

* All would have to mate with ♂ chs (See Part b)

Textbook problems ~~10, 12, 13, 14, 15, 16~~ Chapter 5 - Insights & Solutions p 135, probs 1-8, 14, 16.

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).

Symbols
c = curly
h = hourglass
s = short

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

① $\frac{c\ h\ s}{c\ h\ s} \times \frac{++\ +}{++\ +}$ ♀ ♂

② $\frac{c\ +\ s}{c\ +\ s} \times \frac{+\ h\ +}{+\ h\ +}$ ♀ ♂

③ $\frac{c\ +\ +}{c\ +\ +} \times \frac{+\ h\ s}{+\ h\ s}$ ♀ ♂

* other possibilities

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

the 2 most common types of flies are

hour-glass eyes and curly wings/short antennae $+\ h\ +$ and $c\ +\ s$

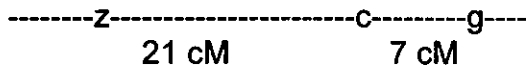
the least common types of flies are

wild type and curly wings/short antennae/ hour-glass eyes $+\ +\ +$ and $c\ h\ s$

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?

Since the most common phenotypes are $+\ h\ +$ and $c\ +\ s$, these are the parental combinations. It follows that double crossovers are least consistent with wild genotype. $\frac{+\ h\ +}{c\ +\ s} \times \frac{c\ h\ s}{c\ h\ s}$ Parents (NCO) $\frac{+\ h\ +}{c\ h\ s}$ and $\frac{c\ +\ s}{c\ h\ s}$ DCO $\frac{c\ h\ s}{c\ h\ s}$ and $\frac{++\ +}{c\ h\ s}$

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



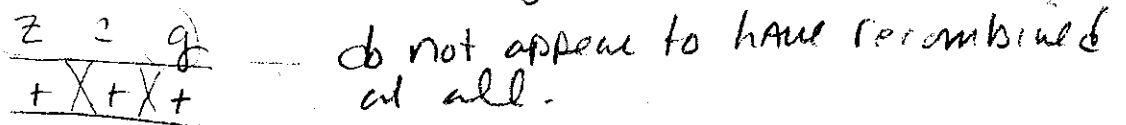
A. In theory, if you looked at 1000 offspring from a 2-point cross set up to map distance between z and g, how many recombinant offspring might you expect?

$$21 \text{ cM} + 7 \text{ cM} = 28 \text{ cM}$$

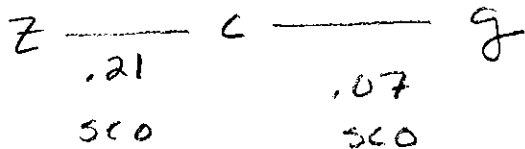
• $28 \times 1000 = \boxed{280 \text{ recombinants}}$

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

We might expect fewer recovered recombinants since DCO in the region would end up looking NCO, for any 2 genes.



C. In a 3 point cross you examined 1000 F1 offspring and observed 9 double crossover offspring. What phenomenon are you observing? Describe it quantitatively.



$$\text{Expected DCO} = (.21)(.07) \times 1000 = 14.7$$

Since fewer DCO were seen than expected we are observing interference.

$$I = 1 - C$$

$$C = \frac{\text{observed}}{\text{expected}}$$

$I = 1 - \frac{9}{14.7} = 0.388$

Positive interference = + 0.388