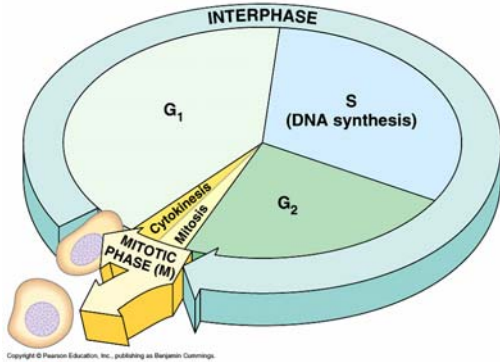


Asexual Reproduction

◆ The Cell Cycle

--The cell cycle is made up of several phases which include two growth phases (**G₁** & **G₂**), a DNA synthesis phase (**S phase**) and a **M or mitotic** phase (includes **mitosis** or nuclear division and **cytokinesis** or cytoplasm division).



--**Interphase:** Includes the G₁, G₂, and S phases. During interphase, chromosomes exist as **chromatin** (picture a nucleus filled with a bunch of strings or spaghetti that are indistinguishable).

--**G₁ phase:** This is the part of the cell cycle where the cell spends a large part of its functional "life".

**Cell grows during this phase

**Necessary organelles are synthesized

--**G₀ phase:** Cell decides if will enter another cell division.

**If the cell does not continue into another cell division, it will exit the cell cycle and remain in the G₀ resting phase.

--**S phase (DNA Synthesis):** chromosomes are copied as the cell readies itself for division.

**Chromosomes go from single stranded chromosomes in G₁ to double stranded chromosomes in the S phase.

**In animal cells, centrioles are also doubled.

--**G₂ phase:**

**Cell checks that DNA replication is completed

**Cell goes through another period of growth

**Spindle fibers are assembled

◆ DNA Replication:

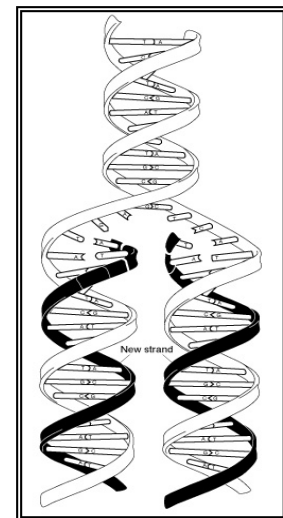
--the enzyme **helicase** unzips of the parent molecule by breaking the hydrogen bonds between the base pairs

--DNA polymerase binds to one strand of the DNA and starts to begin to synthesize a complimentary strand by joining DNA nucleotides together.

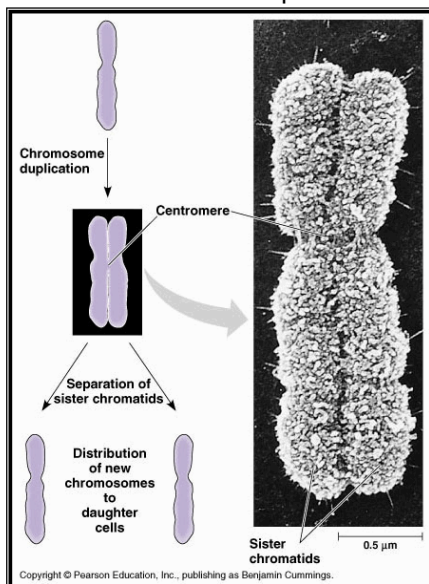
--DNA polymerase also has a proofreading function, checking each newly synthesized DNA strand is a compliment of the original strand

--The original DNA molecule acts as a **template** (plan or model) for the formation of the new DNA strands

--The result is two new daughter DNA molecules, each with one original DNA strand and one newly synthesized strand. **Therefore, DNA replication is semi-conservative.**



- ◆ **The M phase of the cell cycle begins with Mitosis**, which involves the division of the nuclear material. There are 4 phases to mitosis which include **Prophase, Metaphase, Anaphase, and Telophase**. A good way to remember the phases of mitosis including interphase is the acronym **IPMAT**.



◆ Mitosis

--**Prophase:**

**Double stranded chromosomes become visible by condensing and thickening.

Double stranded or sister chromosomes are now called **chromatids. They are held together by a **centromere**.

**The nuclear membrane dissolves.

**In animal cells, spindle fibers forms from the centrioles. In plant cells, spindle fibers are formed by enzymes in the cytoplasm.

**Double stranded chromosomes start to move toward the equator of the cell.

--**Metaphase:**

**Centromeres of sister chromatids attach to the spindle fibers

**Sister chromosomes line up along the equatorial plate of the cell

**Centromeres replicate

--**Anaphase: (opposite of prophase)**

**Spindle fibers shorten, pulling the sister chromatids to opposite poles of the cell

--**Telophase:**

**Nuclear membranes form around each set of chromatids (now called chromosomes)

**Spindle fibers disappear

**Chromosomes lengthen and thin to form chromatin again

Cytokinesis:

--In Animal Cells:

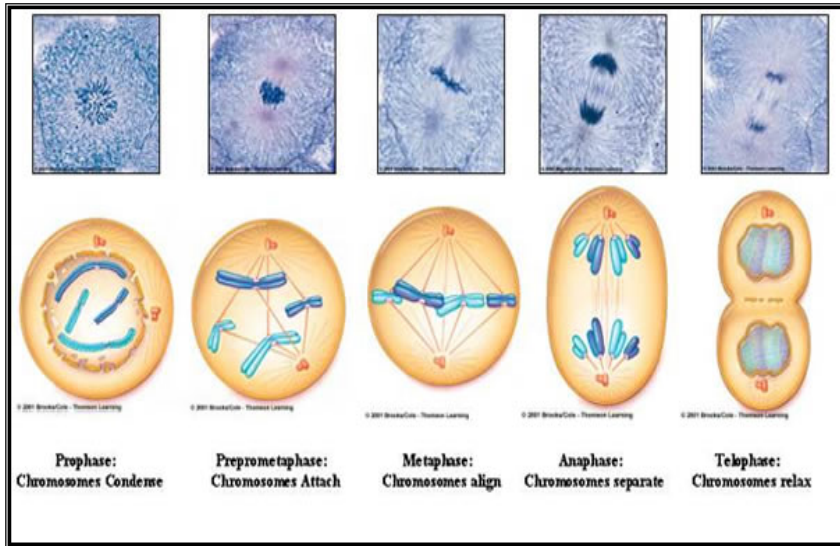
- **During anaphase, the cell begins to pinch inward forming a cleavage furrow.
- **The cell continues to pinch inward until the cytoplasm completely divides.

--In Plant Cells:

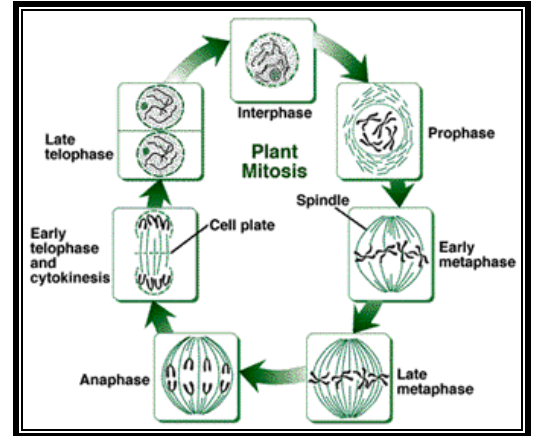
- **A cell plate begins to form from the middle outward eventually forming a cell wall.

- ◆ **Results of Mitosis and Cytokinesis:** Two daughter cells that are genetically identical to the parent cell, only smaller in size.

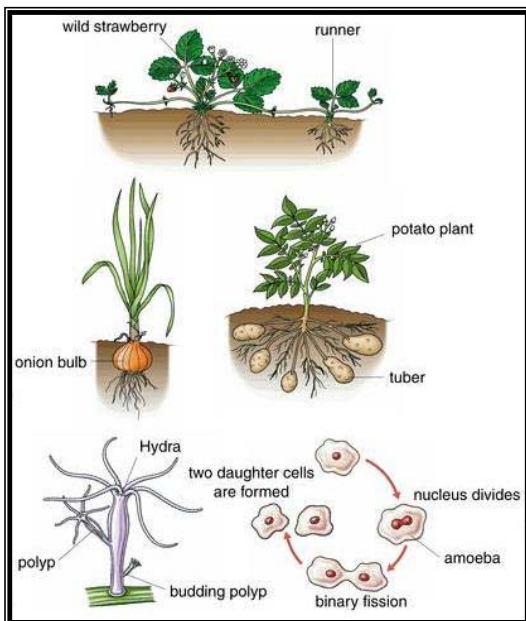
Animal Mitosis and Cytokinesis



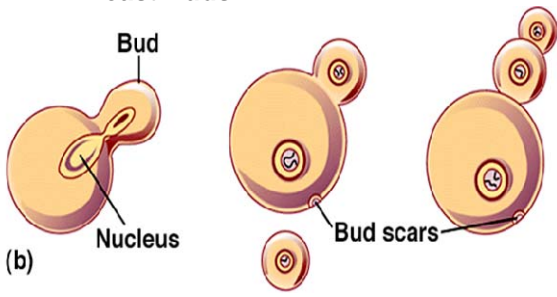
Plant Cell Mitosis and Cytokinesis



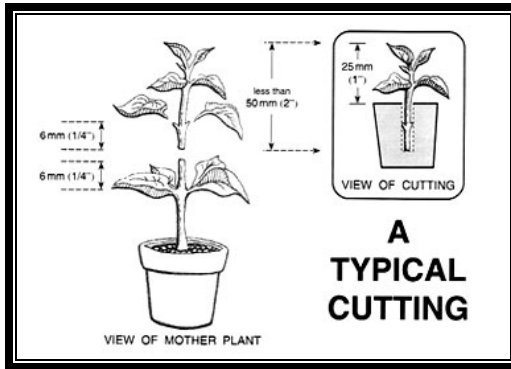
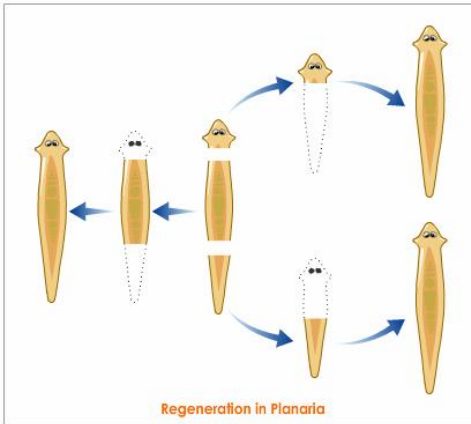
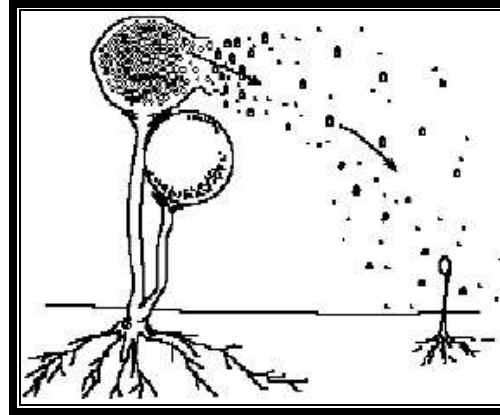
- ◆ **Binary Fission:** nuclear and cytoplasmic division is equal (ameba, paramecium)
- ◆ **Budding:** equal nuclear division, unequal cytoplasmic division
 - unicellular – yeast
 - multicellular – hydra
- ◆ **Sporulation:** spores produced are genetically identical to parent (fungi)
- ◆ **Regeneration:** the ability of an organism to develop a genetically identical organism from part of the parent organism (planaria, starfish) or to replace lost parts (lobster claw, lizard tail)
- ◆ **Vegetative Propagation**
 - bulb:**genetically identical plants grow from bulbs or underground stems (onions, tulips)
 - tuber:** also a type of underground stem. New genetically identical plants grow from the buds of “eyes” of the tuber (potato, yam)
 - runner:** plants have above ground horizontal stems that grow genetically identical plants along the stems (strawberry)
 - cutting:** a part of the stem is rooted and planted – will grow into a new genetically identical plant
 - graft:** when a cutting is inserted into a cut in another tree. The cutting will develop its own fruit – the host plant (stock) will continue to develop its own fruit. (cutting from a lime tree is matched to a branch on a rooted orange tree – the cutting still produces limes and the rooted tree still produces oranges).



Yeast Buds



Sporulation – fungi



Graft

