Section Ch. 6.5 Traits and Probability
I. Heredity patterns can be calculated with probability.

1. ***Probability*** is the likelihood that something will happen.
2. Probability predicts an ***average number of occurrences***, not an exact number of occurrences.

- Probability = number of ways a ***specific event*** can occur / number of ***total possible outcomes***

- Probability applies to **random events** such as ***meiosis and fertilization.***

II. Punnett Squares

In 1905, Reginald Punnett, an English biologist, devised a shorthand way of finding the expected proportions of ***possible genotypes*** of crosses.

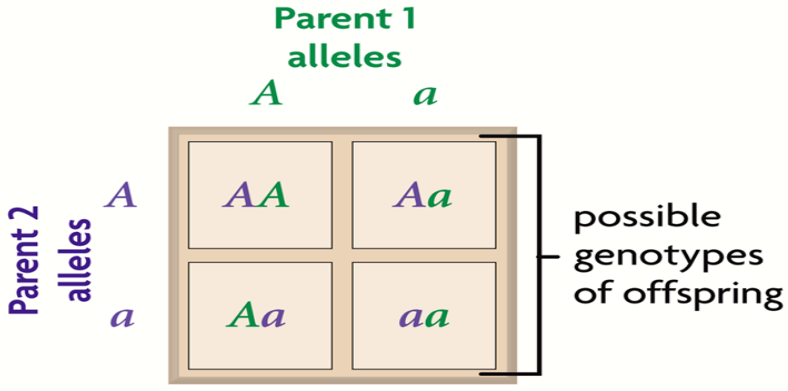
- Punnett squares are good for showing all the possible ***combinations*** of gametes and the likelihood that each will occur.
- It is important to remember that the results predicted by probability are ***more*** likely to be seen when there is a ***large number*** of offspring.

- The Punnett square is a grid system for ***predicting*** all possible genotypes resulting from a cross.
  1. The axes represent the possible ***gametes of each parent***.
  2. The boxes show the possible ***genotypes of the offspring***.
  3. The Punnett square yields the ***ratio of possible*** genotypes and phenotypes.

A. Monohybrid crosses

- The gametes that each parent forms are listed on the top and left side of the Punnett square.

The **Punnett square** is a grid system for predicting possible genotypes of offspring.



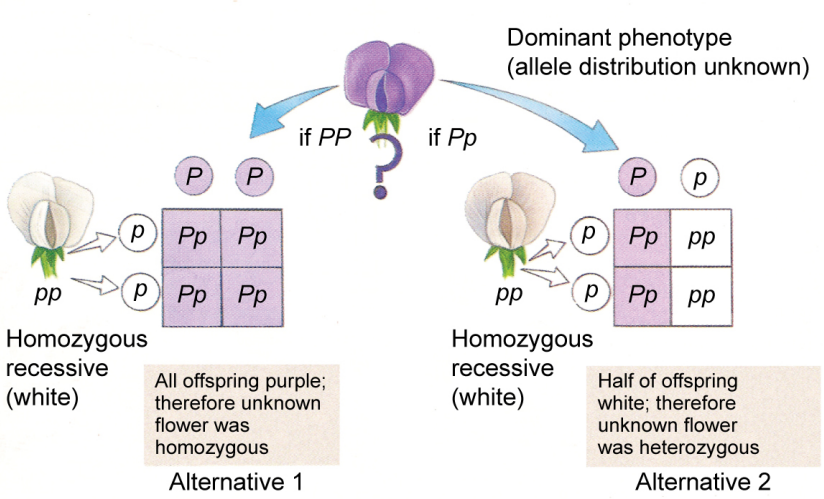
- **Rules for recording the results of crosses**
  1. Use the ***same letter*** for the different alleles of the ***same gene***.
     Ex: Use **T** for the tall and short trait.

  2. Use ***uppercase*** letters for dominant alleles.
     Ex: **TT** or **Tt** for a tall plant's alleles.

  3. Use ***lowercase*** letters for recessive alleles.
     Ex: **tt** for a short plant's alleles.

  4. Always write the ***dominant*** allele first. (Easier to interpret in a Punnett square.)

B. A ***testcross*** is a cross between an organism with an ***unknown genotype*** and an organism with the ***recessive phenotype.***



III. Mendel's Dihybrid Crosses

- Mendel performed another set of crosses in which he used peas that differed from each other in ***two*** traits.

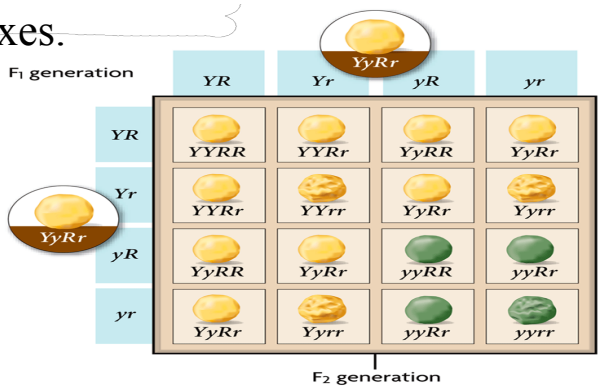
A. The first generation

1. Mendel took true-breeding pea plants that had ***round yellow*** seeds (RRYY) and crossed them with true breeding pea plants that had ***wrinkled green*** seeds (rryy).

2. F_1 generation all had ***round yellow*** seeds.

B. The second generation

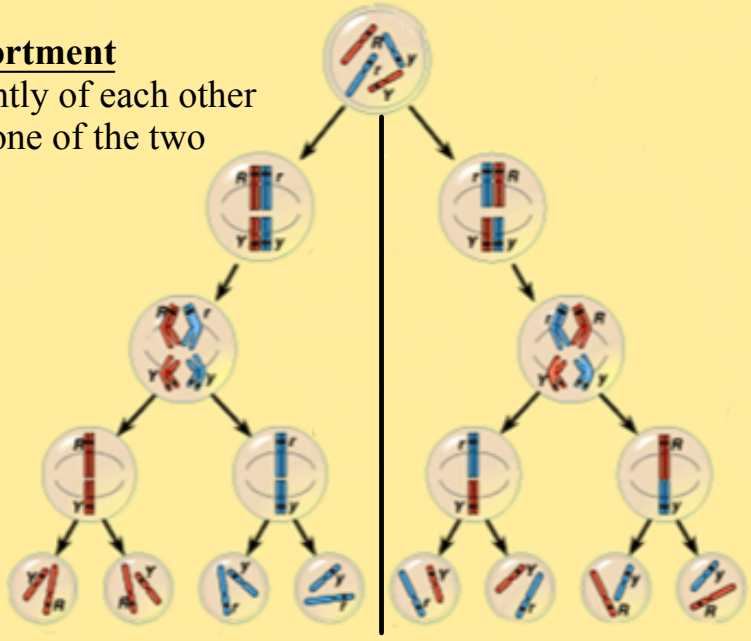
1. Mendel let the F_1 plants ***pollinate*** themselves.
2. In the F_2 generation he found that they appeared in a definite ratio of phenotypes - ***9*** round yellow; ***3*** round green; ***3*** wrinkled yellow; ***1*** wrinkled green.
3. A Punnett square for a dihybrid cross will need to have ***4*** boxes on each side for a total of ***16*** boxes.



III. The law of independent assortment

- The law of independent assortment states that ***genes*** for different traits are inherited independently of each other.
- Ex: When a pea plant with the ***genotype*** **RrYy** produces ***gametes***, the alleles **R** and **r** will separate from each other (law of segregation) as well as from the alleles **Y** and **y** (law of independent assortment).

Law of Independent Assortment
Alleles sort out independently of each other
This germ cell can divide one of the two following ways:



Section 6.6 Meiosis and Genetic Variation

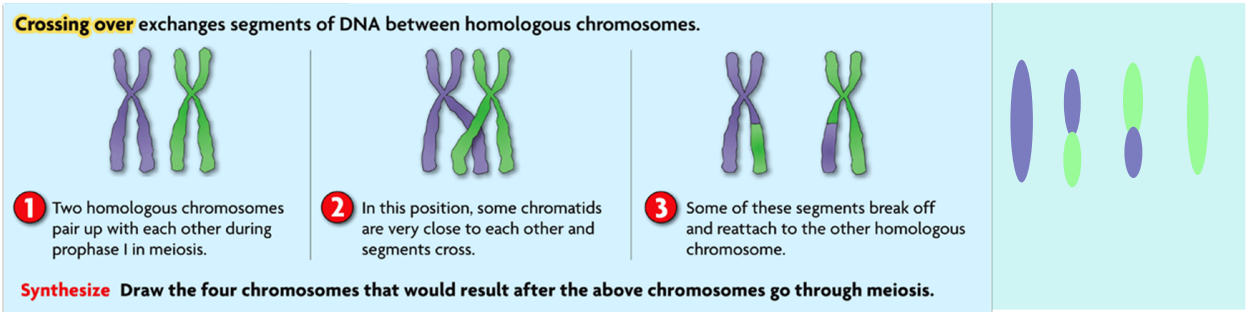
Sexual reproduction ***creates*** unique combination of genes.

- ***independent assortment*** of chromosomes in meiosis
- ***random fertilization*** of gametes

Unique phenotypes may give a ***reproductive advantage*** to some organisms.

I. Crossing over is the exchange of ***chromosome segments*** between homologous chromosomes.

- occurs during ***prophase I of meiosis I***
- results in ***new combinations*** of genes



II. Chromosomes contain many genes.

- Genes have specific placements or ***locus*** on a chromosome.

- The ***farther apart*** two genes are on a chromosome, the more likely they are to be ***separated*** by crossing over.

- Genes ***located close*** together on a chromosome tend to be ***inherited together***, which is called genetic linkage.

- ***Genetic linkage*** allows the ***distance*** between two genes to be calculated.