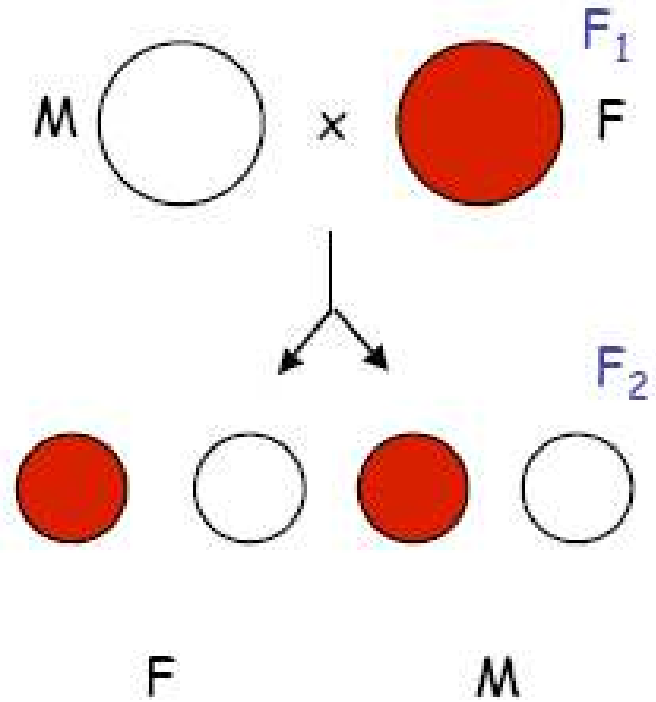
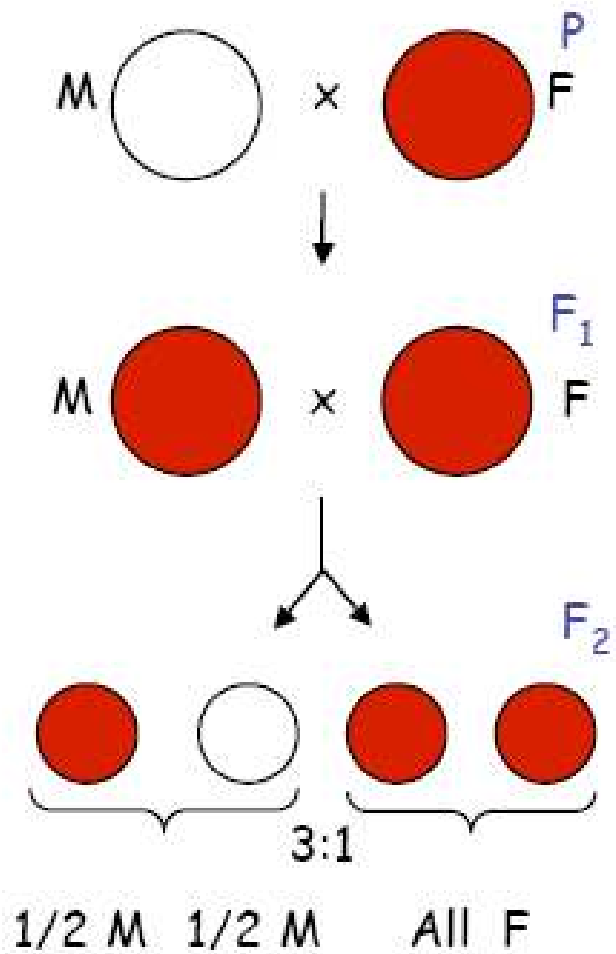


Last week . . .



Sex-linkage vs autosomal inheritance

- **Sex-linkage: Gene for a trait lies on sex chromosomes**

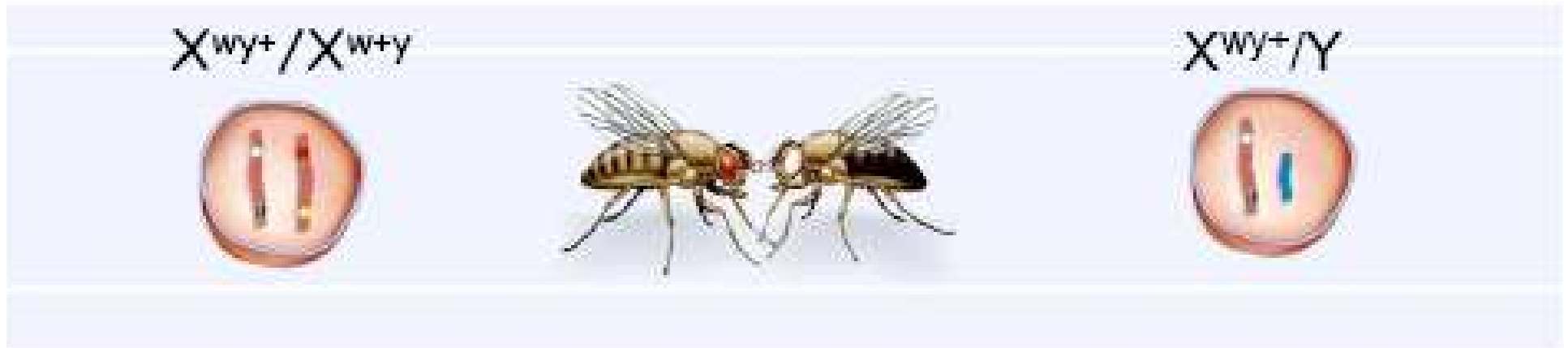
(being male or female is linked with the trait)

- **X-linkage: Only on X chromosome**
- **Y-linkage: Only on Y chromosome**

Autosomal inheritance: inheritance of genes on non-sex chromosomes

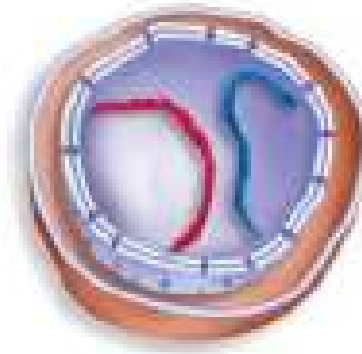
Consider two genes: If genes lie on chromosomes, and chromosomes assort independently, then what type of assortment should we expect from genes that lie on the SAME chromosome?

- 1. Dependent assortment**
- 2. Independent assortment**

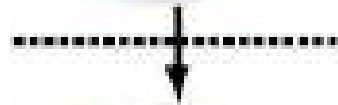


- What phenotypic ratios do we expect in male offspring from this cross?
- 1:1 white, Gray : Red, yellow

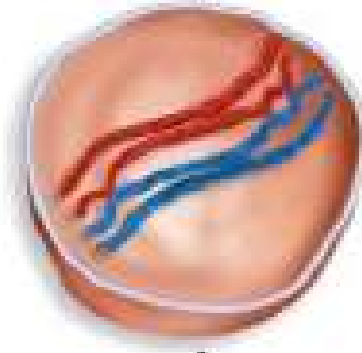
- What genotypic ratios do we expect?
- 1:1 X^{wy+}/Y : X^{w+y}/Y



Diploid parent cell



Chromosome replication



Prophase I

Tetrads form by the synapsis of homologous chromosomes.

Crossing over occurs.



Metaphase I

Homologous pairs align at the metaphase plate.



**Crossing over
disrupts linkage!**

Work with a partner. . .

A female with the genotype X^{w+y}/X^{wy+} produces gametes, but during meiosis crossing over occurs at the locus for body color

What gametes are produced?

**Morgan referred to these individuals as
*recombinants!***

Physical distance and recombinant production

- **Cross-over can occur anywhere, but is more likely to occur between two genes when they are “far apart”**

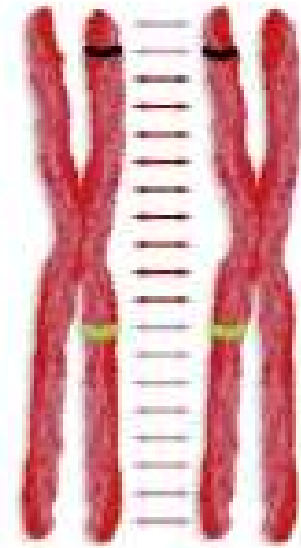
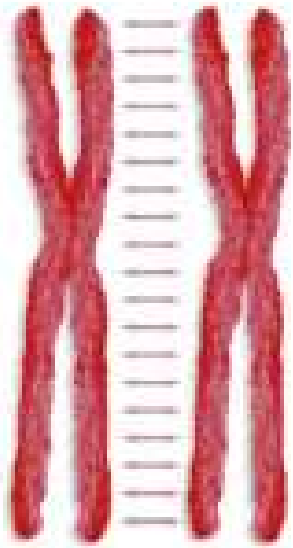
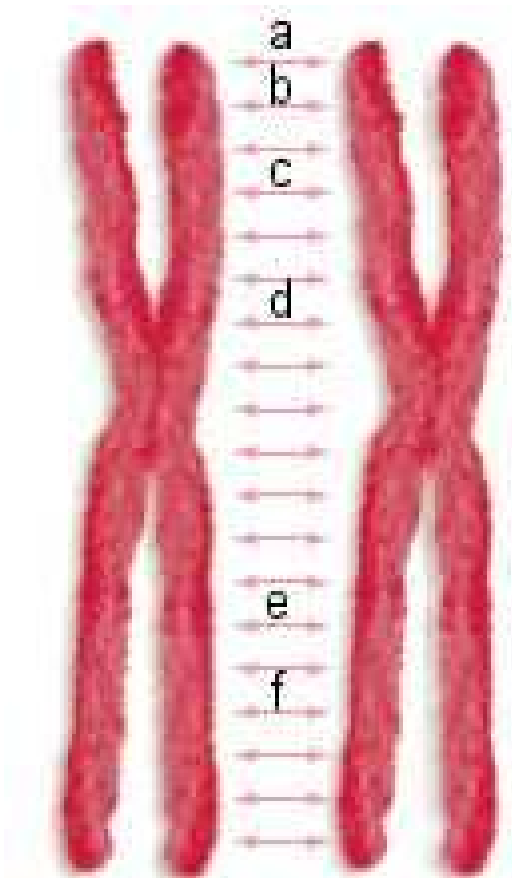


Figure 13-15 Biological Science, 2/e
© 2005 Pearson Prentice Hall, Inc.

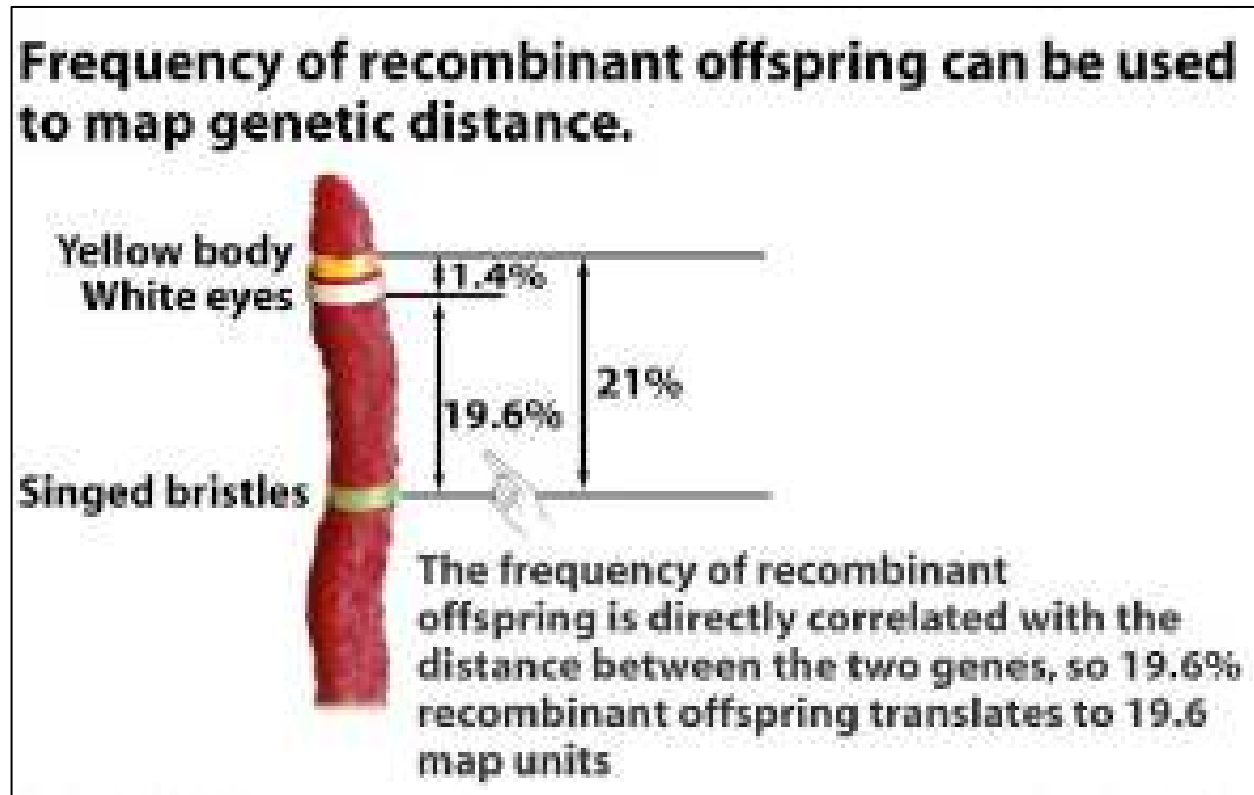
Which of the following two genes would demonstrate the highest incidence of crossing over?



- a. Gene a and gene b**
- b. Gene c and gene d**
- c. Gene c and gene e**
- d. Gene e and gene f**

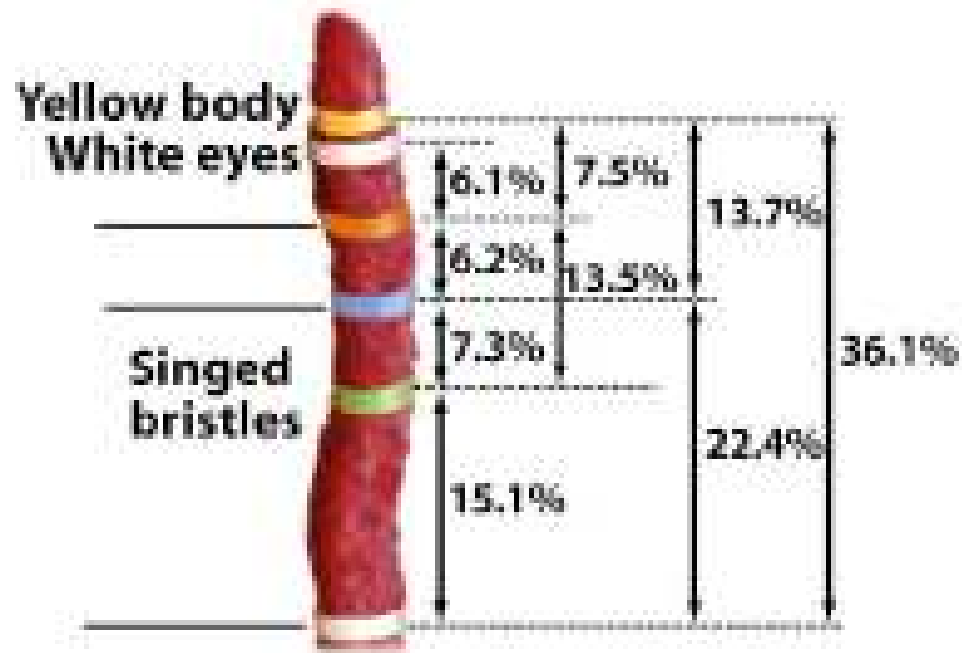
Genetic map units

- A. H. Sturtevant (Morgan's student), realized that frequency of recombinant offspring correlates with distance
- Creates centiMorgan (cM) as unit of measure; 1cM = 1% recombinant offspring



Two powerful tools

- Determine relative positions of genes on same chromosome
- Determine average distance separating those genes



Extensions of Mendel's Rules

Incomplete dominance

Codominance

Pleiotropy

Environmental effects

Epistasis

Incomplete dominance in flower color

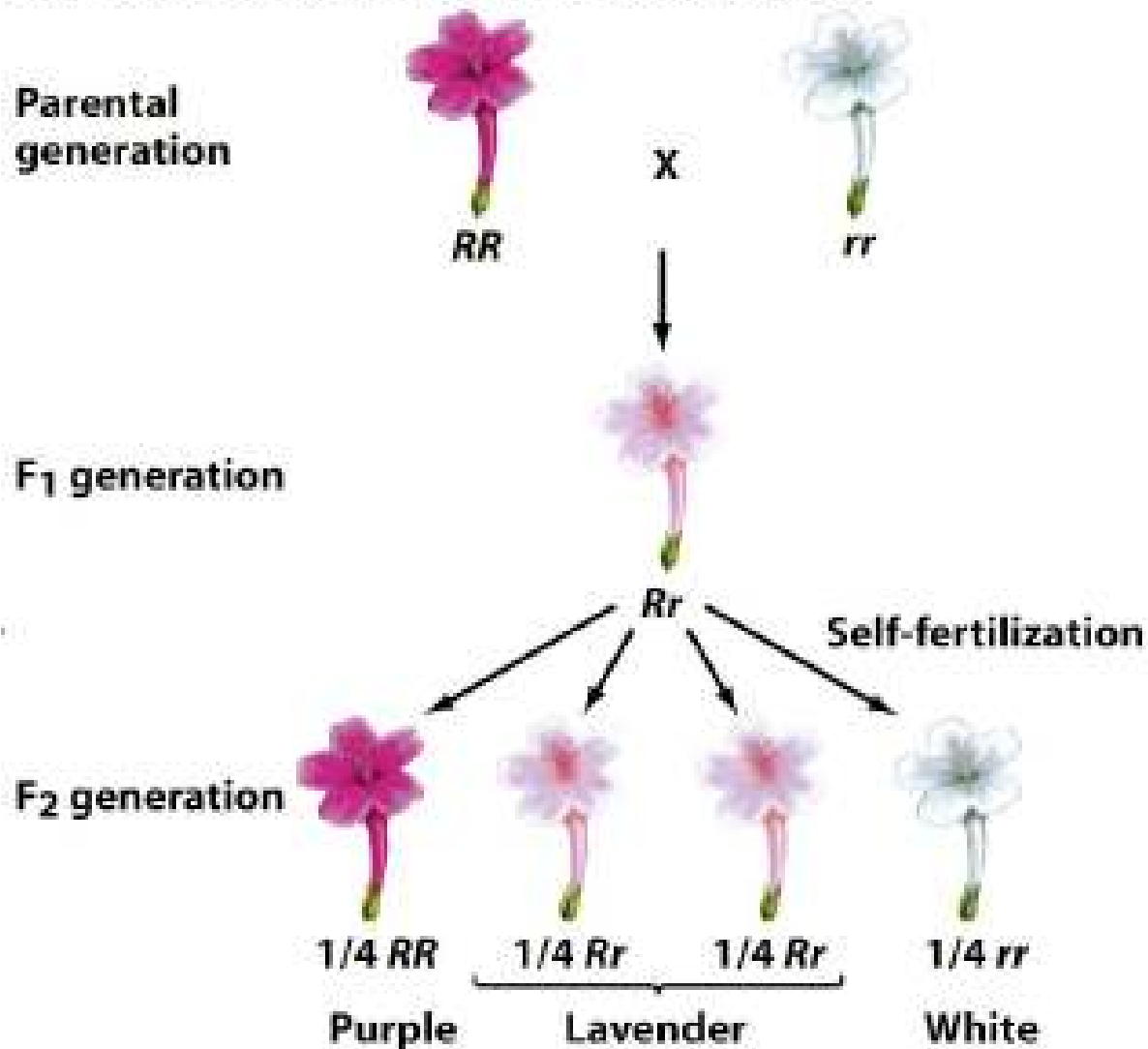


Figure 1.3-17b Biological Science, 2/e

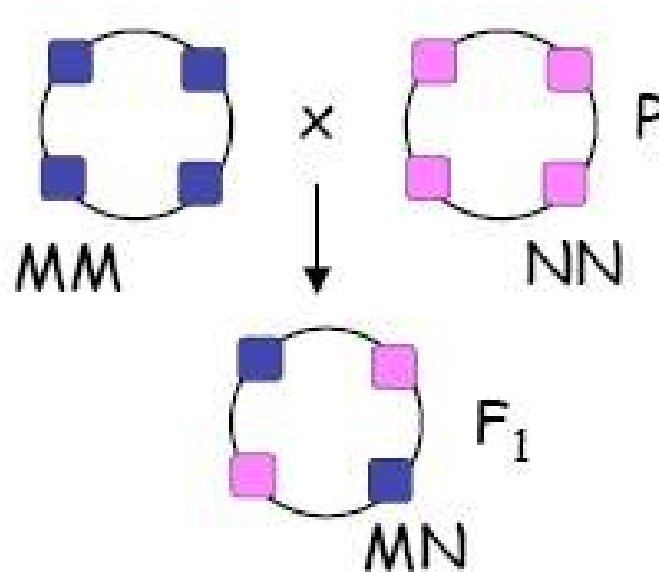
QUESTION

(with respect to Four-o'clocks)

What would be the phenotype ratios of offspring produced by a mating between an rr and an Rr individual?

Codominance

- Heterozygotes have phenotypes of **BOTH** parents
 - Ex: MN cell membrane proteins



Epistasis (two genes interact)

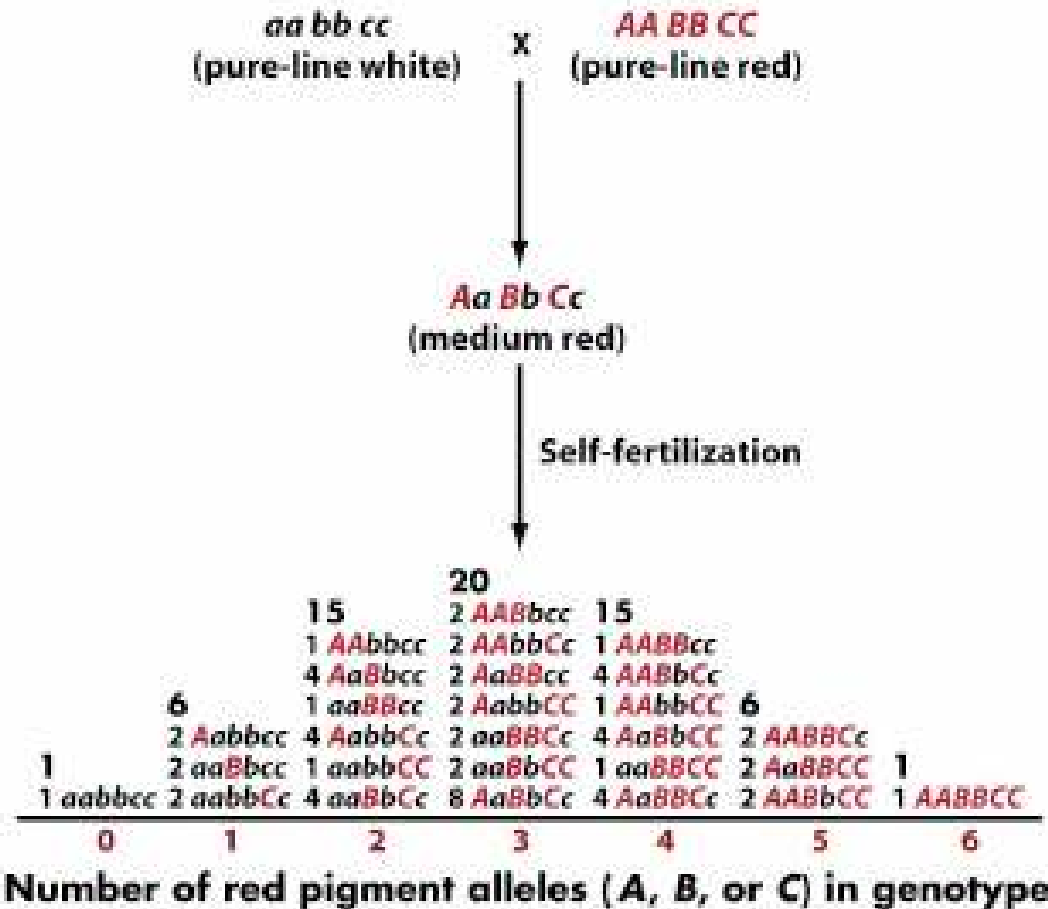
Hypothesis to explain 9 : 3 : 3 : 1 pattern observed above:
Two genes interact to produce pepper color.

Gene 1	Gene 2
<i>R</i> = Red	<i>Y</i> = Absence of green (no chlorophyll)
<i>r</i> = Yellow	<i>y</i> = Presence of green (chlorophyll)
(-) = <i>R</i> or <i>r</i>	(-) = <i>Y</i> or <i>y</i>

Genotype	Color	Explanation of color
<i>R-Y-</i>	Red	Red pigment + no chlorophyll
<i>rrY-</i>	Yellow	Yellow pigment + no chlorophyll
<i>R-yy</i>	Brown	Red pigment + chlorophyll
<i>rryy</i>	Green	Yellow pigment + chlorophyll

Quantitative Traits – Polygenic Traits

Hypothesis to explain inheritance of kernel color

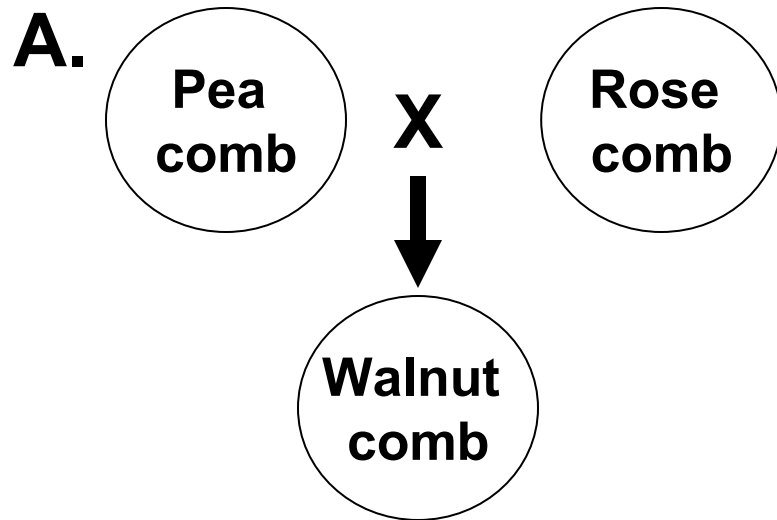


PRACTICE QUESTIONS . . .

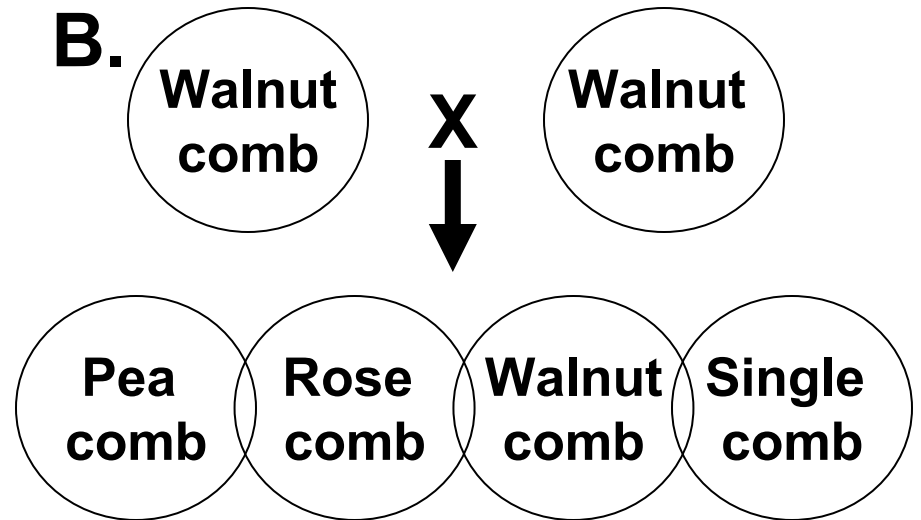
Polymorphism and ABO Blood Groups

QUESTION:

How many possible phenotypes could result from a mating between $I^B i$ x $I^A i$?



all are Walnut comb



New phenotype!

Which of the following statements best explains this result?

- a. The alleles of a single gene are interacting to produce the different phenotypes.
- b. The phenotypes are the result of incomplete dominance.
- c. The alleles of two genes are interacting to produce the different phenotypes.
- d. The phenotypes are the result of codominance.

Which of the following statements is true about a six foot tall man that has children with a five foot tall woman (assume the children had adequate nutrition during development)?

- a. All male offspring will always be six feet tall.
- b. All female offspring will always be five feet tall.
- c. The height of the offspring will vary in a normal distribution near the average height of the parents.
- d. The height of the offspring will vary with no relationship to the average height of the parents.

Over the past 75 years IQ test scores have increased dramatically in industrialized nations. What is the most probable explanation for this increase in test scores?

- a. The genetic composition of the population results in more intelligent people.
- b. Better education has resulted in a population with skill sets that help performance on IQ tests.
- c. Mating patterns changed in the past century.
- d. The genetic composition of the population was altered by selection of individuals resistant to infectious diseases such as Influenza.