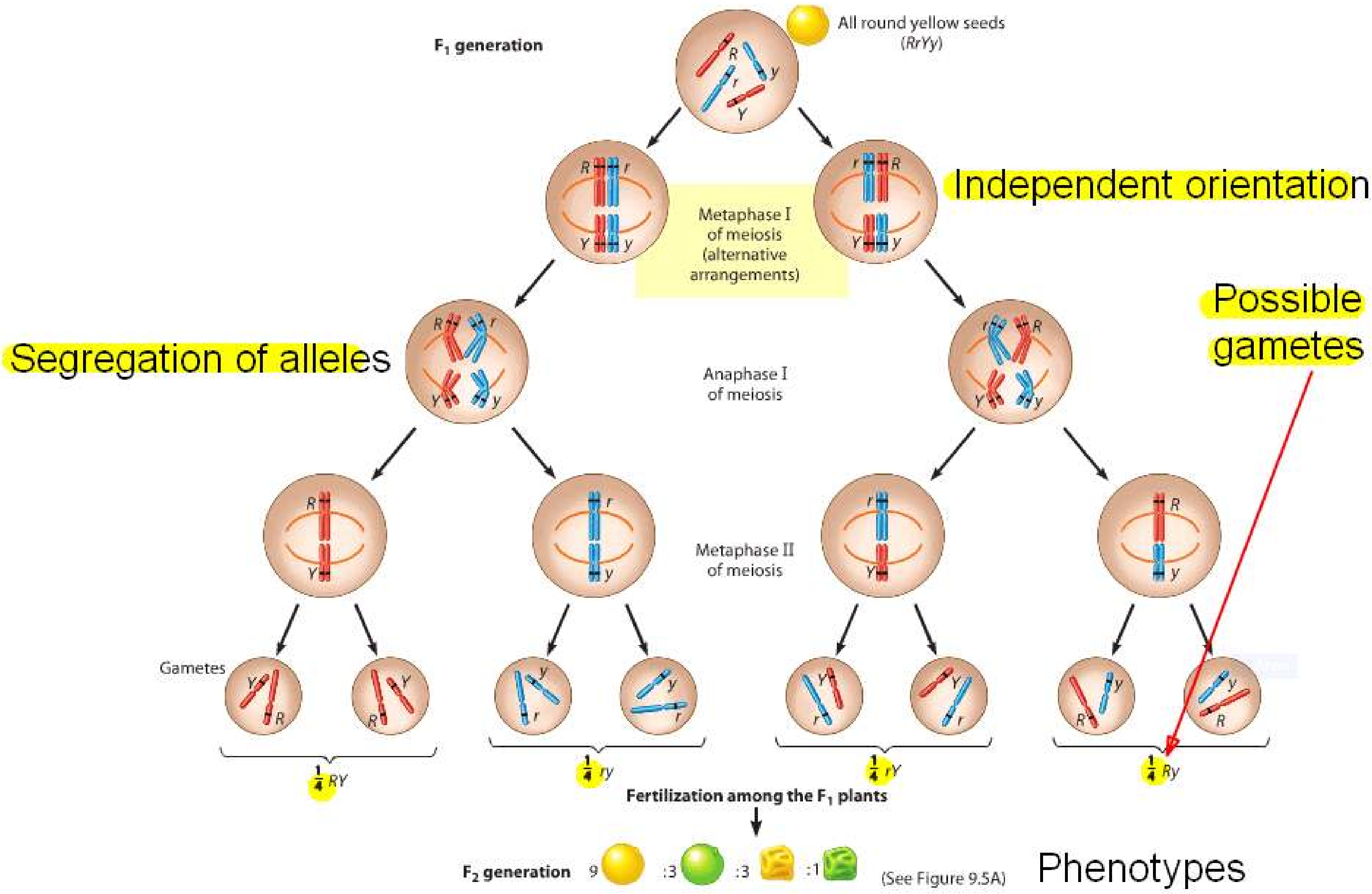
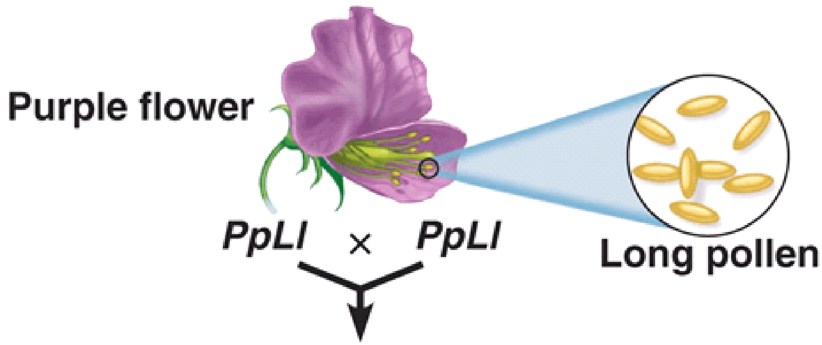
Patterns of Inheritance (Mendel and otherwise) can be traced to the behavior of chromosomes during meiosis



Mendel's 9:3:3:1 phenotype ratio was due to genes on <u>different</u> chromosomes.

Genes that are "linked" (on the same chromosome) do NOT follow the same pattern...the phenotypic ratios are different

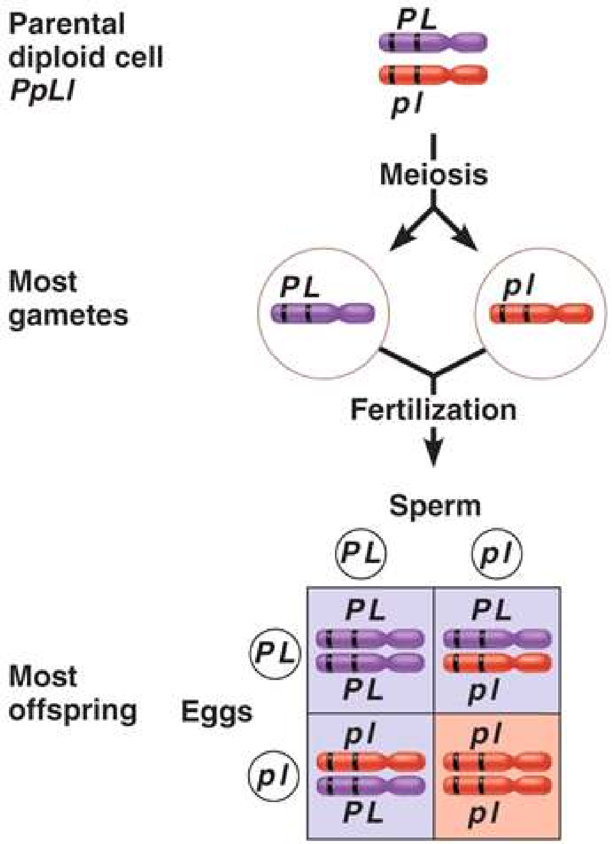
Experiment



Phenotypes	Observed offspring	Prediction (9:3:3:1)
Purple long	284	215
Purple round	21	71
Red long	21	71
Red round	55	24

These genes (flower color and pollen shape) are on the same chromosome...so meiosis yields mostly two types of gametes (PL and pl) rather than equal numbers of the four possible gametes (PL, pL, Pl and pl)

Explanation: linked genes



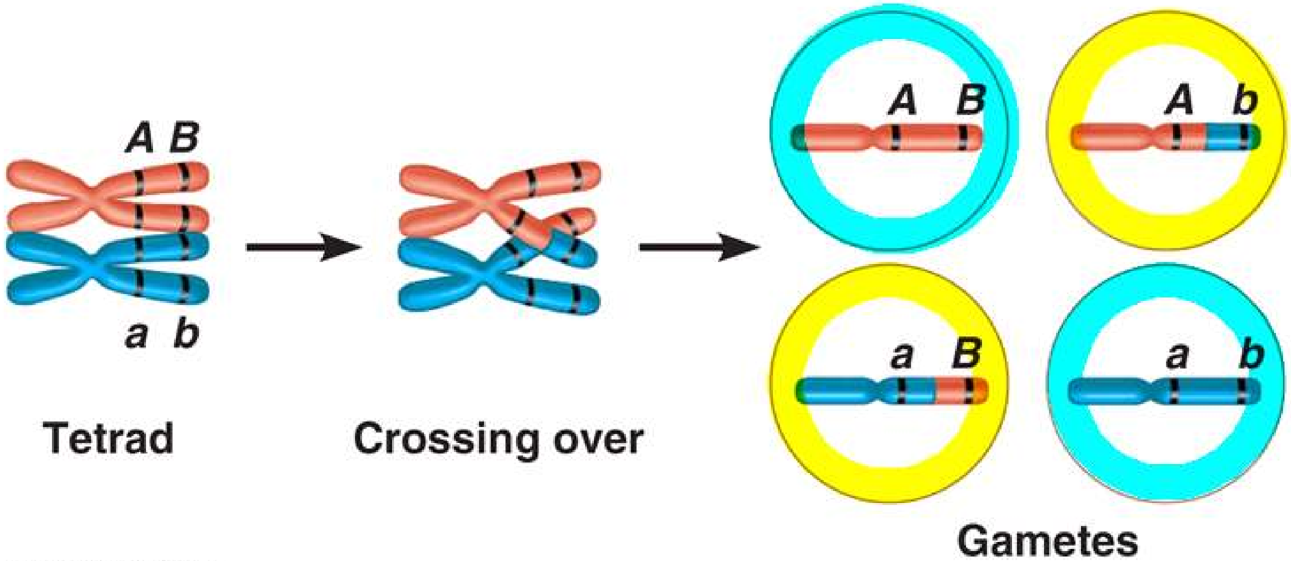
3 purple long : 1 red round

Not accounted for: purple round and red long

Crossing over accounts for those "missing" allele combinations (pL and Pl)

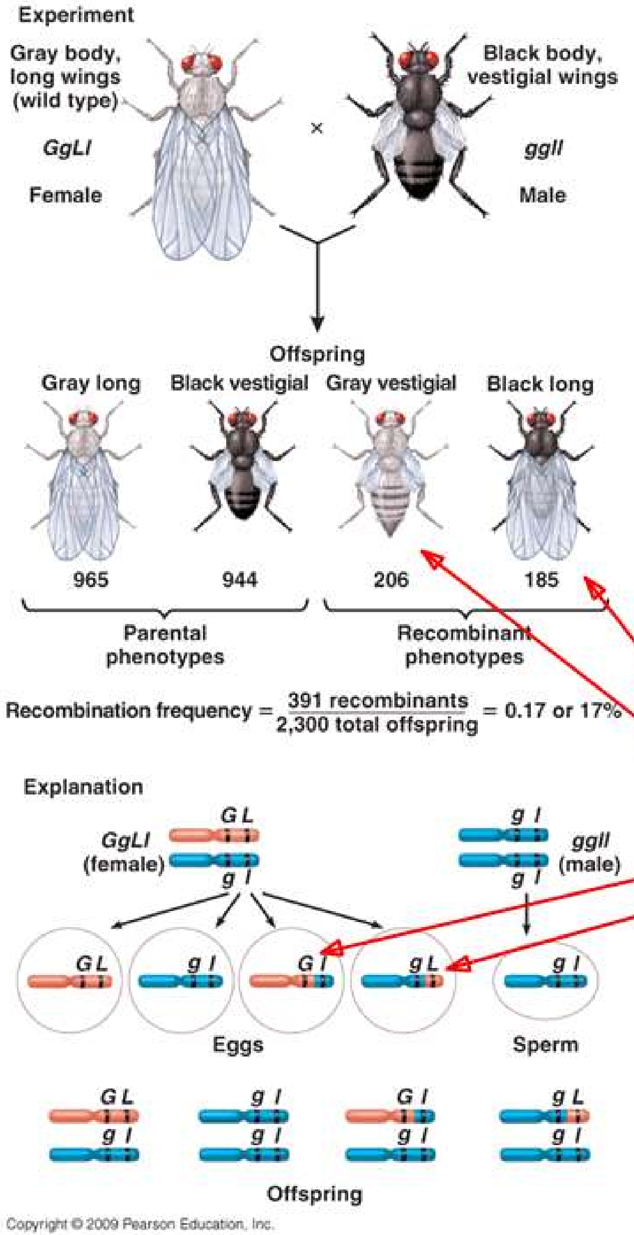
Recombinant gametes are produced by crossing over...

Crossing over can reshuffle genes that were linked...



can be explained by independent orientation/segregation

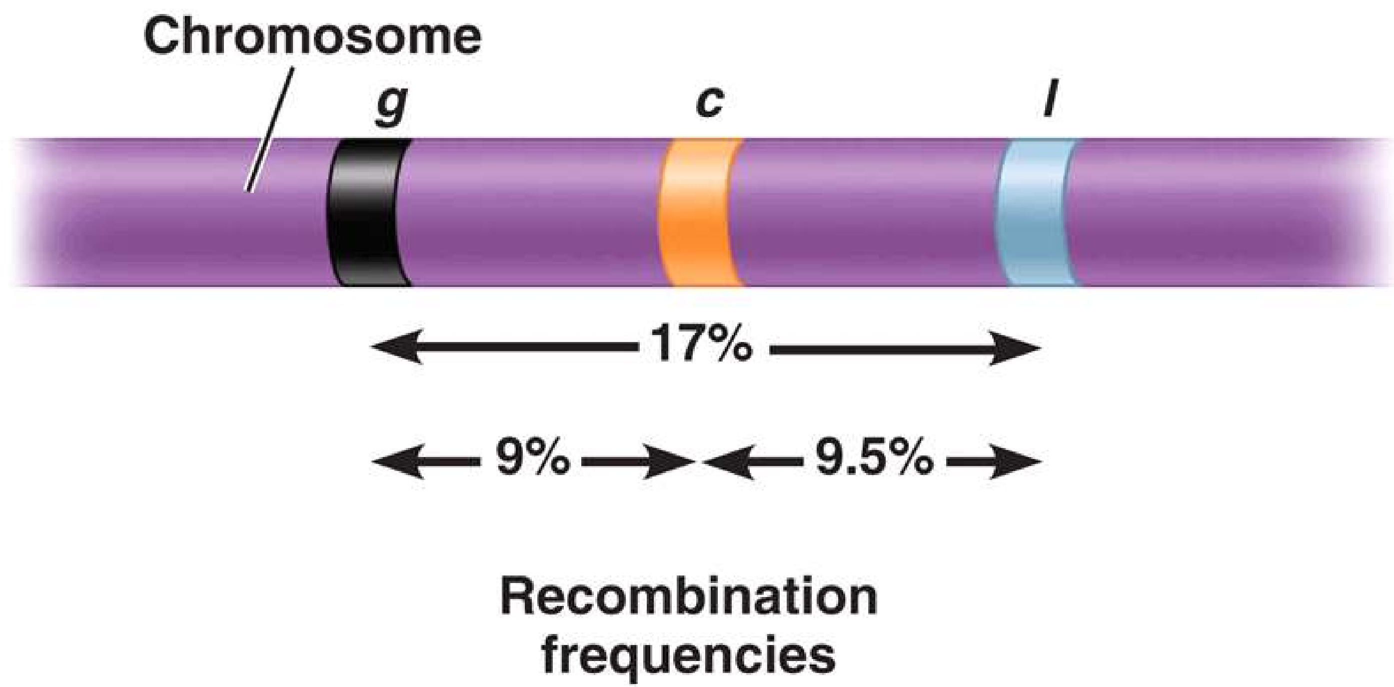
can only be possible if crossing over occurs



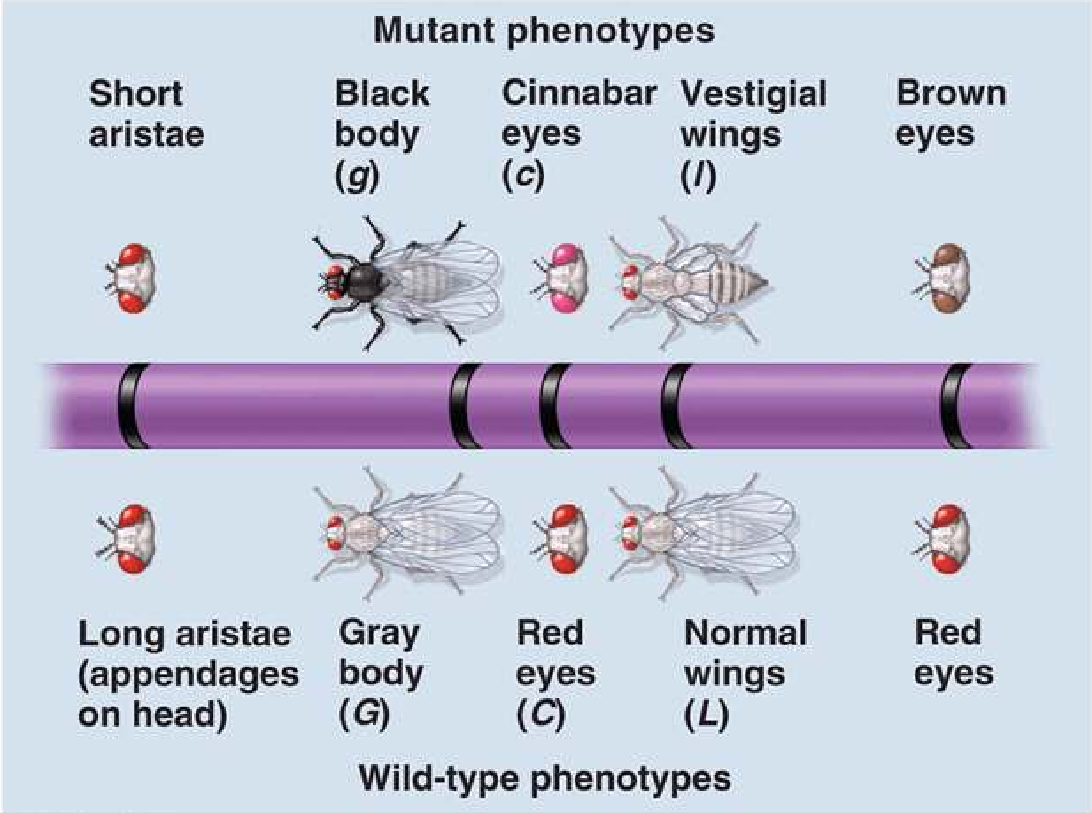
Note the genotypes!

If not linked...1:1:1:1 would be expected (remember the corn lab?)...if linked then ratio would be different (which it was)!

Percentage of offspring with recombinant phenotype determines the recombination frequency...in this case 17%

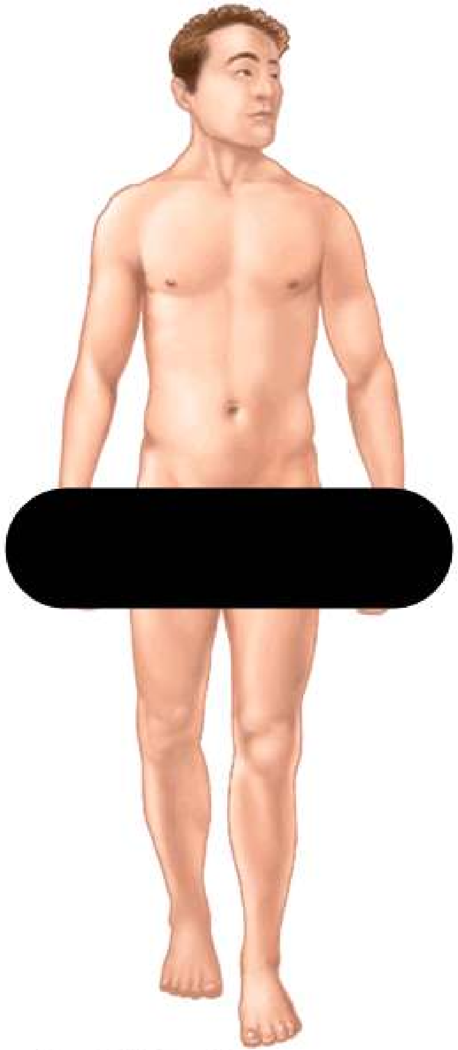


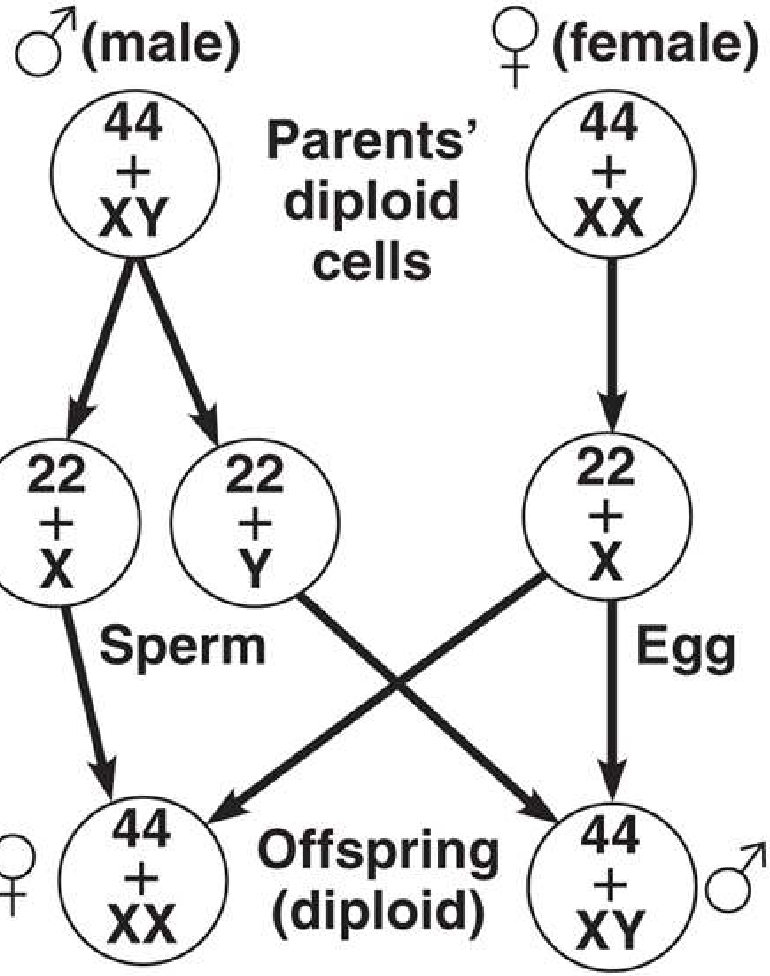
Recombination frequency can be used to determine relative distances between linked genes on a chromosome...the greater frequency (percentage) the greater the distance between the genes. Why?



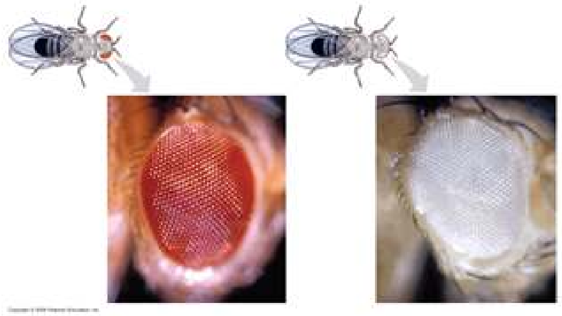
The farther apart the linked genes are on a chromosome...the more likely they are to be "recombined" when crossing over occurs!

Sex Chromosomes determine sex…duh!





Eye Color in fruit flies is sex-linked...gene is located on X chromosome



Males only have 1 X chromosome...
so they're stuck with whatever allele they get for the genes on that X chromosome...and it will be expressed!

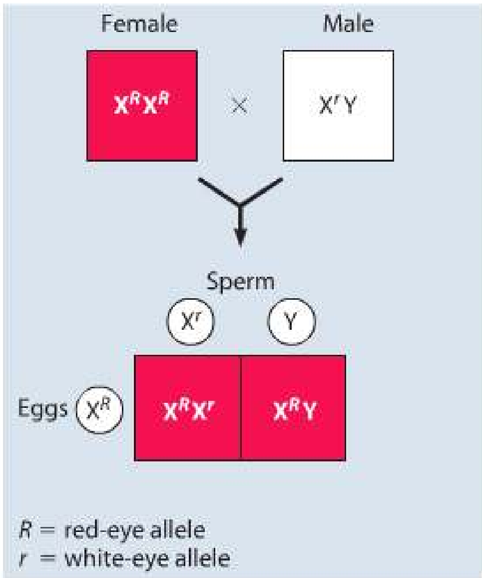


Figure 9.21B Homozygous, red-eyed female × white-eyed male

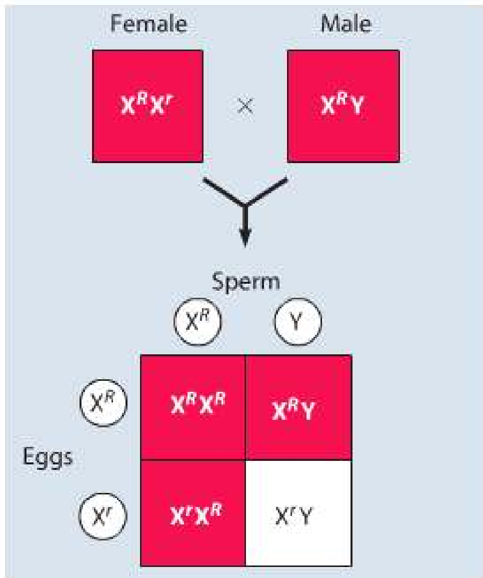


Figure 9.21C Heterozygous female × red-eyed male

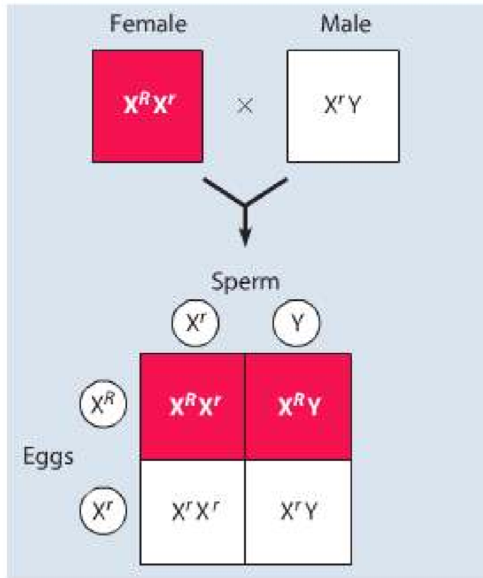


Figure 9.21D Heterozygous female × white-eyed male

For any sex linked type of problem/Question… Think:

What are the parent genotypes?

What gametes would be possible?

Draw out the Punnet Square!

I.D. sex and phenotype of potential offspring!

$X^H X^H$ = female, normal

$X^H X^h$ = female, carrier

$X^h X^h$ = female, hemophiliac

$X^H Y$ = male, normal

$X^h Y$ = male, hemophiliac

Show the cross of a man who has hemophilia with a woman who is a carrier.

What is the probability that their children will have the disease? ___________

7. A woman who is a carrier marries a normal man. Show the cross. What is the probability that their children will have hemophilia? What sex will a child in the family with hemophilia be?

28. In humans the gene for normal color vision **C**, is dominant to the gene from red-green color blindness, **c**. This trait is sex-linked and found on the X chromsome. The gene for brown eyes, **B**, is dominant to the gene for blue eyes, **b**. Calculate the probable genotype and phenotype of the children born to a blue-eyed woman who is heterozygous for color vision and a heterozygous brown-eyed man who is colorblind.

Woman: X^CX^cbb

Man: X^cYBb

Possible Gametes: X^Cb and X^cb

Possible Gametes: X^cB X^cb YB Yb

Genotypes:

Gametes	X^cB	X^cb	YB	Yb
X^Cb	X^CX^cBb	X^CX^cbb	X^CYBb	X^CYbb
X^cb	X^cX^cBb	X^cX^cbb	X^cYBb	X^cYbb

Phenotypes:

	X^cB	X^cb	YB	Yb
X^Cb	Female, color vision, brown	Female, color vision, blue	Male, color vision, brown	Male, color vision, blue
X^cb	Female, color blind, brown	Female, color blind, blue	Male, color blind, brown	Male, color blind, blue