

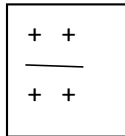
Series 2: Cross Diagrams - Mapping

There are two alleles for each trait in a diploid organism

In *C. elegans* gene symbols are **ALWAYS italicized**.

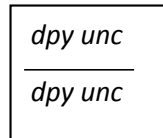
To represent two different genes on the same chromosome:

When both genes are wild-type: + is the wild type or non-mutant form of a gene:



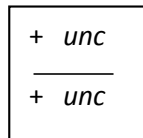
The phenotype of this worm is wild type

When both genes are mutant:

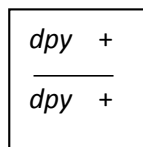


**The phenotype of this worm is double mutant
Dpy and Unc phenotype.**

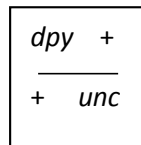
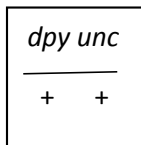
When one gene is wild type and the other mutant:



The phenotype of this worm is Unc



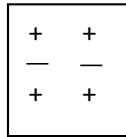
The phenotype of this worm is Dpy



The phenotype of these worms is wild type

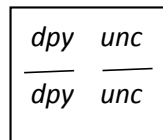
To represent two different genes on different chromosomes:

There is noticeable space between the two chromosomes



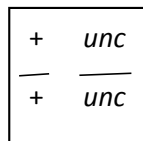
The phenotype of this worm is wild type

When both genes are mutant:

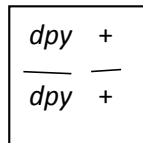


**The phenotype of this worm is double mutant
Dpy and Unc.**

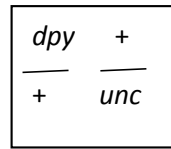
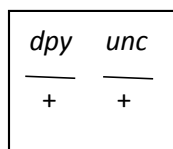
When one gene is wild type and the other mutant:



The phenotype of this worm is Unc



The phenotype of this worm is Dpy



The phenotype of these worms is wild type

Mating symbols:

- X – symbolizes mating between two different individuals
- $\textcircled{\text{X}}$ - symbolizes a self cross – when the hermaphrodite worms fertilize their own eggs

NAME: _____

In order to determine how closely linked two genes are on a chromosome you must determine the distance, in map units from one gene to the other. This is one kind of “mapping”.

You have identified which chromosome your *dpy* gene is on from the linkage analysis. We will continue from the progeny of the linked cross.

Two possible scenarios present themselves.

- 1) **Worms are Unc and carry the *dpy* gene**
- 2) **Worms are Unc and DO NOT carry the *dpy* gene**

Work through the expectations for each cross scenario. Show all work and answer all questions for full credit.

Cross 1: Self cross of Unc (non-Dpy) hermaphrodites with *dpy* gene.

$$\begin{array}{r} + \quad unc \\ \hline dpy \quad unc \end{array}$$

Self cross of Unc non Dpy worms

_____ List the gametes each parent can produce

_____ Give the genotype of the F1 progeny

_____ Give the phenotype of the F1 progeny

What progeny will you continue with for the final mapping? WHY?

Cross 2: Self cross of Unc (non-Dpy) hermaphrodites lacking the *dpy* gene.

$$\begin{array}{r} + \text{ } unc \\ \hline + \text{ } unc \end{array}$$

What gametes can this worm make?

Give the genotype of the progeny

Give the phenotype of the progeny

These worms are not useful to us. WHY?

Continue on for final mapping crosses.

Cross 3: Making heterozygous double mutant Dpy Unc males

$$\begin{array}{ccc}
 \underline{dpy \ unc} & \text{X} & \underline{+ \ +} \\
 dpy \ unc & & + \ +
 \end{array}$$

_____ What gametes can these worms make?

_____ What is the genotype of the progeny?

_____ What is the phenotype of the progeny?

Why do we have to make heterozygous males?

Cross 4: Test Cross of double mutant hermaphrodite with heterozygous males.

$$\begin{array}{ccc}
 \underline{dpy \ unc} & \text{X} & \underline{+ \ +} \\
 dpy \ unc & & dpy \ unc
 \end{array}$$

_____ What parental gametes can these worms make?

_____ What recombinant gametes can these worms make?

What are the genotypes of the progeny?

_____ **Parental genotypes**

_____ **Recombinant genotypes**

What are the phenotypes of the progeny?

_____ **Parental phenotypes**

_____ **Recombinant phenotypes**

What is the equation you will use to determine recombination frequency or map distance?