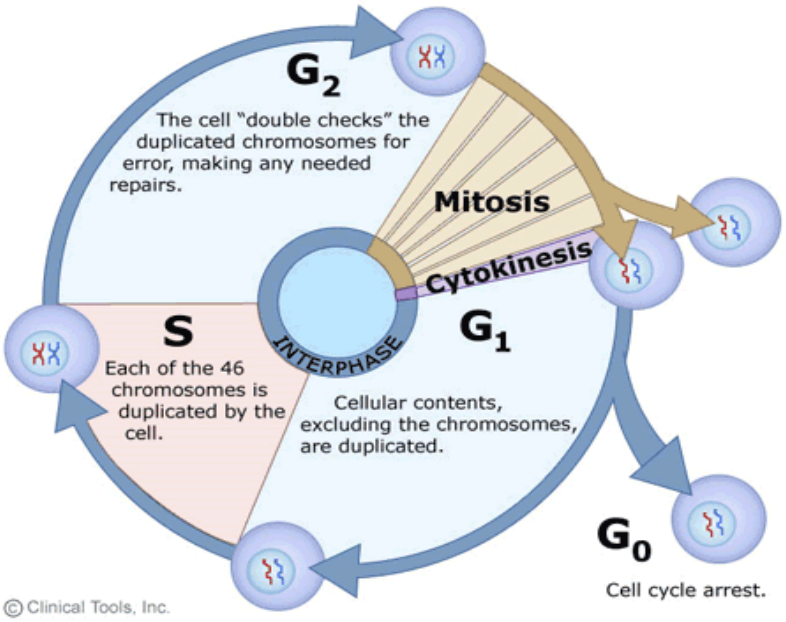
Cell life cycle (Mitosis)

- The cell cycle or cell-division cycle is the series of events that take place in a cell leading to its division and duplication of its DNA (DNA replication) to produce two daughter cells.
- The cell cycle tightly regulated and controlled by a series of biochemical switches (checkpoints) by responding to internal and external signals. In addition to replicating their genome (Genetic information), most cells replicate their other organelles and macromolecules.
- DNA molecules in a cell are packaged into chromosomes - Prokaryotes- circular DNA -Eukaryotes- linear DNA.
- The cell cycle consists of four distinct phases: G1 phase, S phase (synthesis), G2 phase (collectively known as interphase) and M phase (mitosis). M phase is itself composed of two tightly coupled processes: karyokinesis (Nucleus division) in which the cell's chromosomes are divided, and cytokinesis, in which the cell's cytoplasm divides forming two daughter cells.



(Cell cycle)

State	Phase	Abbreviation	Description
Resting	Gap 0	G0	A phase where the cell has left the cycle and has stopped dividing.
Interphase	Gap 1	G1	Cells increase in size in Gap 1. The G1 checkpoint control mechanism ensures that everything is ready for DNA synthesis
	Synthesis	S	DNA replication occurs during this phase
	Gap 2	G2	During the gap between DNA synthesis and mitosis, the cell will continue to grow. The **G2 checkpoint** control mechanism ensures that everything is ready to enter the M (mitosis) phase and divide.
Cell division	Mitosis	M	Cell growth stops at this stage and cellular energy is focused on the orderly division into two daughter cells. A checkpoint in the middle of mitosis (Metaphase Checkpoint) ensures that the cell is ready to complete cell division

Mitosis

Karyokinesis

1-Prophase: Chromatin in the nucleus begins to condense and becomes visible in the light microscope as chromosomes. The nucleolus disappears. Centrioles begin moving to opposite ends of the cell and fibers extend from the centromeres. Some fibers cross the cell to form the mitotic spindle.

2- Prometaphase: The nuclear membrane dissolves, marking the beginning of prometaphase. Proteins attach to the centromeres creating the kinetochores. Microtubules attach at the kinetochores and the chromosomes begin moving.

3- Metaphase: Spindle fibers align the chromosomes along the middle of the cell nucleus. This line is referred to as the metaphase plate. This organization helps to ensure that in the next phase, when the chromosomes are separated, each new nucleus will receive one copy of each chromosome.

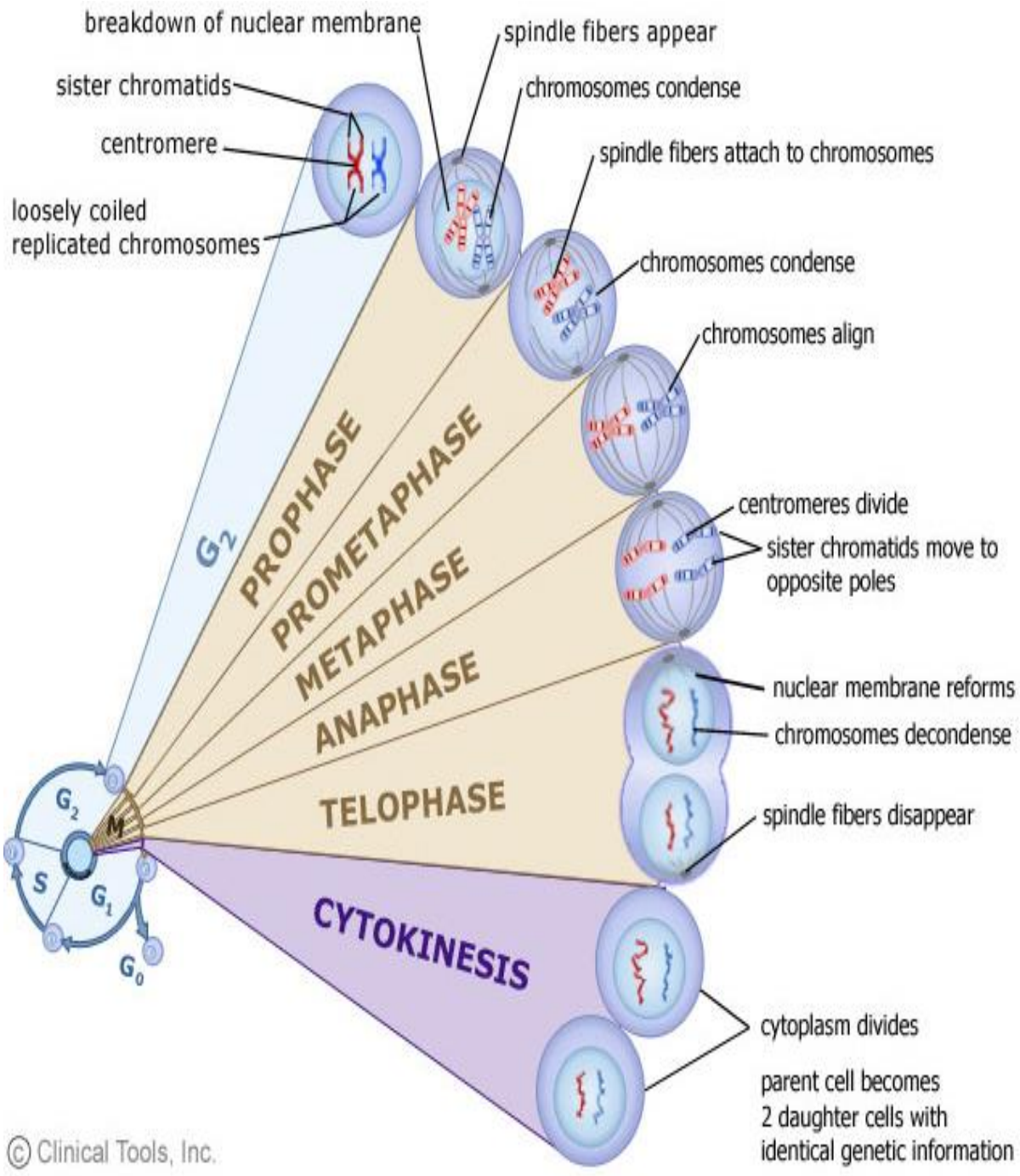
4 – Anaphase: The paired chromosomes separate at the kinetochores and move to opposite sides of the cell.

5 – Telophase: Chromatids arrive at opposite poles of cell, and new membranes form around the daughter nuclei. The chromosomes disperse and are no longer visible under the light microscope. The spindle fibers disperse.

Cytokinesis

- In animal cells, cytokinesis results when a fiber ring composed of a protein called actin around the center of the cell (cleavage furrow) contracts pinching the cell into two daughter cells, each with one nucleus.

❖ In plant cells, the rigid wall requires that a cell plate be synthesized between the two daughter cells.



(Mitosis)