

Chapter No. 21**Cell Cycle****Short questions:**

1. What is Necrosis? (LB-2014)



Ans: Necrosis:

The cell death due to tissue damage is called necrosis. During necrosis the typical cell swells and bursts, releasing the intra cellular contents, which can damage neighboring cells and cause inflammation.

2. What is tumor? (LB-2014)

Ans: Tumor Formation:

Sometimes the control, that regulates the cell multiplication, breaks down. A cell in which this occurs, begins to grow, and divide in unregulated fashion without body's need for further cells of its type. When such cells produce new cells which continue to proliferate (multiple) in uncontrolled fashion, an **unwanted clone of cells** called **tumor** is formed.

These are of two types of tumors:

1. Benign tumor
2. Malignant tumor

3. What is Klinefelter's syndrome? (LB-2016)

Ans:

Klinefelter's syndrome:

It is one of the genetic disorders that occur due to non-disjunction of **sex** chromosomes pair in human.

1. Additional X chromosome:

The individuals will have **additional X** chromosome e.g., males with 47 chromosomes (44 autosome + XXY), with 48 chromosomes (44 autosomes + XXXY), and with 49 chromosomes (44 autosomes + XXXXY).

Symptoms:

They are phenotypically **male** but frequently have

- enlarged breasts
- tendency to tallness
- obesity
- small testes with no sperms at ejaculation
- under-developed secondary sexual characters

2. Additional Y chromosome:

The individuals will have **additional Y** chromosome e.g., Males with 47 chromosomes (44 autosomes + XYY) are also observed.

4. What is metastasis? (LB-2016)

Ans: Malignant Tumors / Metastasis:

The cells composing a malignant tumor or cancer, divide more rapidly, mostly invade surrounding tissue, get into body's circulatory system and setup areas of proliferation, away from their site of original appearance. This spread of tumor cells and

establishment of secondary areas of growth is called as **metastasis**.

5. What is the importance of bivalent formation? (LB-2012)

Ans: Bivalent or Tetrad:

During Zygotene stage of prophase I of meiosis, the **homologous chromosomes synapse (pair)** with each other. Each paired but not fused complex structure is called **Bivalent or Tetrad**.

6. What happens during metaphase I? (LB-2013)

Ans: Metaphase-I:

During **metaphase I**:

- Nuclear membrane disorganizes.
- Spindle fibers originate and the kinetochore fibers attach to the kinetochore of homologous chromosome from each pole and arrange the bivalents at the equator.
- The sister chromatids of individual chromosome in bivalent behave as a unit.

7. What are mutagens? Give one example. (LB-2018)

Ans: Mutagens:

Mutagens are chemical compounds or forms of radiation (such as ultraviolet (UV) or X-rays) that cause irreversible and heritable changes (mutations) in the cellular genetic material, '**deoxyribonucleic acid (DNA)**'.

8. What are the apparent symptoms or effects of Down's syndrome? (OR) What is Down's syndrome? (OR) Describe causes and symptoms of Down's syndrome. (OR) Write symptoms of Down's syndrome. (LB-2014, 2018)

Ans:

- **Down's syndrome or Mongolism:**

It is a human genetic disorder that occurs due to **autosomal non-disjunction** of **21st pair of chromosomes**.

- **Additional autosomal chromosome:**

During this 21st pair of chromosome fails to segregate (separate), resulting in gamete with 24 chromosomes. When this gamete, fertilizes a normal gamete, the individual will have 47 (2n+1) chromosomes.

This non-disjunction occurs in ova and is related to the age of the mother. It is more common in older mother (45 years)

- **Symptoms:**

The affected individuals have

- flat and broad face
- squint eyes with the skin fold in the inner corner
- protruding tongue
- mental retardation
- defective development of central nervous system

9. What are the symptoms of Turner's syndrome? (OR) How Turner's syndrome is caused and give its features. (OR) What is Turner's syndrome? (LB-2013, 2014, 2022)

Ans:

• **Turner's syndrome:**

It is a genetic disorder that occur due to the non-disjunction of sex chromosomes.

• **Missing one X chromosome:**

The affected individuals have **one missing X-chromosomes**, with only 45 chromosomes (44 autosomes + XO).

• **Symptoms:**

The individuals with Turner's syndrome often do not survive pregnancy and are aborted.

Those who survive have

- female appearance with short stature
- webbed neck
- without ovaries
- complete absence of germ cells

10. What is Apoptosis? (OR) Differentiate between Necrosis and Apoptosis. (OR) How cell death (Apoptosis) is beneficial for organisms? (LB-2014, 2019)

Ans:

Necrosis	Apoptosis
The cell death due to tissue damage is called necrosis . During necrosis, the typical cell swells, and bursts, releasing the intra cellular contents, which can damage neighboring cells and cause inflammation.	Apoptosis is the internal program of events and sequence of morphological changes by which cell commits suicide is collectively called as frequently. The dying cell shrinks and condense, ultimately splits up into small vesicles the apoptotic bodies. These apoptotic bodies are then phagocytosed, so they have no deleterious effects.

11. What is mitotic apparatus? (OR) What is mitotic apparatus? Give its functions. (OR) Describe mitotic apparatus. (LB-2013, 2016, 2018, 2019, 2022)

Ans:

Mitotic Apparatus:

The specialized microtubule structure including asters, and spindles is called **mitotic apparatus**. This is larger than the nucleus.

Functions:

It is designed to attach and capture chromosomes, aligning them at equator and finally separating them so that equal distribution of chromosomes is ensured.

12. Define cell cycle. (OR) Sketch and label cell cycle. (LB-2010, 2015)

Ans: **Cell cycle:**

The cell undergoes a sequence of changes which involves period of growth, replication of DNA, followed by cell division. This sequence of changes is called **cell cycle**.

It comprises of two phases:

- Inter-phase
- Mitotic Phase

Sketch of Cell cycle:

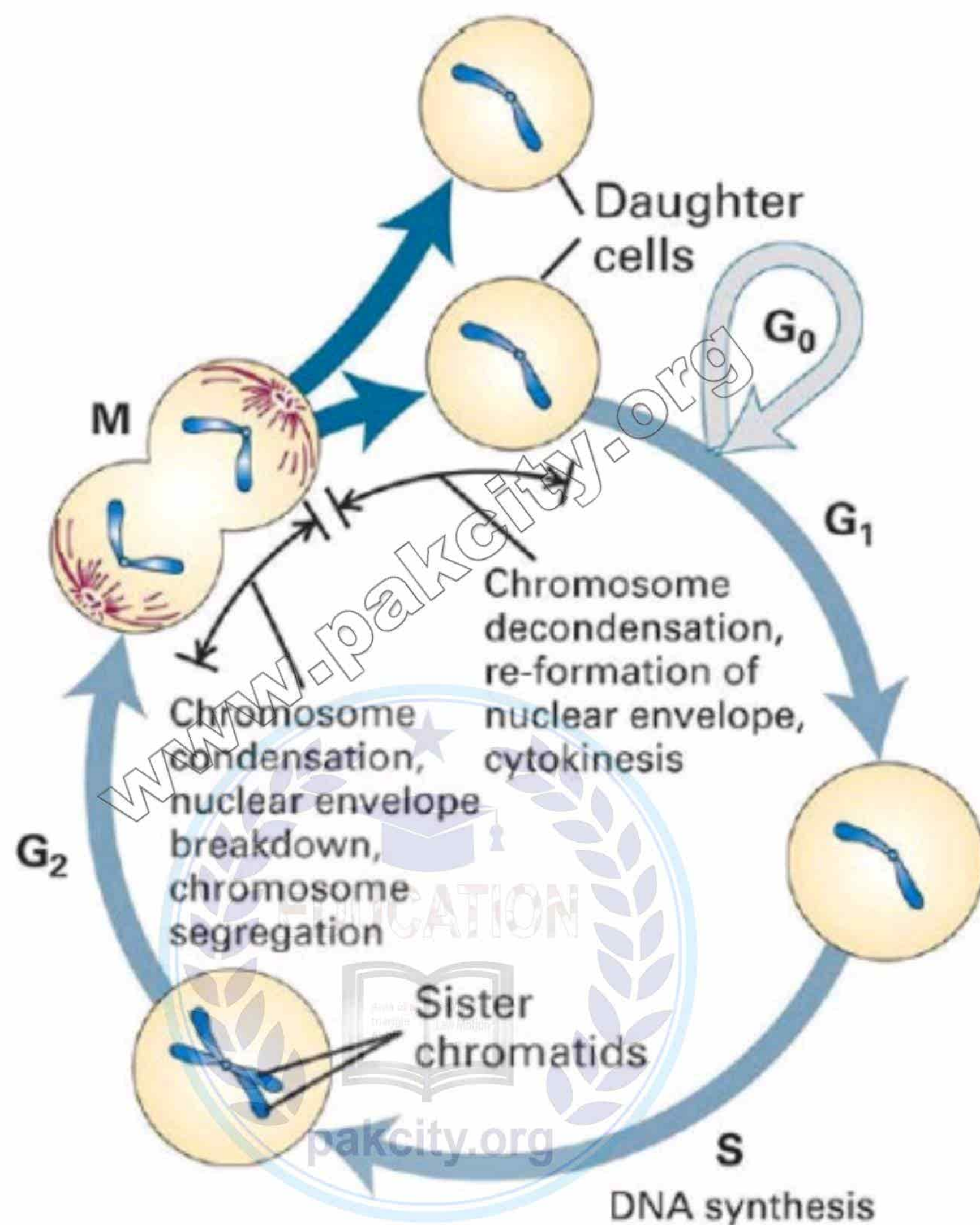


Fig. 21.1 The fate of a single parental chromosome throughout the eukaryotic cell cycle.

13. Define non-disjunction. (OR) What is non-disjunction or meiotic errors? (OR) What do you mean by non-disjunction? (OR) What is meant by non-disjunction? Write its consequences. (LB-2017, 2021)

Ans: **Meiotic Errors (Non-disjunctions):**

Sometimes during meiosis chromosomes fail to segregate during anaphase and telophase and do not finish with equal distribution of chromosome among all the daughter nuclei. This results either increase or decrease in the number of chromosomes, causing serious physical, social and mental disorders. Non-disjunction may be autosomal or sex-chromosomal e.g., Mongolism, Turner's and Klinefelter's syndrome.

14. Define karyokinesis and cytokinesis. (OR) How do karyokinesis and cytokinesis phases of cell division differ? (LB-2014)

Ans:

Karyokinesis	Cytokinesis
The division of the nucleus is termed as Karyokinesis . It involves the following phases: <ul style="list-style-type: none"> • Prophase • Metaphase • Anaphase • Telophase. 	The division of whole cell is called cytokinesis . During late telophase the astral microtubules send signals to the equatorial region of the cell, where actin and myosin proteins are activated and form a contractile ring, followed by cleavage furrow, which deepens towards the center of the cell, dividing the parent cell into two daughter cells.

15. Define meiosis and mitosis.

Ans:

Mitosis	Meiosis
It is the type of cell division, which ensures the same number of chromosomes in the daughter cells as that in the parent cells.	Meiosis is the special type of cell division in which the number of chromosomes in daughter cells is reduced to half , as compared to the parent cell.
It can take place in haploid as well as in diploid cells.	It takes place only in diploid cells.
After mitosis, each cell produces two daughter cells .	After meiosis, each diploid cell produces four haploid cells .
It occurs in plants as well as in animals, nearly in all parts of the body if and when required.	Likewise, it occurs in plants as well as in animals. <ul style="list-style-type: none"> • In animals, it occurs at the time of gamete formation • In plants, it occurs when spores are produced.

16. What is the importance of mitosis and meiosis? (OR) Give two main importance of meiosis. (LB-2013, 2017)

Ans:

Importance of Mitosis:

- Provides equal distribution of chromosomes to the daughter cells.
- Genetic information remains unchanged generation after generation.
- Involved in **asexual reproduction** of animals and plants.
- Helps in regeneration, healing of wounds, and replacement of older cells.
- Orderly controlled mitosis helps in growth and development of multicellular organisms.
- Helps in tissue culture and cloning.

Importance of Meiosis:

- Crossing over results in a large number of recombinations.
- Random assortment during anaphase gives a wide range of variety of gametes.
- Both crossing over and random assortment cause variations and modifications in the genome. These variations are not only the bases of evolution but also make every individual specific, particular, and unique in his characteristics. Even the progeny (offspring's) of same parents i.e., brothers and sisters are not identical to each other.
- Helps to maintain the number of chromosomes constant generation after generation.

17. Differentiate between benign and malignant tumor.

Ans:

Benign Tumors	Malignant Tumors / Metastasis
These tumors are of small size and localized, not transferred to other parts. Benign tumor cells usually behave like normal cells and have little deleterious effects only due to either its interference with normal cells or its hormone-like secretions.	The cells composing a malignant tumor or cancer, divide more rapidly, mostly invade surrounding tissue, get into body's circulatory system, and set up areas of proliferation, away from their site of original appearance. This spread of tumor cells and establishment of secondary areas of growth is called as metastasis .

18. Differentiate between G_0 -phase and S-phase of interphase. (OR) Describe changes occur during G_1 -phase. (LB-2011, 2012, 2016)

Ans: **Phases of Inter phase:**

It is divided into the following sub phases.

- **G_1 or Gap 1:**
It is the period of extensive metabolic activity in which cell normally grows in size, specific enzymes are synthesized, and DNA base units are accumulated for DNA synthesis.
- **G_0 :**
Post mitotic cell can exit the cell cycle during G_1 entering G_0 and remain for days, weeks or in some cases for lifetime (e.g., nerve cells and cells of the eye lens) of the organism without proliferating further.
- **S-Phase (Synthesis phase):**
Following the G_1 is the S-Phase during which the DNA is synthesized by replication and chromosome number is doubled.
- **G_2 or Gap 2 (Pre-mitotic phase):**
This phase prepares the cell for division e.g., energy storage for chromosome movements, mitosis specific proteins, RNA, and microtubule subunits (for spindle fibers) synthesize.

19. Differentiate between interphase and mitotic phase.

Ans:

Interphase	Mitotic phase
<p>The period of life cycle of cell (cell cycle) between two consecutive divisions is termed as the interphase or misleadingly called resting phase. It is the period of great biochemical activity. It is further subdivided into different sub phases.</p> <ul style="list-style-type: none"> • G₁-phase • S-phase • G₂-phase 	<p>It is the period of division also known as mitotic phase. It is further subdivided into different sub-phases.</p> <p>1. Karyokinesis</p> <ul style="list-style-type: none"> • Prophase • Metaphase • Anaphase • Telophase <p>2. Cytokinesis</p>

20. Give events of Zygotene. (LB-2013)

Ans: **Zygotene:**

It is a sub phase of prophase-I of meiosis. In this phase the pairing of homologous chromosomes called **synapsis** starts. This pairing is highly specific and exactly pointed, but with no definite starting point. Each paired but not fused, complex structure is called as **Bivalent or tetrad**.

21. How can you identify Cancer cells? (OR) Cancer is uncontrolled cell division, explain. (OR) What are cancer cells? How cancer cells can be distinguished from normal cells? (OR) Write any two differences between normal cells and cancer cells. (LB-2011, 2019, 2021, 2022)

Ans: **Identification of cancer cells:**

Cancer cells:

- Are less differentiated than normal cells.
- Exhibit characteristics of rapidly growing cells.
- Have high nucleus to cytoplasm ratio.
- Have prominent nucleoli.
- Undergo many mitosis.

22. In what respects does mitosis in plant cells differ from that in animal cells? (OR) Explain cytokinesis in plants. (OR) How cytokinesis occurs in plants? (LB-2010, 2018)

Ans: Mitosis in plant cells differ from that in animal cells just in **cytokinesis**.

Difference	
Cytokinesis in animals	Cytokinesis in plants
Animals have centrioles which give rise to spindle microtubules radiate	Most higher plants lack visible centrioles instead they have its analogous regions from which spindle microtubules radiate.
Animal cell shape changes.	Plant cell shape does not change greatly because it is surrounded by a rigid cell wall.

In animals, cytokinesis occurs by forming a contractile ring which splits the cell in to two.	In plants at cytokinesis, vesicles from Golgi complex form Phragmoplast. These vesicles originate actually during metaphase, line up in the in the center of the dividing, where they fuse to form the Phragmoplast at the end of the telophase. The membrane vesicles become the plasma membrane of daughter cells. These vesicles contain precursor of cellulose and pectin for future cell wall.
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23. How meiosis plays its role in producing genetic variations? (LB-2019)



Ans:

- Crossing over results in a large number of recombination's.
- Random assortment during anaphase gives a wide range of variety of gametes.
- Both crossing over and random assortment cause variations and modifications in the genome. These variations are not only the bases of evolution but also make every individual specific, particular, and unique in his characteristics. Even the progeny (offspring's) of same parents i.e., brothers and sisters are not identical to each other.

24. Briefly explain prophase in mitosis. (LB-2021)

Ans: Prophase:

- At the beginning of prophase, the chromatin material gets condensed by folding and the chromosomes appear as thin threads (0.25µm - 50µm in length).
- Chromosomes become more and more thick ultimately each chromosome is visible having two sister chromatids, attached at centromere.
- Towards the end of prophase, nuclear envelope disappears, and nuclear material is released in the cytoplasm, nucleoli disappear.
- Mitotic apparatus is organized.
- Cytoplasm becomes more viscous.

25. How malignant tumor or cancer is caused? (LB-2021)

Ans: Cause of Malignant Tumors / Cancer:

Cancer is caused mainly by mutations in somatic cells. Secondly, the cancer results from the accumulation of as few as three to as many as twenty mutations, in genes that regulate cell division. These mutations bring two basic changes in the cancer cells.

- First, the metastatic cells break their contact with other cells and overcome the restrictions on cell movement provided by basal lamina and other barriers, ultimately metastatic cells can invade other parts of the body.
- Secondly, they proliferate, unlimitedly, without considering the checks or programmes of the body.