Tutorial session 5: Linkage in diploid organisms

Exercise 1

One breeder was interested in two traits (eyesight, and horns). He crossed cows with normal sight and hornless cows, with blind bulls with normal horns (the crossbred parents were purebreds). He obtained: (i) 125 females with normal sight and normal horns, (ii) 125 males with normal sight and normal horns. These males were crossed with blind, hornless cows. The phenotypes of the vows obtained are as follows:

Females	Normal sight, hornless	455
	Normal sight, normal horns	45
	Blind, Normal horns	455
	Blind, hornless	45
Males	Blind, hornless	45
	Blind, Normal horns	455
	Normal sight, normal horns	45
	Normal sight, hornless	455
Total		2000

1. Give the genotype and phenotypes of the first-generation calves.
2. What are the gametes produced by the males and females of the first generation (indicate their frequency)?
3. Are the two genes studied in this cross independent or linked?

Exercise 2

We are studying the ct and v mutations in Drosophila. Knowing that these two genes are linked and distant from each other by 20 centimorgans. By crossing wild male Drosophila of pure lineage [ct^+ v^+], with mutant females [ct v]. F1 offspring are all wild.

1. Give the genotypes of the parents and F1 individuals.
2. By crossing F1 individuals, we obtain offspring with 4 different phenotypes (F2). What are the gametes produced by the F1 individuals and their frequencies?
3. If we cross an F1 female with a male of genotype ct^+ v/ct v^+. What gametes are produced by the two Drosophila, and what are their frequencies?

4. What are the phenotypes obtained from this last cross, and what are their frequencies?