Que: Mendel published his work in 1865 but why his work remain un recognised till 1900?

Ans: Because of the following reasons-

❖ He was a monk and not a scientist.

❖ Communication was not easy (as it is now) in those days and his work could not be widely publicised

❖ Mendel's theories of inheritance and heredity were in opposition to Darwin's theories.

❖ He used statistical methods and mathematical logic which were unfamiliar to other biologists at that time

❖ His concept of genes as stable and discrete units that controlled the expression of traits and of the pair of alleles which did not 'blend' with each other was not accepted by contemporaries as an explanation for the apparently continuous variation seen in nature.

❖ He could not provide any physical proof for the existence of factors and what they were made of.

Que: How Mendel work was rediscovered?

Ans: In 1900, three scientist, Hugo de Vries of Holland, Carl Correns of Germany and Erich von Tschermak of Austria work independently & rediscovered Mendel's results on the inheritance of characters.

Chromosomal Theory of Inheritance -1902

➢ Advancements in microscopy led to discovery of chromosomes (coloured bodies when stained).

➢ Chromosomes double just before Cell Division.

➢ In 1902- the chromosome movement during meiosis worked-out.

➢ Walter Sutton and Theodore Boveri noted that the behaviour of chromosomes was parallel to the behaviour of genes.

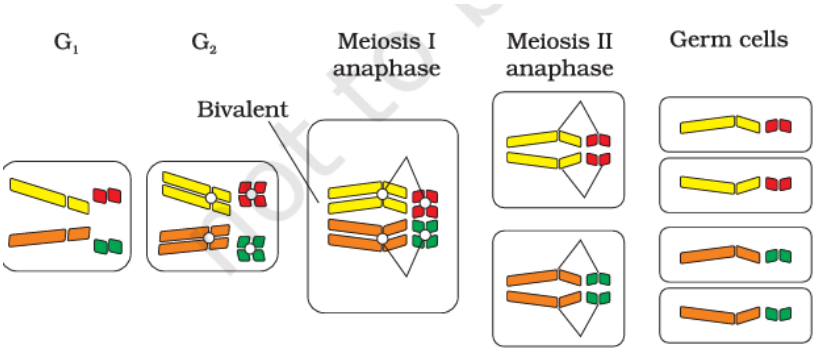
➢ The two alleles of a gene pair are located on the same locus on homologous chromosomes.

➢ Pairing and separation of a pair of chromosomes would lead to segregation of a pair of factors (gene) they carried.

➢ Sutton united the knowledge of chromosomal segregation with mendelian principles and called it the chromosomal theory of inheritance.

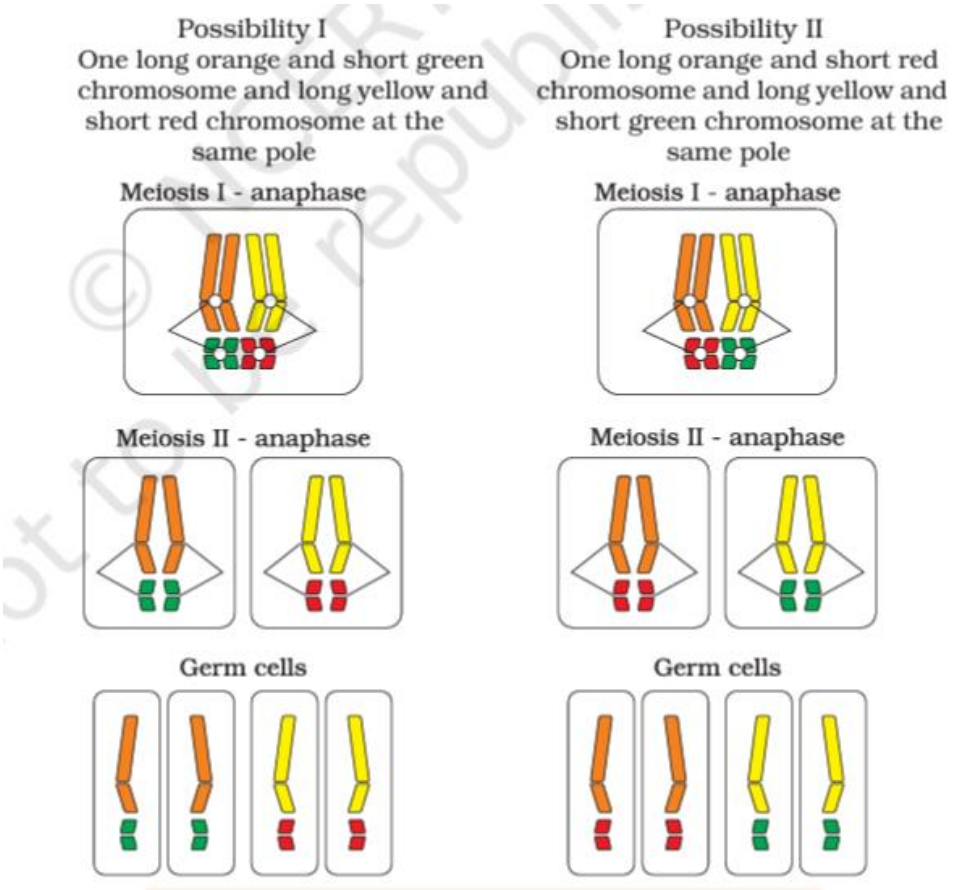
➢ Experimental Verification of Chromosomal theory of Inheritance was done by- Thomas Hunt Morgan & his colleagues.

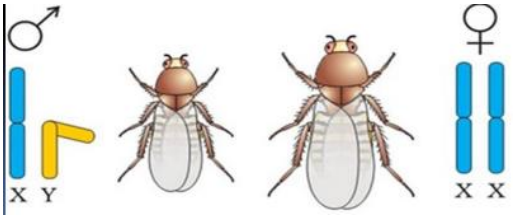
Anaphase- Meiosis I	**Anaphase-II Meiosis II**
➢ Homologous chromosomes align to Metaphase plate & move to opposite ends of the cell.	➢ Two sister chromatids align to meta phase plate get separated and move to opposite poles.



During S phase DNA gets double which leds to formation of two stister cromatids in G_2 phase.

Gene	**Chromosomes**
Occur in pairs	Occur in pairs
Segregate at the time of gamete formation such that only one of each pair is transmitted to a gamete	Segregate at gamete formation and only one of each pair is transmitted to a gamete
Independent pairs segregate independently of each other	One pair segregates independently of another pair .





Que: Why did Morgan select tiny Fruit Fly (Drosophila melanogaster)?

➢ It can be easily grown in synthetic medium.

➢ Short lived (2weeks)

➢ Clear variation in male and female as well as their characters- visible via low power microscope.

➢ Single mating can produce large no. of off-springs.

➢ Easily crossed

Que: Who did the experimental verification of the Chromosomal theory of Inheritance?

Ans: Experimental verification of the chromosomal theory of inheritance by Thomas Hunt Morgan and his colleagues.

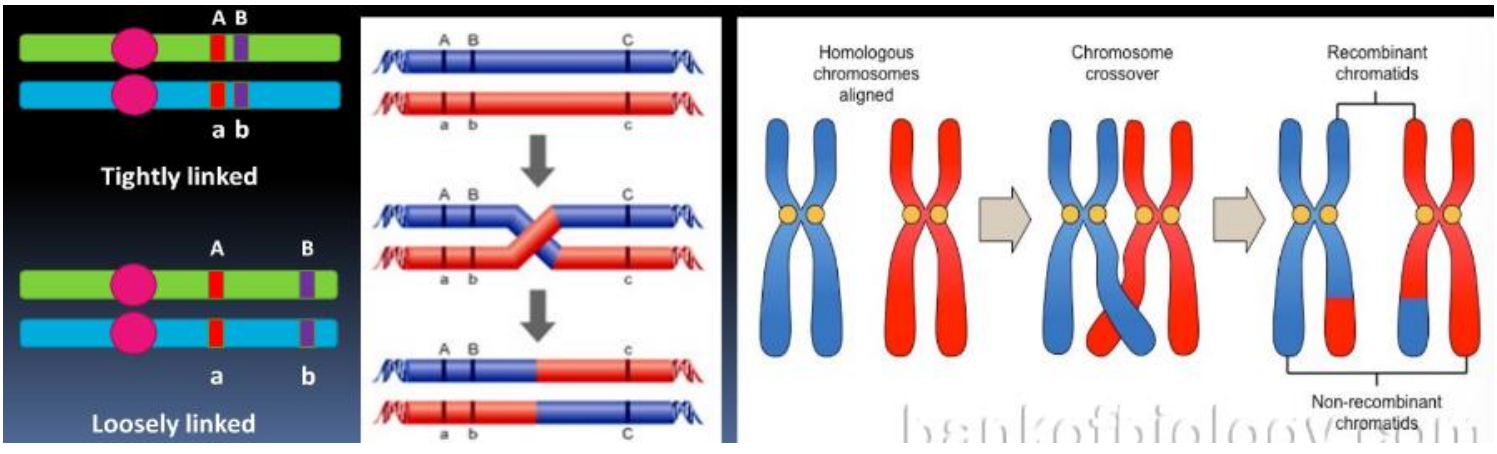
Que: What are chromosomes and who discovered chromosomes? (Non-NCERT)

A12. Chromosomes are thread-like structures present within the nucleus of a cell. They are the vehicle of heridity. Each species has a unique number of chromosomes and it varies from one organism to another. Humans have 23 pairs of chromosomes and Humans have 23 pairs of chromosomes.

Carl Wilhelm von Nageli, a Swiss botanist, first observe chromosomes in plant cells in the year 1842. Walther Flemming is generally recognized as the first person to discover chromosomes in 1882 while studying cell division in salamander larvae.

Linkage & Recombination:

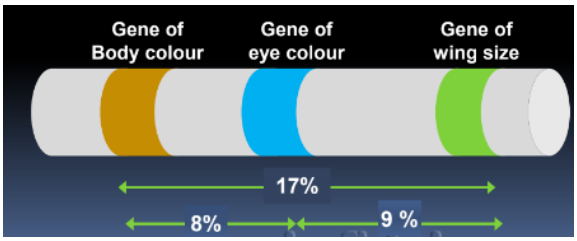
T. H. Morgan carried out several dihybrid crosses in Drosophila and find out that:

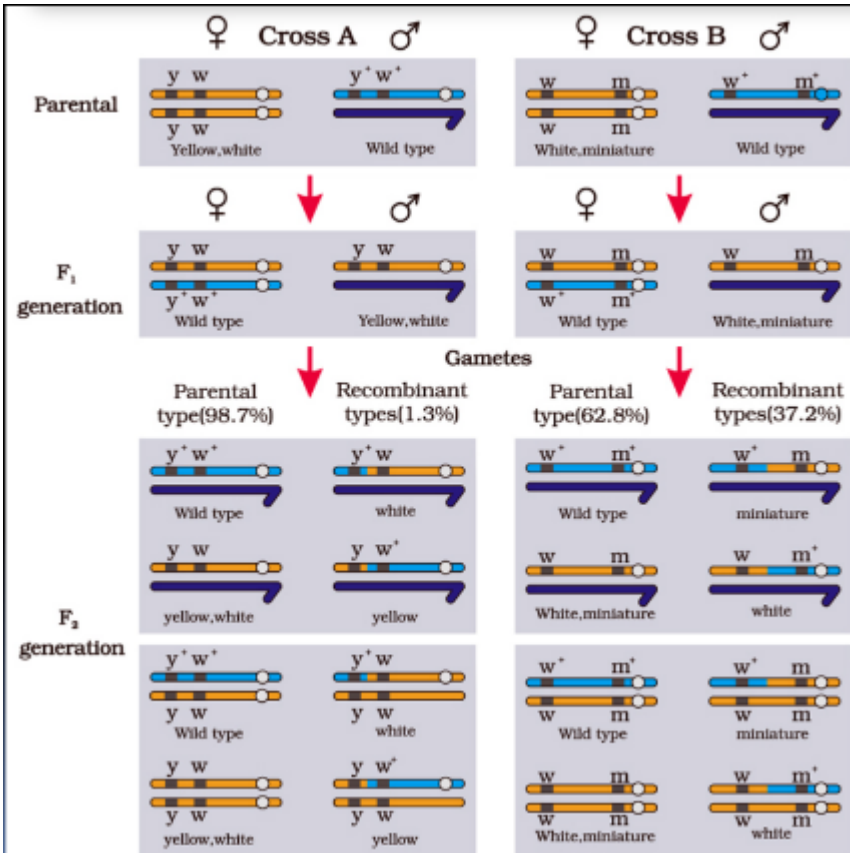


Linkage is physical association of 2 or more genes on a chromosome. It Do not show Independent Assortment.

Recombination is the generation of non-parental gene combinations occur due to crossing over.

- Two genes did not segregate independently.
- Ratio deviated from 9:3:3:1
- He knew that gene was located on X chromosome.
- He observed that when the two genes in a dihybrid cross are located on the same chromosome, the proportion of parental gene combinations in the progeny was much higher than the non-parental or recombination of genes. ▪
- He found that, when genes are grouped on the same chromosome, some genes are tightly linked or associated and show little recombination & loosely linked shows higher recombination.
  Ex: Gene White & Yellow were tightly linked -1.3 percent recombination
  Gene White & Miniatured winged were loosely linked- 37.2 percent recombination.
- Morgon Student Alfred Sturtevant mapped the position of gene on Chromosomes (Gene Mapping) using frequency of recombination. He found the distance between gene and mapped their position on chromosome.





▪ Results

Cross A shows crossing between two tightly linked genes y (yellow bodied) and w (white eye) with Wild type (+) sign (dominant type) i.e Brown Body & Red Eye.

F2 gen: **98% parental & 1.3% recombinant**

Cross B shows crossing between two loosely linked genes w (white eye) & miniature wing with Wild type (+) sign (dominant type) i.e Red Eye & Large wing.

F2 gen: **62.8% parental & 37.2% recombinant**

Sex Determination

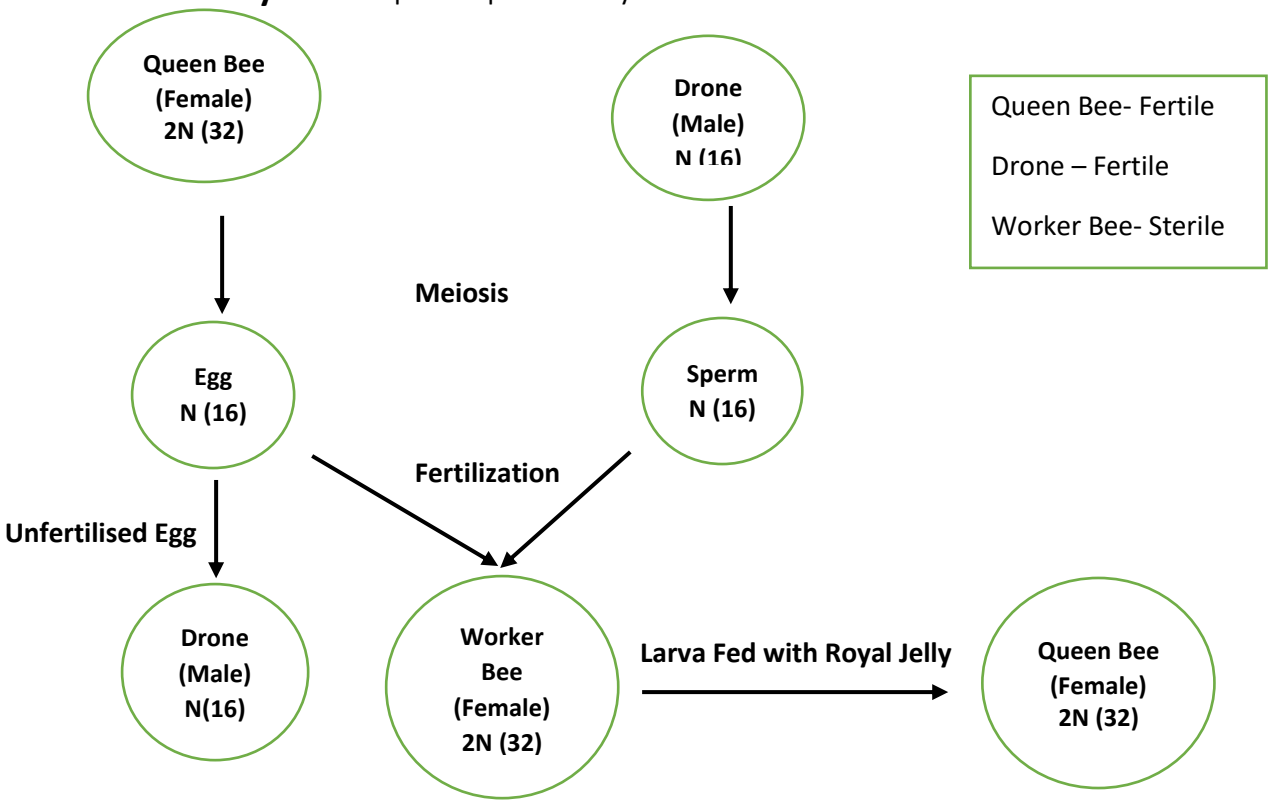
Henking (1891) traced specific nuclear structure all through spermatogenesis in a few insects and observed 50% sperms receive X-Structure (Called X Chromosome).

Chromosomes determines sex of individual are called Sex Chromosomes and rest all are called Autosomes.

Organism	Male	Female	Gametes	Chromosome No.
Grasshopper (Insects)	XO	XX	Male Heterogamy	Males have one less chromosome than female
Humans (Mammals) Drosophila (Insects)	XY	XX	Male Heterogamy	Same in both males & females
Birds	ZZ	ZW	Female Heterogamy	Same in both males & females

In Humans Father is responsible for determination of Sex of a child.

Sex Determination in Honey Bee- Haploid-Diploid Life Cycle



Drones (Male) do not have father and can not produce son, have a grandfather and can have grandson.

Queen	Drone	Worker Dee
Diploid (32 Chromosomes)	Haploid (16 Chromosomes)	Diploid (32 Chromosomes)
Fertile	Fertile	Sterile
Lives upto several years	Lives 60 days max	Lives for 40-140 days
One Queen Per hive	Several Hundreds	Several thousands (100 per drone)
Function is to lay lots of eggs and produce chemical scents that help regulate the unity of the colony	Only function is to mate Queen & dies after mating as his abdomen rips open when his endophallus is removed.	Jobs include housekeeping, feeding the queen, drones and larvae, collecting the pollen and nectar, and making the wax

Que: Define artificial selection. Has it affected the process of natural selection?

A. Artificial selection is the intentional breeding of plants and animals where the breeders select the desired traits and make them breed to produce offsprings with the required characteristics. It is an ancient method of genetic engineering. It surely affects the process of natural selection. The individuals cannot evolve on their own. The process is a threat to biodiversity. The traits are not selected considering the fitness of the organism.