

QUESTIONS

How many different chromosome arrangements (at the metaphase plate of Meiosis I) could a cell have that is $2n = 6$?

What is the probability that a gamete will get ONE PARTICULAR chromosomal arrangement?

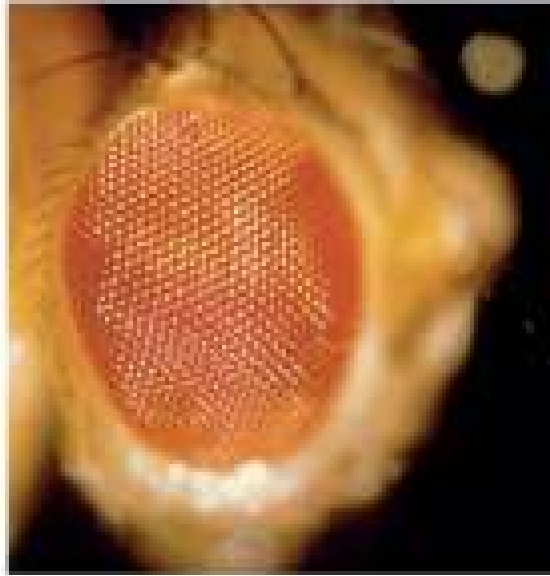
T. H. Morgan ~ 1908



Drosophila

- **Another model organism**
 - **Small**
 - **Easy to keep and propagate**
 - **~ 10 day reproductive cycle**
 - **~ 100 offspring per mating**

Mutants



W+

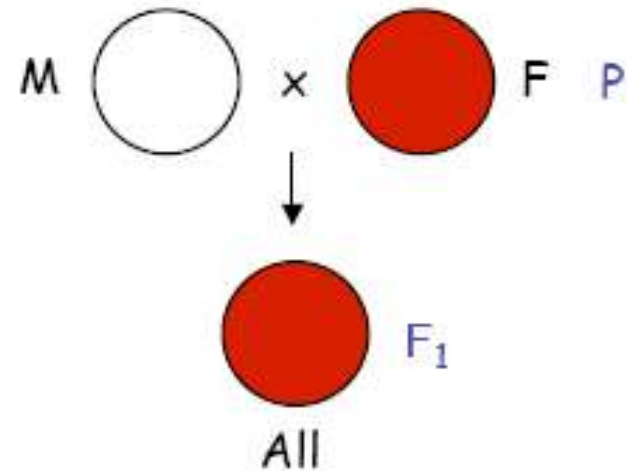


W

QUESTION:

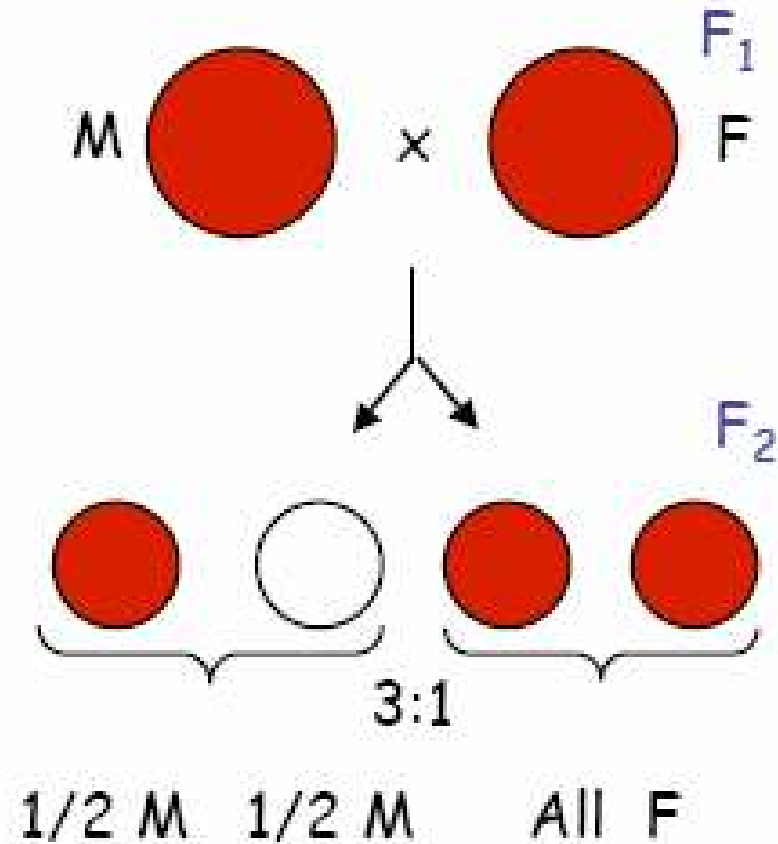
Given what you know about dominant/recessive relationships, what would you tentatively conclude about the relationship between Red eyes and white eyes?

1. Allele for red eyes is dominant over white
2. Allele for white eyes is dominant over red
3. None of these



Offspring are all red, regardless of gender

Crosses



Why do these crosses always give me RED FEMALES?

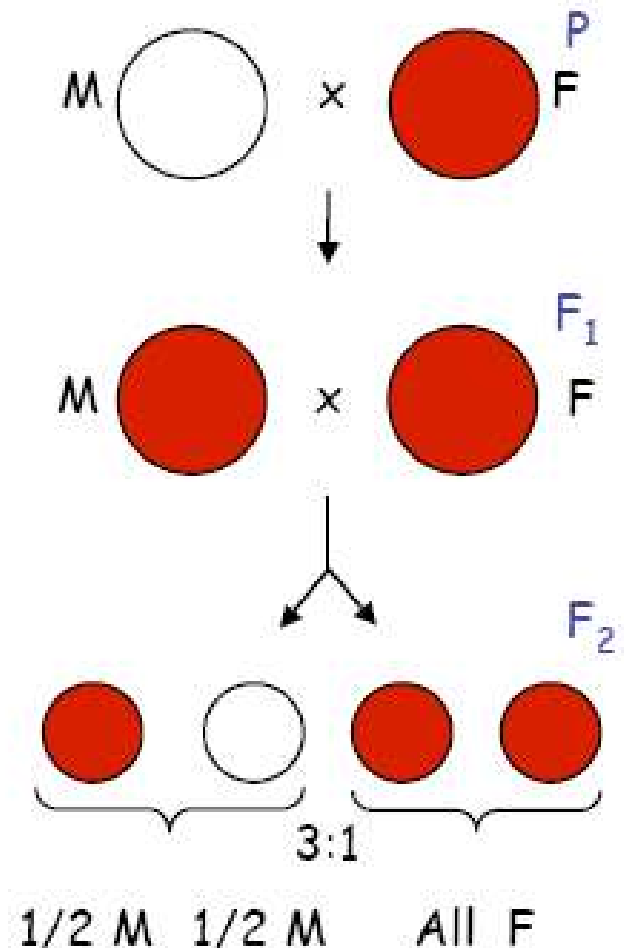
So far, only males have white eyes. What do think about this?

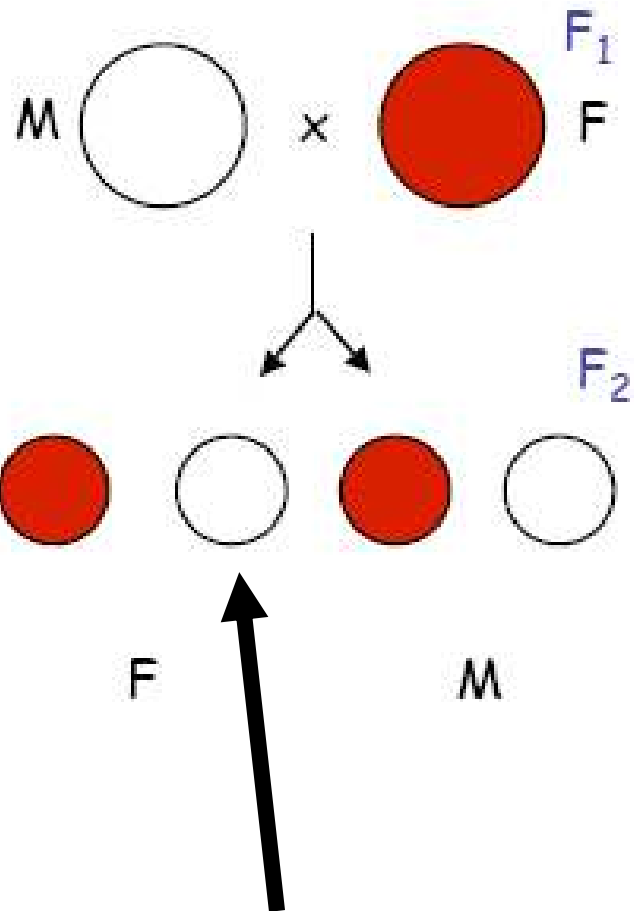
With a partner:

A. state a hypothesis

B. Pretend your are T.

Morgan and design an experiment with the fly strains that you have to the right.





Hey, we can get white-eyed females!

Sex-linkage vs autosomal inheritance

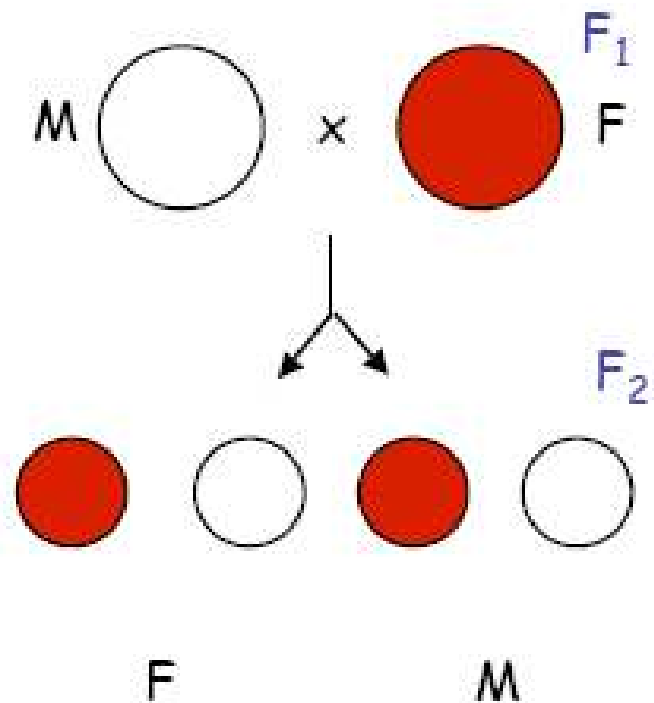
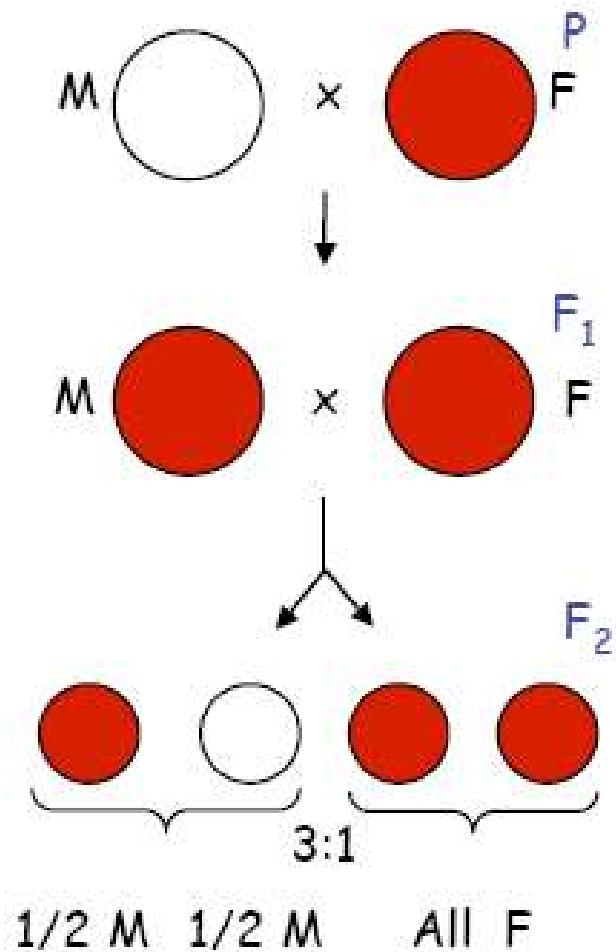
- **Sex-linkage: Gene for a trait lies on sex chromosomes**

(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

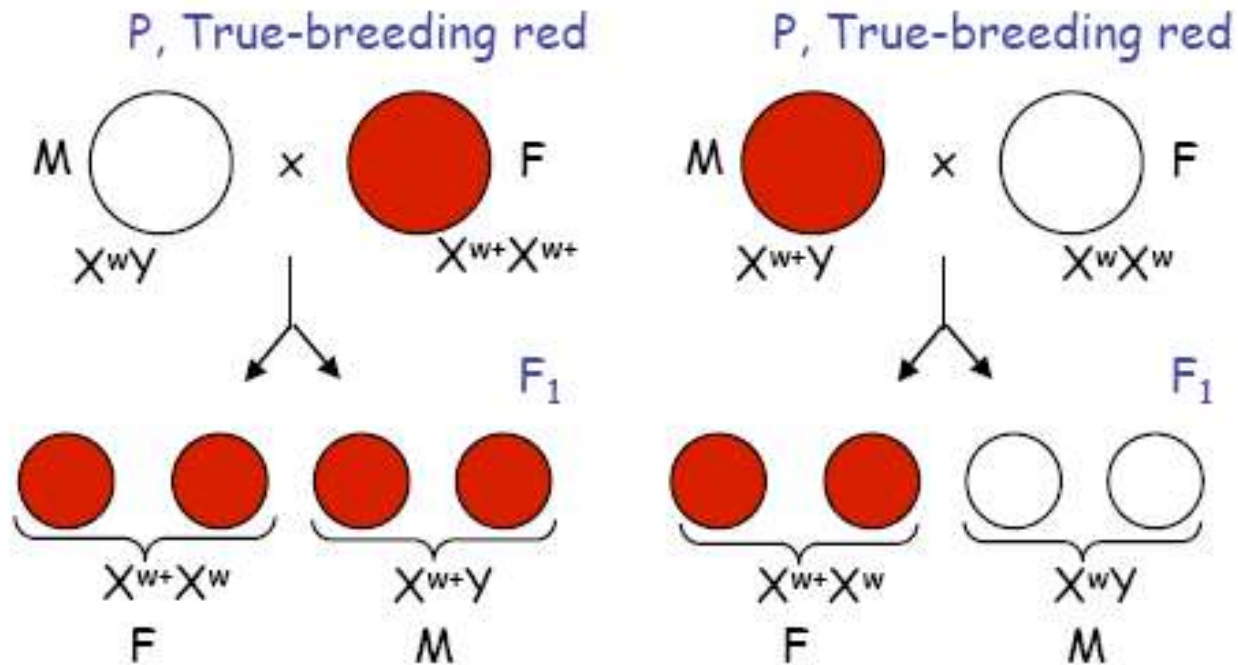
With a partner, draw Punnett squares of all three of these crosses.



Work with a partner

- 1. Determine the genotypes of true-breeding flies (both male and female) for white-eyes and red eyes.**
- 2. Draw a cross between a true breeding white-eyed male with a true breeding red-eyed female**
- 3. Draw the reciprocal cross**

Do your crosses look like this?



Work with a partner

- 1. What are the genotype ratios in female offspring when we cross red-eyed males ($w+Y$) with red-eyed females ($w+w$)?**
- 2. In the same cross, what are the genotype and phenotype ratios of the males?**

New Problem – discuss this with your partner

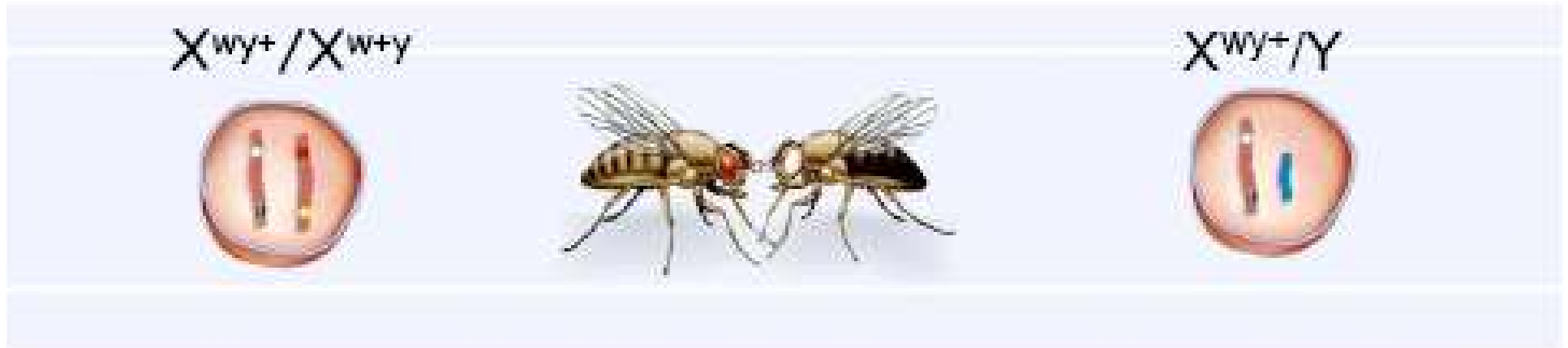
Consider two genes: If genes lie on chromosomes, and chromosomes assort independently, then what type of assortment should we expect from genes that lie on the **SAME chromosome?**

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

Work with a partner

How many gamete types can a female who is heterozygous for eye color and body color produce?

Draw it!

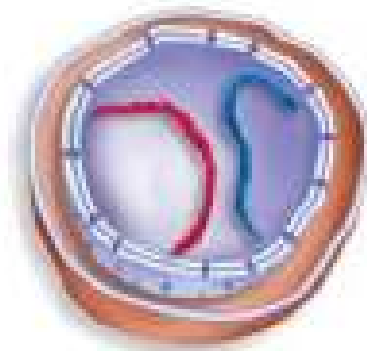


- What phenotypic ratios do we expect in male offspring from this cross?
- 1:1; white, Gray : Red, yellow
- What genotypic ratios do we expect?
- 1:1 X^{wy+}/Y : X^{w+y}/Y

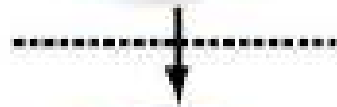
Work with a partner



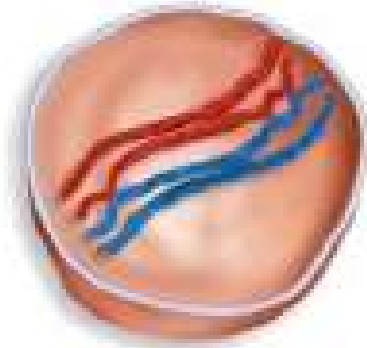
- What phenotypic ratios do we expect in female offspring from this cross?
 1. 1:1 white, gray : white, yellow
 2. 1:1 white, gray : red, gray
 3. 1:1 white, gray : red, yellow
 4. 1:1 red gray : red, yellow



Diploid parent cell



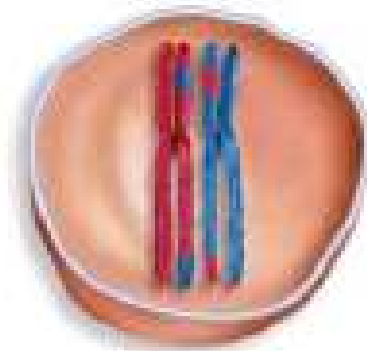
Chromosome replication



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. . . (NOT YOUR BOOK)

Draw meiosis I and II whereby a female produces gametes, her genotype is wy^+/w^+y , and crossing over has occurred 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”**

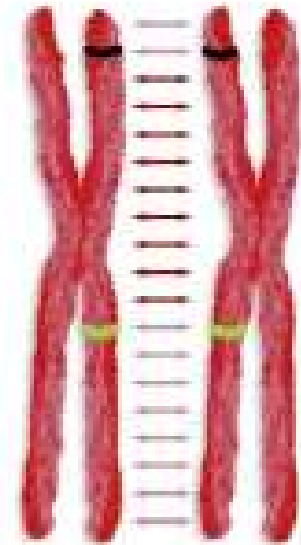
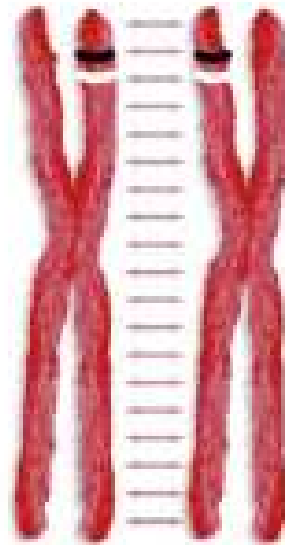
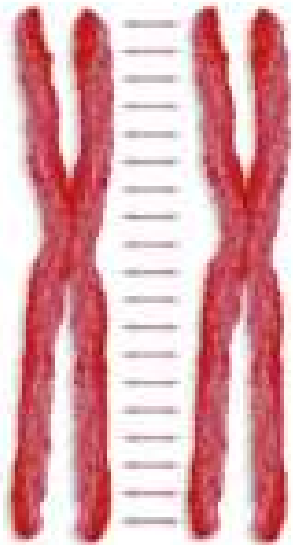
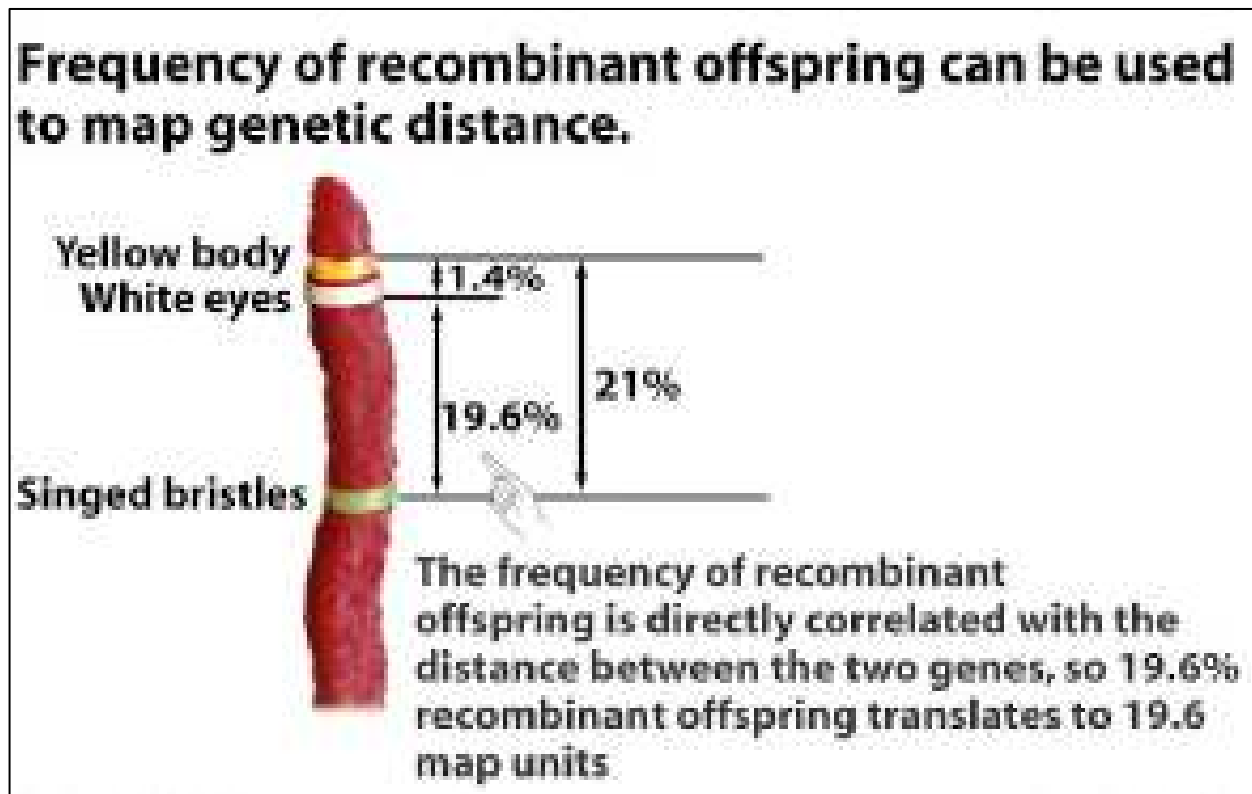


Figure 13-15 Biological Science, 2/e
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Genetic map units

- 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

