Tutorial session 4: Linkage in diploid organisms

Exercise 1

1. What is the purpose of a three-point test cross?

a) To calculate mutation rates.

b) To determine the order and distances between three linked genes.

c) To identify dominant and recessive alleles.

d) To study unlinked genes.

2. In a three-point test cross, what does the deviation from a 1:1:1:1:1:1:1:1 ratio indicate?

a) Random assortment of alleles.

b) Mutation in one of the alleles.

c) Linkage between genes.

d) Equal likelihood of crossover events.

3. What are the genotypes with the highest frequency in a three-point test cross?

a) Double recombinants.

b) Single recombinants.

c) Parental genotypes.

d) Triple recombinants.

4. Which genotypes are used to determine the gene order in a three-point test cross?

a) Parental genotypes.

b) Single recombinant genotypes.

c) Double recombinant genotypes.

d) Any genotype with equal frequencies.

5. In a three-point test cross, how is the distance between two genes calculated?

a) By dividing the number of double recombinants by total offspring.

b) By multiplying the recombination frequencies of all genes.

c) By summing single and double recombinants between the genes, dividing by total offspring, and multiplying by 100.

d) By using only the parental genotypes.

Exercise 2

We are studying three linked genes in Drosophila: cn (eye color), vg (wing shape), and b (body color), with :

cn^+: red-brown eye, cn: white eye

vg^+: normal wings, vg: vestigial wings

b^+: yellow body, b: black body

By crossing tri-hybrid Drosophila (cn^+cn vg^+ vg b^+ b) with a homozygous recessive (, we obtain the following phenotypic results:

Phenotypes	Observed
(cn^+ vg^+ b^+)	810
(cn vg b^+)	90
(cn^+ vg^+ b)	94
(cn^+ vg b)	4
(cn^+ vg b^+)	106
(cn vg b)	790
(cn vg^+ b^+)	6
(cn vg^+ b)	100

1. Identify the parental, single recombinant, and double recombinant phenotypes. Explain your reasoning.
2. Determine the gene order based on the double recombinant classes.
3. Calculate the distances between the genes cn and vg, cn and b, and vg and b in map units (cM).
4. Draw the genetic map showing the distances between each pair of genes.