Inheritance

Chromosomes and genes;

cell division by mitosis and meiosis

- ***Chromosome***: is a long thread of DNA and protein, appears in the nucleus during cell division. It is formed of genes.
- Each chromosome of on chromatid contains one molecule of DNA.
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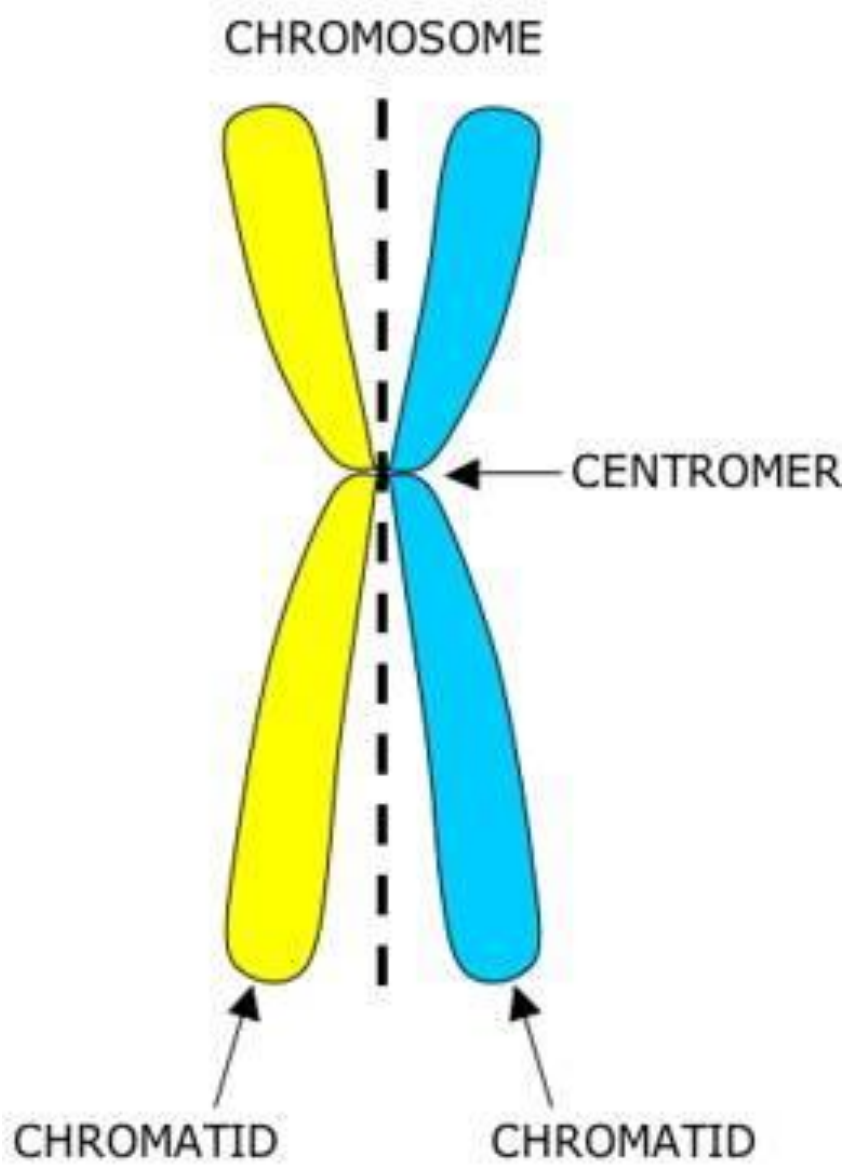
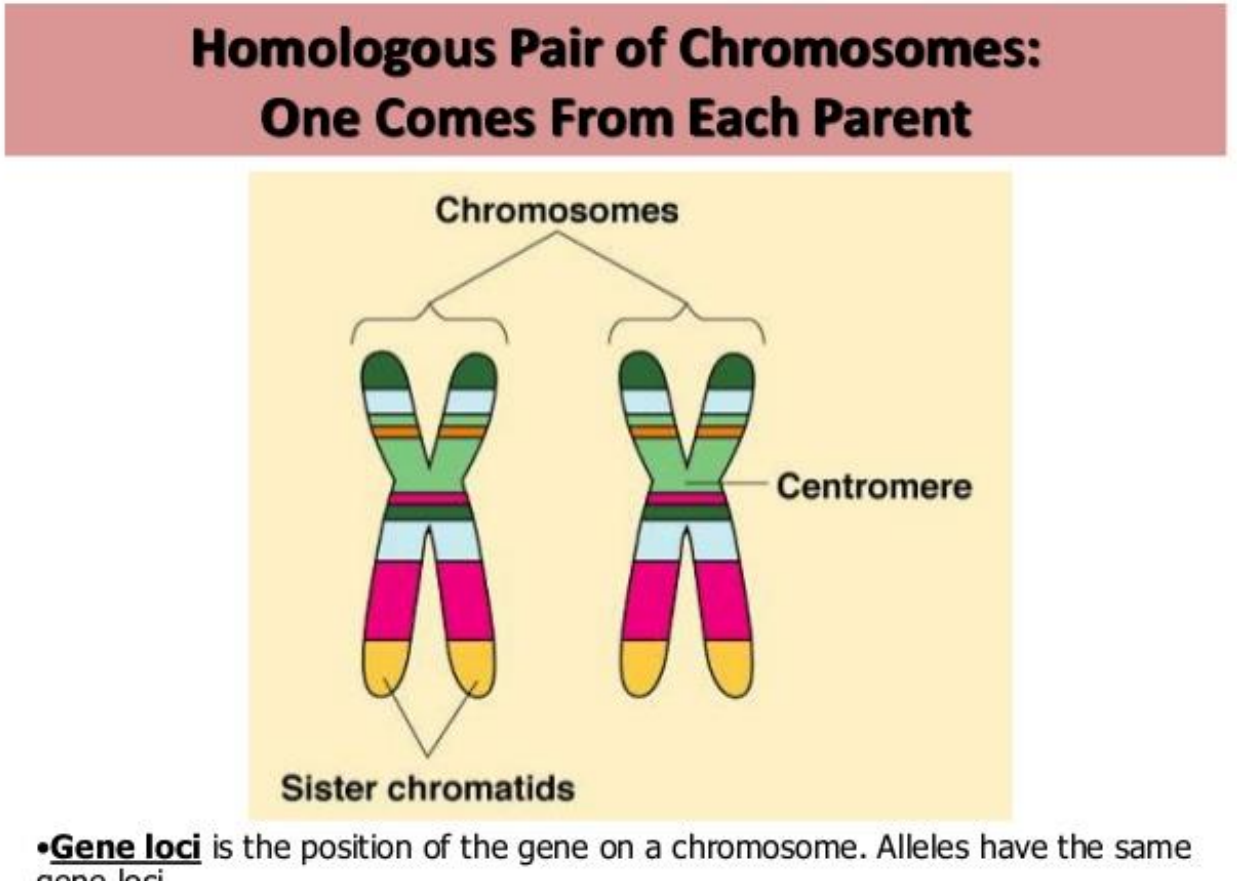
- ***Gene*** is a length of DNA that codes for a protein (one polypeptide).



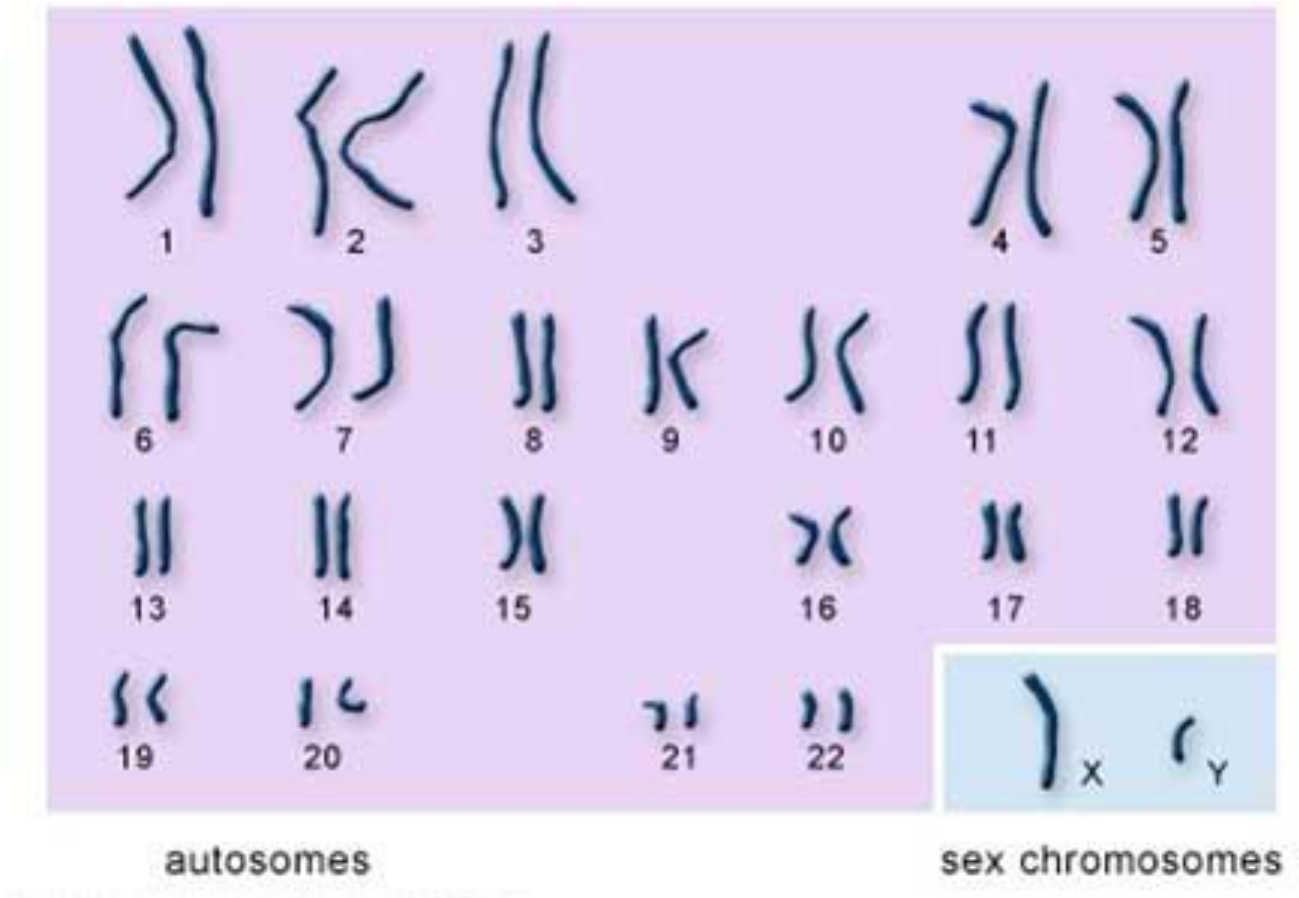
Homologous Chromosomes

- Homologous Chromosomes are similar pair of chromosomes, one comes from the male gamete and the other from the female gamete. Homologous chromosomes have same length, shape, genes for same characteristics on the same position called locus and same position of centromere.
- Homologous chromosomes may carry different alleles.



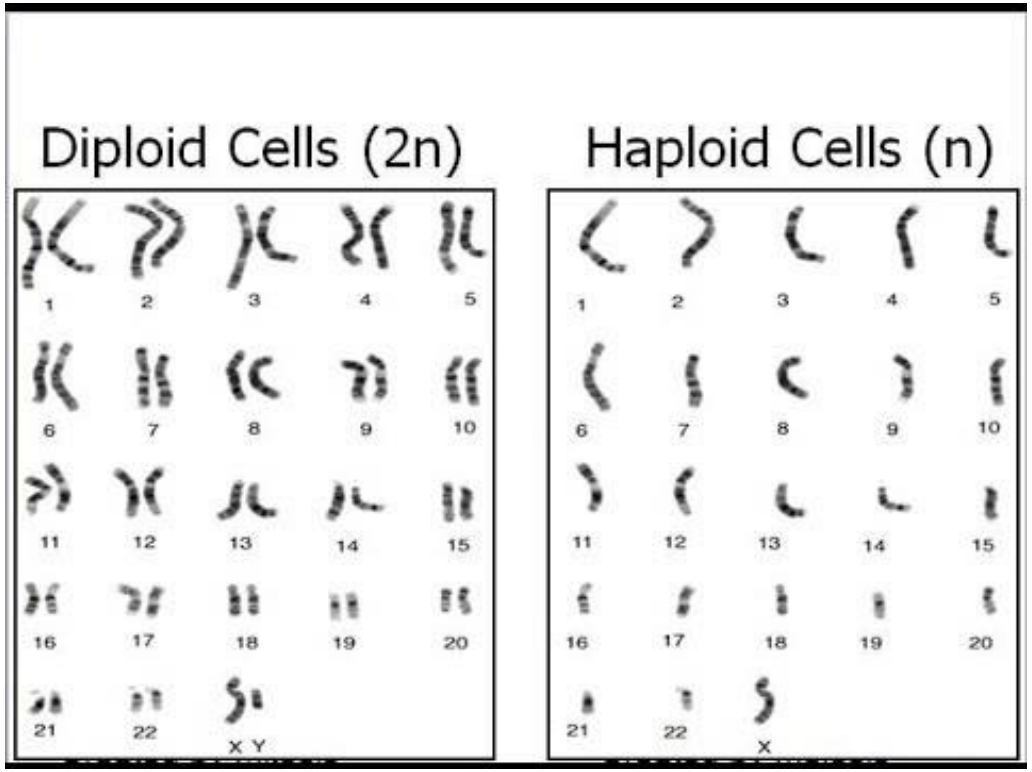
Diploid cell

- A cell which has in its nucleus two of each kind of chromosomes, or it contains two sets of chromosomes.
- Somatic cells are diploid cells.



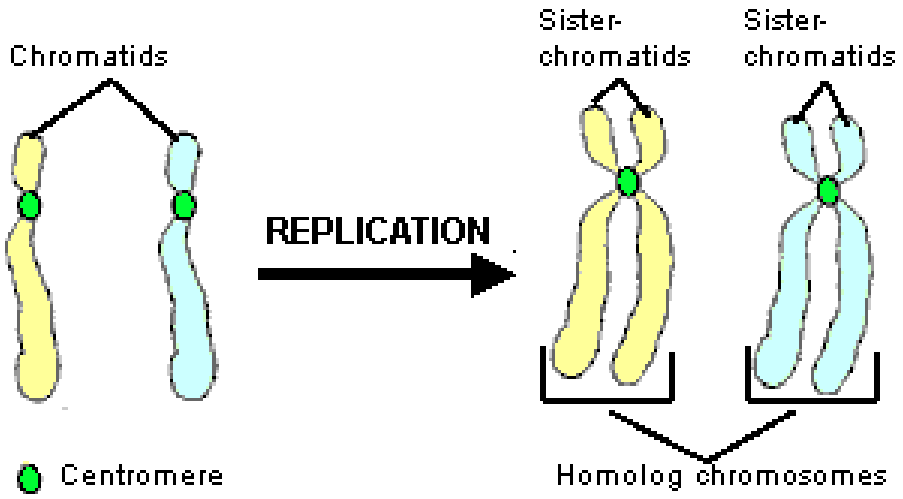
Haploid Cell

A cell which has in its nucleus only one of each kind of chromosomes, one set of unpaired chromosomes (half the number of the diploid cell).
It results from meiosis which gives rise to gametes.
Gametes are haploid cells.



Replication

- Replication is the process of copying for each chromosome (of one chromatid) to make a replica (exact copy) of itself. Chromosome of one chromatid passes into a state of two chromatids. The number of chromosomes stays the same but the quantity of DNA doubles



Number of Chromosomes

- There is a fixed number of chromosomes in each species.
  human body cell = 46 chromosomes
  mouse cell = 40 chromosomes
  pea cell = 14 chromosomes

- The number of chromosomes in a species is the same in all of its body. A human liver cell has 46 chromosomes, a WBC has 46 chromosomes, except gametes.

- The chromosomes are always in pairs. This is because when the zygote is formed, one of each pair comes from the male gamete and one from the female gamete.

Find the number of chromosomes in each of the following human cells

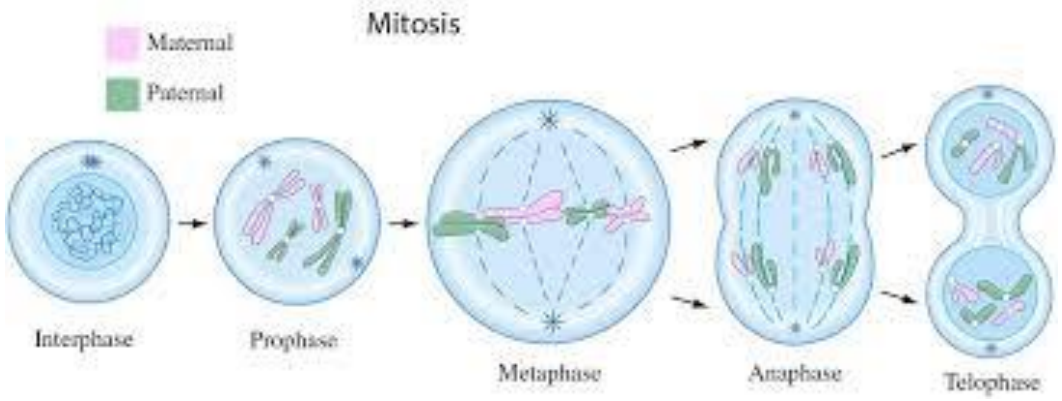
Cell	Number of chromosomes
WBC	46
SKIN	
RBC	
Sperm	
Bone	
Ovum	

Mitosis

- Mitosis is a nuclear division which gives rise to genetically identical daughter cells

Mitosis has 4 Phases

- 1st Phase
- Chromatin condenses (=shorter and thicker) to form thread-like structures called chromosomes.
- Each chromosome consists of two chromatids (strands) attached by a centromere.
- Nuclear membrane disappears
- Spindle fibres appear.



2nd Phase

- Chromosomes gather at the equator of the cell foaming the equatorial plate.
- Chromosomes can be counted.

3rd Phase

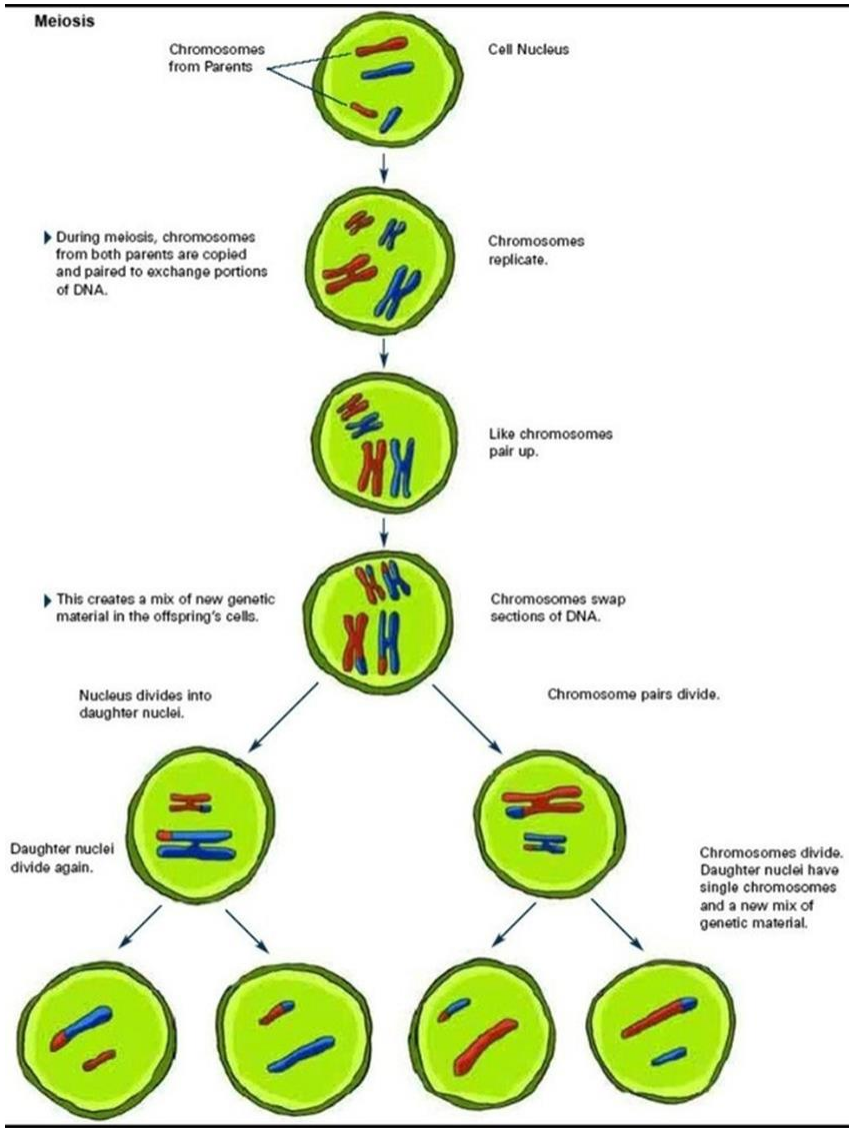
- The centromere divides, separating the sister (two) chromatids of the same chromosome.
- Chromosomes of one chromatid each move to opposite poles.

4^{th} Phase

- Chromosomes become chromatin.
- Nuclear membrane reappears.
- A pinch (constriction) forms at the middle of parent cell, dividing it into two identical daughter cells.

Meiosis

- Meiosis is reduction division in which the chromosome number is halved from diploid to haploid, resulting in genetically different cells.
- Gametes are haploid cells produced by meiosis.
- Meiosis produces genetic variation.



- First division – meiosis I
  - Homologous chromosomes pair together, crossing over takes place.
  - Homologous chromosomes separate. One from each pair goes into each daughter cell.
- Second division – meiosis II
  - Each chromosome separates into two chromatids. One chromatid of each kind goes into each daughter cell.

DNA and protein synthesis

- A DNA molecule is made up of two long strands.
- Each strand is made up od small subunits called nucleotides.
- There are four different nucleotides, each containing a different base – A, C, T, or G.
- The sequence of amino acids in a protein molecule determines the final shape of the molecule.
- The shape affects how the protein works.
- DNA contains a code that determines exactly what sequence of amino acids a cell should string together when it makes a particular protein.

- A gene determines what protein what protein will be made.
- The protein affects a feature of the organism.

The genetic code

- The DNA bases are read in sets of three, called triplets.
- For example, the sequence CCG in a DNA molecule stands for the amino acid glycine. CAG stands for valine.
- So the base sequence: CCG CAG tells the cell: join a valine amino acid to glycine amino acid.

Protein synthesis

- DNA is found in the nucleus.
- Protein synthesis happens on the ribosomes, in the cytoplasm.
- To carry information from DNA to the ribosome, a messenger molecule called messenger RNA (mRNA) is used.
- When a protein is to be made, a mRNA molecule is made in the nucleus, copying the base sequence from the appropriate length of DNA.
- The mRNA then moves out from the nucleus into the cytoplasm, and attaches to a ribosome.
- The ribosome links amino acids together in exactly the right order to make the desired protein, following the code contained on the mRNA molecule.