

**Exercise Questions**

Page number – 171-172

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

Average cell cycle span for a mammalian cell is 24 hours.

**2. Distinguish cytokinesis from karyokinesis.****Solution:**

<b>Cytokinesis</b>	<b>Karyokinesis</b>
It is the cell division of cytoplasm occurs during the M phase of the cell cycle.	It is the separation of daughter chromosomes corresponding to M phase of cell cycle

**3. Describe the events taking place during interphase.****Solution:****Events taking place during interphase are as follows:**

- $G_1$  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
- $G_2$  phase (Gap 2) – During this phase, the cell advances to grow and prepare itself for division. It is during this stage that the RNA and proteins that are required for mitosis are generated.

**4. What is  $G_0$  (quiescent phase) of cell cycle?****Solution:**

In adult animals some cell will not exhibit the cell division, and many other cells occasionally divide when there is need to replace cells that have lost because of injury or cell death. These cells exit the  $G_1$  phase to enter inactive stage of the cell cycle called  $G_0$  phase. Cells in  $G_0$  phase does 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) Centromeres split and chromatids separate in the Anaphase
- iii) Pairing between homologous chromosomes take 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

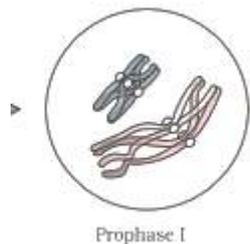
7. Describe the following:

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

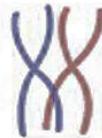
Draw a diagram to illustrate your answer.

**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 complex formed by a pair of synapsed homologous chromosome 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	Animals cytokinesis
Occurs by cell plate formation	Takes place by cleavage
Cell plate moves to the centre and extends towards the exterior	Cleavage begins at the periphery and advances inwards
The fusion of vesicles originates in cell plate formation	Cleavage starts with contraction of a peripheral ring of microfilaments
Midbody is not formed	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.**

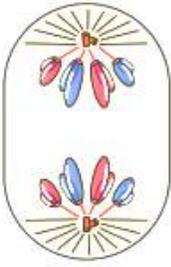
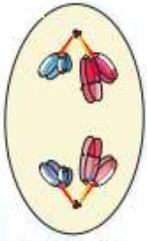
**Solution:**

During formation of male gametes in human beings (sperms), four daughter cell formed during meiosis are equal in size. The formation of female gamete (ovum) during meiosis results in 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	Anaphase I of meiosis
Centromere splits and chromatids separate	centromere does not split and sister chromatids remain associated at their centromere
 <p>Anaphase</p>	 <p>Anaphase I</p>

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

**Solution:**

The differences are as follows:

Mitosis	Meiosis
Occurs in somatic cells	Occurs in germ cells
Number of chromosomes stays the same as the parent cell	The number of chromosomes gets halved in comparison to parent cells.
Two daughter cells are formed	Four daughter cells are formed
Chromosomes replicate before each mitotic division	Chromosomes does not replicate before each meiotic division

**12. What is the significance of meiosis?**

**Solution:**

Significances of Meiosis:

- It conserves specific chromosome number of each species achieved across generation.
- Enhances the genetic variability in the population of organisms from generation to generations. These variation 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. Few of these can be beneficial to organisms.

**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.**

**Solution:**

- i) Haploid insects where cell division occurs is drones of honey bee and lower plants are Spirogyra, Chlamydomonous, 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 ‘S’ phase?**

**Solution:**

During 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.

**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**

**Solution:**

i) Yes, DNA replication can take place in G<sub>1</sub> phase of cell cycle. The number of chromosomes remain the same and each chromosome is formed from one chromatid. In the S phase, chromosome is formed by two sister chromatids joined at the centromere. Similar conditions continue in the G<sub>2</sub> phase, while in M phase, sister chromatids separate and move to different cells. The number of chromosomes stays the same in mitosis.

ii) Amount of DNA content in the cell remains the same in G<sub>1</sub> phase but in S phase it doubles as the DNA replication takes place. It remains double in G<sub>2</sub> phase but halved in the M phase of the cell cycle.