D II (Hons) Zoology Paper III. Group B

Topic - Sex linked Inheritance Lecture - 19

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SEX LINKED INHERITANCE.

There are two types of chromosomes: one is autosomes and other is sex-chromosomes. Sex chromosomes (XX - XY chromosomes) are primarily concerned with the sex determination but these do carry some genes for other body characters. Such body characters whose genes are located on the sex chromosomes and follow sex during inheritance are known as Sex-linked characters. The genes governing the Sex-linked characters are called Sex-linked genes and their inheritance is called Sex-linked inheritance.

The genes located on the x-chromosome are called Sex-linked genes or X-linked genes, and the genes present on y-chromosome are described as holoandric genes, because they present only in males.

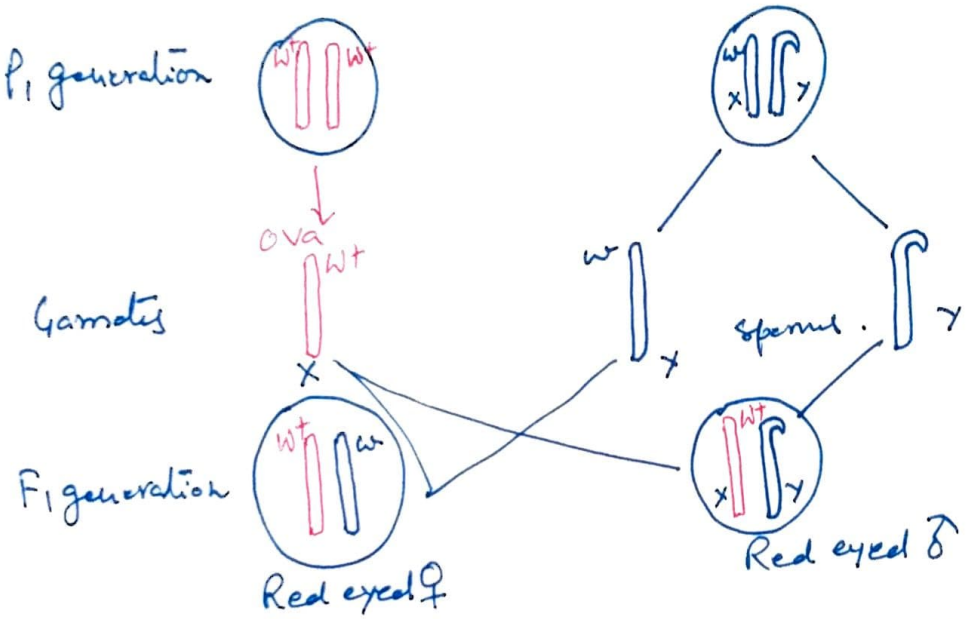
Discovery:

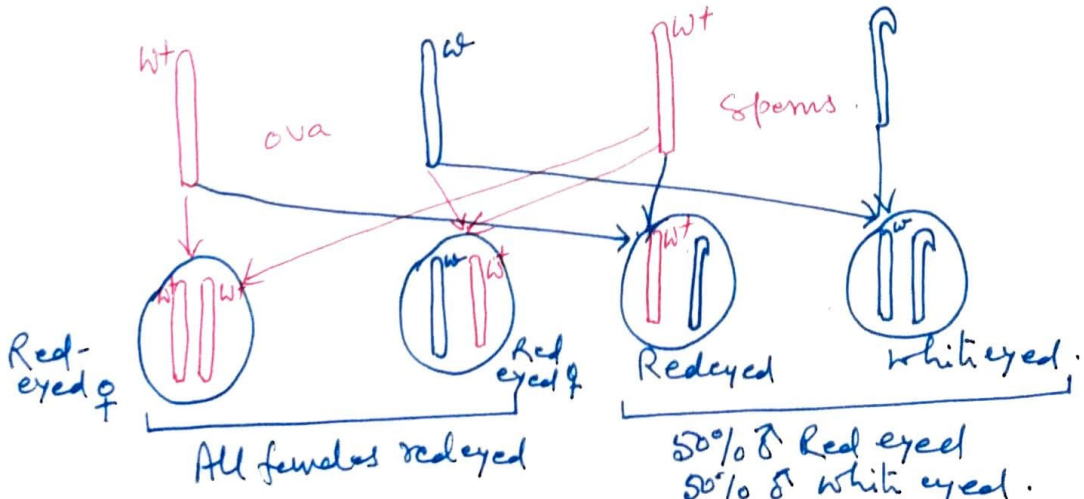
one of the earliest known example of Sex linked characters is the bleeding disease, haemophilia found only in males in the royal family of Spain. However T. H. Morgan in 1910 first introduced the concept of sex-linked inheritance while working on Drosophila melanogaster.

Sex linked inheritance in Drosophila

Morgan and his coworkers noted the sudden appearance of one white eyed male in the culture of wild red-eyed Drosophila. This

White eyed male when mated with red-eyed female, the F_1 flies (both male and female) were all red-eyed which indicated that white eyed mutation (w) is recessive to red-eyed wild (w+). When F_1 flies mate freely the red eyed flies and white-eyed flies appeared in 3:1 ratio. But all the white eyed flies were male. The red-eyed females males were equally numerous. The all females were red-eyed. The white-eyed females did not appear.



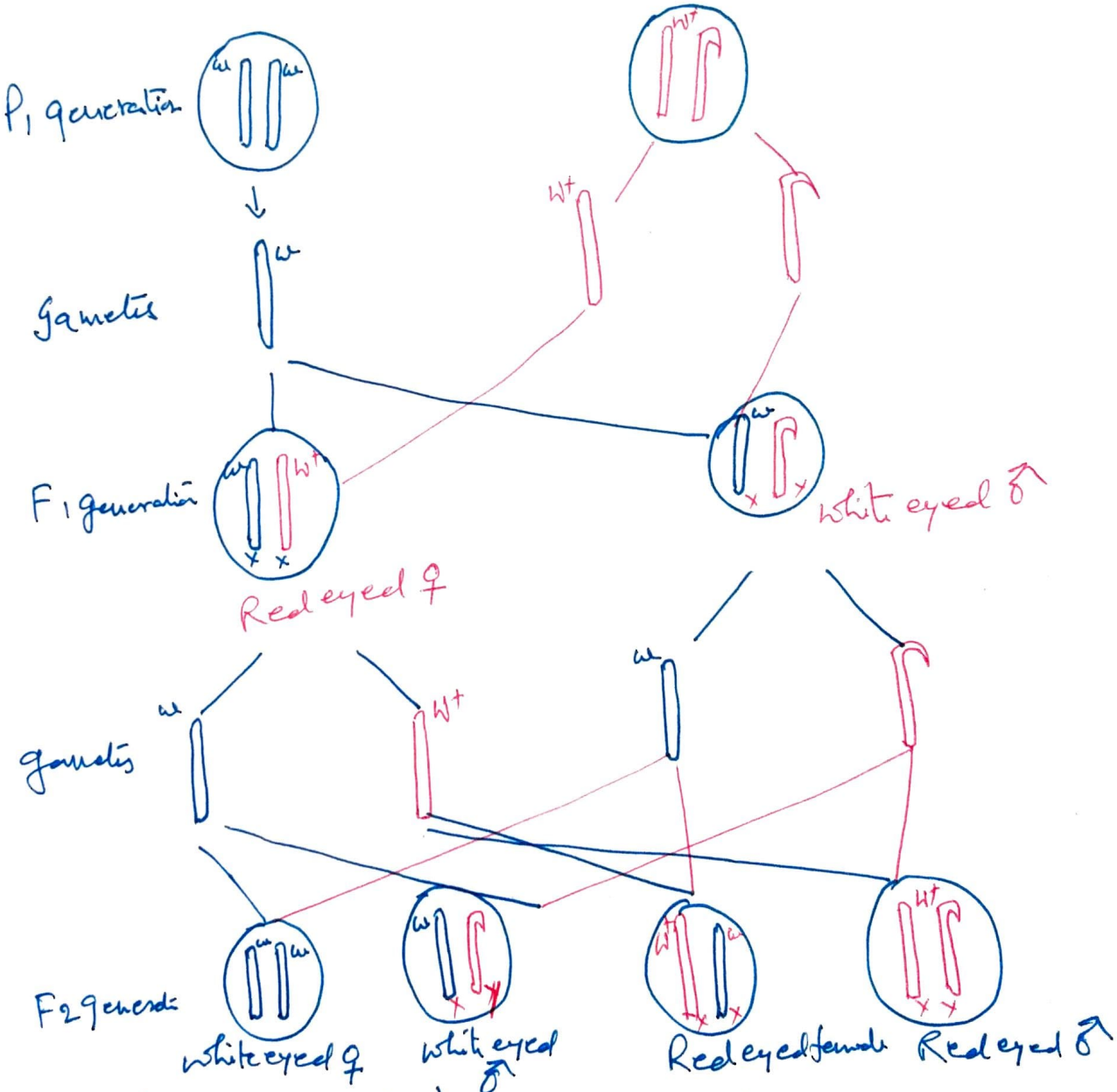


Sex-linked inheritance in Drosophila melanogaster
A Cross between red eyed female & white eyed males.

Morgan concluded that the genes for eye colour is located on the X-chromosome. The F_1 red eyed females were heterozygous (w+w). A white eyed female could only appear when it is homozygous for (ww) genes i.e. when both its chromosomes

Possess recessive genes for white eye. A single gene(w) for white eye colour expresses itself in a male offspring, because male possess single x-chromosome & y-chromosome is devoid of homologus allele.

In a reciprocal cross when a red-eyed males was crossed to a white eyed female, The F_1 offspring instead of being all red-eyed consisted 50% red eyed & 50% white eyed and all red eyed offsprings were female and all male offsprings were white eyed.



Sex-linked inheritance in Drosophila.
A cross between white eyed female and red eyed male.

When these F_1 offsprings were crossed their offsprings consisted of red and white individuals in equal proportion in both the sexes. The male transmits his sex-linked traits to grandsons through his daughters. Such condition is called Criss-Cross inheritance.

The inheritance of white eye colour in Drosophila can be explained by

① Gene for white eye colour is located in the x-chromosomes and y-chromosome is empty.

② The white eye females carry genes for white eye on both of its x-chromosome.

③ The white eye male receive x-chromosome with w gene from mother & y-chromosome with no w gene from father.

Sex-linked Inheritance in Man

Approximately 20 characters of man show sex linked inheritance and their genes are located on x-chromosomes. But the most popular examples of sex-linked characters are:
① Colour Blindness & ⑪ Haemophilia.

Colour Blindness – Red-green colour blindness :– Persons unable to distinguish certain colour are called colour-blind. Several type of Colourblindness are known but the most common is red-green Colourblindness. It was first described by Horner (1876). The red blindness is called Protanopia and the green blindness deuteranopia. x-chromosome possesses a normal gene which controls the formation of Colour sensitive cells in the retina. Its recessive allele fails to do its work properly and results in colour blindness. These alleles are present in x-chromosome & is proved by following crosses.

To be continued.