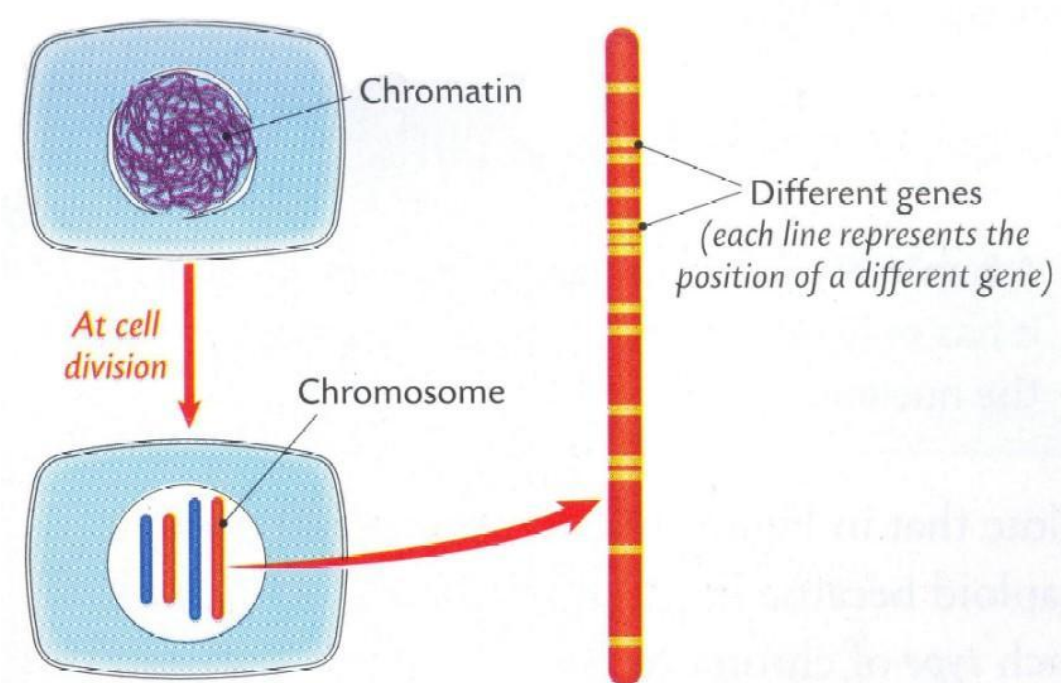


2.5.6 Genetics & Inheritance 1

allele(s): alternative forms of a gene or a pair of genes found at the same locus/position on homologous chromosomes controlling the same trait.

chromosome: rod/thread-like structure composed of DNA and protein, contains the genetic information (genes) which is passed from one generation of cells or organisms to the next. Occur in pairs in most plant and animal cell nuclei.



colour-blindness: inherited condition (sex-linked recessive trait) where certain colours cannot be distinguished.

contrasting traits: traits that are in opposition to one another or show a striking difference to one another, e.g. tall and dwarf, yellow and green, etc.

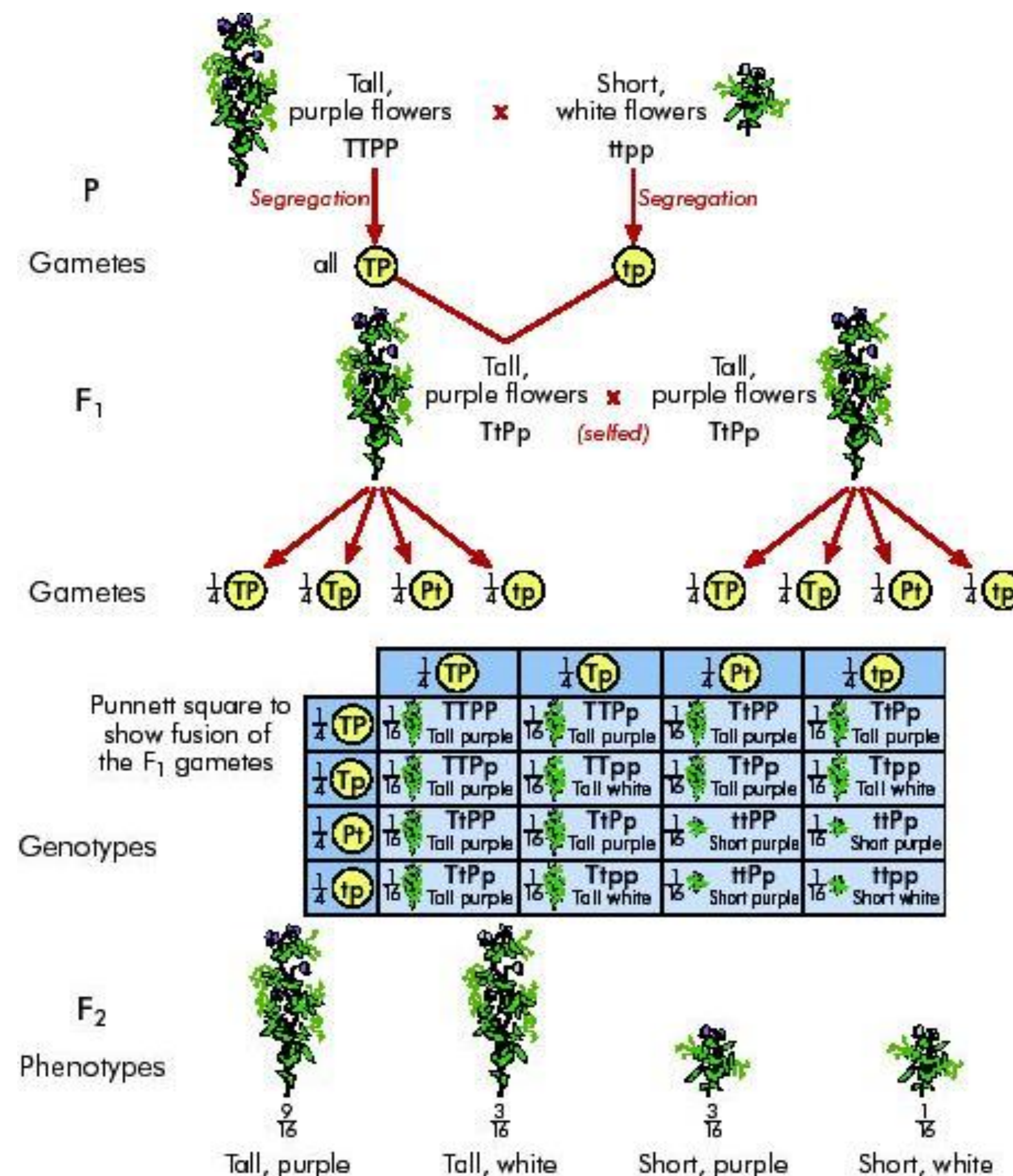
DNA: substance found in cell nuclei in the chromosomes. Regulates protein synthesis and is the main molecule of genes.

DNA profile: a picture (auto radiograph) of the pieces of DNA produced when an organism's DNA is broken up using specific enzymes and then sorted by size on a gel.

The stages involved are:

1. Cells are broken down to release DNA.
2. DNA strands are cut into fragments using restriction enzymes.
3. Fragments are separated on the basis of size using gel electrophoresis.
4. The pattern of fragment distribution is analysed.

dihybrid cross: a genetic cross which examines the transmission of two traits together, e.g. shape and colour of seed (green and wrinkled).



dominant: characteristic, trait or gene which expresses itself in offspring, even when the corresponding opposite one (recessive) is also inherited, e.g. Tt = tall, T is dominant or, simply, dominant gene = gene that is expressed in the heterozygous condition.

F₁ generation: the first filial (daughter) generation. Offspring from crossing the parental generation (homozygous parents differing in one or more characteristics or traits).

F₂ generation: the second filial (daughter) generation. Offspring from crossing members of the F₁ generation with each other.

gamete: any cell which must fuse with another cell in order to produce a new individual. Haploid reproductive cell, i.e. contains half the required genetic information for the formation of a new individual or half the somatic number of chromosomes (in humans = 23), e.g. sperm cells, egg.

gene: unit of heredity found on a chromosome, and is an instruction to the cell to make a particular substance, a protein, which helps regulate a trait (characteristic) of an organism.

gene expression: the process of changing the information in a gene into a protein and the effect that protein has on the organism.

gene linkage: genes on a chromosome transmitted together.

genetic engineering: modern techniques or processes used to artificially alter the genetic information in the chromosome of an organism. The process involves the following:

- isolation of gene
- cutting (restriction)
- transformation (ligation), introduction of base sequence changes
- expression.

genetic screening: tests to identify the presence or absence of changed or harmful genes possessed by an individual.

genotype: genetic makeup of an individual or the genes that they inherit, e.g. Tt.

heredity: the natural law or property of organisms whereby their offspring have various physical and mental traits of their parents or ancestors, i.e. certain traits, controlled by a genetic code within the chromosomes, are transmitted from one generation to the next.

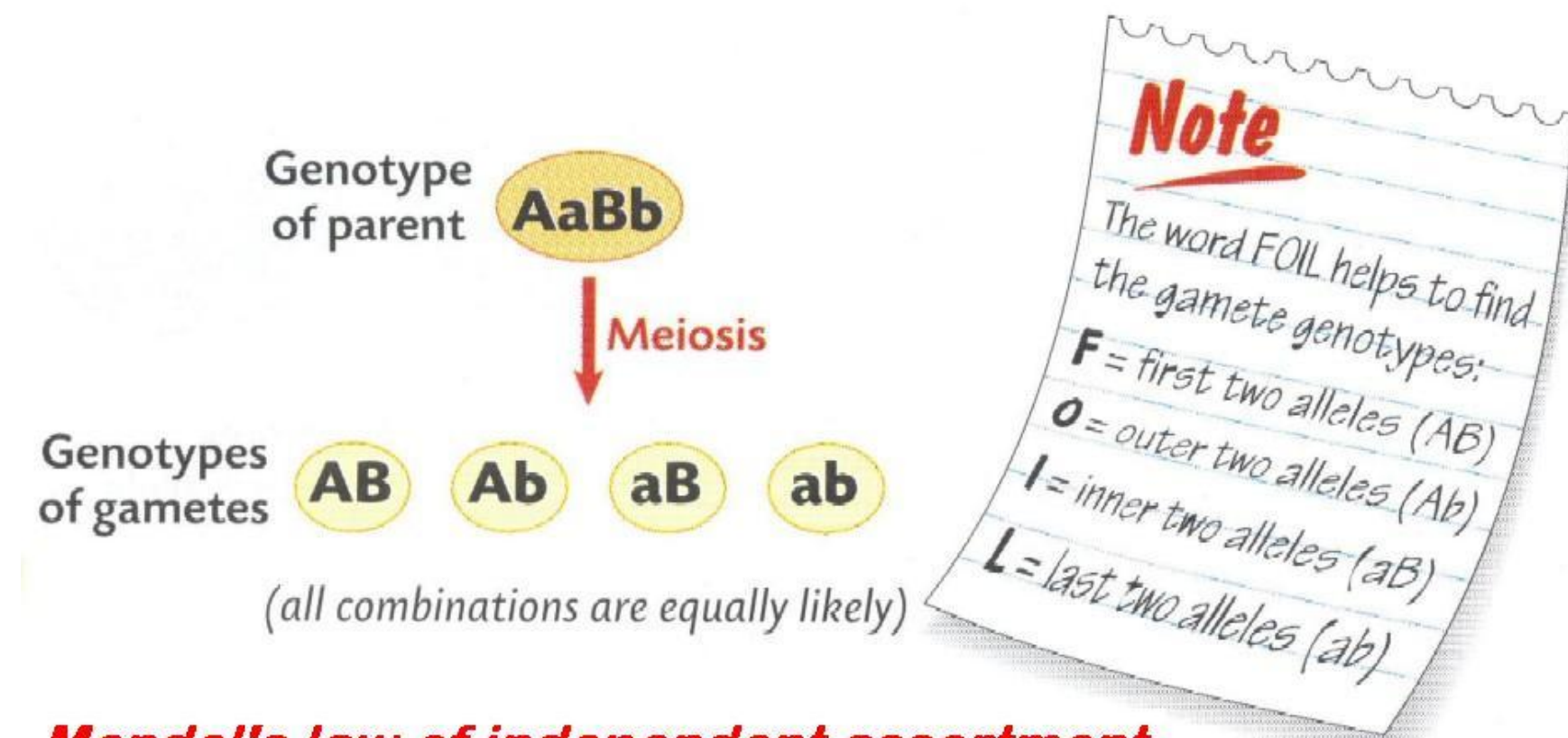
2.5.6 Genetics & Inheritance 2

heterozygous: possessing a pair of dissimilar genes for a trait, e.g. Tt, i.e. the dominant and recessive genes.

homozygous: an organism that breeds true (true-breeding) for a particular trait, because it possesses a pair of similar genes for the trait, e.g. TT or tt.

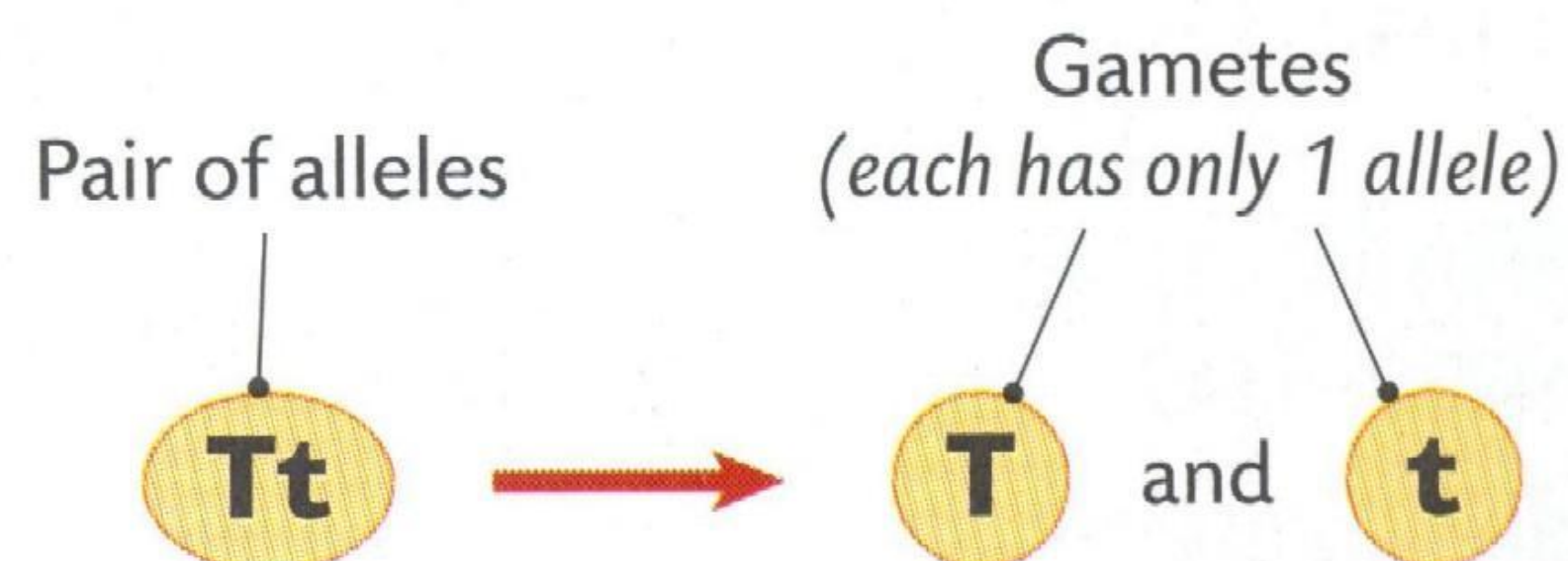
incomplete dominance: in the heterozygous condition both alleles show complete dominance and an intermediate phenotype results, e.g. in shorthorn cattle red x white, F_1 = Roan. Also called co-dominance.

law of independent assortment: states that during gamete formation each member of a pair of genes may combine randomly with either of another pair.



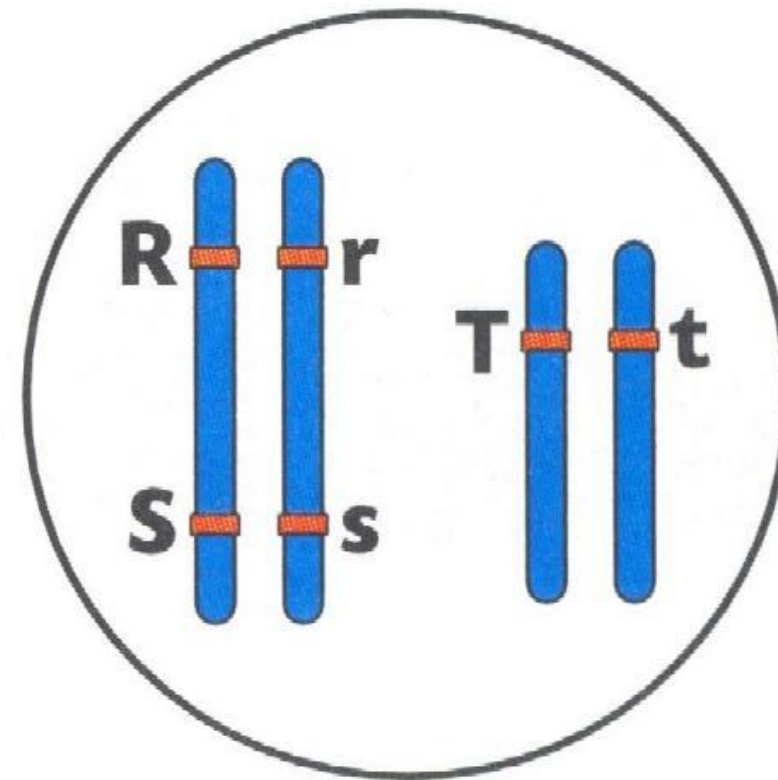
Mendel's law of independent assortment

law of segregation: states that characters (traits) are controlled by pairs of genes (e.g. Tt) that separate (segregate) at gamete formation. Each gamete carries only one gene for the trait. At fertilisation the new organism will have two genes for each trait – one received from each parent.



Mendel's law of segregation - behaviour of alleles

linkage: genes on the same chromosome that are not separated at gamete formation and are inherited together. Complete linkage, i.e. genes never separating, seldom occurs. The closer the genes are on a chromosome the greater the degree of linkage; the further apart, the lesser the degree of linkage. In the diagram R and S are linked; as are r and s.



Chromosome diagram showing linkage

mutagen: a substance or agent capable of causing or bringing about a mutation, e.g. UV light/radiation, x-rays and certain chemicals.

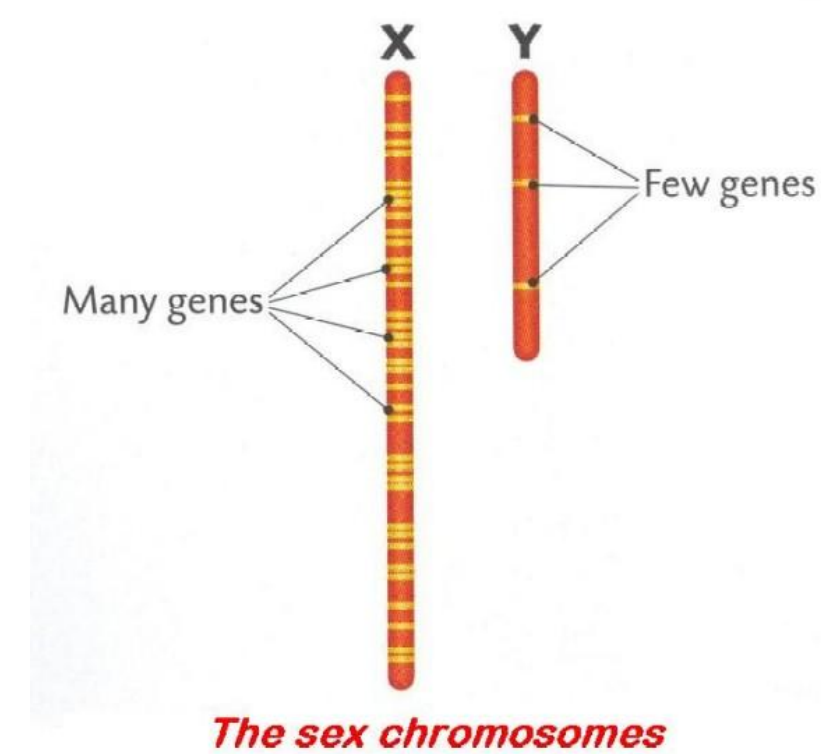
mutation: a spontaneous change in the sequence of nitrogenous bases in a gene or a chromosome. There are two types of mutation – chromosome mutation (e.g. Down's syndrome) and gene mutation (e.g. Sickle cell anaemia).

phenotype: physical appearance of an individual as a result of the interaction of the genotype with the environment.

recessive (allele): gene which can only be expressed when both alleles are the same, i.e. homozygous condition, e.g. tt = dwarf; t is recessive.

segregate: to separate a pair of allelic genes during the process of meiosis and resulting in each gamete having only one of the pair of genes.

sex chromosome: one of a pair of chromosomes

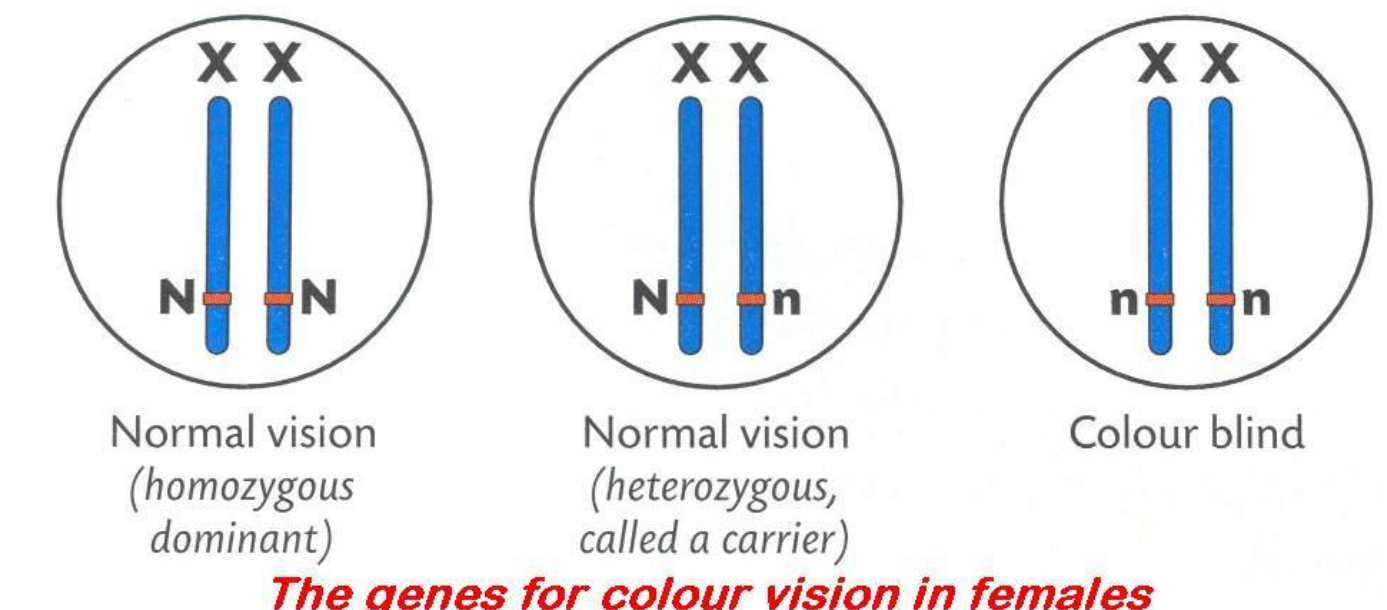


which contains the genes that helps determine the sex of an individual, e.g. in humans

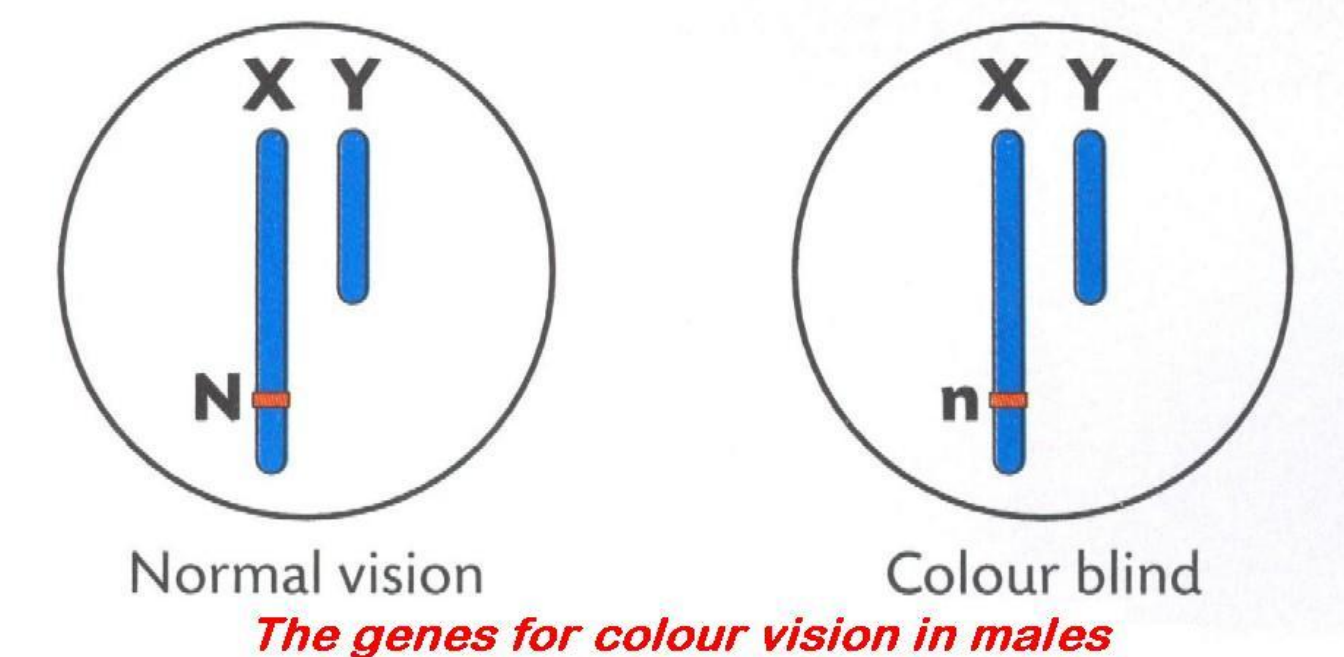
XX = female,

XY = male.

sex-linkage: genes carried on the sex chromosomes (i.e. X and Y chromosomes) are sex-linked. They are transmitted together so the phenotype is related to the sex of the individual. Those that are carried on the part of the X chromosome and have no corresponding part on the Y chromosome (i.e. non-homologous part of X chromosome) are X-linked. Examples of such genes are those controlling haemophilia and red/green colour-blindness in humans.



The genes for colour vision in females



The genes for colour vision in males

species: group of animals or plants that can interbreed and produce viable, fertile offspring. Members of a species share the same characteristics and differ only in minor details. Each member of a species is unique.