

Name _____

By printing your name above you acknowledge that while there may have been group discussions of these problems, the work below is yours.

I want to encourage you to work together on these problems, but make sure you understand how to solve each problem on your own. Show all of your work. No credit will be given for answers without work. If a question requires you to determine a genotype show how you obtained it. Please write neatly. If I can't read it, I can't grade it. The homework is due Wednesday, February 16th, before class begins. If it is handed in after class has started there is a 5-point deduction and a further 5 points for each day it is late.

You are studying a newly discovered Bacteriophage virus and have isolated a number of mutants that you call flop (fuzzy little opaque plaque) mutants. You perform a series of pair-wise complementation tests with ten different point mutants on an appropriate bacterial host and obtain the results shown in the table below. A "+" indicates a wildtype plaque phenotype was observed, where as a "-" indicates the mutant flop phenotype was observed.

	f1	f2	f3	f4	f5	f6	f7	f8	f9	f10
f1	-	+	-	-	+	+	+	+	+	+
f2	+	-	+	+	+	+	+	+	+	+
f3	-	+	-	-	+	+	+	+	+	+
f4	-	+	-	-	+	+	+	+	+	+
f5	+	+	+	+	-	-	+	+	-	-
f6	+	+	+	+	-	-	+	+	-	-
f7	+	+	+	+	+	+	-	-	+	+
f8	+	+	+	+	+	+	-	-	+	+
f9	+	+	+	+	-	-	+	+	-	-
f10	+	+	+	+	-	-	+	+	-	-

- How many genes control this trait? **4 There are 4 different complementation groups**
- Identify which point mutants are located in the same gene.

Gene 1: f1, f3, f4 Gene 2: f2 Gene 3: f5, f6, f9, f10 Gene 4: f7, f8

After you have determined how many different genes can produce the flop phenotype in the experiment above, you run across an 11th mutant in the back of the freezer. When you do the complementation test with this mutant it acts very strangely:

	f1	f2	f3	f4	f5	f6	f7	f8	f9	f10
f11	-	+	-	-	-	-	+	+	-	-

Describe how just one genetic change in this new phage mutant could have produced the results you observed.

f11 is failing to complement mutations in Gene 1 and Gene 3 suggesting it carries mutations for both. One genetic change that could produce this is if gene 1 and 3 were next to one another on the chromosome and f11 carries a deletion that removes both of the genes. The deletion would act like a mutation in both. I also accepted a recombination event between

one phage that carries a mutation in gene 1 and a phage that carries a mutation in gene 3 to produce a double mutant phage.

In *Drosophila*, mutations in the *singed* gene produce flies with short curled bristles. There is a recessive loss-of-function allele, sn^P , of the *singed* gene that exhibits unusual characteristics. Flies that are homozygous for this particular mutation (sn^P/sn^P) have short curled bristles. They also have numerous patches of wildtype (sn^+) bristles on their heads and bodies. Describe the mechanism by which these wildtype patches are being produced in a homozygous (sn^P/sn^P) mutant fly.

The sn^P allele likely has a transposable element inserted in the *sn* gene. This insertion destroys the gene's function and produces the *singed* phenotype. The wildtype patches of bristles are likely due to the transposable element moving out of the sn^P allele thus restoring wildtype *sn* gene function and normal bristles appear again.

When these homozygous sn^P/sn^P mutant flies are mated some of the crosses produce only *singed* progeny while some of the crosses produce both *singed* and wildtype progeny in variable numbers. Explain the genetic basis for these observations.

$$sn^P/sn^P \times sn^P/sn^P$$


all *singed* progeny

$$sn^P/sn^P \times sn^P/sn^P$$


singed and *wildtype* progeny

The all *singed* progeny are produced when the transposable element does not move out of the sn^P gene. All the progeny remain mutant.

The mixture of *singed* and wildtype progeny could be produced by the mobilization of the transposable element at a couple of different points:

- 1. The transposable element could have been removed from an sn^P allele during meiosis in one of the parents producing a sperm or egg that now carries a wildtype allele and thus produces wildtype progeny.**
- 2. The transposable element could have been removed from an sn^P allele right after fertilization or very early in the development of the fly so that almost all the cells have a wildtype allele.**