10.3- Gene linkage and Polyploidy

Genetic recombination- The new combination of genes produced by crossing over and independent assortment

Gene Linkage and Polyploidy

Combinations due to **independent assortment** can be calculated using the formula 2^n, where *n* is the number of chromosome pairs.

Humans have 23 pairs-

2^{23} = 8,388,608 gene

Gene Linkage and Polyploidy

Any possible male gamete can fertilize any possible female gamete, so

the possible combinations after fertilization are 2^n X 2^n.

Humans:
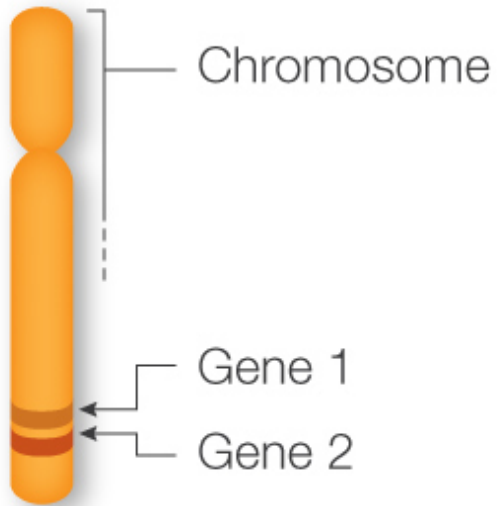
2^{23} x 2^{23} = 70,368,744,000,000
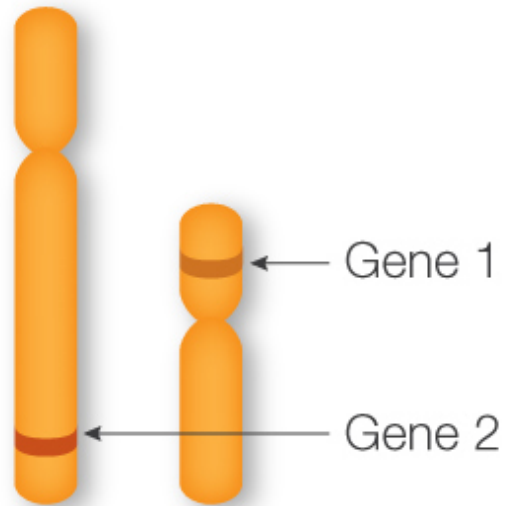
(that's over 70 trillion)

Gene Linkage

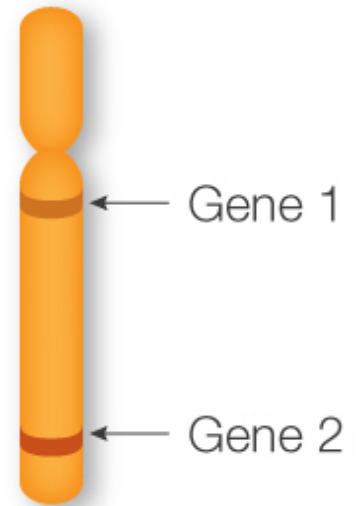Genes located close together are called **linked** and usually travel together during gamete formation.

- Gene linkage breaks Mendel's law of independent assortment.

Chromosome

Gene 1
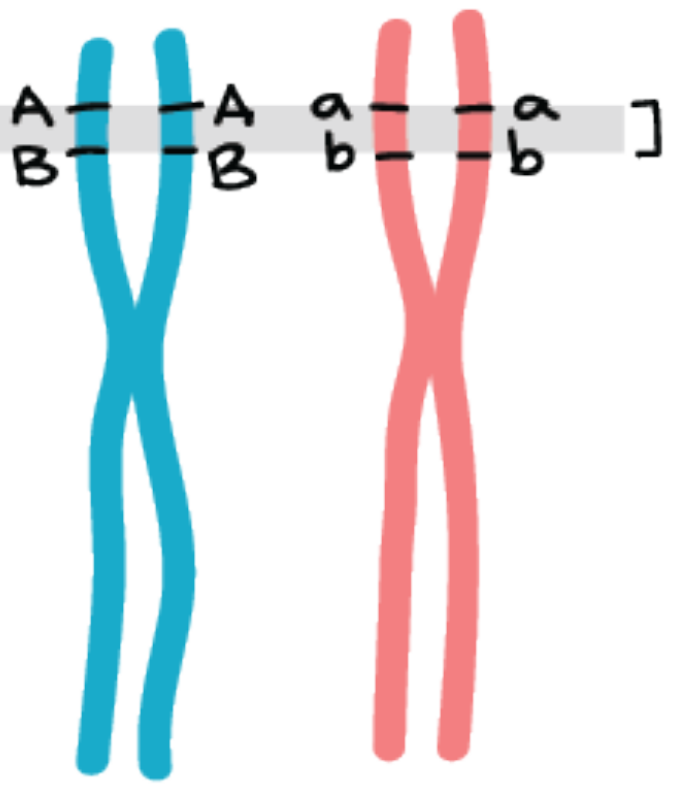Gene 2

Gene 1

Gene 2

Gene 1
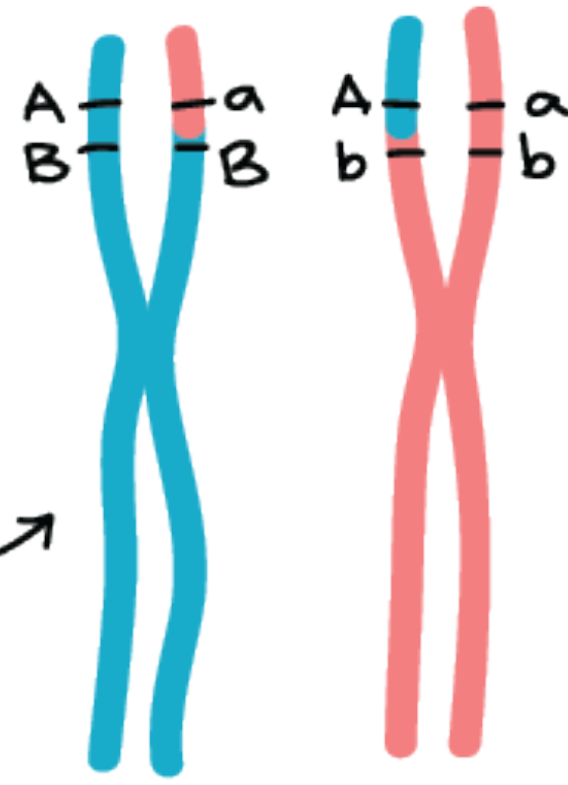
Gene 2

Linked

Not Linked

Not Linked

Only crossovers happening in this small region can produce Ab or aB chromosomes

Recombinant chromosomes do form, but not very often!

Chromosome maps

- Crossing over occurs more between genes that are farther apart.

- Cross over data can be used to create chromosome maps that show how genes are arranged on a chromosome.
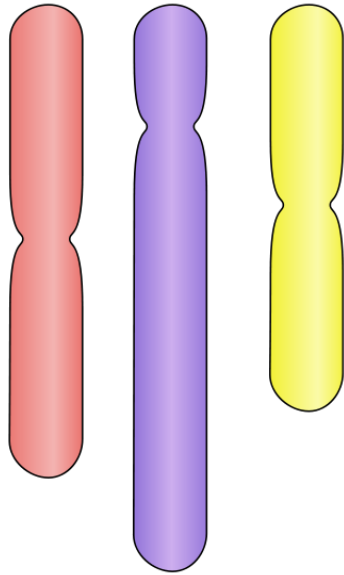
Wild type

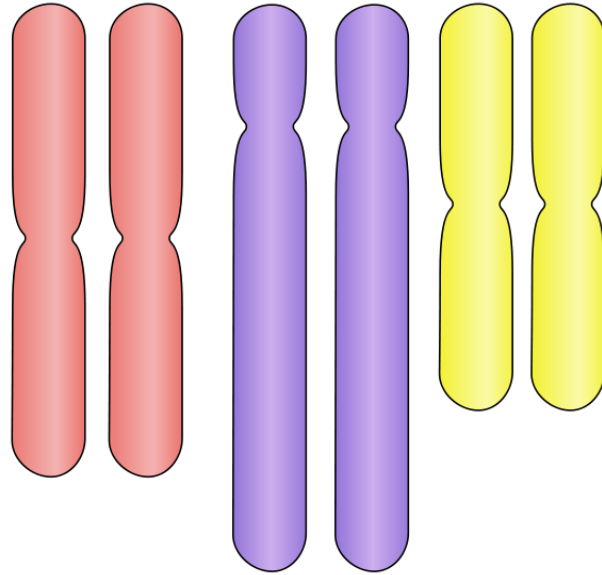Yellow body color

White eye color

Vermilion eye color

y

w

v

Polyploidy is one or more extra sets of all chromosomes in an organism.

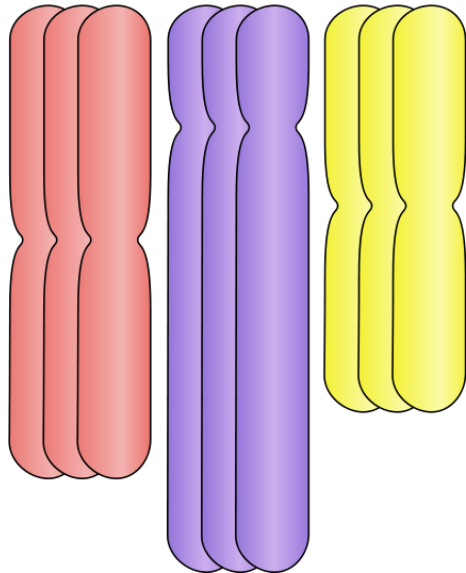ex) triploid ($3n$) means an organism has three complete sets of chromosomes.
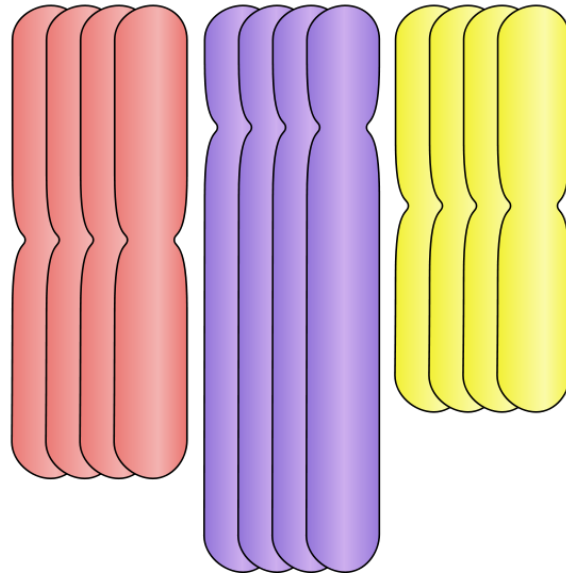
Haploid (N)

Diploid (2N)

Triploid (3N)

Tetraploid (4N)

Polyploidy is **always fatal** in humans and is usually fatal in most animals.

Many crops are polyploid.
Ex: Wheat (6n), oats (6n), and sugar cane (8n)

- Polyploid plants often have increased vigor and size

A

normal fruit

B   2n   2n

C

D

fruit of
polyploid

Monoploid (n) and triploid (3n) plant lines are usually sterile, and sometimes seedless.