Part A

A) Data Set

wild type, males 310
orange eyes, males 99
orange eyes, females 195
orange eyes, black body, males 97
wild type, females 630
black body, males 320
TOTAL: 1651

B) Assigning Genetic Symbols

Eyes:

- e^+ = wild type
- e = orange eyes

Body - sex linked

- x^+ = wild type
- x = black bodied

C) Mode of Inheritance Illustrated by a Cross Diagram

It is predicted the mode of inheritance for the gene for eye color is autosomal dominant for the wild type. In addition, it is predicted that the gene for black body colour is recessive and sex-linked, as no females exhibit the black body phenotype.

Expected Phenotypic Ratios

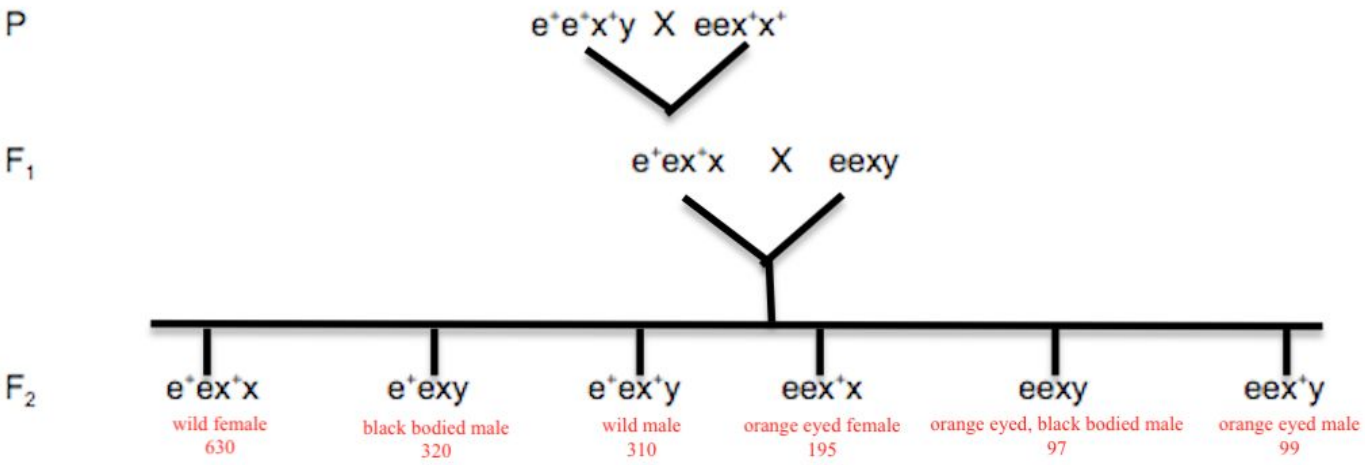
Eye Colour - autosomal dominal for wild type

- Parental generation = 1:1
    - wild type : orange eyed
- F_1 generation = 1
    - All wild type
- F_2 generation = 3:1
    - Wild type: orange eyed

Body Colour - sexlinked rescessive for black bodied for

- Parental generation = 1:1
    - wild type females : black bodied males
- F_1 generation = 1:1
    - Black bodied males: wild type females
- F_2 generation = 2:1:1
    - Wild type females: wild type males: black bodied males

D)



Expected phenotypic ratios:

- Parental generation = 1:1
  - wild type : orange eyed
- F_1 generation = 1:1
  - All wild type
- F_2 generation = 9:3:3:1
  - Wild type: orange eyed: black bodied: black bodied and orange eyed

Chi-Square Test: Males Body (sex linked)

Cross between e^+ex^+x and eexy

Phenotype	# Observed (O)	# Expected (E)	Deviation $(O-E)^2$	$\frac{(O-E)2}{E}$
Wild type	409	412	9	0.02
Black body	417	412	25	0.05

$X^2 = 0.02 + 0.05 = 0.07$

Therefore this rejects the null hypothesis and the hypothesis that this trait is sex-linked recessive is correct.

E) Chi-Square Test: Female Body (sex linked)

Cross between e^+ex^+x and eexy

Phenotype	# Observed (O)	# Expected (E)	Deviation $(O-E)^2$	$\frac{(O-E)2}{E}$
Wild type	825	825	0	0
Black body	0	0	0	0

$X^2 = 0 + 0 = 0$

Therefore this rejects the null hypothesis and the hypothesis that this trait is sex-linked recessive is correct.

Chi-Square Test: Female and Male Eyes (autosomal)

Cross between e^+ex^+x and eexy

Phenotype	# Observed (O)	# Expected (E)	Deviation $(O-E)^2$	$\frac{(O-E)2}{E}$
Wild type	1260	1238	484	0.39
Orange Eyed	391	412	441	1.07

$X^2 = 0.39 + 1.07 = 1.46$

Therefore this fails to reject the null hypothesis and this suspected hypothesis that this trait is autosomal dominant, is correct.

Part B

<u>Data Set</u>

+ b + 696
+ b c 698
a + c 701
a + + 716
a b c 1148
+ + c 22
+ + + 1156
a b + 24
TOTAL: 5161

Parental Class: *abc* and +++

These two classes have the highest frequency of 1148 and 1156 respectively.

Single Cross Over Region I (most distant): *a*++ and *a*+*c*

These two classes have the second highest frequencies (716 and 701)

Single Cross Over Region II (closest): +*b*+ and +*bc*

These had the third highest amount of occurrences (696 and 698).

Double Cross Over Class: ++c and *ab*+

These had the least frequent occurrences (22 and 24)

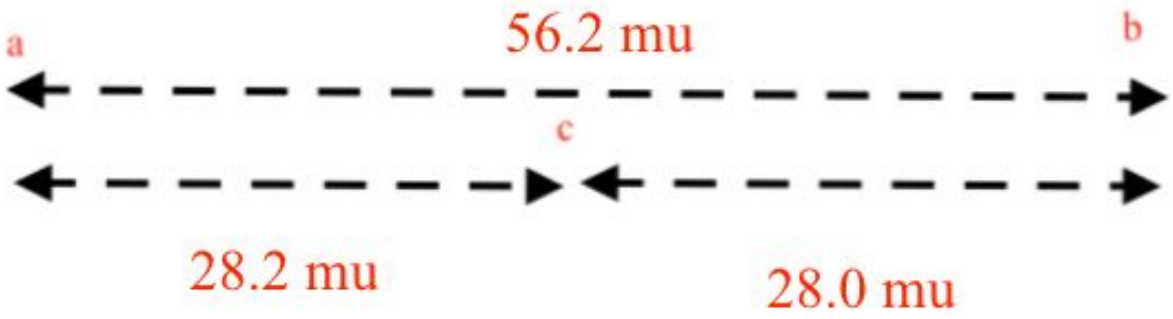
<u>Determining the Map Distance</u>

- Analyzed 2 genes and summed all their recombinant phenotypes then divided by the total number of offspring and multiply by 100.
- This is done for each gene pair
- Performed correction for the 2 genes that are furthest apart (A-B in this case)
    - This is done by adding in the double cross overs twice

$a - b = \frac{716 + 696 + 696 + 701}{5161} \times 100 = 54.4 \text{ mu} \rightarrow \frac{716 + 696 + 696 + 701 + (22 + 22 + 24 + 24}{5161} \times 100 = 56.2 \text{ mu}$

$a - c = \frac{716 + 698 + 22 + 24}{5161} \times 100 = 28.2 \text{ mu}$

$b - c = \frac{696 + 701 + 22 + 24}{5161} \times 100 = 28.0 \text{ mu}$



The gene order must be a, c, b because the distance between a and b are the longest and therefore c must reside within that distance.