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Chromosomal Theory of Inheritance

Rediscovery of Mendel's Work

- Mendel's work remained unrecognised for several years because of the following reasons.
 - Lack of communication and publicity
 - His concept of factors (genes) as discrete units that did not blend with each other was not accepted in the light of variations occurring continuously in nature.
 - Mendel's approach to explain biological phenomenon with the help of mathematics was also not accepted.
 - In 1900, three scientists Hugo deVries, Correns and Von Tschermak independently rediscovered Mendel's work.

Chromosomal Theory of Inheritance

- By 1900, due to the advancement in microscopy, chromosomes were also discovered.
- Sutton and Boveri discovered that the behaviour of chromosomes was parallel to the behaviour of genes.
- Chromosomes and genes both occur in pairs—two alleles of a gene pair are located on **homologous sites of homologous chromosomes**.
- Sutton and Boveri further proposed that it is the pairing and separation of a pair of chromosomes that ultimately leads to segregation of the pair of factors they carry.
- Union of knowledge of chromosomal segregation with Mendelian principles constitutes chromosomal theory of inheritance.

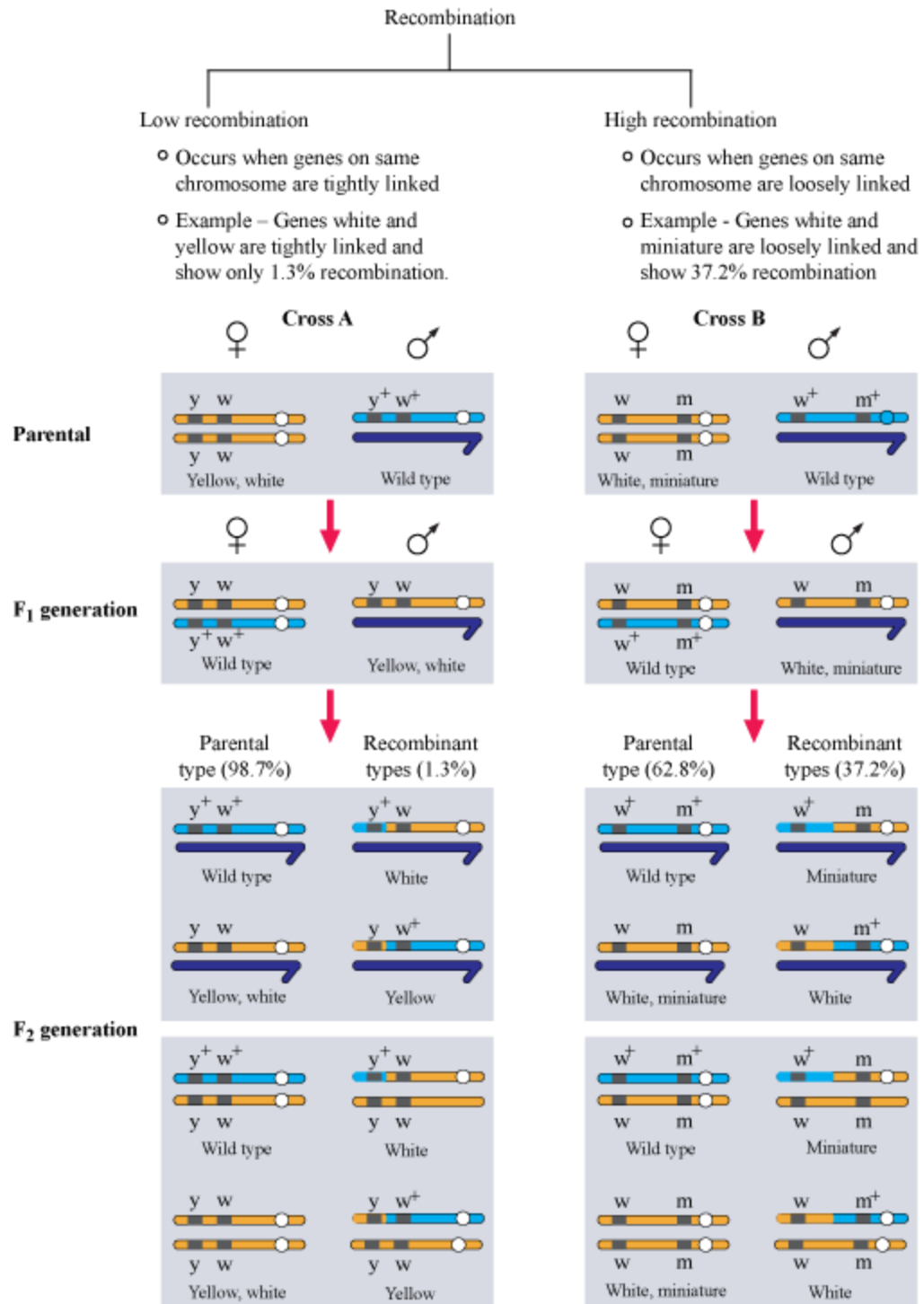
Dihybrid Cross in Drosophila to Study Linkage and Recombination

Linkage and Recombination

- Thomas Hunt Morgan discovered the basis of variations that sexual reproduction produced.

- He worked on fruit flies, *Drosophila melanogaster* . He chose *Drosophila* because of the following reasons:
 - They were suitable to grow on synthetic medium in laboratory.
 - Their life cycle is complete in two weeks.
 - Single mating produces many progeny flies.
 - Clear differentiation of sexes – Easily distinguishable male and female
 - Hereditary variations clearly visible with low power microscopes ● Morgan’s experiment
 - Dihybrid cross was carried out on fruit flies. Yellow bodied, white eyed females were crossed with brown bodied, red eyed males.
 - F₁ progeny was obtained, which were inter-crossed.
 - F₂ progeny was obtained and F₂ ratio was observed.
 - F₂ ratio was observed to be significantly different from 9:3:3:1 as observed in Mendelian dihybrid cross.

- Explanation of deviation from Mendelian ratio:
 - Genes involved are located on X chromosome.
 - When two genes are located on the same chromosome, the proportions of parental gene combinations were much higher than those of non-parental.
 - Linkage – Physical association of genes on a chromosome
 - Recombination – Non-parental gene combination



- Alfred Sturtevant utilised the knowledge of frequency of gene recombination as a measure of physical distance between two genes and to map their position on chromosomes.
- In this way, genetic maps were prepared, which are extensively used today for genome sequencing projects as in human genome project.