Section 6.2 – Linked Genes

SBI3U

MRS. FRANKLIN

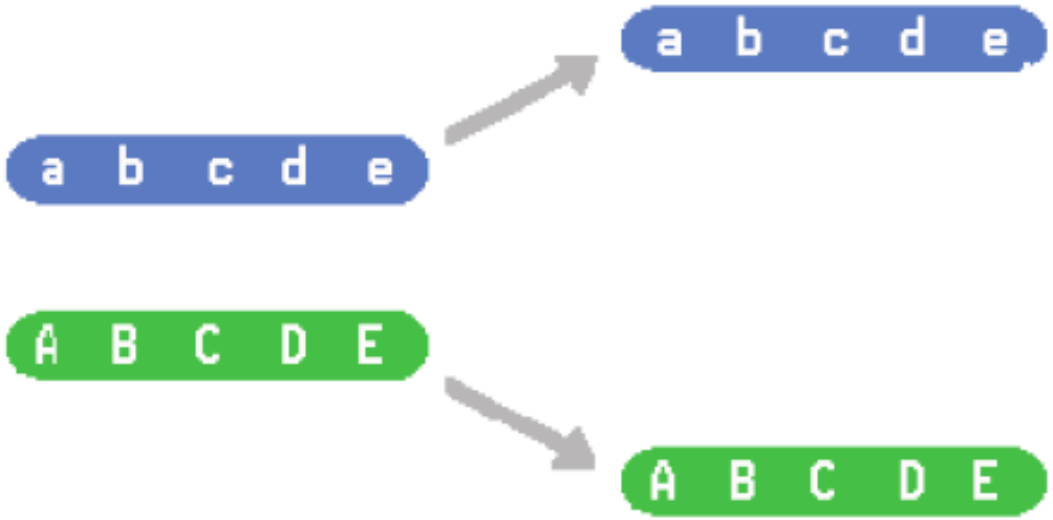
After Mendel

Walter Sutton, discovered that alleles on the same chromosome do not assort and segregate independently.

Some genes are inherited together because they are linked.

Linked Genes

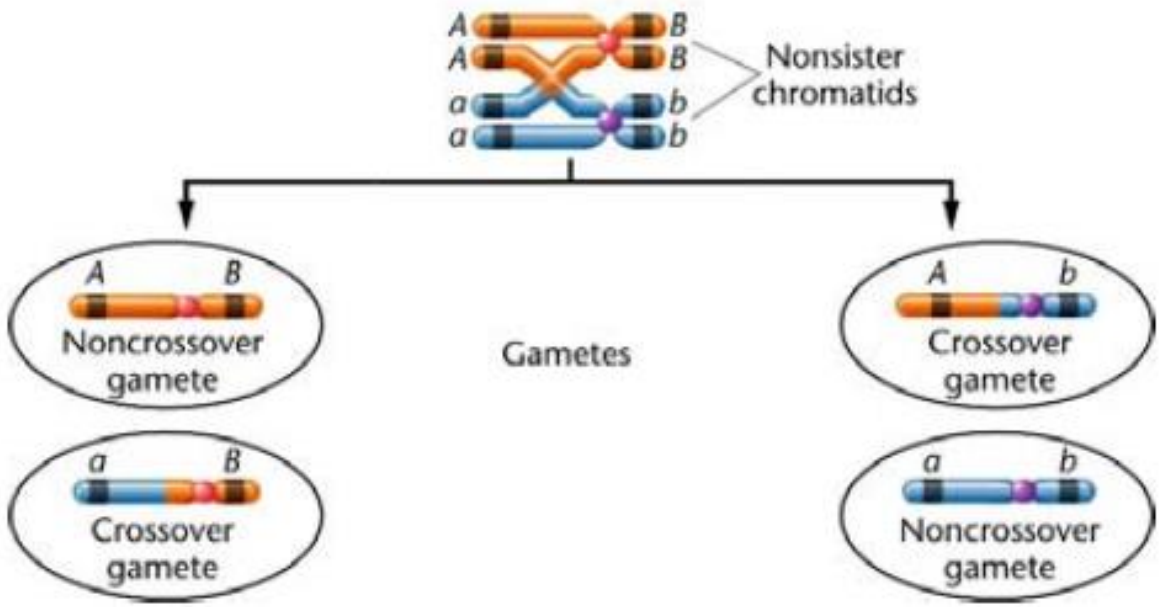
Genes that are located on the same chromosome tend to segregate together.



Linked genes: genes that are on the same chromosome and that tend to be inherited together.

Linked Genes

Linkage group:

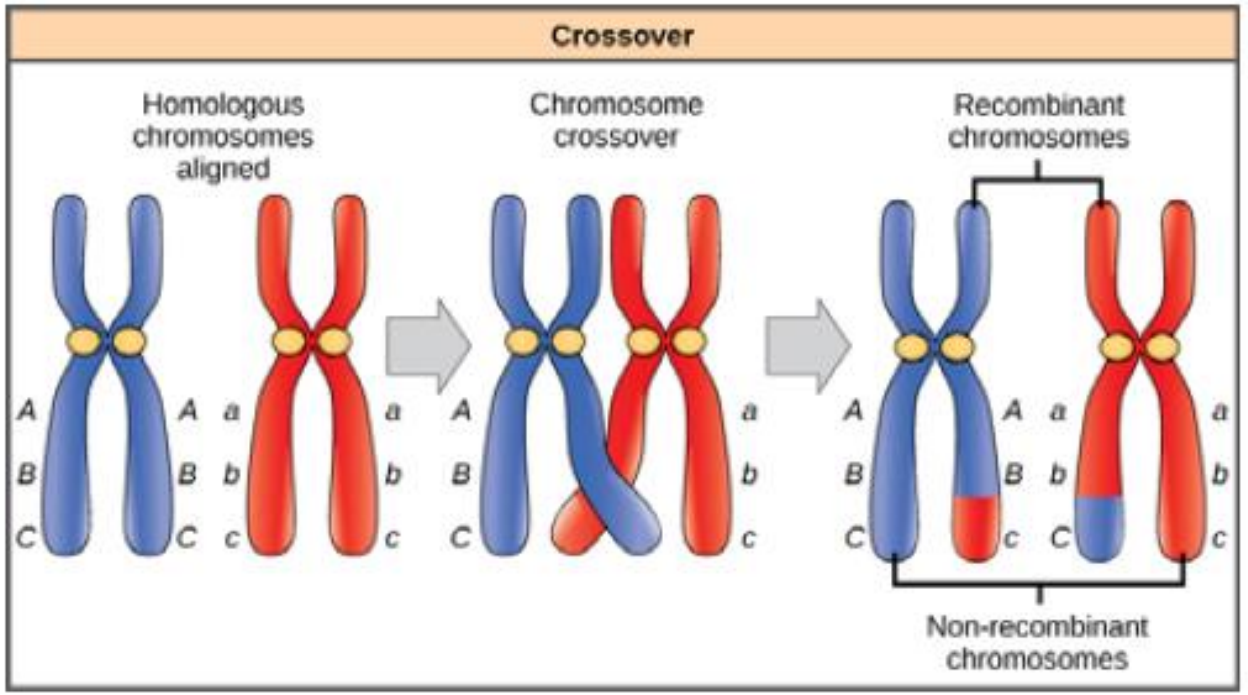


All genes in a linkage group are inherited together unless crossing over occurs.

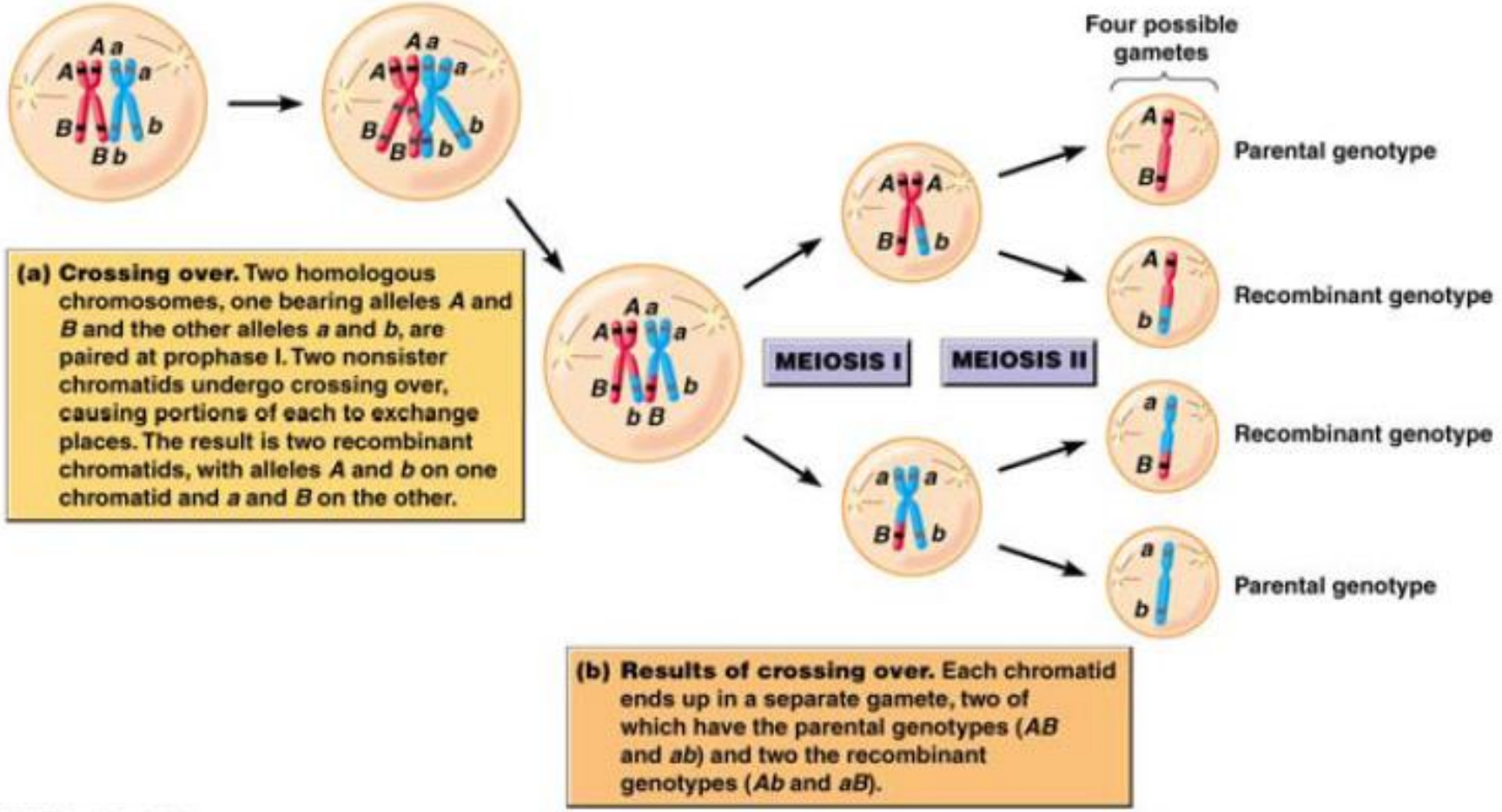
Crossing Over

If crossing over occurs, the linkage group is disrupted. Genes that were inherited together, now segregate separately due to the event of crossing over.

Recombinant alleles: *linked genes that have been separated during crossing over.*



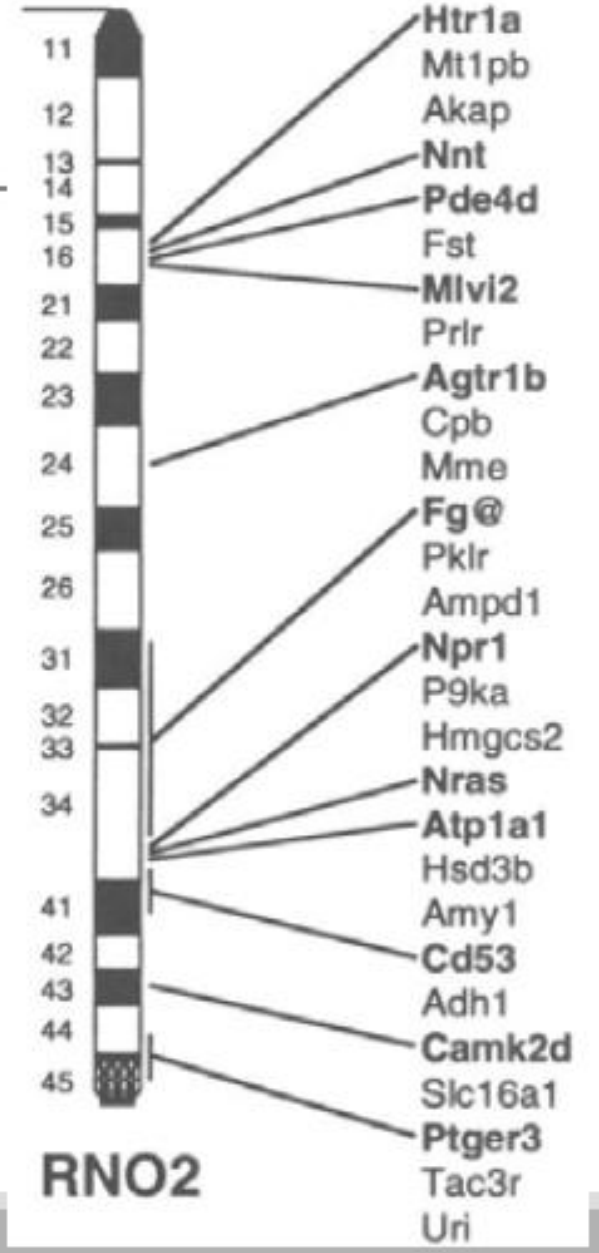
Crossing Over



Chromosome Mapping

Alleles that seperate during crossing-over do so with a predictable frequency. Crossing-over is more common between alleles that are far apart on the chromosomes.

The % of recombinant gametes varies, dependent upon location of the loci. The closer the genes are, the less likely recombination will occur



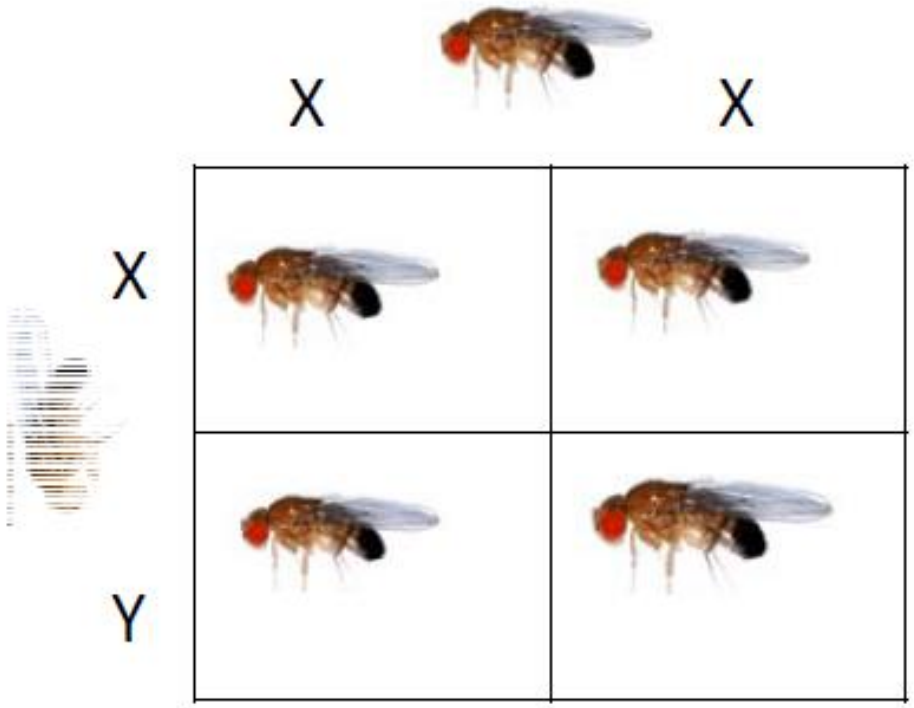
Sex - Linked Inheritance

Thomas Hunt Morgan, conducted research on ***'Drosophila Melanogaster'***

Through his research, he discovered that certain traits are controlled by genes that are linked on the sex chromosomes.

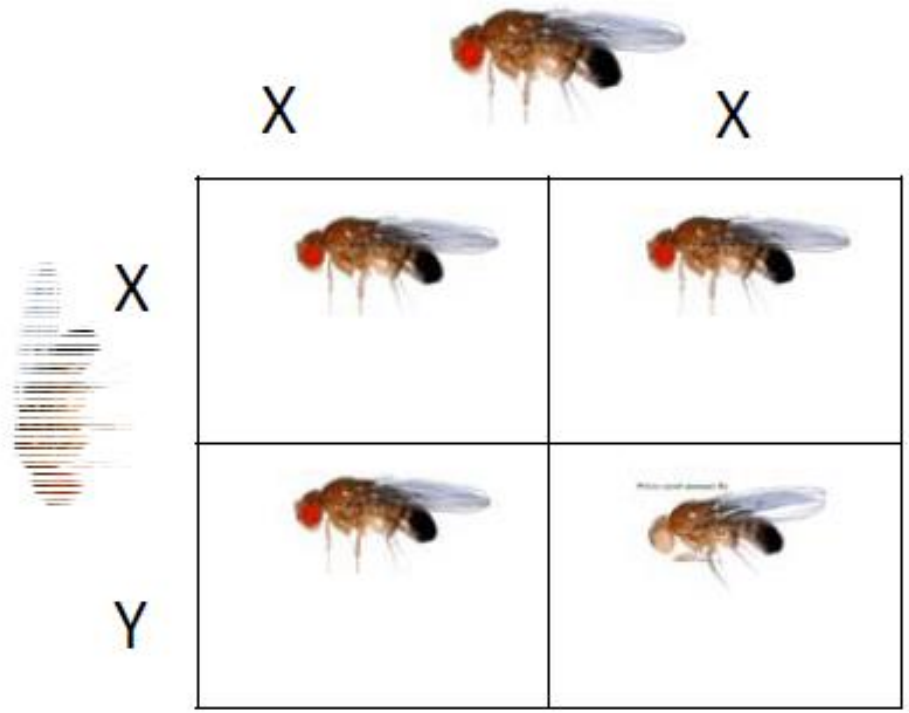
This phenomenon is known as ***'Sex-linked trait'.***

Sex - Linked Inheritance



In the F1 generation, both males and females had red eyes.

Sex - Linked Inheritance



In the F2 generation, All of the females have red eyes.

50% of the males have white eyes

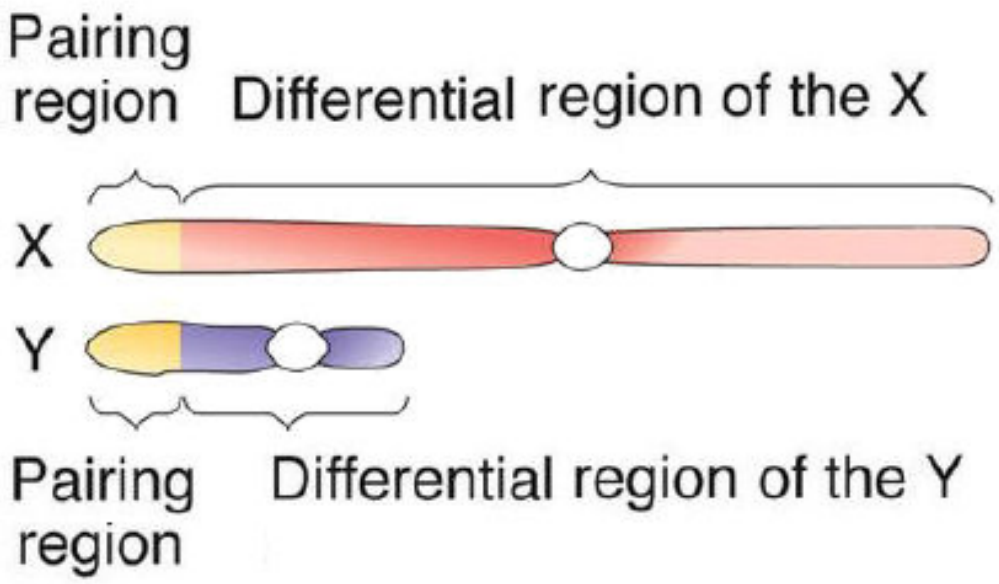
50% of the males have red eyes.

Why are Males and Females Different?

Morgan hypothesized that perhaps these chromosomes were located on the sex chromosomes, thus influencing wether the male or female would inherit a certain allele.

Sex Chromosomes

There is only one area that is similar which allows it to pair as homologous chromosomes



X and Y chromosomes differ in terms of their length and the type/number of genes that are present.

Sex-linked gene:

Sex Chromosomes

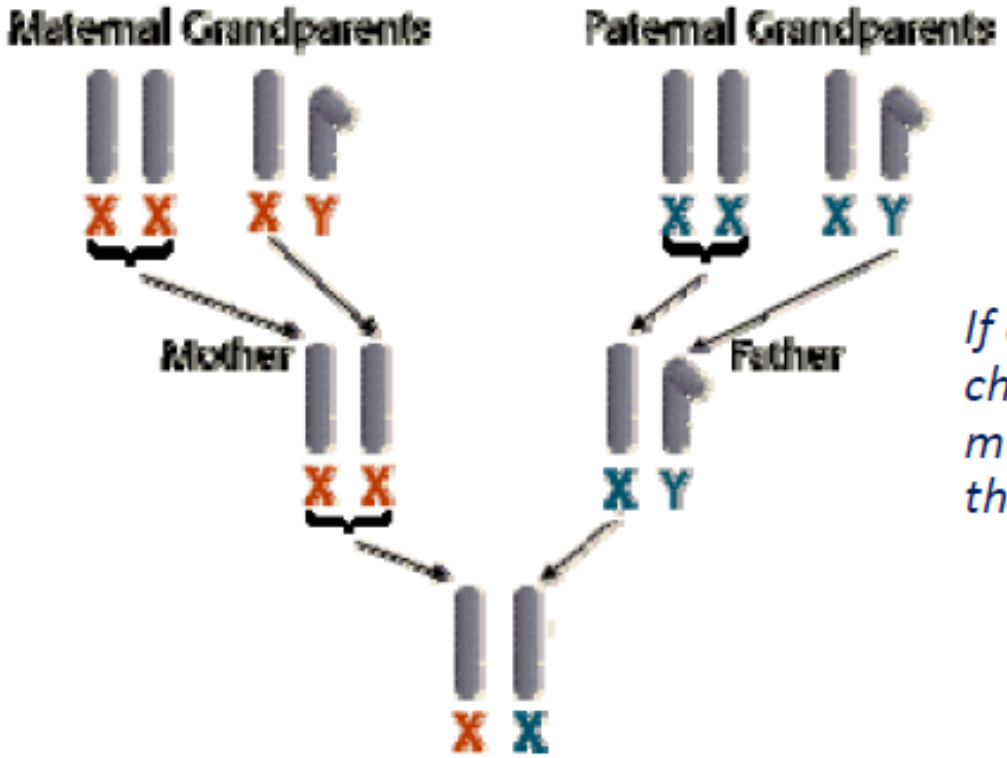
X-linked genes: genes located on the X chromosome

Alleles are identified as either dominant or recessive through superscripts (X^R , X^r)

Y linked genes: genes located on the Y chromosome

Alleles are identified as either dominant or recessive through superscript. (Y^R , Y^r)

Sex – Linked Inheritance



If a gene is located on the X-chromosome, the males must inherit the trait from their mother.

Sex – Linked Inheritance

Female: $X^r X^r$

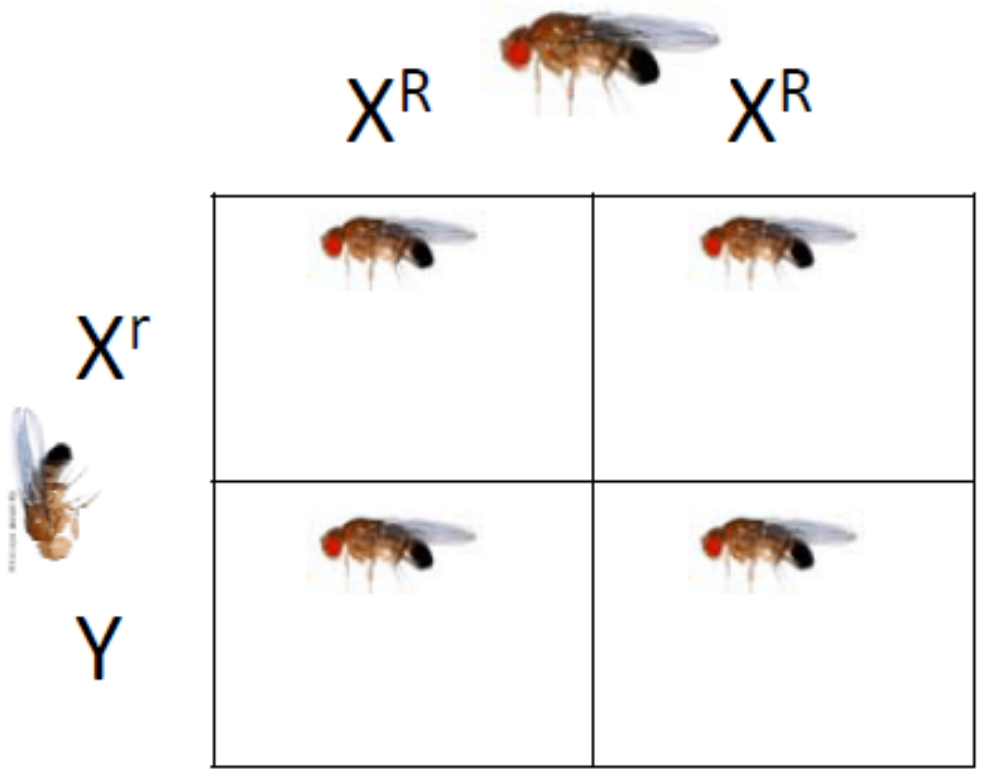
Male: $X^r Y$

Female: $X^R X-$

Male: $X^R Y$

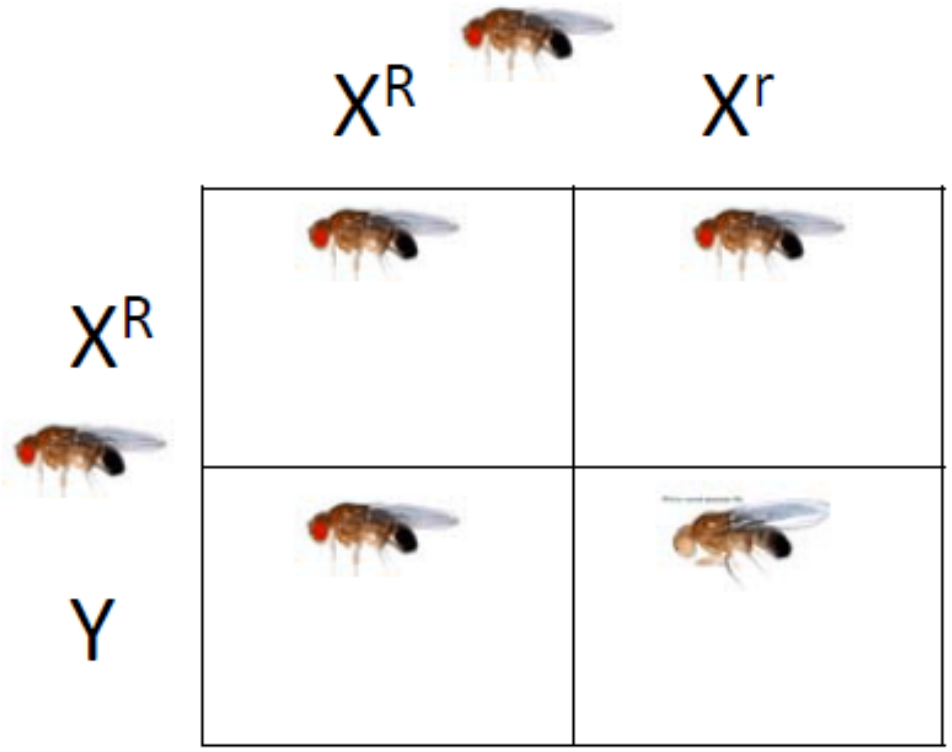
Genotype	Phenotype
$X^R X^R$	Female with red eyes (homozygous dominant)
$X^R X^r$	Female with red eyes (heterozygous)
$X^r X^r$	Female with white eyes (homozygous recessive)
$X^R Y$	Male with red eyes
$X^r Y$	Male with white eyes

Morgan's Experimental Evidence



Males only have one X chromosome, thus they express whichever alleles they've inherited from the mother.

Morgan's Experimental Evidence



50% of the males have red eyes because they have inherited (X^R)

50% of males have white eyes because they have inherited (X^r)

Sex – Linked Inheritance

1) *Recessive X-linked:* the female will only express it if she is homozygous recessive ($X^r X^r$)

2) *Dominant X-linked:* the female will express is if she is homozygous dominant or heterozygous ($X^R X_-$)

3) The male will always express the phenotype of the X chromosome that is inherited.

***Because the male only has one chromosome he is considered hemizygous (not hereto- or homo-)*

Checking for Understanding

Hemophilia is an X-linked recessive disorder. Determine the probability that a woman who is a carrier for hemophilia and a man without hemophilia will have a child with hemophilia.

Checking for Understanding

CVD is an X-linked recessive disorder. Suppose that a woman who is a carrier for CVD and a man who has CVD decide to have children.

a) ***Determine the genotypes of these two people.***

b) ***What is the expected ratio of genotypes and phenotypes among their children.***

Homework

Textbook: p. 258 - 16, 18-20