M-PHASE:

The M phase, or mitotic phase, represents the pivotal stage in the cell cycle where actual cell division occurs. This phase is the most dynamic and crucial period, following the cell's duplication of components in the preceding stages. During the M phase, the duplicated components are systematically distributed, involving two fundamental processes:

- **Karyokinesis:** This process entails the division of the nucleus.
- **Cytokinesis:** This process involves the division of the cytoplasm.

Prophase

Prophase, the initial stage of Karyokinesis in mitosis, succeeds the interphase of the cell cycle. Key events during prophase include:

- Condensation of chromatin material, resulting in the formation of compact mitotic chromosomes.
- Chromosomes appear double, with two coiled sister chromatids connected by a centromere.
- Centrosomes (in animal cells) undergo duplication and move towards opposite poles, radiating microtubules called asters, which, along with spindle fibers, form the mitotic apparatus.
- Microscopic observation reveals the absence of the Golgi complex, endoplasmic reticulum (ER), nuclear membrane, and nucleolus in cells at the end of prophase.

Metaphase

Metaphase, the second stage of mitosis, involves the following events:

- Disintegration of the nuclear envelope marks the initiation of metaphase, with chromosomes spreading through the cell's cytoplasm.
- Chromosomes display two chromatids connected through the centromere, forming short rod-like structures.
- Mitotic spindle formation is complete, aligning all chromosomes at the equator in what is termed the metaphasic plate.
- The centromere joins the sister chromatids, and kinetochores form around the centromere, serving as sites for spindle fiber attachment.

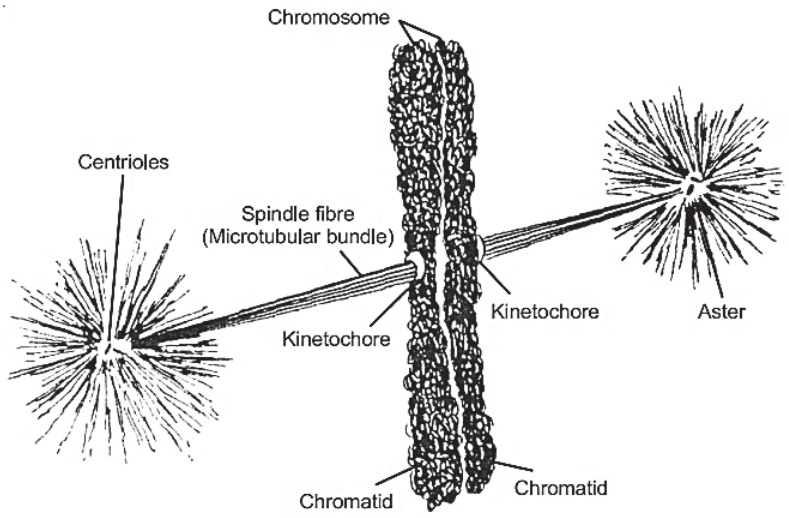

Fig. : A metaphase chromosome with kinetochores joined by spindle microtubules

Anaphase

Anaphase, where chromatids move towards the poles, involves the following processes:

- Centromeres split, separating daughter chromatids into individual chromosomes for the future daughter nuclei.
- Attached spindle fibers shorten, initiating the migration of daughter chromosomes towards opposite poles. Interzonal fibers form during this phase.
- Chromosomes always move away from the equatorial plate during migration, with the centromere leading the way and the arms trailing behind.

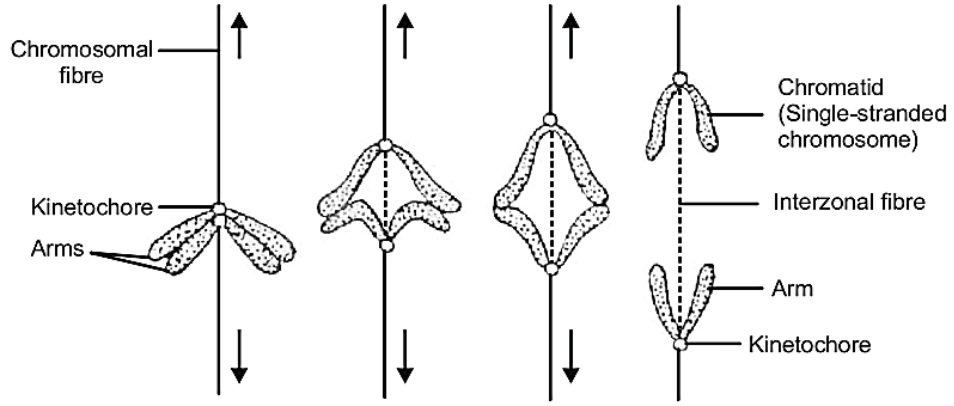

Fig. : Separation of chromatids during anaphase

Telophase

Telophase, the concluding stage of Karyokinesis, encompasses the following events:

- Chromosomes (sister chromatids) reach their respective poles, leading to the disappearance of the mitotic spindle.
- Chromosomes gradually uncoil, becoming thin, slender, and indistinguishable, losing their identity.
- The reappearance of nucleolus, endoplasmic reticulum, Golgi bodies, and other organelles occurs in the daughter cells.
- Nuclear envelopes form around chromatin clusters at each pole, giving rise to two distinct daughter nuclei. Telophase marks the completion of the cell division process.

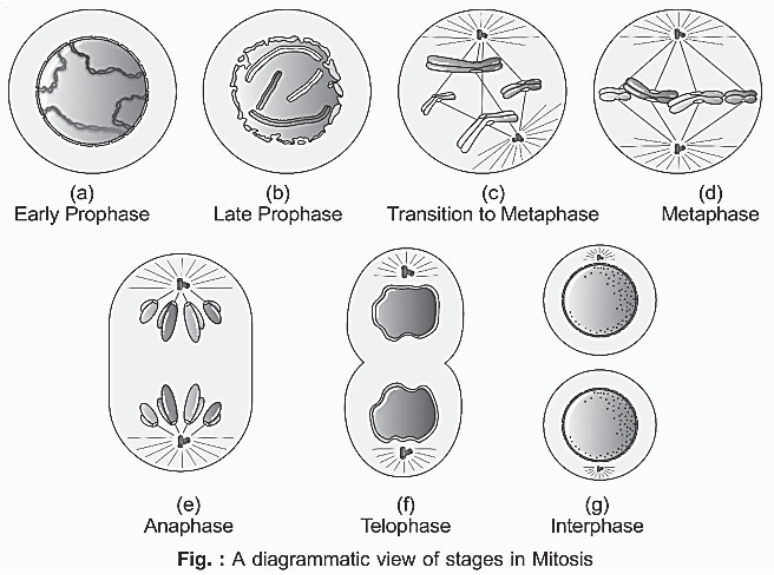

Fig. : A diagrammatic view of stages in Mitosis

Cytokinesis

Cytokinesis is the cellular process that involves the division of the cytoplasm, resulting in the separation of one cell into two daughter cells following nuclear division (either mitosis or meiosis). During cytokinesis, the cytoplasmic contents, including organelles and cellular components, are distributed between the two daughter cells, ensuring that each new cell receives a complete set of essential structures necessary for its survival and function. This process is crucial for the completion of the cell cycle and the generation of new cells for growth, repair, and reproduction in multicellular organisms.