

NCERT Class 11 Biology Chapter 10 – Cell Cycle and Cell Division

1. What is the average cell cycle span for a mammalian cell?

Solution:

The average cell cycle span for a mammalian cell is 24 hours.

2. Distinguish cytokinesis from karyokinesis.

Solution:

Cytokinesis

It is the cell division of cytoplasm that occurs during the M phase of the cell cycle.

Karyokinesis

It is the separation of daughter chromosomes corresponding to the M phase of the cell cycle

3. Describe the events taking place during interphase.

Solution:

Events taking place during interphase are as follows:

- G₁ phase (Gap 1) – During this stage, the cell is metabolically active. It grows and prepares the DNA to replicate.
- S phase (Synthesis) – During this stage, the synthesis of DNA takes place. The DNA quantity doubles, whereas the number of chromosomes remains unchanged
- G₂ phase (Gap 2) – During this phase, the cell advances to grow and prepares itself for division. It is during this stage that the RNA and proteins that are required for mitosis are generated.

4. What is G₀ (quiescent phase) of cell cycle?

Solution:

In adult animals, some cells will not exhibit cell division, and many other cells occasionally divide when there is a need to replace cells that have been lost because of injury or cell death. These cells exit the G₁ phase to enter an inactive stage of the cell cycle called the G₀ phase. Cells in the G₀ phase do not proliferate unless called on to do so. Hence, the cells in this phase tend to become inactive, stop dividing and become specialized through the differentiation process.

5. Why is mitosis called equational division?

Solution:

Mitosis is called equational division because the number of chromosomes in the parent and progeny cells is the same.

6. 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) Chromosomes are moved to the spindle equator in the Metaphase.
- ii) Centrosomes split, and chromatids separate in the Anaphase
- iii) Pairing between homologous chromosomes takes place in the Zygotene stage of prophase 1 in meiosis
- iv) Crossing over between homologous chromosomes takes place during the Pachytene stage of prophase 1 in meiosis

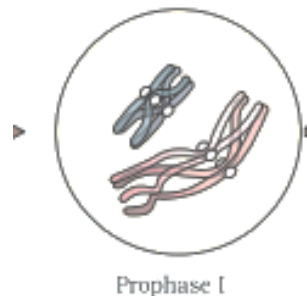
7. Describe the following:

(a) synapsis (b) bivalent (c) chiasmata

Draw a diagram to illustrate your answer.

Solution:

a) Synapsis – Homologous chromosomes pair together during Zygotene of prophase-I of meiosis. This pairing is called synapsis.



b) Bivalent or tetrad is the pair of complexes formed by a pair of synapsed homologous chromosomes during the zygotene of prophase I of meiosis.



A Tetrad
4 Homologous Chromatids
Or 2 Homologous Chromosomes

c) Chiasmata

During diplotene, the paired chromosomes form an X-shaped structure known as chiasmata. At chiasmata, the crossing over between two non-sister chromatids takes place.

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

Solution:

Plant cytokinesis

Occurs by cell plate formation

Cell plate moves to the centre and extends towards the exterior

The fusion of vesicles originates in cell plate formation

Midbody is not formed

Animals cytokinesis

Takes place by cleavage

Cleavage begins at the periphery and advances inwards

Cleavage starts with the contraction of a peripheral ring of microfilaments

Midbody is formed with dense material in the middle of the cell.

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

Solution:

During the formation of male gametes in human beings (sperms), the four daughter cells formed during meiosis are equal in size. The formation of the female gamete (ovum) during meiosis results in the formation of four daughter cells, unequal in size. The unequal daughter cells are – one big mature ovum and 3 small polar bodies.

10. Distinguish anaphase of mitosis from anaphase I of meiosis.

Solution:

The differences are as follows:

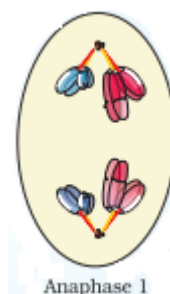
Anaphase of mitosis

Centromere splits and chromatids separate



Anaphase I of meiosis

centromere does not split, and sister chromatids remain associated at their centromere



11. List the main differences between mitosis and meiosis.

Solution:

The differences are as follows:

Mitosis

Occurs in somatic cells

The number of chromosomes stays the same as the parent cell

Two daughter cells are formed

Chromosomes replicate before each mitotic division

Meiosis

Occurs in germ cells

The number of chromosomes gets halved in comparison to parent cells.

Four daughter cells are formed

Chromosomes do not replicate before each meiotic division

12. What is the significance of meiosis?

Solution:

Significances of Meiosis:

- It conserves the specific chromosome numbers of each species achieved across generations.
- Enhances the genetic variability in the population of organisms from generation to generation. These variations are significant for the evolution process.
- It produces gametes for sexual reproduction
- Promotes crossing over. It introduces a new combination of variations or traits
- Chromosomal mutations can occur due to abnormalities during meiosis. A few of these can be beneficial to organisms.

13. Discuss with your teacher about

(i) haploid insects and lower plants where cell division occurs.

(ii) some haploid cells in higher plants where cell division does not occur.

Solution:

i) Haploid insects where cell division occurs are drones of the honey bee, and lower plants are Spirogyra, Chlamydomonas, and Pteridophytes. These haploid gametes are produced by them through mitosis and not meiosis.

ii) Spermatozoa and ova of higher animals and microspores of higher plants will not undergo cell division.

14. Can there be mitosis without DNA replication in the 'S' phase?

Solution:

During the S phase, DNA synthesis or replication of DNA takes place. DNA replication is essential for cell division.

Without DNA replication, cell division will not take place.

15. Can there be DNA replication without cell division?

Solution:

Yes, DNA replication can take place without cell division. In order to prepare for cell division, DNA replication is necessary. Cell division is the succeeding logical step that occurs post cell division.