Mitosis and Meiosis

Cell Continuity -is the unbroken succession of cells since life evolved 3.8 billion years ago.

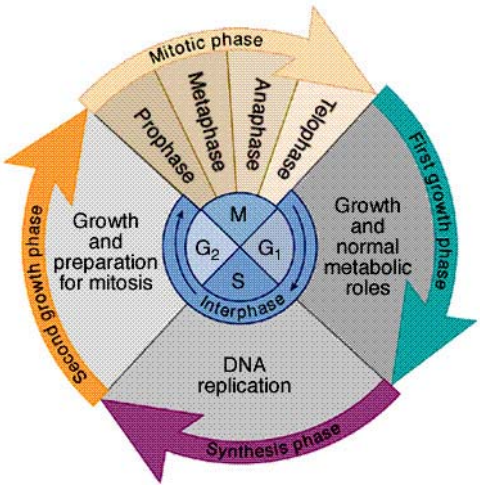
- New cells can only be produced by cell division.
- New cells are needed for
  - reproduction,
  - formation of multicellular organisms, and
  - cell replacement.

Cell Cycle

There are three stages of the cell cycle:

1. **Interphase -**The cell grows, proteins are made, the number of organelles increases, DNA replication.
2. **Division of the Nucleus:**
   - **Mitosis**: two daughter nuclei, genetically identical the original nucleus, are formed.
   - **Meiosis**: formation of four haploid genetically different daughter nuclei from the original diploid nucleus.
3. **Cytokinesis:**

- The cytoplasm divides between the new daughter nuclei.
- Therefore each nucleus with its allocation of cytoplasm becomes a new cell.



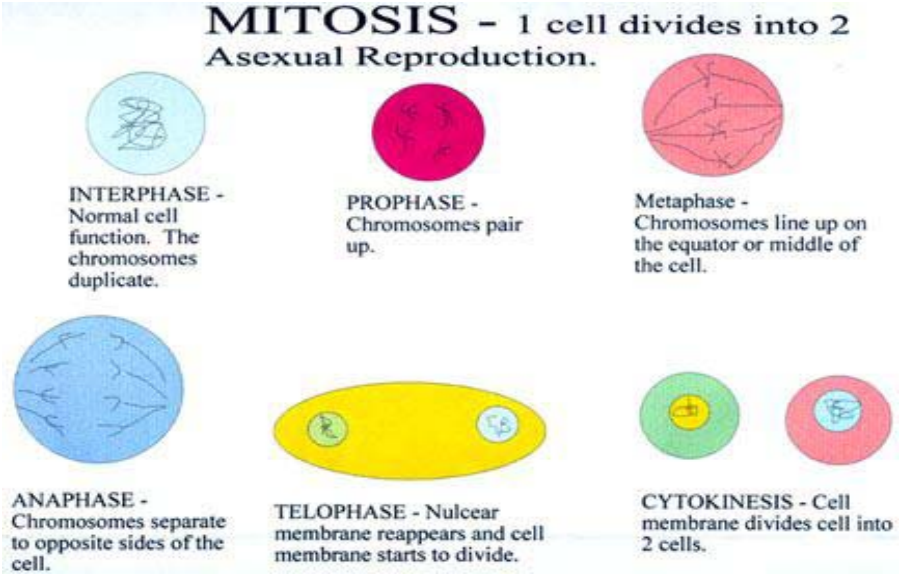
Mitosis

All nuclei can undergo mitosis.

- **Haploid** (n): one set of chromosomes is present in the nuclei (i.e. only one of each different chromosome is present.)
- **Diploid** (2n): two sets of chromosomes are present in the nuclei (i.e. two of each different chromosome are present.)

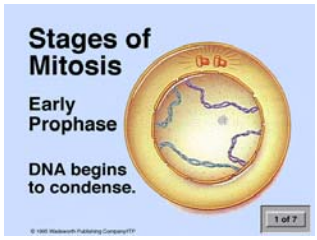
Role of Mitosis

- Formation of a multicellular organism.
- Asexual reproduction e.g. Amoeba, yeast and vegetative reproduction of plant.
- Cell replacement and regeneration.
- Faithful copying of genes and their transfer to the next generation of nuclei or cells.
- Maintains the correct chromosome number of **somatic** (= normal body) cells.

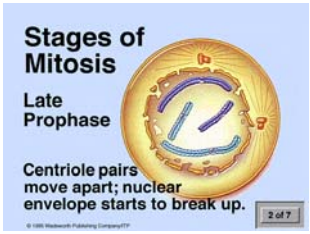


Stages of Mitosis (Interphase)**;** Metaphase, Anaphase, Telophase. (Interphase)
(Mnemonic – I Pee MAT)

Prophase

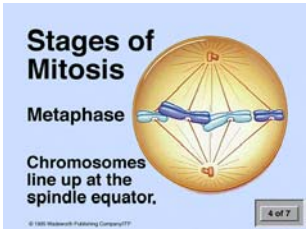


- chromatin condenses forming chromosomes
- chromosomes **shorten, thicken, coil, dehydrate**
- each chromosome consists of two identical sister **chromatids**
    - connected at the **centromere**
- **centriole** divides – forming the **spindle fibres**
- nuclear envelope breaks down at the end of prophase



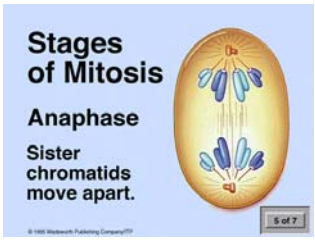
Metaphase

- chromosomes placed individually along the equator of the cell
- each chromosome is connected by two sets of spindle fibres attached to the centromeres



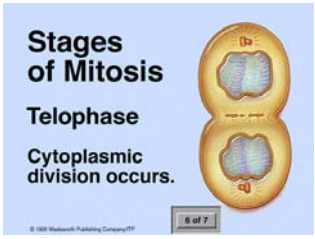
Anaphase

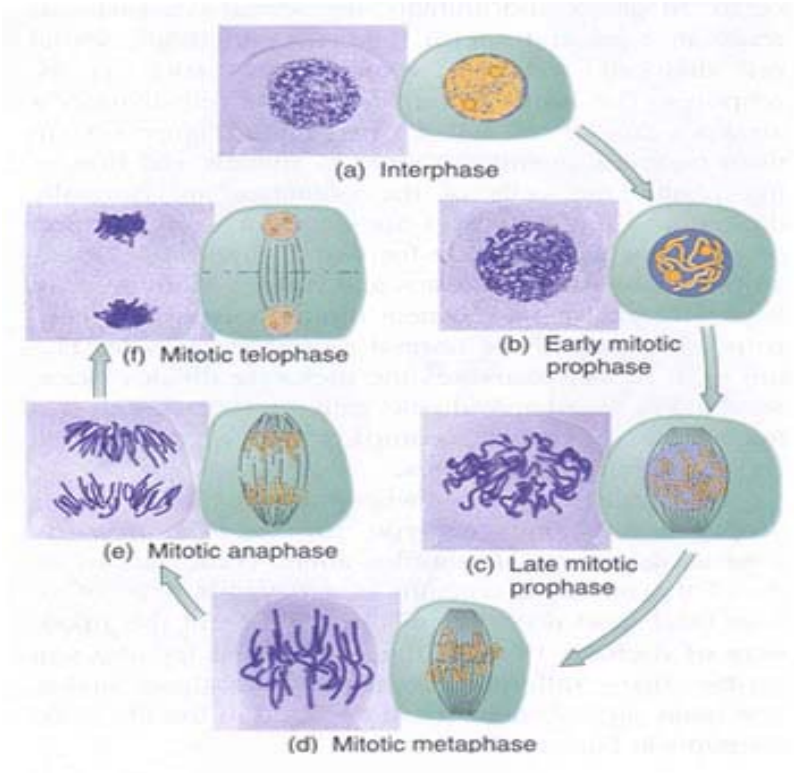
- separation of sister chromatids, **now termed chromosomes**
- the centromeres spit when the spindle fibres shorten
- shortening results in two identical sets of chromosomes at opposite sides of the cell



Telophase

- each chromosome group becomes a nucleus when a nuclear envelope is formed around it
- the chromosomes uncoil to chromatin
    - chromosomes **lengthen, uncoil, rehydrate**





Definitions

Chromatin: DNA in its 'normal', i.e. functional state — condenses to form chromosomes.

Chromosomes:

- condensed chromatin showing up as a group of short thread-like structures
- **only** visible with the light microscope in nuclei during mitosis and meiosis
- each chromosome carries a specific set of genes in linear order at particular **loci** (= sites)

Chromatid:

- often described as '*half a chromosome'*
- it is one of two threads of condensed chromatin forming one chromosome
- the two threads are connected together at the **centromere** after DNA replication (**S phase**)
- they exist **only** during prophase and metaphase (i.e. *when chromosomes are X-shaped*)

Centromere: a non-DNA region of a chromosome where sister chromatids are held together and spindle fibres attach.

Meiosis

Meiosis: the division of a diploid nucleus to form four haploid genetically different daughter nuclei.

Role of Meiosis

- Increases genetic variation in the population – role in evolution
- Makes sexual reproduction possible
- Gamete formation in animals, fungi, protoctista e.g. Man

Site of Meiosis
Animals

- testis - forming sperm, the haploid male gametes;
- ovary - forming egg cells, the haploid female gametes.

Flowering plants:

- anther of the stamen - forming the haploid male spores (microspores),
- ovule of ovary - forming the haploid female spores (megaspores).