

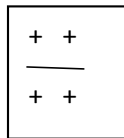
Series 1: Cross Diagrams

There are two alleles for each trait in a diploid organism

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

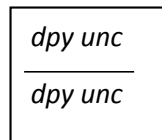
To represent two different genes on the same chromosome:

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



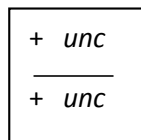
The phenotype of this worm is wild type

When both genes are mutant:

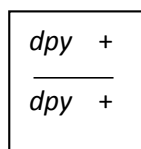


**The phenotype of this worm is double mutant
Dpy and Unc phenotype.**

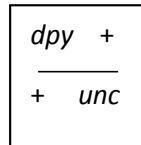
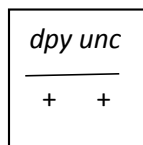
When one gene is wild type and the other mutant:



The phenotype of this worm is Unc



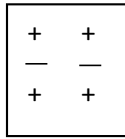
The phenotype of this worm is Dpy



The phenotype of these worms is wild type

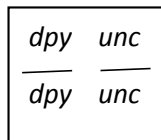
To represent two different genes on different chromosomes:

There is noticeable space between the two chromosomes



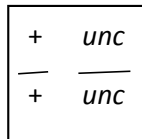
The phenotype of this worm is wild type

When both genes are mutant:

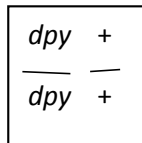


**The phenotype of this worm is double mutant
Dpy and Unc.**

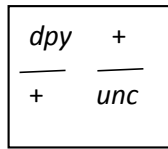
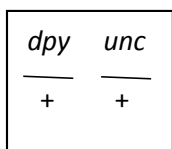
When one gene is wild type and the other mutant:



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
- **(X)** - symbolizes a self cross – when the hermaphrodite worms fertilize their own eggs

NAME: _____

To investigate patterns of inheritance in three strains of double mutant animals with the same phenotype, you must understand expectations in the ratios of progeny for each of the following possible scenarios:

- 1) Both genes on the same autosome (linkage)
- 2) Both genes of the sex-chromosome (linkage)
- 3) One autosomal gene and one X-linked gene (unlinked)

Work through the expectations for each cross scenario as you will obtain different expected ratios of progeny for each one. Show all work and answer all questions for full credit.

Autosomal and linked genes

Double mutant hermaphrodites x to wild type males

$\frac{dpy\ unc}{dpy\ unc}$	X	$\frac{+ +}{+ +}$	Parental Generation Genotype
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_____ _____ List the gametes each parent can produce



_____ Give the genotype of the F1 progeny

_____ Give the phenotype of the F1 progeny

We will now self-cross the F1 progeny to determine what we expect to see in the F2 generation.

Carry the F1 progeny genotype over to this page:

_____ Self cross (basically like crossing to a worm of the same genotype)

List the gametes this worm can make

_____ Parental gametes

_____ Recombinant gametes? List them if they can be made



What are the genotypes of the progeny that can be created from the above F1 self cross gametes? List them here:

What are the phenotypes of the progeny from the above F1 self cross?

Can you determine the ratio of each phenotype from this self cross? If yes give the ratio with corresponding phenotype. If NO explain why.

Autosomal and unlinked genes

Double mutant hermaphrodites x to wild type males

$\frac{dpy}{dpy} \frac{unc}{unc} \times \frac{+}{+} \frac{+}{+}$ Parental Generation Genotype

_____ List the gametes each parent can produce

↓

_____ Give the genotype of the F1 progeny

_____ Give the phenotype of the F1 progeny

We will now self-cross the F1 progeny to determine what we expect to see in the F2 generation.

Carry the F1 progeny genotype over to this page:

_____ Self cross (basically like crossing to a worm of the same genotype)

_____ List the gametes this worm can make



What are the genotypes of the progeny that can be created from the above F1 self cross gametes? List them here:

What are the phenotypes of the progeny from the above F1 self cross?

Can you determine the ratio of each phenotype from this self cross? If yes give the ratio with corresponding phenotype. If NO explain why.

One Autosomal and one sex-linked gene

Double mutant hermaphrodites x to wild type males

$\frac{dpy}{dpy}$	$\frac{unc}{unc}$	X	$\frac{+}{+}$	$\frac{+}{O}$	Parental Generation Genotype
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_____	_____	List the gametes each parent can produce
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_____	_____	Give the genotype of the F1 progeny
Hermaph.	Male	

_____	_____	Give the phenotype of the F1 progeny
Hermaph.	Male	

From the results of the F1 progeny you can determine which gene is sex-linked. WHY?

We will now self-cross the F1 progeny to determine what we expect to see in the F2 generation.

Carry the F1 hermaphrodite progeny genotype over to this page:

_____ Self cross (basically like crossing to a worm of the same genotype)

_____ List the gametes this worm can make



What are the genotypes of the progeny that can be created from the above F1 self cross gametes? List them here:

What are the phenotypes of the progeny from the above F1 self cross?

Can you determine the ratio of each phenotype from this self cross? If yes give the ratio with corresponding phenotype. If NO explain why.