

Unit 5: Cell Cycle

Short Questions

1. Define Cell cycle. Text Book Page # 87 (LHR 2015, GRW 2013, BWP 2014)

Ans: **Definition:**

“The series of events from the time a cell is produced until it completes mitosis and produces new cells is called cell cycle”.

The major phases of cell cycle are:

- (i) Interphase
- (ii) Metaphase

2. Define Interphase.

Ans: “Interphase is the time when a cell’s metabolic activity is very high, as it performs various functions”.

It is divided into three phases:

- (i) G1 Phase (First Gap)
- (ii) S – Phase (Synthesis Phase)
- (iii) G2 Phase (Second Gap)

3. What are the changes that occur in a cell during G1 phase? (LHR 2012, 2013)

Ans: “This is called as the First Gap. After its production, a cell starts its cell cycle in G1 phase”.

Events:

- Cell increases its supply of proteins.
- Cell increases the number of its organelles (mitochondria, ribosomes)
- Cell grows in size.
- Synthesis of various enzymes required in the S Phase, for the duplication of chromosomes.

4. What do you mean by S-phase? Text Book Page # 88 (SWL 2014, FSD 2015)

Ans: **S-Phase:**

In this phase, cell duplicates its chromosomes. As a result, each chromosome consists of two sister chromatids.

5. Describe G2 phase.

(MTN 2015, DGK 2015, SGD 2015)

Ans: In the G2 phase, cell prepares proteins that are essential for mitosis, mainly for the production of spindle fibres.

6. What is G0 phase?

Ans: “Cells that have temporarily or permanently stopped dividing are said to have entered a state of quiescence, called G₀ phase. In multicellular eukaryotes, cells enter G₀ phase from G₁ and stop dividing”.

Example:

- Neurons remain in G₀ Phase for indefinite period.
- Some cells of liver and kidney enter G₀ phase semi-permanently.

7. Define MITOSIS and describe its discovery.

Text Book Page # 89

(LHR, GRW2013, BWP 2014, SWL 2015, RWP 2014)

Ans: Definition:

“The type of cell division in which a cell divides into two daughter cells, each with the same number of chromosomes as were present in the parent cell is called mitosis”.

Discovery:

In 1880s, a German biologist, Walther Flemming observed that in a dividing cell, nucleus passes through a series of changes which he called mitosis.

Occurrence:

- Mitosis occurs only in eukaryotic cells.
- In multicellular organisms, the somatic cells undergo mitosis.

8. What is the difference between somatic and germ line cells?

(LHR, GRW 2014, LHR 2015, SWL 2015)

Ans:

SOMATIC CELLS	GERM LINE CELLS
<ul style="list-style-type: none">• Somatic Cells are those which form the body of organisms.• Somatic Cells undergo mitosis.	<ul style="list-style-type: none">• Germ line Cells are those which give rise to gametes.• Germ line Cells undergo meiosis.

9. Why PROKARYOTES do not undergo proper MITOSIS?

Ans: Prokaryotic cells undergo a process similar to mitosis called binary fission. Their division is not called mitosis because they do not have proper nucleus and do not form spindles during division.

10. What is binary fission?

(DGK 2015)

Ans: “It is a type of asexual reproduction in which an organism divides into two parts.”

Example:

Prokaryotic cells undergo a process similar to mitosis called binary fission.

11. Name the phases of MITOSIS in order.

(MTN 2015, BWP 2015)

Ans: The process of mitosis is divided into two major phases:

(a) Karyokinesis:

The division of nucleus known as karyokinesis is divided into four phases:

- (i) Prophase
- (ii) Metaphase
- (iii) Anaphase

- (iv) Telophase
(b) Cytokinesis

The division of cytoplasm is known as cytokinesis.

12. Define Kinetochore.

Ans: Each chromosome has a kinetochore at centromere. Kinetochore is a complex protein structure that is the point where spindle fibers attach.

13. What are spindle fibres?

Ans: Centrosomes give rise to microtubules by joining tubulin proteins present in cytoplasm. The microtubules thus formed are called spindle fibres.

- Complete set of spindle fibers is known as the mitotic spindle.

14. Enlist the important changes that occur in PROPHASE.

Ans: Important changes that occur in prophase are:

(i) Chromosome:

At the onset of prophase, chromatin condenses into highly ordered structures called chromosomes.

(ii) Kinetochore:

Each chromosome has kinetochore at centromere where spindle fibers attach.

(iii) Migration of Centrosomes:

Both centrosomes migrate to opposite poles of cell.

(iv) Formation of Mitotic Spindle:

Centrosome give rise to microtubules by joining tubulin proteins present in cytoplasm. The microtubules thus formed are called spindle fibers.

(v) Nuclear Changes:

Nucleolus and nuclear envelope have degraded, and spindle fibres have invaded the central space.

15. What is Telophase?

Ans: It is the last phase of karyokinesis in mitosis.

The events that occur in Telophase are:

- Telophase is the reversal of prophase.
- A new nuclear envelope forms around each set of separated chromosomes.
- Both sets of chromosomes, now surrounded by new nuclear envelopes, unfold back into chromatin. Nuclear division is completed.

16. What is difference in CYTOKINESIS in animal and plant cells?

Text Book Page # 90 (LHR 2016)

Ans: Definition:

“The division of cytoplasm is called cytokinesis”.

Cytokinesis in Animal Cells:

- In animal cells, cytokinesis occurs by a process known as cleavage.
- A cleavage furrow develops where the metaphase plate used to be.

- The furrow deepens and eventually pinches the parent cell into two daughter cells.

Cytokinesis in Plant Cells:

- In plant cells, vesicles derived from Golgi apparatus move to the middle of the cell.
- These vesicles fuse to form a membrane-bounded disc which is called cell plate or phragmoplast.
- This plate grows outward and more vesicles fuse with it.
- Finally, the membranes of cell plate fuse with plasma membrane, and its contents join the parental cell wall.
- The result is two daughter cells, each bounded by its own plasma membrane and cell wall.

17. Define phragmoplast.

(SGD 2014)

Ans: Phragmoplast:

“Cytokinesis in plant cells occurs differently. Vesicles derived from the Golgi apparatus move to the middle of cell and fuse to form a membrane bounded disc called cell plate or phragmoplast.”

18. Nucleus is only visible in interphase while chromosomes are only visible in cell division stage. Why is that?

Ans: Nuclear membrane breaks during cell division so there is no distinct nucleus. In interphase, nuclear material is in the form of fine chromatin which condenses during prophase to get into the shape of chromosomes.

19. What is importance of MITOSIS?

Text Book Page # 92

Ans: The importance of mitosis is the maintenance of chromosomal set, i.e. each daughter cell receives chromosomes that are alike in composition and equal in number to the chromosomes of parent cell.

20. Define regeneration.

(SWL 2014, DGK 2014, MTN 2015, SGD 2014)

Ans: “The process in which an organism can regenerate its lost parts through mitosis is called regeneration.”

Example:

Sea Star regenerates its lost arms through this process.

21. How mitosis helps in Asexual reproduction?

Text Book Page # 93

Ans: Some organisms produce genetically similar offsprings through asexual reproduction. Mitosis is a means of asexual reproduction.

Example:

Hydra reproduces asexually by budding. The cells at the surface of hydra undergo mitosis and form a mass called bud. Mitosis continues in the cells of bud and it grows into a new individual.

22. What can be the results of ERRORS in MITOSIS?

Ans: Errors in the control of mitosis may cause cancer.

Tumor Development:

All cells have genes that control the timing and number of mitosis. Sometimes mutations occur in such genes and cells continue to divide. It results in growths of abnormal cells called tumors.

There are following types of tumors.

- (i) Benign Tumor
- (ii) Malignant Tumor

23. What is difference between Malignant and Benign tumor?

(LHR 2014, GRW 2015, MTN 2015, SGD 2015)

Ans: As long as tumors remain in their original location, they are called benign tumors. But if they invade other tissues, they are called malignant (cancerous) tumors and their cells are called cancer cells.

24. Define Metastasis.

(BWP 2015)

Ans: “Malignant tumors can send cancer cells to other parts in body where new tumors may form. This phenomenon is called metastasis (spreading of disease).”

25. Define Meiosis.

Text Book Page # 95 (LHR 2013)

Ans: Meaning:

The word meiosis comes from Greek word ‘Meioun’ meaning “to make smaller” since it results in a reduction in chromosome number.

Definition:

“The process by which one diploid ($2n$) eukaryotic cell divides to generate four haploid ($1n$) daughter cells is called meiosis.”

Meiosis occurs in two phases:

- (i) Meiosis I
- (ii) Meiosis II

26. What is the difference between diploid and haploid cells? (GRW 2012, SGD 2014)

Ans: Diploid means the cells in which chromosomes are in pairs (homologous pairs) while haploid means the cells with half the number of chromosomes i.e. chromosomes are not in the form of pairs.

27. Define Synapsis.

Text Book Page # 96 (FSD 2014)

Ans: During prophase I the homologous chromosomes line up with each other and form pairs by a process called synapsis.

28. What is the difference between Meiosis-I and Meiosis-II?

Ans:

MEIOSIS-I	MEIOSIS-II
<ul style="list-style-type: none">• In Meiosis-I, the homologous chromosomes in a diploid cell separate	<ul style="list-style-type: none">• In meiosis-II, two haploid cells separate and so four haploid daughter cells are

and so two haploid daughter cells are produced.	produced. It is the second part of meiosis and is similar to mitosis.
• It is the step in meiosis that generates genetic variations.	• It is the step in meiosis where no genetic variation takes place.
• Prophase-I takes more time.	• Prophase-II takes less time.

29. Describe process of CROSSING OVER in MEIOSIS?

(LHR 2013, SWL 2014, MTN 2014, DGK 2015, BWP 2015, SGD 2015, RWP 2015)

Ans: "The non-sister chromatids of homologous chromosomes exchange their segments. This phenomenon is known as crossing over."

Significance of Crossing Over:

The exchange of segments results in the recombination of genetic information. After crossing over, each pair of homologous chromosomes remains as a bivalent.

30. What is the contribution of Thomas Hunt Morgan? Text Book Page # 97

Ans: In 1911, the American geneticist Thomas Hunt Morgan observed the phenomenon of crossing over in fruit fly *Drosophila melanogaster*.

31. During crossing over, genetic material is exchanged between sister/non-sister chromatids of homologous/non-homologous chromosomes?

Ans: Non-sister chromatids of homologous chromosomes.

32. What is Inter-kinesis?

Ans: "After meiosis I, both haploid daughter cells enter a period of rest, known as interkinesis or interphase II."

Difference:

The interphase II is different from interphase of mitosis and meiosis I. There is no S Phase and so there is no duplication of chromosomes during this stage.

33. What is the importance of Meiosis according to August Weismann?

Text Book Page # 100

Ans: Role of August Weismann:

The significance of meiosis for reproduction and inheritance was described in 1890 by a German biologist August Weismann. He pointed out that:

"Meiosis was necessary not only to maintain the number of chromosomes in the next generation, but also to produce variations in the next generation."

34. What kind of error can occur during Meiosis?

(GRW 2014, FSD 2014)

Ans: Disjunction:

"During Anaphase I, chromosomes separate and go to opposite poles, while during anaphase II, sister chromosomes separate. This is called Disjunction."

Non-disjunction:

Sometimes the separation of chromosomes is not normal and it is called as 'Non-disjunction'.

Non-disjunction results in the production of gametes which have either more or less than the

normal number of chromosomes. If such an abnormal gamete fuses with a normal gamete, it results in an abnormal number of chromosomes in the next generation,

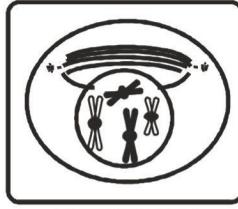
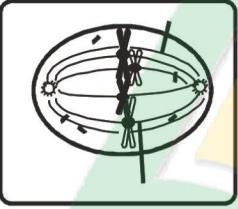
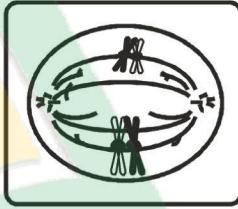
Example:

45 or 47 chromosomes in humans

35. State any two major differences between MITOSIS and MEIOSIS.

Text Book Page # 101

Ans:

MITOSIS	MEIOSIS
 <p>PROPHASE</p> <ul style="list-style-type: none"> Homologous chromosomes do not form pairs. There is no crossing over. 	 <p>PROPHASE I</p> <ul style="list-style-type: none"> In prophase I, there is pairing of chromosomes and crossing over between homologous chromosomes.
 <p>METAPHASE</p> <ul style="list-style-type: none"> Single chromosomes align to form metaphase plate. 	 <p>METAPHASE I</p> <ul style="list-style-type: none"> Homologous pairs align to form metaphase plate.

36. Define Apoptosis and describe its advantages.

Text Book Page # 102
(LHR 2015, RWP 2015)

Ans: Definition:

"The type of cell death which is well-programmed and regulated is called apoptosis."

- Apoptosis can occur when a cell is damaged or undergo stress conditions. Apoptosis removes the damaged cell, preventing it from getting further nutrients.
- Apoptosis prevents the spread of infection.
- Apoptosis also gives advantages during development.

Example:

During the formation of fingers, the cells between them undergo apoptosis and the digits separate.

37. Define blebs. What is an other name of these?

(LHR 2016)

Ans: Cell membrane makes irregular buds known as blebs. Blebs break off from the cell and are now called apoptotic bodies, which are then phagocytosed by other cells.

38. Define Necrosis and describe its causes.

Text Book Page # 103

Ans: Definition:

“The accidental death of cells and living tissues is called necrosis.”

Causes of Necrosis:

There are many causes of necrosis, including:

- Injury
- Infection
- Cancer
- Hypoxic environment
- Lack of proper care to a wound site
- Spider bites

