

# 03 - Meiotic division

## Meiotic division

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1. Cell cycle Each cell undergoes a natural cycle in terms of its replication and nucleic acid synthetic activity. The cell cycle consists of four separate phases: G1 phase, S phase, G2 phase and M phase. G1 stands for growth phase 1, S for the synthetic phase, G2 for growth phase 2 and M phase for mitosis phase. Cells in the quiescent G0 phase of the cycle are stimulated by the growth factors (e.g. EGF, epithelial growth factor; PDGF, platelet-derived growth factor; IGF, insulin-like growth factor) and result in activation of transcription factors and lead to the initiation of DNA synthesis, followed by mitosis and cell division. Thus from G0 the cell moves on to G1 when the chromosomes are prepared for replication. This is followed by the synthetic (S) phase, when the 46 chromosomes are duplicated into chromatids, followed by another gap phase (G2), which eventually leads to mitosis (M). Note that while certain cells pause or freeze the cycle temporarily and stay in G0, e.g. liver cells, neurons remain in G0 indefinitely.
  2. Cell division Cell division is a process by which cells reproduce. During cell division, a sequence of steps enables the replicated genetic material in a parent cell to be equally distributed to two daughter cells. Before a dividing cell enters mitosis, it undergoes a period of growth called interphase. Interphase can be termed as the "holding" stage occurring between two consecutive cell divisions. Replication of cellular genetic material and organelles occurs during interphase in preparation for the next division. It is the longest phase, and all steps in the cell cycle (i.e. G0, G1, G2 and S) except stage (M) constitute interphase. Mitotic division Mitosis is composed of several stages. □ Prophase: Condensation of chromatin to discrete chromosomes, accompanied by a breakdown of the nuclear envelope and the formation of spindles at opposite cellular "poles". □ Metaphase: Alignment of chromosomes at the metaphase plate (a plane that is equidistant from the two spindle poles) - equatorial alignment. □ Anaphase: Separation of paired chromosomes (sister chromatids) followed by migration to opposite ends of the cell. This separation of chromatids preserves the chromosomal numbers in daughter cells. □ Telophase: In this last stage, the chromosomes are packed into distinct new nuclei in the emerging daughter cells. Cytokinesis (division of cytoplasm) also starts at this time. Meiotic division □ Meiosis is divided into two parts: meiosis I and meiosis II. At the end of the meiotic process, four daughter cells are produced (only two are produced at the end of the mitotic process), each with one-half of the number of chromosomes as the parent cell, unlike mitosis where each cell has the same number of chromosomes as the parent. Meiosis 1 is a reduction division.
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