Chapter 4: CELL CYCLE AND INTERPHASIC NUCLEUS

A. CELL CYCLE

The cell cycle is the time interval between the moment when a cell has just been formed (after mitosis) and the moment when it divides and gives birth to two daughter cells; on a cellular scale, it corresponds to the life span of a generation. The cell cycle is divided into two major phases: **interphase** and **mitosis** (**Figure 1**).

I. INTERPHASE

Interphase is subdivided into three phases (G1, S and G2).

1. G phase

G from the word *gap*. It occurs at the end of the telophase (the last stage of mitosis). Because of the variability of its duration, this phase determines the length of the cell cycle.

G1 = 0: characterizes rapidly dividing cells (e.g. young embryonic cells, stem cells from specific tissues and cancer cells).

G1 = duration of cell life (G_0) characterizes cells that have lost their ability to divide or mitotic capacity (e.g. muscle cells and red blood cells).

G1 = variable duration for other cell categories.

The G1 phase is characterized by a nucleus containing 2q of DNA (q: quantity). Each DNA molecule, corresponding to a mitotic chromosome, is presented in a single copy, and the chromosomes are not visible. This quantity of DNA remains constant in G1. During this phase, DNA transcription into mRNA is reactivated in the nucleus, and proteins are synthesized in the cytosol, particularly those required for the proper functioning of the cell in the interphase.

2. S phase

S for synthesis lasts 6 to 8 hoursand is constant for a given cell type. During the S phase, DNA is replicated by DNA polymerases. The quantity of DNA is thus doubled. The amount of DNA doubles from 2q to 4q. At the end of the S phase, each DNA molecule is represented in duplicate, corresponding to the two daughter chromatids of the mitotic chromosome. During this phase, proteins are also synthesized in the cytosol,particularly histones, which will be associated with DNA.

3. G_2 phase

Its duration is also constant, but the nucleus has 4q of DNA this time. The cytoplasm prepares for mitosis with a high level of protein synthesis, in particular,the α and β tubulins, which are used to form achromatic spindles. The G2 phase can be blocked by the action of colchicine, which prevents the elongation of the microtubule polymer, or by X-rays.

II. MITOSIS

Mitosis corresponds to the Mphase. The chromosomes (2n) become visible and will be distributed in the two daughter cells, all of which will have 2n chromosomes and 2q of DNA, thanks to the separation of sister chromatids at the anaphase. Numerous proteins regulate the cell cycle.

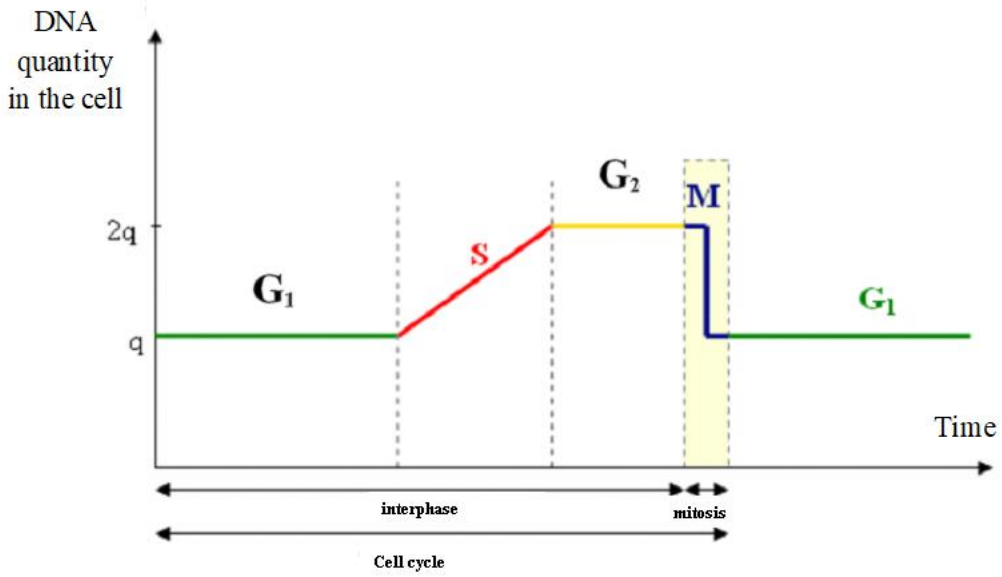

Figure 1:DNA quantity (q) evolution during the cell cycle.