

Laws of Inheritance-8

10+2

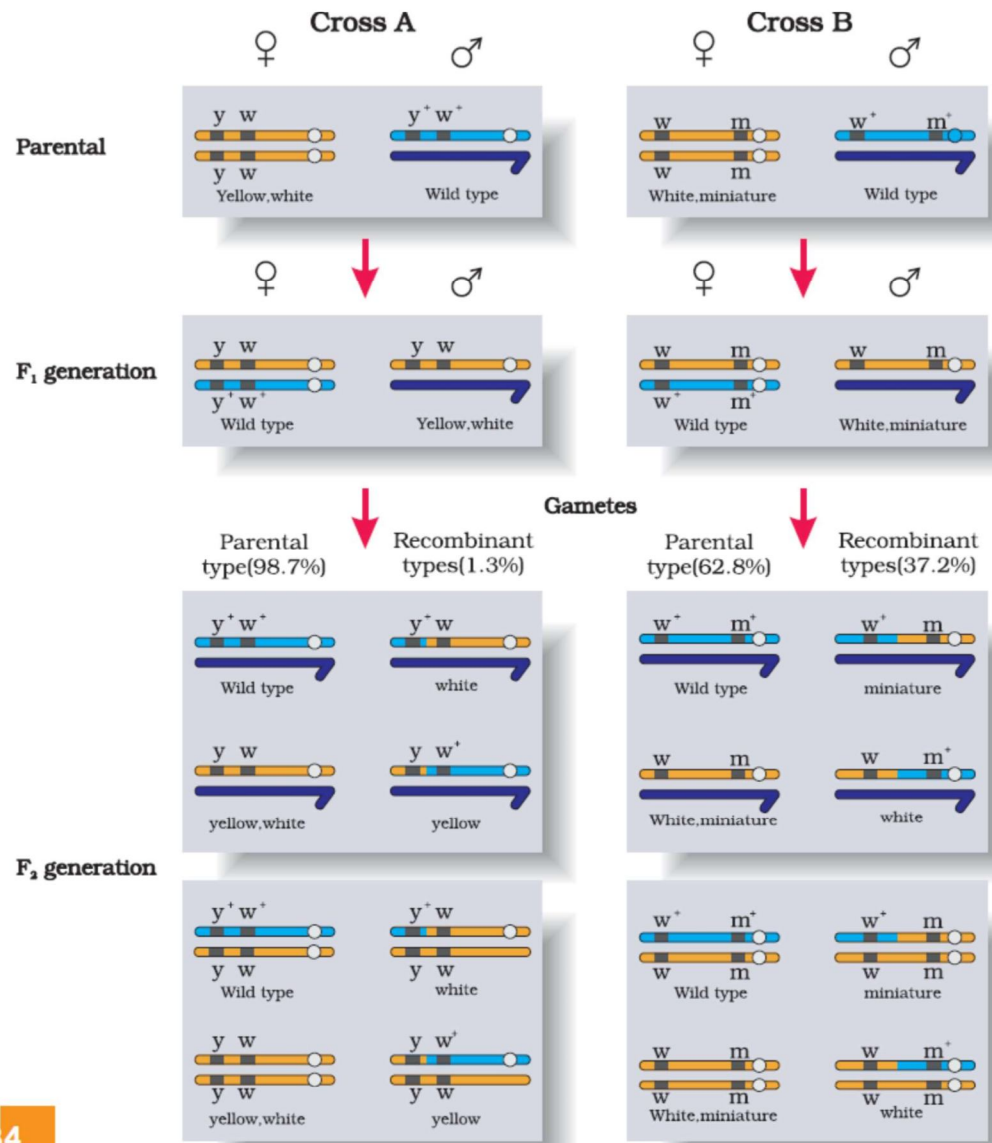
Linkage and Recombination

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T H Morgan carried out numerous dihybrid crosses in *Drosophila melanogaster* to study the sex-linked genes. His crosses in *Drosophila* were similar to that of carried out by G Mendel in *Pisum sativum*. For example, Morgan hybridised yellow-bodied, white-eyed females to brown-bodied, red-eyed males and the F₁ progenies were obtained. F₁ progenies were intercrossed. In the F₂ generation, He observed that the F₂ ratio deviated very significantly from the standard dihybrid ratio of 9:3:3:1, meaning that the two genes did not segregate independently of each other.

Morgan and his group aware of the fact that the genes were located on the X chromosome and realized quickly that when the two genes in a dihybrid cross were on the same chromosome, the proportion of parental gene combinations were much higher than that of non-parental type. Morgan attributed this due to the physical association of the two genes and coined the term *linkage* to describe the physical association of genes on a chromosome and the term *recombination* to describe the generation of non-parental gene combinations.

Morgan and his group also found that when genes were located on the same chromosome, some genes were very tightly linked (showing very low recombination) while others were loosely linked (showing higher recombination). For example, he found that the genes white and yellow were very tightly linked and exhibited only 1.3 per cent recombination while white and miniature wing showed 37.2 per cent recombination. His student Alfred Sturtevant used the frequency of recombination between gene pairs on the same chromosome as a measure of the distance between genes and 'mapped' their position on the chromosome. These days, genetic maps are extensively used as a starting point in the sequencing of whole genomes such as in the Human Genome Sequencing Project.



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Figure. Results of Morgan's dihybrid crosses. Cross A crossing between gene y and w ; Cross B crossing between genes w and m . Dominant wild type alleles are represented with superscript $+$. Linkage strength between y and w is higher than w and m .

References: NCERT 10+2 Biology