CHAPTER

10 CELL CYCLE AND CELL DIVISION

CLASS 11TH

NCERT EXERCISE AND SOLUTIONS - BIOLOGY

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

ANSWER:-

The cell cycle of a typical mammalian cell has an average duration of 24 hours.

Q. 2. Distinguish cytokinesis from karyokinesis.

ANSWER:-

Cytokinesis	Karyokinesis
Refers to the division of the cytoplasm during the M phase of the cell cycle.	Refers to the division of the nucleus, involving the separation of daughter chromosomes during the M phase of the cell cycle.

Q. 3. Describe the events taking place during interphase.

ANSWER:-

The interphase involves the following events:

- **G1 Phase (Gap 1):** The cell remains metabolically active, grows in size, and prepares for DNA replication.
- **S Phase (Synthesis):** DNA synthesis occurs, doubling its quantity, while the number of chromosomes remains constant.
- **G2 Phase (Gap 2):** The cell continues to grow and prepares for division by producing RNA and proteins necessary for mitosis.

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

ANSWER:-

In adult animals, certain cells do not undergo cell division, while others divide occasionally to replace cells lost due to injury or cell death. These cells leave the G1 phase and enter an inactive stage of the cell cycle known as the G0 phase. Cells in the G0 phase remain dormant and do not proliferate unless triggered. During this phase, the cells cease division and become specialized through the process of differentiation.

Q. 5. **Why is mitosis called equational division?**

ANSWER:-

Mitosis is referred to as equational division because it ensures that the chromosome number remains identical in both the parent and daughter cells.

Q. 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.

ANSWER:-

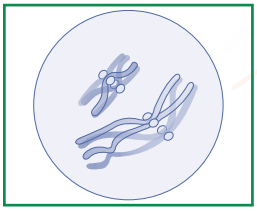
i. During Metaphase, chromosomes align at the spindle equator.
ii. In Anaphase, centromeres divide, and chromatids separate.
iii. Pairing of homologous chromosomes occurs in the Zygotene stage of prophase I during meiosis.
iv. Crossing over between homologous chromosomes happens in the Pachytene stage of prophase I during meiosis.

Q. 7. **Describe the following:**

(a) synapsis
(b) bivalent
(c) chiasmata
Draw a diagram to illustrate your answer.

ANSWER:-

a. **Synapsis:** Homologous chromosomes pair up during the Zygotene stage of prophase I in meiosis, a process referred to as synapsis.



b. **Bivalent or Tetrad:** A bivalent or tetrad is the structure formed by a pair of synapsed homologous chromosomes during the Zygotene stage of prophase I in meiosis.

A Tetrad 4 Homologous Chromatids Or 2 Homologous Chromosomes

c. **Chiasmata:** During Diplotene, paired chromosomes form X-shaped structures called chiasmata. These are the sites where crossing over occurs between two non-sister chromatids.

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

ANSWER:-

Plant Cytokinesis	Animal Cytokinesis
Occurs through the formation of a cell plate.	Happens via the process of cleavage.
The cell plate develops at the center and extends outward.	Cleavage begins at the periphery and progresses inward.
Vesicle fusion leads to the formation of the cell plate.	Cleavage starts with the contraction of a peripheral ring of microfilaments.
No midbody is formed	A midbody with dense material forms in the center of the cell.

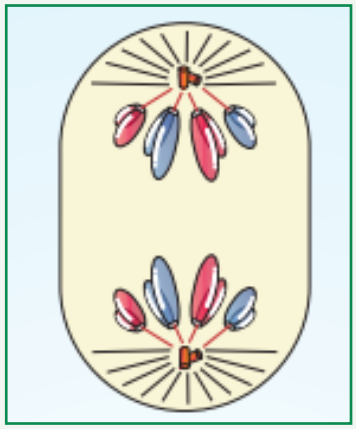
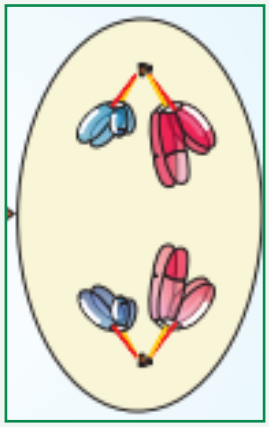
Q. 9. Find examples where the four daughter cells from meiosis are equal in size and where they are found unequal in size.

ANSWER:-

In humans, during the production of male gametes (sperms), meiosis results in four daughter cells of equal size. However, during the formation of the female gamete (ovum), meiosis produces four daughter cells of unequal size: one large, mature ovum and three smaller polar bodies.

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

ANSWER:-

Anaphase of Mitosis	Anaphase I of Meiosis
The centromere splits, and chromatids separate.	The centromere remains intact, and sister chromatids stay connected at the centromere.
	

Q. 11. List the main differences between mitosis and meiosis.

ANSWER:-

Mitosis	Meiosis
Takes place in somatic cells.	Occurs in germ cells.
Maintains the same chromosome number as the parent cell.	Reduces the chromosome number to half compared to the parent cell.
Results in the formation of two daughter cells.	Results in the formation of four daughter cells.
Chromosomes replicate prior to every mitotic division.	Chromosomes do not replicate before each meiotic division.

Q. 12. What is the significance of meiosis?

ANSWER:-

Significance of Meiosis:

- Maintains the constant chromosome number of a species across generations.
- Increases genetic diversity within populations across generations, which plays a vital role in the evolutionary process.
- Facilitates the production of gametes necessary for sexual reproduction.
- Encourages crossing over, leading to new combinations of traits or variations.
- May result in chromosomal mutations due to meiotic abnormalities, some of which can be advantageous for the organism.

Q. 13. Discuss with your teacher about

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

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

ANSWER:-

i. Haploid organisms where cell division occurs include drones of honeybees and lower plants like *Spirogyra*, Chlamydomonas, and Pteridophytes. These organisms produce haploid gametes through mitosis instead of meiosis.

ii. Spermatozoa and ova in higher animals, as well as microspores in higher plants, do not undergo cell division.

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

ANSWER:-

During the S phase, DNA synthesis or replication occurs, which is crucial for cell division.

Cell division cannot proceed without the replication of DNA.

Q. 15. Can there be DNA replication without cell division?

ANSWER:-

Yes, DNA replication can occur independently of cell division. It is a prerequisite for cell division, serving as a preparatory step. Cell division logically follows DNA replication.

Q. 16. Analyse the events during every stage of 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

ANSWER:-

i. Yes, DNA replication can occur during the G1 phase of the cell cycle. At this stage, the number of chromosomes remains constant, and each chromosome consists of a single chromatid. In the S phase, each chromosome forms two sister chromatids connected at the centromere. This arrangement persists through the G2 phase, while in the M phase, sister chromatids separate and are distributed into different cells. The chromosome number remains unchanged during mitosis.

ii. The DNA content in the cell remains constant during the G1 phase. However, it doubles during the S phase due to DNA replication. The doubled DNA content is maintained in the G2 phase but reduces by half during the M phase as the cell divides.