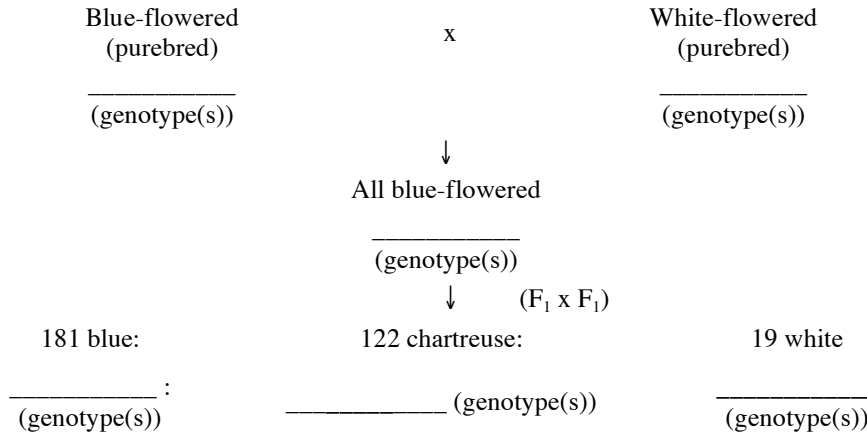




2. A new variety of tulip has been discovered in Europe. This tulip is unique because it has three different distinct phenotypes: blue, chartreuse, and white. Geneticists have discovered that these different colors can be explained by a particular pattern of inheritance. Below are the results of one series of crosses that helped geneticists to determine the pattern of inheritance involved:



(A) Explain the genetic basis for the particular pattern of color inheritance depicted above: As you write your explanation, define your genotypic symbols and be sure to indicate the gene(s) responsible for each color. (0.5 pts.)

(B) In the spaces provided beneath each phenotype, write the genotype(s) of each class of offspring. (1 pt.)

3. A diploid individual with genotype AABB is crossed to another individual with genotype aabb.

(A) The F<sub>1</sub> offspring resulting from this mating is then testcrossed. What is the genotype of the individuals being mated here? (0.5 pt.)

(B) What proportion of offspring of this testcross will have the following genotypes if the two genes are i) on separate chromosomes; ii) completely linked (no crossing over at all); iii) linked with 20 map units between them (0.25 pts. Per blank, 1.5 pts. Total).

Genotype of offspring	Proportion of offspring if the 2 genes are:		
	i) on separate chromosomes	ii) completely linked (no crossing over)	iii) linked with 20 map units between
aabb	_____	_____	_____
Aabb	_____	_____	_____

4. The following data are from Bridges and Morgan's work on the genes black (body color), curved (wings), purple (eye color), speck (black specks on wings) and vestigial (crumpled wings). All 5 genes are on chromosome 2 of *Drosophila*.

Genes in cross	Total progeny	Number of Recombinants	% recombination
Black, curved	62,679	14,237	23
Black, purple	48,931	3,026	6
Black, speck	685	326	48
Black, vestigial	20,153	3,578	18
Curved, purple	51,136	10,205	20
Curved, speck	10,042	3,037	30
Curved, vestigial	1,720	141	8
Purple, speck	11,985	5,474	46
Purple, vestigial	13,601	1,609	12
Speck, vestigial	2,054	738	36

- i.) On the basis of this data, map the chromosome for these 5 genes. Remember that determinations for short distances are more accurate than those for long ones. (1 pt.)
- ii.) For the first cross in the table, an F<sub>1</sub> heterozygous female (for both genes) was testcrossed to a male fly that had a black body and curved wings. The recombinants referred to in the table had either a tan (wildtype) body and curved wings, or a black body and straight (wildtype) wings. Draw the 2 copies of chromosome 2 in the F<sub>1</sub> female fly, only with respect to these 2 genes, showing the linkage of the alleles involved (0.5 pts.).
5. A female animal heterozygous for the genes A and B (genotype=AaBb) is testcrossed with a male of the same species. Their progeny include 442 AaBb, 458 aabb, 46 Aabb, 54 aaBb.
- a) What is the genotype of the male the female was mated with? Why is this important? (0.5 pts.)
- b.) Are the genes A and B on the same chromosome? If so, how far apart are they? (0.5 pts.)
- c.) Draw the chromosomes of the female parent used in the testcross, showing the positions of the genes and alleles (0.5 pts.)
- d.) What is the name of the linkage phase shown in (c)? (0.5 pts.)

6. In cucumbers, heart-shaped leaves (*hl*) is recessive to normal leaves (*Hl*) and many fruit spines (*ns*) is recessive to few fruit spines (*Ns*). The genes for leaf shape and number of spines are located on the same chromosome; previous mapping experiments indicate they are 32.6 map units apart. A cucumber plant has heart-shaped leaves and many spines is crossed with a plant that is homozygous for normal leaves and few spines. The  $F_1$  offspring are then testcrossed.

(A) What are the genotypes of the individuals in the testcross? (0.5 pts.)

$F_1$  offspring : \_\_\_\_\_ x testcross individual: \_\_\_\_\_

(B) Draw the chromosomes present in the  $F_1$  heterozygote. What is the name of the linkage phase shown in the  $F_1$  heterozygote? (0.5 pts.):

(C) What percentage of offspring from the testcross will have (0.5 pts.)

i. heart-shaped leaves and many spines?

ii. What percentage of offspring will have heart-shaped leaves and few spines?