

#424447

Topic: Mitosis

Distinguish cytokinesis from karyokinesis.

Solution

Cytokinesis	Karyokinesis
(i) Cytokinesis is the biological process involving the division of a cell's cytoplasm during mitosis or meiosis.	(i) Karyokinesis is the biological process involving the division of a cell's nucleus during mitosis or meiosis.
(ii) Stages such as prophase, metaphase, anaphase, and telophase are not present in cytokinesis.	(ii) It is divided into four stages – prophase, metaphase, anaphase, and telophase.

#424448

Topic: Cell cycle

Describe the events taking place during interphase?

Solution

Interphase involves a series of changes that prepare a cell for division. It is the period during which the cell experiences growth and DNA replication in an orderly manner.

Interphase is divided into three phases :

(i) G_1 phase

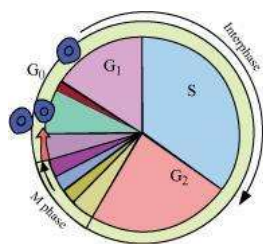
(ii) S phase

(iii) G_2 phase

G_1 phase – It is the stage during which the cell grows and prepares its DNA for replication. In this phase, the cell is metabolically active.

S phase – It is the stage during which DNA synthesis occurs. In this phase, the amount of DNA (per cell) doubles, but the chromosome number remains the same.

G_2 phase – In this phase, the cell continues to grow and prepares itself for the division. The proteins and RNA required for mitosis are synthesised during this stage.



#424449

Topic: Cell cycle

What is G_0 (quiescent phase) of cell cycle?**Solution**

G_0 or quiescent phase is the stage where cells remain metabolically active, but do not proliferate unless called to do so. Such cells are used for replacing the cells lost during injury.

#424450

Topic: Mitosis

Why is mitosis called as equational division?

Solution

Mitosis is the process of cell division wherein the chromosomes replicate and gets equally distributed into two daughter cells. The chromosome number in each daughter cell is equal to that in the parent cell, i.e., diploid. Hence, mitosis is known as equational division.

#424451

Topic: Meiosis

Name the stage of cell cycle at which one of the following events occur.

- (i) Chromosomes are moved to spindle equator.
- (ii) Centromere splits and chromatids separate.
- (iii) Pairing between homologous chromosomes takes place.
- (iv) Crossing over between homologous chromosomes takes place.

Solution

- (i) Metaphase
- (ii) Anaphase
- (iii) Zygotene of meiosis I
- (iv) Pachytene of meiosis I

#424452

Topic: Meiosis

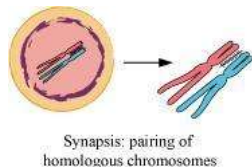
Describe the following :

- (a) Synapsis
- (b) Bivalent
- (c) Chiasmata

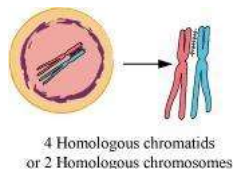
Draw a diagram to illustrate your answer.

Solution

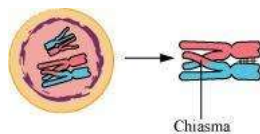
(a) Synapsis : The pairing of homologous chromosomes is called as synapsis. This occurs during the second stage of prophase I or zygotene.



(b) Bivalent : Bivalent or tetrad is a pair of synapsed homologous chromosomes. They are formed during the zygotene stage of prophase I of meiosis.



(c) Chiasmata : Chiasmata is the site where two non-sister chromatids have crossed over. It represents the site of cross-over. It is formed during the diplotene stage of prophase I of meiosis.



#424453

Topic: Mitosis

How does cytokinesis in plant cells differ from that in animal cells?

Solution

Cytokinesis in plant cells	Cytokinesis in animal cells
The division of the cytoplasm takes place by cell plate formation.	The division of the cytoplasm takes place by cell furrow method.
Cell plate formation starts at the centre of the cell and grows outward, toward the lateral walls.	Furrow starts at the periphery and then moves inward, dividing the cell into two parts.

#424454

Topic: Meiosis

Find examples where the four daughter cells from meiosis are equal in size and where they are found unequal in size.

Solution

(a) Spermatogenesis or the formation of sperms in human beings occurs by the process of meiosis. It results in the formation of four equal-sized daughter cells.

(b) Oogenesis or the formation of an ovum in human beings occurs by the process of meiosis. It results in the formation of four daughter cells which are unequal in size, i.e., a large mature ovum and 3 small polar bodies.

#424455

Topic: Meiosis

Distinguish anaphase of mitosis from anaphase I of meiosis.

Solution

Anaphase of mitosis	Anaphase I of meiosis
1. The centromere of every chromosome divides.	1. The centromere do not divide.
2. Separation of sister chromatids takes place.	2. Homologous chromosomes are separated.
3. Only one chromatid of every chromosome moves to the pole.	3. Each homologous pair of chromosomes moves to the pole with both the chromatids.
4. The chromatids moving to one pole are genetically identical to those moving to the opposite pole.	4. The chromosomes moving to one pole are not genetically identical to those moving to the opposite pole.

#424456

Topic: Meiosis

List the main differences between mitosis and meiosis?

Solution

<u>Mitosis</u>	<u>Meiosis</u>
1) This division takes place in somatic cells and as a result of this division growth occurs.	1) This takes place usually in reproductive cells and as a result of this character one generation pass into the other.
2) Completed in one stage.	2) Completed in two stages.
3) Prophase is smaller (as compared to prophase of Meiosis).	3) Prophase longer than prophase of mitosis and divided into five substages.
4) No crossing over takes place.	4) Crossing over takes place in which exchange of segments of chromatids occurs.
5) Synapsis does not take place at metaphase.	5) Synapsis between homologous chromosomes takes place (bivalent stage).
6) At metaphase, centromere is towards equatorial plate and ends of chromosomes towards poles. Centromere divides.	6) At metaphase I, the centromere is towards poles and ends of chromosomes towards equatorial plate. Centromere does not divide.
7) Chromatids are long and thin.	7) Chromatids are shorter and thick
8) Cytokinesis follows karyokinesis.	8) After Telophase I, cytokinesis does not takes place always (may occur).

#424457

Topic: Meiosis

What is the significance of meiosis?

Solution

The significance of meiosis:

1. It maintains the same chromosome number in the sexually reproducing organisms.
2. It restricts the multiplication of chromosome number and maintains the stability of the species.
3. Maternal and paternal genes get exchanged during crossing over. It results in variations among the offspring.

#424459

Topic: Cell cycle

Can there be mitosis without DNA replication in S phase?

Solution

Mitotic cell division cannot take place without DNA replication in S phase. Two important events take place during S phase – one is the synthesis or duplication of DNA and the other is the duplication of the centriole. DNA duplication is important as it maintains the chromosome number in the daughter cells and hence mitosis is an equational division. Therefore, the duplication of DNA is an essential step and without it, no mitosis can take place.

#424460

Topic: Cell cycle

Can there be DNA replication without cell division?

Solution

There can be DNA replication without cell division. During cell division, the parent cell gets divided into two daughter cells. However, if there is a repeated replication of DNA without any cell division, then this DNA will keep accumulating inside the cell. This would increase the volume of the cell nucleus, thereby causing cell expansion. An example DNA duplication without cell division is commonly observed in the salivary glands of *Drosophila*. The chromosome undergoing repeated DNA duplication is known as a polytene chromosome.

#424461**Topic:** Cell cycle

Analyse the events during every stage of the cell cycle and notice how the following two parameters change:

- (i) Number of chromosomes (N) per cell
- (ii) Amount of DNA content (C) per cell

Solution

During meiosis, the number of chromosomes and the amount of DNA in a cell change.

- (i) Number of chromosomes (N) per cell

During anaphase I of the meiotic cycle, the homologous chromosomes separate and start moving toward their respective poles. As a result, the bivalents get divided into two sister chromatids and receive half the chromosomes present in the parent cell. Therefore, the number of chromosomes reduces in anaphase I.

- (ii) Amount of DNA content (C) per cell

During anaphase II of the meiotic cycle, the chromatids separate as a result of the splitting of the centromere. It is the centromere that holds together the sister chromatids of each chromosome. As a result, the chromatids move toward their respective poles. Therefore, at each pole, a haploid number of chromosomes and a haploid amount of DNA are present. During mitosis, the number of chromosomes remains the same. The DNA duplicated in the S phase gets separated in the two daughter cells during anaphase. As a result, the DNA content (C) of the two newly-formed daughter cells remains the same.

#526160**Topic:** Meiosis

Can you recall meiosis and indicate at what stage a recombinant DNA is made?

Solution

Pachytene is marked by completion of lateral pairing of homologous chromosomes along the entire length of chromosome and crossing over. Crossing over is the process of exchange of genetic material between non-sister chromatids of homologous chromosomes to produce new genetic combinations or variations. The chromosomes after crossing over contain new genetic combinations and represent rDNA.