

Problem set 5

1. You are given five true-breeding hermaphrodite strains of *C. elegans*, each carrying a dumpy mutation, which makes the animals short and fat. All five strains are known to carry single gene mutations. You cross wild-type males with dumpy hermaphrodites of each strain and obtain F1 progeny of the following phenotypes.

<u>Dpy strain</u>	<u>F1 progeny</u>	
	<u>hermaphrodites</u>	<u>males</u>
P	wt or Dpy	wt
Q	Dpy	Dpy
R	wt or Dpy	Dpy
S	Roller or Dpy	Roller

wt= phenotypically wild-type

Dpy=phenotypically dumpy

Roller= twisted body that causes animals to roll along their longitudinal axis as they move.

For each cross, what is the phenotype of the self progeny?

- i. List the recessive mutation(s)
- ii. List the dominant mutation(s)
- iii. List the incompletely dominant mutation(s)
- iv. List the mutation(s) that could be sex linked

2. The three deficiencies *Df1*, *Df2* and *Df3* remove genes on the *C. elegans* fourth chromosome. In mapping experiments you cross males (m) hemizygous for these three deficiencies (*Df/+*) to hermaphrodites (h) that are doubly mutant for recessive mutations in *dpy-5*, which is on chromosome I, and one of four mutations on chromosome IV: *ced-3*, *ham-1*, *unc-30* and *unc-31*. The phenotypes of the progeny of these crosses are shown in the below.

<u>m parent</u>	<u>h parent</u>			
	<u><i>dpy-5; ced-3</i></u>	<u><i>dpy-5; ham-1</i></u>	<u><i>dpy-5; unc-30</i></u>	<u><i>dpy-5; unc-31</i></u>
<i>Df1/+</i>	+	-	-	+

<i>Df2</i> / +	+	+	-	-
<i>Df3</i> / +	-	+	+	+

“+” indicates complementation for the *ced-3*, *ham-1*, *unc-30* or *unc-31* mutations; “-” indicates failure to complement

The *dpy-5* mutation causes a Dumpy phenotype; the *ham-1* mutation causes a cell differentiation defect; the *unc-30* and *unc-31* mutations cause an uncoordinated phenotype

- In these crosses, why are all of the hermaphrodites made homozygous for the *dpy-5* mutation?
- What are the phenotypic classes and sexes of the progeny produced when *Df1* / + **m** are crossed with *dpy-5*, *unc-31* **h**?
- What are the phenotypes of the progeny produced when *Df1* / + **m** are crossed with *dpy-5*, *unc-30* **h**?
- Draw a map showing the positions of the three deficiencies and the *ced-3*, *ham-1*, *unc-30* and *unc-31* genes.