the centromeres lie at the equator. The limbs of chromosomes are oriented in various directions.	**14**	Limbs of the chromosomes mostly lie at the equator while the centromeres project towards the poles in metaphase I.
15	A centromere is connected with both the spindle poles.	**15**	A centromere is connected to one spindle pole in metaphase I but both in metaphase II.
16	Two chromatids of a chromosome are genetically similar.	**16**	The two chromatids of a chromosome are often genetically dissimilar due to crossing over.
Anaphase			
17	A centromere splits length-wise to form two centromeres in the beginning of anaphase.	**17**	Centromeres do not divide during anaphase I but do so in anaphase II.
18	Anaphasic chromosomes are single stranded.	**18**	Chromosomes are double stranded in anaphase I but single stranded in anaphase II.
Telophase			
19	Telophase is longer and produces interphase nuclei.	**19**	Telophase I is shorter and nuclei never enter the inter-phase.
Cytokinesis			
20	Cytokinesis follows every mitosis. It produces two cells.	**20**	Cytokinesis often does not occur after the first or reductional division. It is then simultaneous after second division to result in four new cells.