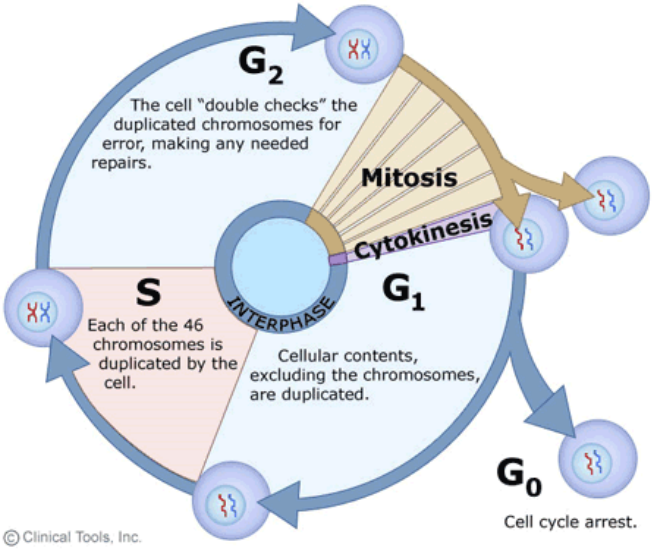
I. Mitosis

A.Cell Cycle

1. **G1 phase**- Most of the cells growth occurs where cells increase in size and synthesize new proteins and organelles. *Period of intense growth and activity*
2. **S phase**-Synthesis phase, where new DNA is synthesized when the chromosomes are replicated. The cell at the end contains double the # of DNA from the start.
3. **G2 phase**- Organelles of a cell are replicated within the cell [Shortest phase of interphase]
4. **M phase**-The parent cell turns into two daughter cells through mitosis and cytokinesis
5. **Apoptosis**-Planned cell death in areas between fingers and toes



B. Cell cycle: regulated by checkpoints and it is necessary to prevent cells from dividing without replicating organelles or DNA or to replace old or damaged cells.

C. When the cell cycle is not regulated properly, a tumour will occur and cells will start to divide too much and will skip the replication of DNA and organelles, such as in cancer.

D. Vocab

DNA-genetic material inherited from parents

Gene- instruction of a chromosome for a trait

Allele-alternate forms of genes in the same category

Chromosome-threadlike structure of DNA and protein that contains genetic information

Chromatin-uncondensed and scrambled form of chromosomes

Replicated Chromosome-A chromosome replicated prior to cell division

Sister Chromatids-Identical chromosomes after replication

Centromere-region of a chromosome where the two sister chromatids attach

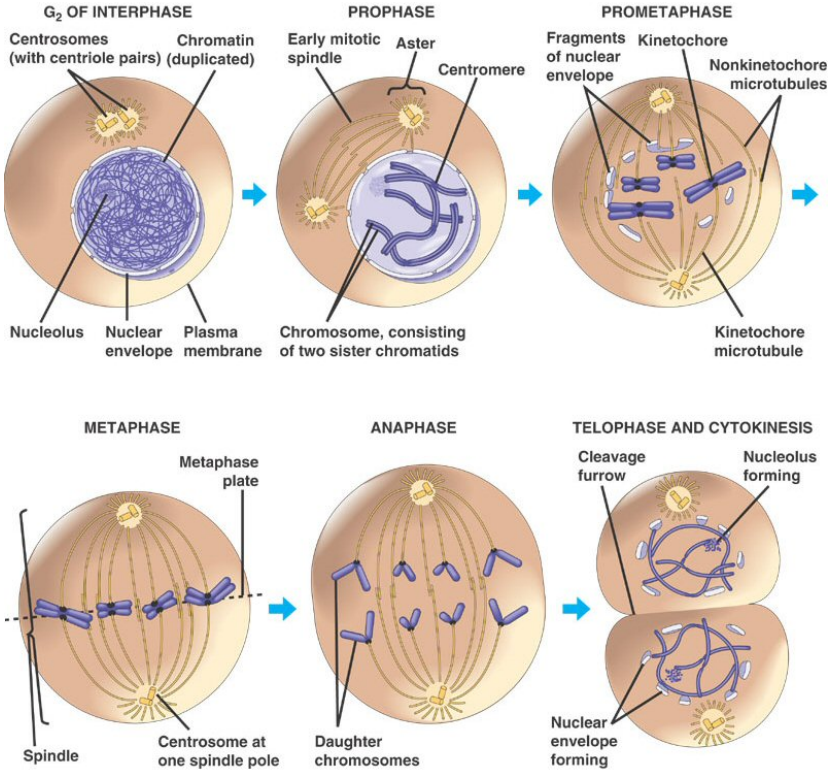
E**. Diploid cell**: A standard cell in the body with two complete sets of inherited chromosomes unlike haploid cells which only contain one set of chromosomes (sex cells).

F. **Purposes of mitosis:** To continue the lifespan of an organism and to assure that offspring will be produced.

G. Phases of Mitosis

1. **Prophase**-Genetic material in the nucleus condenses and and the duplicated chromosomes become visible. Is usually the longest phase. A spindle starts to form outside
2. **Metaphase**-the centromere of the duplicated chromosomes line up in the center of the cell. Spindle fiber connect the centromere of each chromosome to the two poles of the spindle
3. **Anaphase**-chromosomes separate and move to opposite sides of the cell. Chromosome separate and move along spindle fibers to opposite ends
4. **Telophase**-the nucleus divides. Begins to spread out into a tangle of chromatin
5. **Cytokinesis**-division of the cytoplasm to create two daughter cells

When mitosis is done, the chromatins have separated and divided between the new daughter cells. Plant cells lack centrioles and organize spindle directly from their centrosome regions



H. **Role of disjunction:**To separate the chromosomes correctly to make sure each cell has the appropriate amount of chromosomes.

I. **Products of mitosis**: are two genetically identical daughter cells with the potential of growing to the size of the parent cell.

J. **Centrioles and spindle fibres** are used to attach to the centromere of a chromosome and pull each chromatid to a different half of the cell.

K. In plant cells, the cells do not divide into two new cells such as in animal cells but rather builds a wall in between the dividing cell. However, all other phases are carried out the same.

II. Mitosis

A. **Purpose of meiosis:**Meiosis increases the genetic variation, such that there are two divisions meaning four haploids with different sets of chromosomes each. A process of cell division in which gametes are produced. Reduces the diploid cells to haploid cells or gametes.

B. **Vocab**

1. **Tetrad**-structure containing four chromatids that forms in meiosis
2. **Synapsis**-formation of a tetrad
3. **Homologous pair of chromosomes**-chromosomes in which one set comes from a father and one st comes from the mother
4. **Crossing Over**-process in which homologous chromosomes exchange portions of chromatids in meiosis.
5. **Gene Linkage-** Tendency of genes that are located proximal to each other on a chromosome to be inherited together during meiosis.

C. Events in Meiosis- **Neither cell goes through chromosome replication**

Interphase: Prepares for cell division

After interphase 1, the cell begins to divide and he chromosomes pair up.

Prophase 1: Each replicated chromosome then pairs with its corresponding homologous chromosome,pairing forms a tetrad and as they form it they undergo crossing- over. First the chromosome crossover one another. Then the crossed sections of the chromatids/alleles exchange. It produces a new combination of alleles in the cell.

As prophase ends, a spindle forms and attaches to each tetrad.

Metaphase 1: Paired homologous chromosomes line up across the center of the cell.

As cells move into Anaphase 1, the homologous pairs of chromosomes separate

Anaphase 1: Spindle fibers pull each homologous chromosome pair toward opposite ends of the cell When Anaphase 1 is complete, the separated chromosomes cluster at opposite ends of the cell

Telophase 1: A nuclear membrane forms around each cluster of chromosomes.

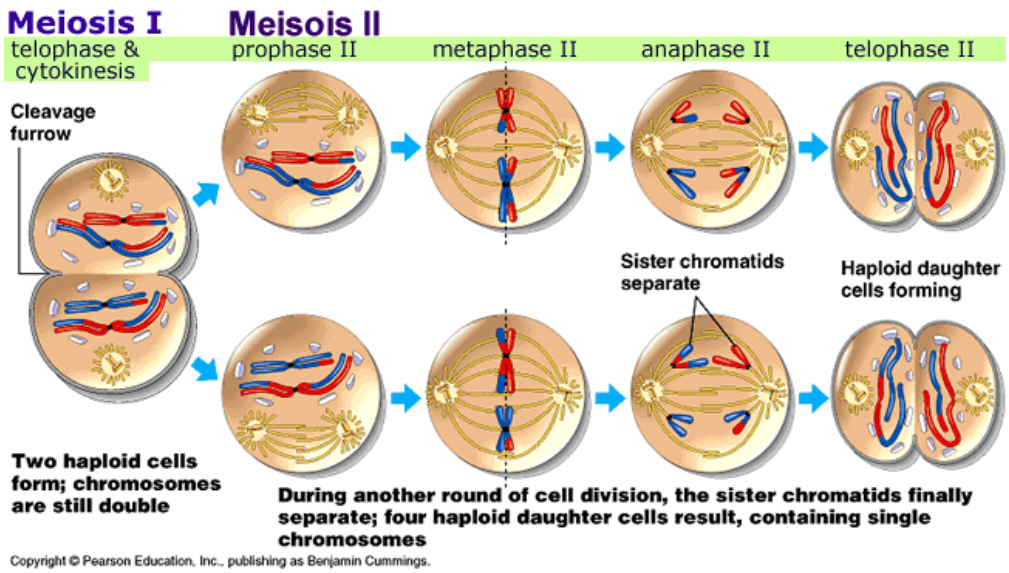
Prophase 2: As the cell enters, their chromosomes become visible. They do not form tetrads, because the homologous pairs were already separated during meiosis 1

Metaphase 2: Chromosomes line up in the center of each cell

As cells enters anaphase, the paired chromatids separate

Anaphase 2: Similar to Anaphase 1

Telophase 2: Similar to Telophase 2



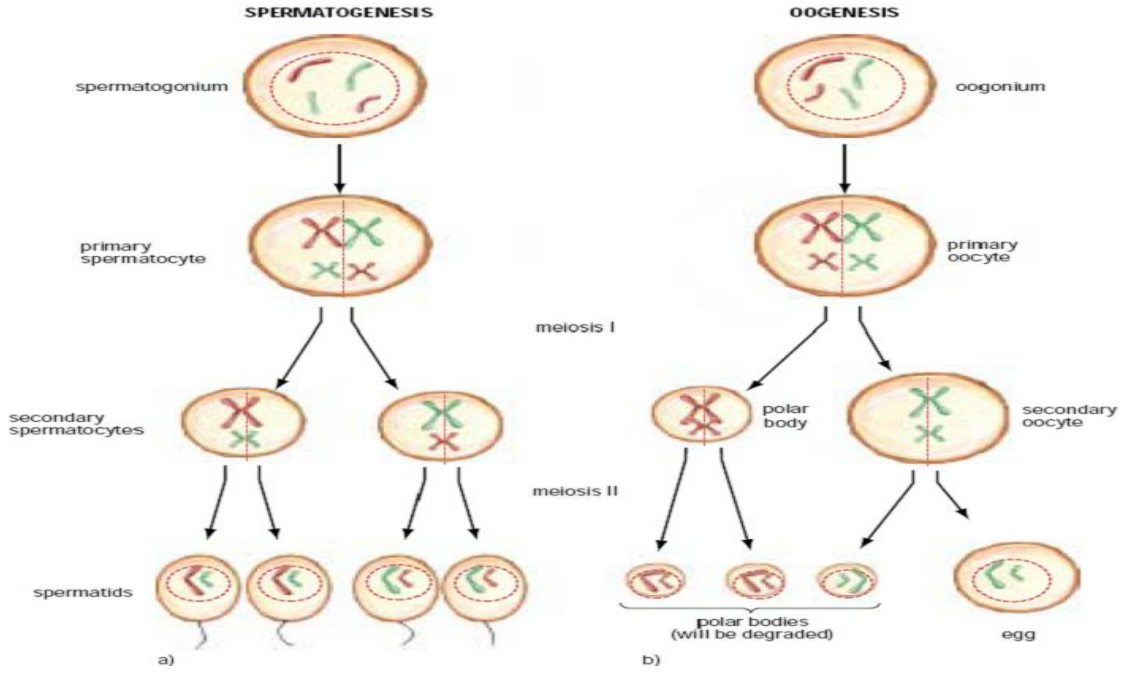
Meiosis I: Results in 2 daughter cells as each pair of homologous chromosomes was separated, neither daughter cell has the 2 complete set of chromosomes.

Microtubules: Help provide structure to cell from the centromere

D. **Spermatogenesis-1**) meiosis, during which the number of chromosomes in the cell is reduced to half or 23 chromosomes each; **2**) meiosis II, during which each haploid cell forms spermatids; and **3**) spermiogenesis, during which each spermatid develops into a sperm cell with a head and tail.

E. **Similarities**: Both go through meiosis 1 and 2. Both after completion of karyokinesis have haploids n sets of chromosomes.

Contrasts: After finishing gametogenesis spermatogenesis will create 4 sperm cells, Oogenesis will create 1 ovum and 3 polar bodies.



F. **Disjunction** assures that the right number of chromosomes goes into each sex cell, preventing disorders such as Down syndrome

G. **Karyotype**: A visual diagram of a person's chromosomes. It can be used to determine if a baby will have a genetic disorder or what specific genetic disorder a person has or will have. It can also be used to tell what organism it is based on the number of chromosomes.

III. ASEXUAL AND SEXUAL REPRODUCTION-

A. Asexual and Sexual reproduction

Asexual

1 Parent, Offspring receives one set of genes, Cell divides by fission,budding and regeneration

- Types: Budding, vegetative reproduction, fragmentation, spore formation

No variation, No formation or fusion of gametes, short time span, two or more offsprings

Sexual

2 Parent, Offspring receives two sets of genes, Male Sex Cell must fertilize the female sex cell Cells divide by meiosis, 1 offspring, long time span, genetic variation, formation or fusion of gametes

- Types: Syngamy and Conjunction

B. Unique aspects of forms of asexual reproduction:

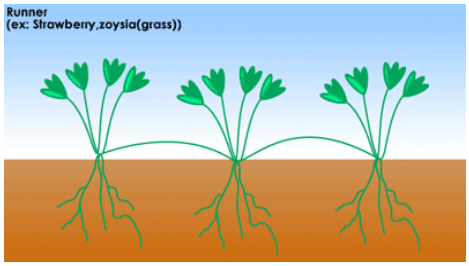
I. Binary Fission-asexual reproduction in which an organism replicates its DNA and divides in half

II. Budding-grafting the meristematic tissue of a plant onto another plant.

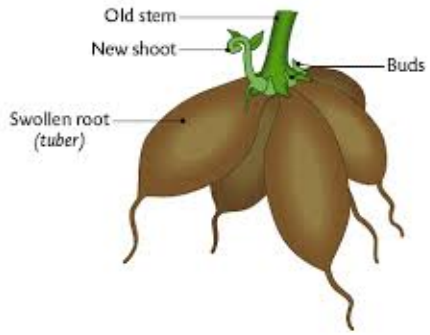
III. Regeneration-(of a living organism) regrow (new tissue) to replace lost or injured tissue.

V. Vegetative Propagation: A form of asexual reproduction where one plant is able to grow into a new plant without seeds or spores. Methods of vegetative propagation include, division, budding, grafting and cutting

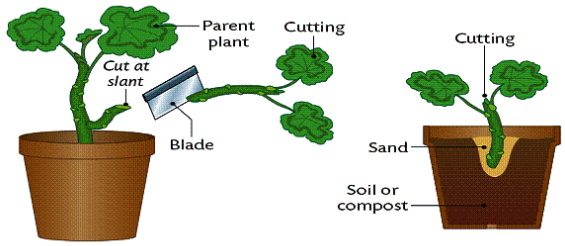
1. Runners: Some plants produce long side shoots that develop roots, eventually forming a new plant. Example Strawberry, Spider plant, hydra



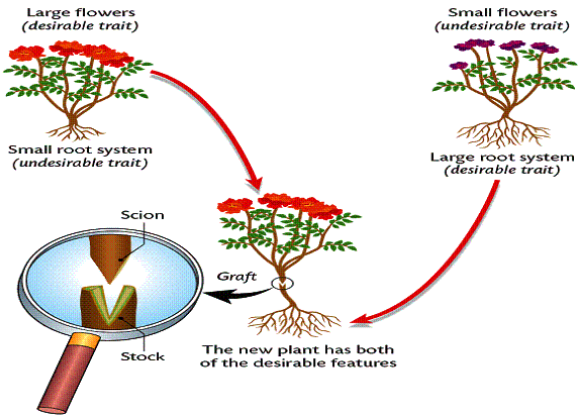
2. Tubers: Swollen underground stems that can develop into new plants. EX: Irish potato, carrots and turnips. Some tubers have swollen roots which are called root tubers. EX: sweet potato, cassava and yam.



3. Cutting: A vegetative plant part which is severed from the parent plant in order to regenerate itself, thereby forming a whole new plant



4. Grafting: In grafting 2 plants are used to develop a new plant with combined traits from the 2 parent plants. In grafting the scion is the aboveground part of one plant. The scion is attached to the stock which is the rooted part of the second plant



C. **Basic process required for sexual reproduction**: Meiosis and Fertilization

Prokaryotic Chromosome: No nuclei and contains a single strand of DNA in cytoplasm

Regulatory Proteins: Cell cycle controlled by regulatory proteins both in and out

Internal: Allow cycle to proceed only when certain events have occurred

Eternal: Directs cell to speed or slow down the cycle

Growth Factors: Stimulate growth and division of cells. These proteins are important in embryor development and wound healing

Other external regulatory proteins on the surface of neighboring cells often have an opposite effect. They cause cells to slow down or stop the cell cycles, This prevents excessive cell growth and keep body tissues from disrupting one another.