

# Chromosome Mapping Worksheet

Answer the following questions in your notebook.

1. Working in the famous “fly room” at Columbia University, you cross a homozygous recessive purple-eyed, vestigial-winged fruit fly ( $ppvv$ ) with a heterozygous normal-eyed, normal-winged fly ( $PpVv$ ). Both genes are found on chromosome 2. You discover the following percentages of flies in the  $F_1$  generation: 42 percent with normal eyes and normal wings; 46 percent with purple eyes and vestigial wings; 6 percent with normal eyes and vestigial wings; and 6 percent with purple eyes and normal wings.

a) What is the expected outcome for a cross involving two linked genes? Why do you think your results differed from the expected outcome?

---

---

b) Which of the offspring are recombinant types?

---

---

c) Determine the recombination frequency for this cross.

---

---

d) Based on your findings, how many map units apart are the genes for eye colour and wing type on chromosome 2?

---

---

2. In the same lab, your colleague is studying the genes for eye colour and body colour found on chromosome 2. She crosses a homozygous recessive purple-eyed, black-bodied fruit fly ( $ppgg$ ) with a heterozygous normal-eyed, normal-coloured fly ( $PpGg$ ). She counts 1000 offspring and finds 454 flies with normal eyes and normal body colour, 466 flies with purple eyes and black body colour, 42 flies with normal eyes and black body colour, and 38 flies with purple eyes and normal body colour.

a) What are the recombination frequency and map distance between the two genes?

---

---

# Chromosome Mapping Worksheet

- b) From the data gathered by a third colleague, you know that the gene for wing type and the gene for body colour are 4 map units apart. Combining your colleagues' data with your own findings in question 1, draw a chromosome map showing the linear arrangement of all three genes on chromosome 2.
3. In another experiment, you decide to cross a white-eyed female fruit fly ( $X^r X^r$ ) with a red-eyed male ( $X^R Y$ ).
- a) Draw a Punnett square for this cross showing the  $F_1$  generation.

b) What is the phenotype ratio for this cross?

---

---

c) Which fly would you cross with the white-eyed male  $F_1$  offspring to get an  $F_2$  generation of all white-eyed flies? Use a Punnett square to support your answer.

# Chromosome Mapping Worksheet

4. In fruit flies, the following mutant genes have been identified: *d* causes short legs, *vg* causes vestigial wings, and *pr* causes purple eye colour. All three genes reside on chromosome 2. Using linked gene notation, write the genotypes of fruit flies that are
- homozygous recessive
  - heterozygous
  - homozygous dominant for these genes

---

---

---

---

---

---

---

5. A geneticist performs the following cross:  $vg\ d/++ \times vg\ d/vg\ d$ . Of 1000 offspring, 385 are wild type, 102 have vestigial wings and normal legs, 108 have normal wings and short legs, and 405 have vestigial wings and short legs.

- a) What is the map distance between the genes for wing type and leg length?

---

---

- b) Previous data shows that the recombination frequency for the genes for wing type and eye colour is 10 percent, while that for leg length and eye colour is 31 percent. All three genes are found on chromosome 2. Draw a chromosome map showing the relative distances between these linked genes.