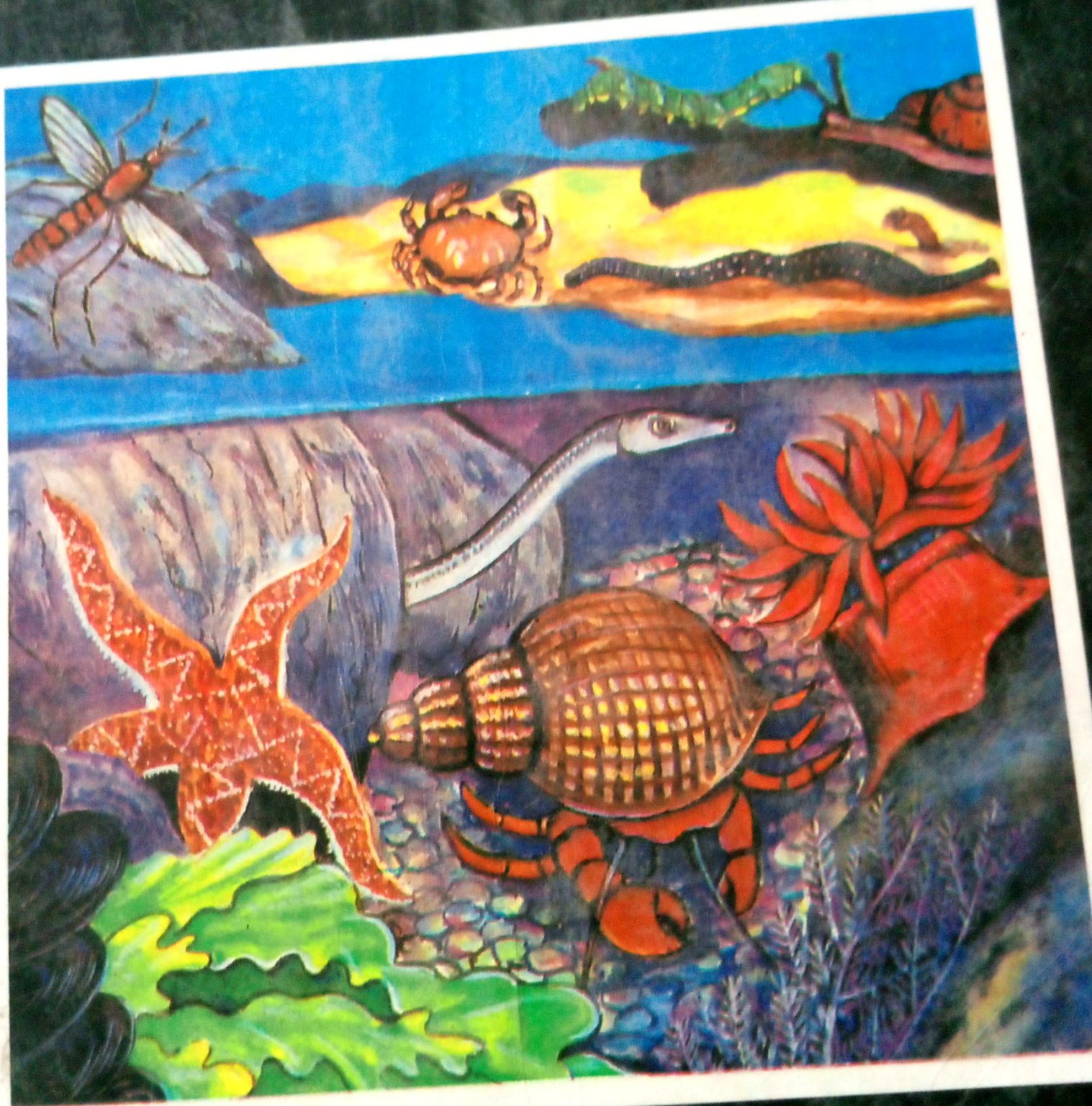


INVERTEBRATE ZOOLOGY



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Cell Division

4. Both chromatids remain connected with each other by the centromere and both remain closely associated along their entire lengths.
5. The chromatids become shortened and thickened.
6. The nucleolus starts to disappear.
7. Each centriole separates and migrates towards the opposite poles of the cell. Each centriole duplicates, so that both poles of the cell contain paired centrioles or diplosome.
8. The centrosome forms an elongated body or bridge known as the **centrodesmus** in between the two centrioles.
9. From the centrodesmus delicate filaments (microtubules) or asters arise and form the spindle.

Prometaphase

In prometaphase (Gr., *pro*=before, *meta*=after, *phasis*=appearance) following changes usually occur in the cell :

1. The nuclear membrane completely disintegrates.
2. A clear zone known as the equator appears in between the mid-line of the spindle and the nucleus.
3. The chromosomes move towards the equator.

Metaphase

The metaphase (Gr., *meta*=after ; *phasis*=appearance) follows the prometaphase and during this phase following events occur in the cell :

1. Each chromosome reaches to the equator and all arrange themselves radially at the periphery of the spindle.
2. The smaller chromosomes usually remain towards the interior, while the larger chromosomes remain at the periphery.
3. Some of the fibres of microtubules of the spindle attach with the centromere of each chromosome and are known as the **chromosomal fibres**.
4. Some of the fibres or microtubules of the spindle remain attached from one end to the other end with the centrioles and are known as **continuous fibres**.
5. Certain fibres occur in between the chromosomes and are known as **interzonal fibres** or **interchromosomal fibres**.

Anaphase

In the anaphase (Gr., *ana*=up; *phasis*=appearance) following changes occur in the cell :

1. The centromere of each chromosome divides into two.
2. The chromatids of the each chromosome are separated and form two chromosomes.
3. The chromosomes become shorter and thicker and migrate towards the opposite poles of the cell.
4. The migration of the daughter chromosomes towards the opposite poles is achieved by the contraction of chromosomal fibres and the stretching of interchromosomal or interzonal fibres. The interzonal fibres push the daughter chromosomes towards the opposite poles.

Telophase

The telophase is the final stage of mitosis and during this phase following events occur :

1. The chromosomes which reach at the opposite poles of the cells now elongate, the coils of DNA protein fibres loosen and the chromosomes become thread-like.
2. The nucleolus reappears.
3. The endoplasmic reticulum forms the new nuclear envelope around the chromosomes and the nucleolus.
4. The microtubules of the aster and mitotic spindle rearrange and disappear.

Thus, after the telophase two daughter nuclei are formed due to the karyokinesis. The karyokinesis is followed by the cytokinesis.

Cytokinesis

In the process of cytokinesis the cytoplasm splits from the equatorial region and the two daughter halves of the cytoplasm are separated. Soon after a unit membrane of lipoprotein develops in between the two daughter cells. The cytokinesis of animal cells involves the cyclosis of the cytoplasm, formation of a contractile ring, the expansion of the cell membrane, ATP and interaction of the spindle and asters with the cell surface, while in the plant cells the cytokinesis involves the movement of the endoplasmic reticulum and dictyosomes to the equator where they fuse to form the primary cell wall.

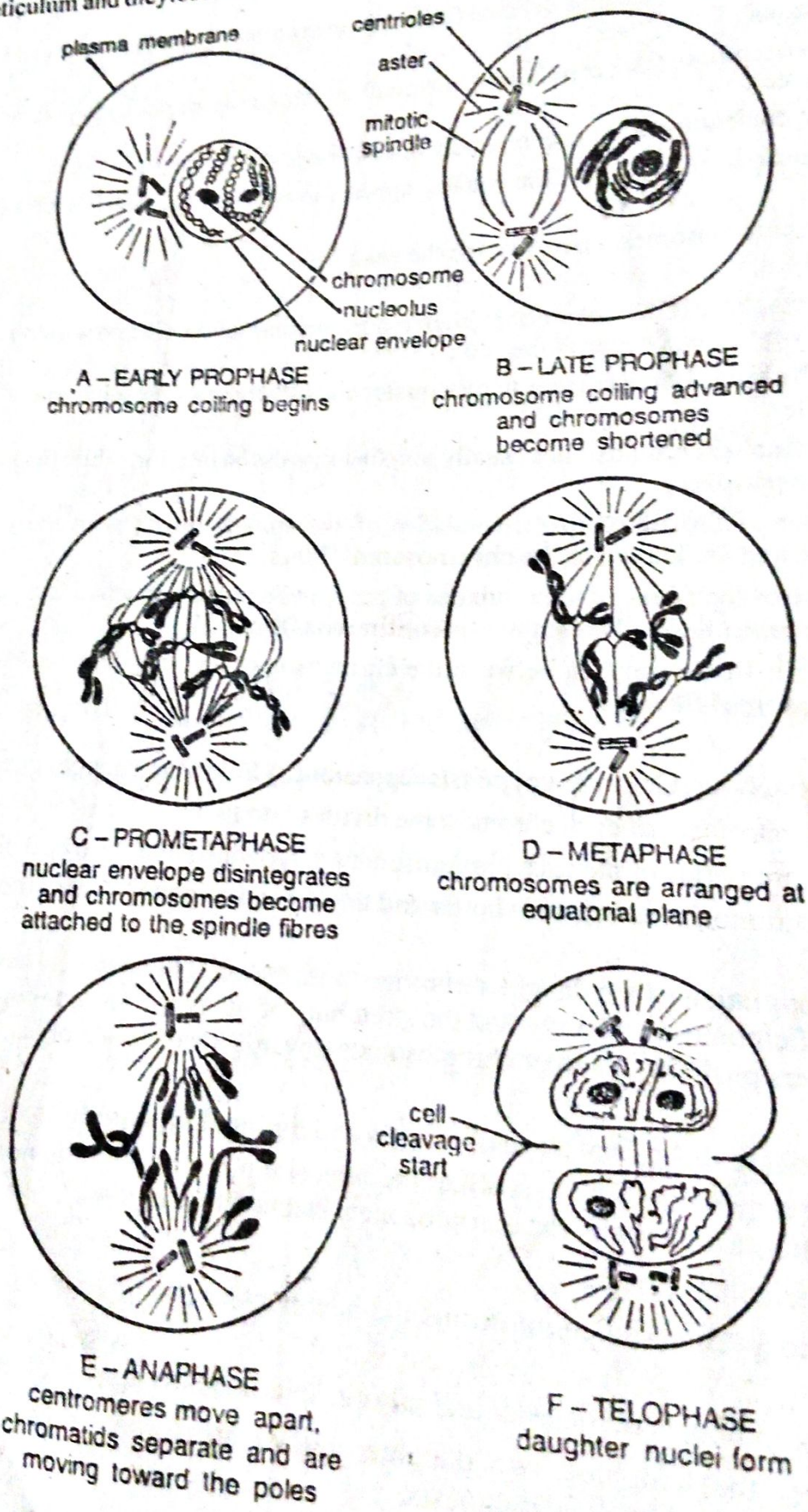


Fig. 5.3. Different stages of mitosis.

Cell Division

Significance of Mitosis

The importance of the mitosis for the organisms has been summarized in the following points :

1. In mitotic division, the chromosome number in each daughter cell remains the same like the parent cell.
2. The mitosis helps the cell in maintaining its proper size.
3. Through the process of the mitosis an equilibrium is maintained in the amount of DNA and RNA contents.
4. The mitosis provides the opportunity for the growth and development of organs and the body of the organisms.
5. Due to the mitosis the old decaying and dead cells are replaced by the new cells.
6. The mitosis helps the organisms in the asexual reproduction.
7. The gonads and the sex cells also depend on the mitosis for the increase in their number.

MEIOSIS

The term meiosis (Gr., *meioun* = to reduce) was coined by J.B. Farmer in 1905. The meiotic division is of utmost importance for those organisms in which the union of the haploid gametes takes place during the sexual reproduction. By reducing the number of chromosomes of the diploid germ cells into the haploid gametes the meiosis maintains a constant number of the chromosomes in the species. Thus, meiosis helps in alternation of generation of haploidic generations of plants and animals. In the process of meiosis the chromosomes divide once and the nucleus and cytoplasm divide twice. Due to the meiosis four haploid cells are formed from the single diploid cell. The process of meiosis is fundamentally same in all the animals and plants but certain biologists recognised following three types of meiotic divisions according to their occurrence at different stages of the life cycle of the organisms.

1. **Sporogenetic meiosis.** The meiosis occurring at the time of spore formation is referred to as the sporogenetic meiosis. This type of meiosis is commonly found in plants.
2. **Gametic meiosis.** In most animals and lower plants the meiosis occurs at the time of gametogenesis (spermatogenesis and oogenesis) and is known as gametic meiosis.
3. **Zygotic meiosis.** In certain lower plants, sometimes the meiosis occurs immediately after the fertilization of the egg by a sperm. This type of meiosis is known as zygotic meiosis.

Meiocytes. The cells in which the meiosis takes place are known as the meiocytes. The meiocytes of the testes or male gonads are known as the spermatocytes and the meiocytes of the ovaries or female gonads are termed as oocytes. The meiocytes of the plant sporangium are known as sporocytes.

Chemical substances initiating meiosis. The process of meiosis seems to depend on the balance of nucleic acids in the nucleus or on certain hormones. For instance, insect moulting hormone, ecdysone is found to initiate the meiosis in certain parasitic flagellate protozoans. Further, when the cell the amount of the DNA material is increased in comparison to the RNA, meiosis is found to occur in the cell. However, till now no information is available about the exact chemical substance which may initiate the meiosis.

Process of Meiosis

The meiotic division includes two complete divisions of a diploid cell resulting into four haploid nuclei. The first meiotic division includes a long prophase in which the homologous chromosomes become closely associated to each other and interchange of hereditary material takes place between them. Further, in the first meiotic division the reduction of chromosome number takes place and two haploid cells are resulted by this division. The first meiotic division is also known as **heterotypic division**. In the second meiotic division, the haploid cell divides mitotically and into four haploid cells. The second meiotic division is also known as the **homotypic division**. In the homotypic division pairing of chromosomes, exchange of the genetic material and reduction of chromosome number do not occur.

Both the meiotic divisions occur continuously and each includes the usual stages of the cell division, i.e., prophase, anaphase and telophase. The prophase of first meiotic division is