Genetics
Linkage Problem Set

Textbook-Chapter 5 –Insights and solutions—starting p.135; Questions 1-8, 14, 16 (Page #s and problems may vary in different editions)

3-point Linkage Problem

1. In *Drosophila*, curly wings are recessive to straight wings, hour-glass shaped eyes are recessive to round eyes, and short antennae are recessive to long antennae. All of the above characteristics are controlled by genes located on chromosome # 4 (not the X- chromosome).

a. Show 3 possible crosses for 3-point mapping involving the 3 characteristics above, making sure that the first 2 criteria for successful mapping are satisfied. (Your goal is just to show 2 flies that can mate and whose offspring will show evidence of recombination between each of the genes.)

b. You note in the F2 offspring of a 3-point cross set up by Dr. Super that :

<u>the 2 most common types of flies are</u>

hour-glass eyes
and
curly wings/short antennae

<u>the least common types of flies are</u>

wild type
and
curly wings/short antennae/ hour-glass eyes

Diagram the way in which Dr. Super set up the 3-point cross and indicate which gene appears to be in the middle of the other 2?

2. In mouse, 3 genes are linked on chromosome 7 in the following order.

--------z----------c---------g----
31 cM 22 cM

A. *In theory*, if you looked at 1000 offspring from a 2-point cross set up to map distance between z and g, how many recombinant offspring might you expect?

B. In practice, would you expect **exactly that many**, **fewer** or **more** recombinants? Explain.

C. In a 3 point cross you examined 1000 offspring and observed 44 double crossover offspring. What phenomenon are you observing? Describe it quantitatively.

Mapping data from a previous year. Use this data, grouping it in the most logical way.

wt,wt,wt	f m w	wt w wt	f wt m	wt wt m	f w wt	f wt wt	wt w m	
42	36	16	17	4	10	10	10	
58	1	7	0	8	0	0	49	
56	25	16	8	7	5	4	34	
53	42	13	16	13	4	9	14	
58	28	20	12	8	4	12	21	
36	11	15	9	6	6	12	10	
63	51	12	18	6	2	11	8	
59	36	12	10	4	4	11	15	
425	**230**	**111**	**90**	**56**	**35**	**69**	**161**	**1177**

Using the F2 offspring data collected by you and your classmates (above), construct a map of the three X-linked genes ---*w*, *f*, and *m* in *Drosophila.* Include in your map the gene order and the distances between genes (showing units). **Explain your reasoning in determining gene order and show all details of determining gene distances!**

B. Did interference occur in this experiment? If so, quantify it (give a numerical value for interference) and briefly describe in words what occurred in this region with respect to cross-overs.

Practice for Linkage Questions

Genetics
Spring 2010

Below is your raw mapping data. Wow, 2823 flies counted among ~28 lab members! Awesome job.

Unfortunately one of the mutations in the flies seems have reverted or made the flies less viable than expected which skewed our data. The data sets don't group together as one would expect, so I have grouped them for you, keeping the numbers you collected.

Use your data (with my groupings) to map the order of genes w, f, and m and the distance between each gene. The relative numbers will tell you which were NCO, DCO and SCO1 and SCO 2.

	wt,wt,wt	fmw	wt w wt	f wt m	wt wt m	f w wt	f wt wt	wt w m	Group Totals	group initials
	120	10	33	30	16	5	36	21	**271**	Rd/LR
	69	23	20	12	28	4	15	43	**214**	TF/KM
	126	87	55	15	18	18	25	45	**389**	MW/AC
	71	21	19	8	27	3	16	31	**196**	ES/DS/GH
	56	14	22	8	28	6	5	28	**167**	AY/ML
	58	7	27	15	34	5	9	53	**208**	AB/DPU
	35	22	25	10	43	21	16	43	**215**	CB/DD
	98	28	56	15	13	15	10	24	**259**	CBAR
	41	18	40	26	62	19	17	38	**261**	LM/MB
	127	86	39	6	24	12	23	32	**349**	LT/JR
	40	1	10	10	6	13	11	6	**97**	JRH
	74	27	29		24	7	14	22	**197**	BGJK
Fly Totals	**915**	**344**	**375**	**155**	**323**	**128**	**197**	**386**	**2823**	

Group 1

wt wt wt

f m w

Group 2

f w wt

wt wt m

Group 3

f wt m

wt w wt

Group 4

f wt wt

wt w m