BIOLOGY

CLASS NOTES FOR CBSE

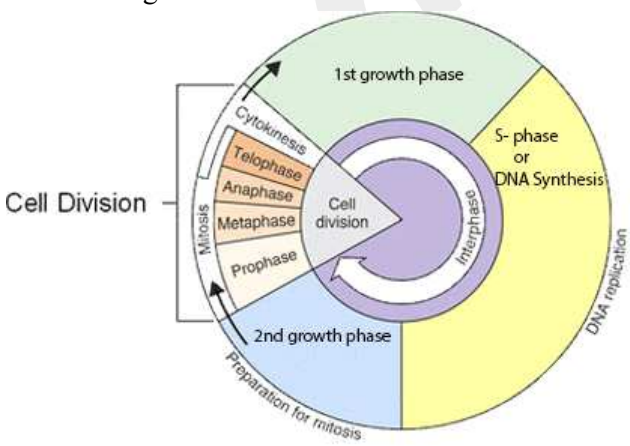
Chapter 10. Cell Cycle and Division

01. Introduction

Growth and reproduction are the two Important characteristic of all living forms. Life of all multicellular organisms starts with a single cell, i.e. zygote. It is then developed into a complete individual by continuous growth and division in it. We all know that new cell arise by the division of pre-existing cell (Rudolf Virchow; 1858). Hence, we can also say that, the process of division work as the foundation stone of continuity of life.

02. Cell Cycle

Cell cycle was first described by Howard and Pelc in 1953. It involves these sequence of events by which a cell duplicates its genome, synthesises new cell constituents, undergoes growth and divides into tow daughter cell



(i) **Interphase**

It is also known an **intermitosis** or **Phase-I**. It looks like the long resting phase or non-dividing phase of the cell cycle However, it is the period of intense cytogenic activities. During interphase, chromosomal material is seen in the form of very loosely coiled threads called chromatin. *This substages are further subdivided as*

(a) **G_1-phase** It is also called the first gap phase or post- mitotic gap phase. During this phase, the cell remains metabolically active and acquires nutrients form its environment to perform its specialised functions. These involve hormone synthesis and secretion mainly. During this process the cell grows in size.

(b) No change is visible in the DNA content of the cell, I.e. DNA is not synthesised during this substage. This phase is mainly involved in the synthesis of cell organelles, RNA, ribosomes, proteins, lipids, etc After G_1-phase, a cell can take one of the following two pathways, i.e. it may continue cell cycle and enter S-phase or it may enter G_0-phase.

(c) **G_o-phase** It is an extension of G_1-phase and is also known as **quiescent stage** The terms 'G_o-phase' was introduced by Lajtha in 1963. A cell attains the phase due to the absence of cyclin proteins which control the cell cybele. During G_o-phase, the cell neither divides nor synthesizes organelles, but the metabolic activity of the cell continues. Muscles and nerve cell of human body remain in G_1-phase permanently.

(d) **S-phase** It is also called the **synthesis phase** . In this phase the cell synthesises a replica of its genome, by the process of DNA replication. The phase also includes the synthesis of histone proteins and Kinetochores. The, DNA content becomes doubled.

(e) **G_2-phase** It is also called as the **premitotic gap** or **second gap phase.** It is the gap between DNA synthesis and next division. in this phase, the preparations are made for genomic separation, This particular phase it spent in synthesising molecules other than DNA, which are required for cell division. Mitochondria and other organelles replicate, chromosomes condense and microtubules begin to assemble to form spindles.

03. Mitosis

The term 'Mitosis' was given by W Flemming in 1882. It is the equational or equal division, i.e the division in which the number of chromosomes in the daughter cell nuclei are same as that of the parental cell nuclei.

Karyokinesis

The term 'Karyokinesis' was given by Schneider (1882. It is the process of division of nucleus. It consists of following four substages

(i) Prophase

(a) This is the longest subphase of karyokinesis. In this subphase chromatin fibers become shorten and thicken by coiling to from compact chromosomes. Each chromosome consists of two chromatids held together by a centromere. held together by a centromere.

(b) In early prophase the chromosomes appear like a ball of wool this stages is known as **spireme stage.**

(c) In animal cells, the centrioles move to opposite poles of the cell and short, microtubules may be seen radiating from them. These radiating microtubules are called asters toward margin and their central counter parts as spindles. Hence, the centrioles are responsible for the formation of spindle fibres animal cell. In plant cell however the spindle fibres are forme without centrioles. Chemically spindles are made up of 3% RNA and 97% tubulin.

(d) The nucleoli disappear and nuclear envelope is no longer visible.

(e) Golgi bodies, endoplasmic reticulum, etc. are not present in this phase.

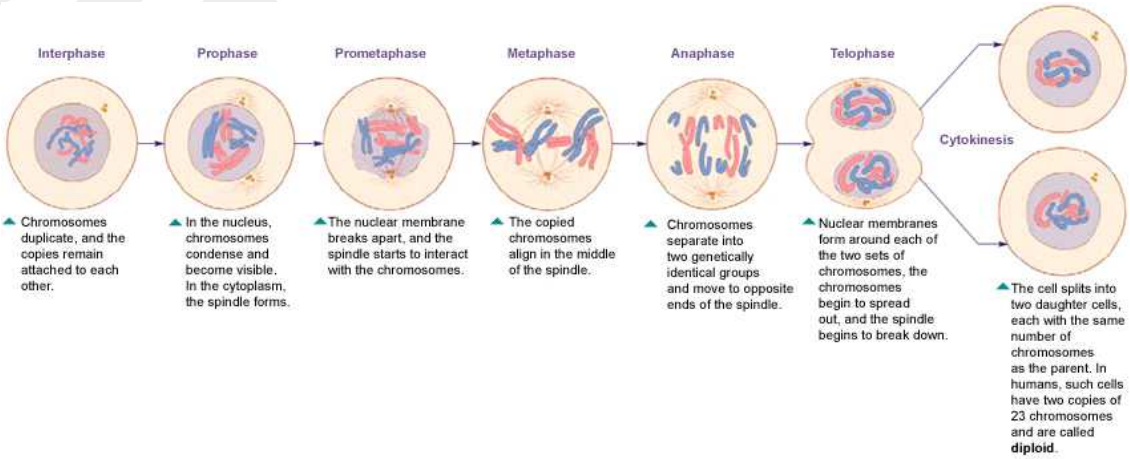
(ii) Metaphase

(a) It is the best stage to observe the shape, size and number of chromosomes. This phase in marked by the complete disintegration of nuclear envelope.

(b) Spindle fibers get attached to kinetochore of chromosomes and bring the chromosomes on the equator of the spindle. The phenomenon is called **congression**

(c) The centromeres of all the chromosomes lie on the equator which forms an apparent plate called metaphase or **equatorial plate.**

(d) In plant cell chromosomes are irregularly arranged on the equatorial plane. In animal cells, on the other hand, smaller chromosomes are usually central and large ones are peripheral in position.



(iii) Anaphase

(a) The onset of this stage is marked by splitting go centromeres into two and the shortening of spindle fibres of the daughter centromeres to opposite poles. The shortening of spindle fibres occur due to slow removal of proteinaceous monomers in the polar region.

(b) The separated chromatids are also pulled along with the centromeres.

(c) All the chromosomes of a cell, except the sex chromosomes, move toward the poles, i.e. away form the equator.

(iv) Telophase

(a) In this stage, the chromatids reach the poles of the cell, uncoil and lengthen to form chromatin again.

(b) The spindle fibres disintegrate and the centrioles (in animal cell) replicate. A nuclear envelope reappears around the chromosomes at each pole and the nucleoli, Golgi bodies, endoplasmic reticulum reappear. Thus, this phase is considered as reverse of prophase.

Significance of mitosis

(a) It results in the production of diploid daughter cells with identical genetic components.

(b) Growth of multicellular animals is due to mitosis.