Introduction to Genetics

- Who is Gregor Mendel?
- Monohybrid and Dihybrid crosses
- Chromosomes and Probability

Genetic Information Review

Gene: basic unit of genetic information that determines inherited characteristics

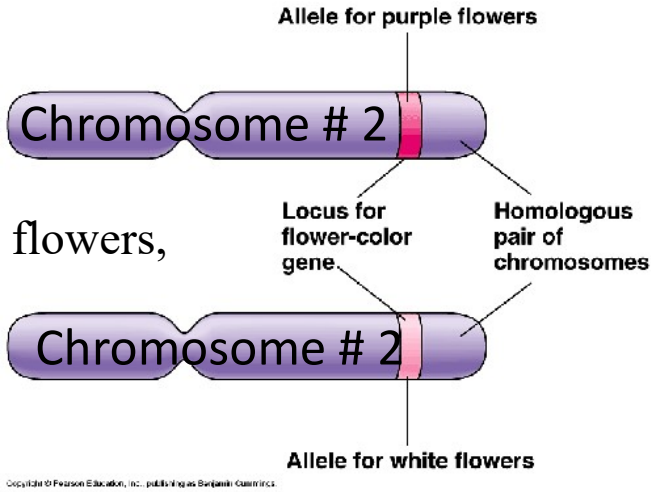
Chromosomes: storage units of genes made up of DNA and histones,(proteins).

Heredity: the transmission of traits from one generation to the next.

Genetics: the study of heredity and hereditary variation in populations

Allele: different versions of the same gene

example: flower color- a version for *purple* flowers, one version for *white*.



Locus: location of a gene/marker on the chromosome.

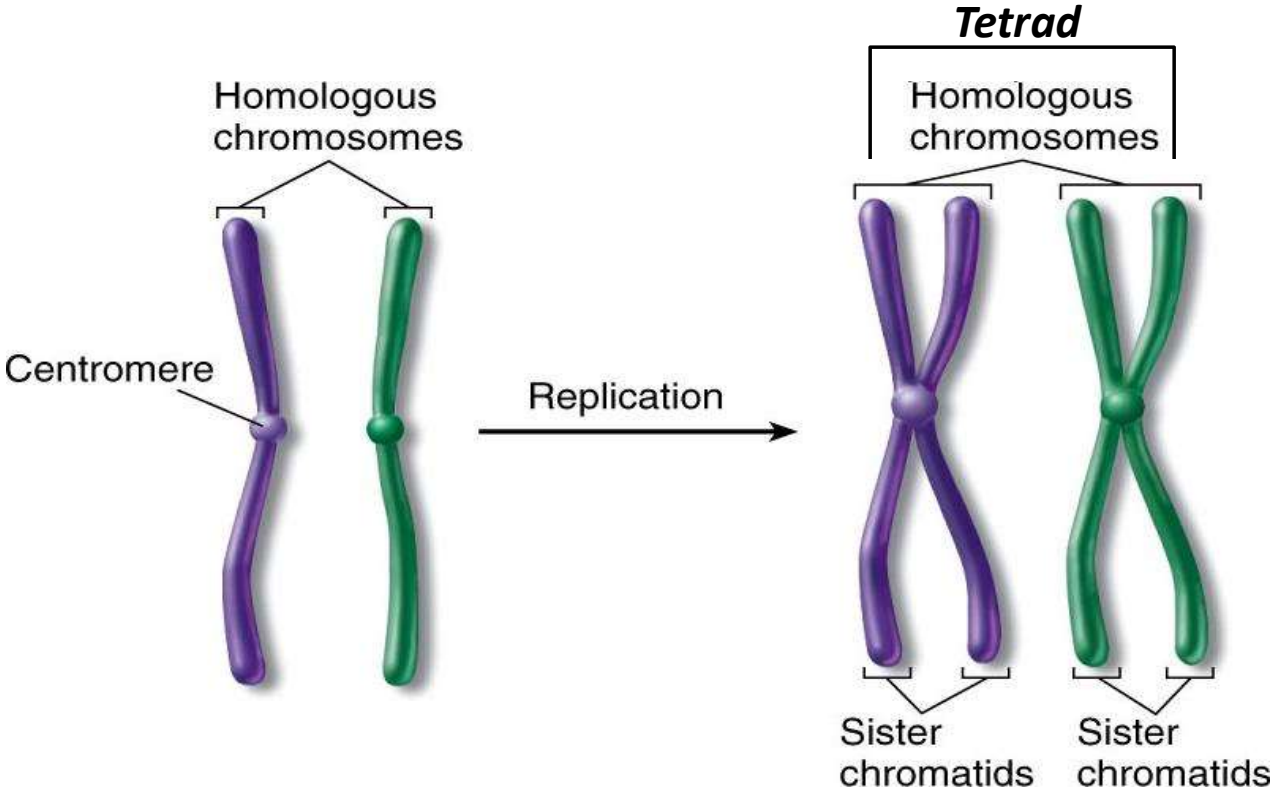
Heterozygous trait: one that contains a dominant and recessive allele, often referred to as "hybrid"

example: Hh, Pp, Ss

Homozygous trait: a pair of identical alleles, often referred to as "purebred"

example: HH, hh, SS, ss, PP, pp

Chromosome Structure



What is Genotype?

Genotype is your genetic make-up, or the presence or absence of certain allelle.

Example of a genotype: bb,BB, Bb , TT, Tt, tt

What is Phenotype?

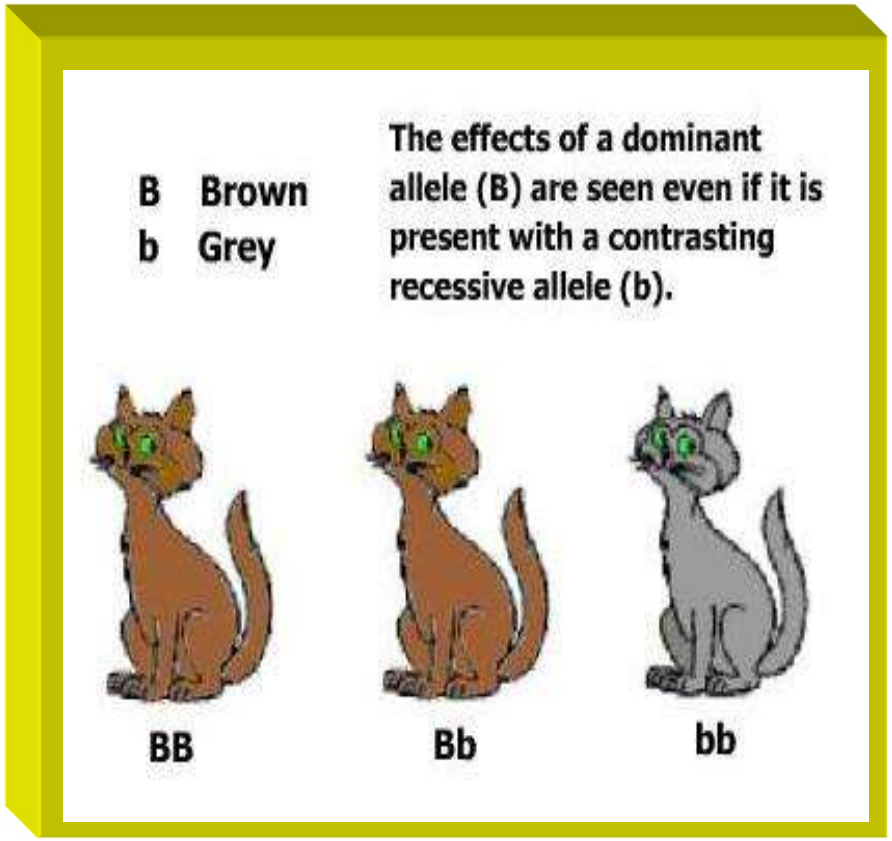
Phenotype is the physical characteristics, what you look like.

Example of a phenotype: Blue eyes, green eyes, Tall or short

Dominant vs. Recessive

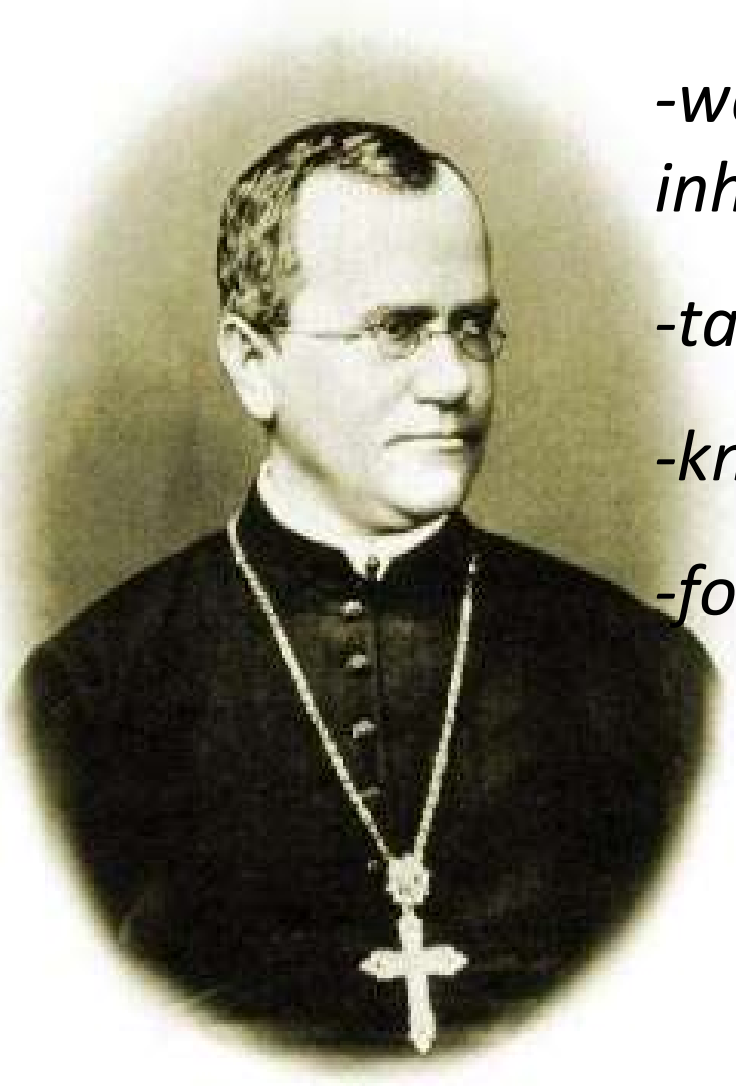
A ***dominant*** allele is expressed even if it is paired with a recessive allele. Represented by a capital letter. **B**

A ***recessive*** allele is only visible when paired with another recessive allele. Represented by a lower-case



Work of Gregor Mendel

Who was Gregor Mendel?



-was an Austrian Monk that studied the inherited traits in pea plants.

-taught high school

-known as the "Father of Genetics"

-founded the study of Heredity

Work of Gregor Mendel

-Chose his subject carefully

-Used garden peas to study which contain male & female *gametes* (sex cells)

- Male & female same flower

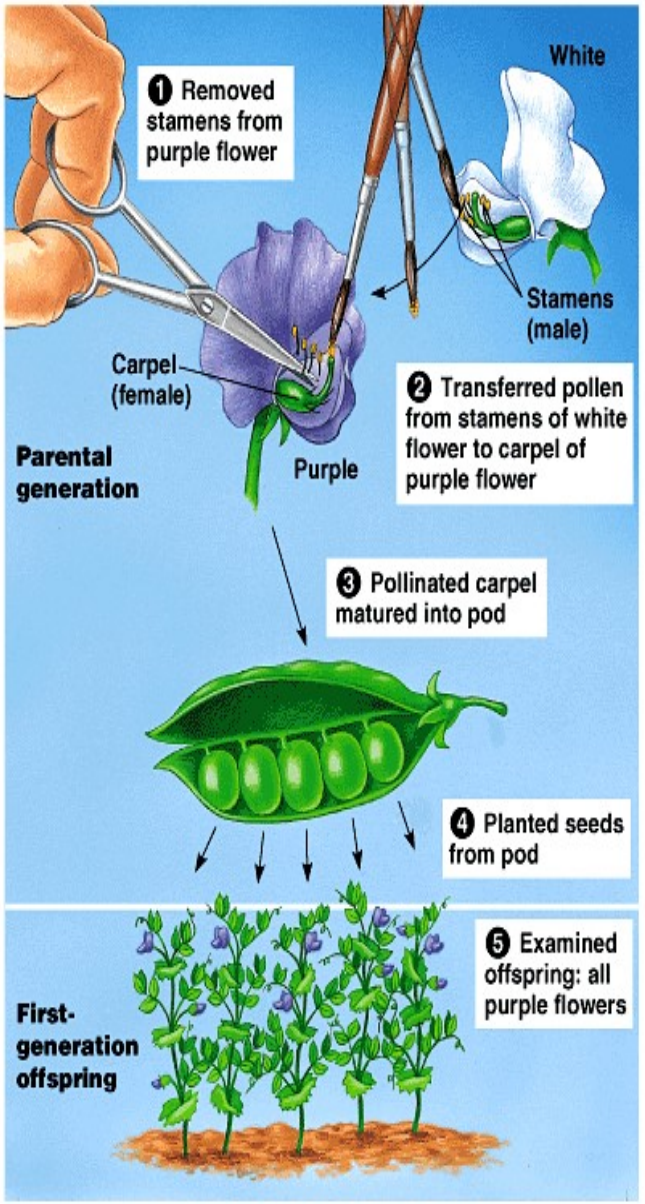
-He could control the fertilization process and first look at one trait crosses between plants

a Monohybrid cross

***Example** : seed color*

Mendel also looked at ***dihybrid crosses***, or crosses Between plants that had two different traits.

***Example: seed, and seed shape*, plant height, flower color.**



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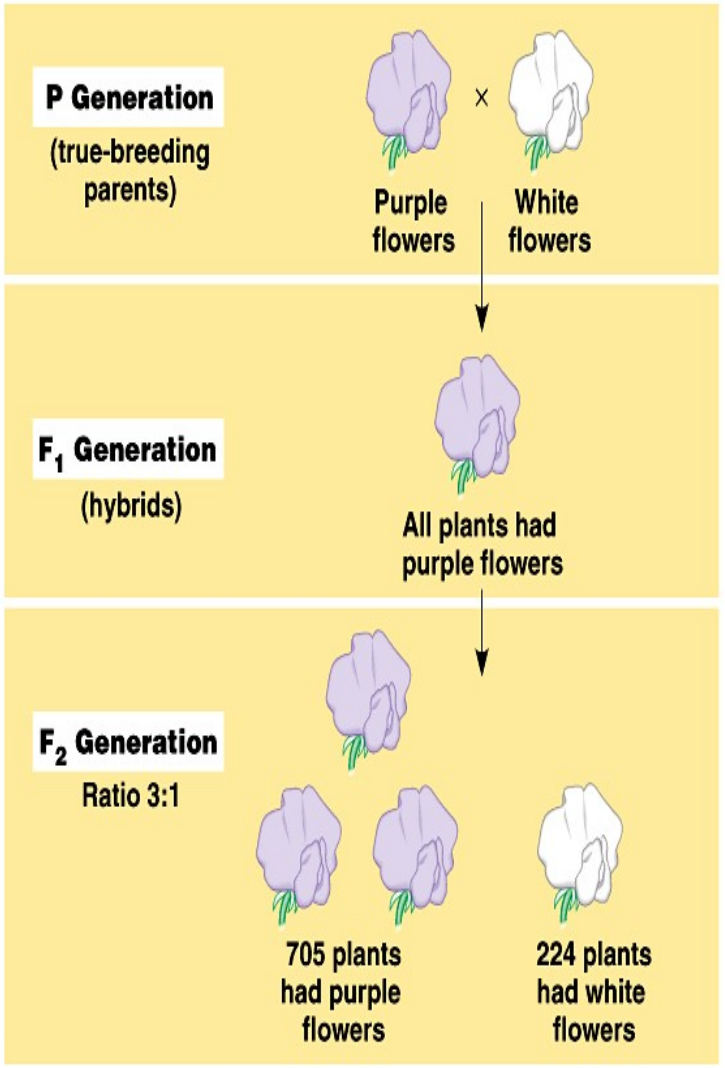
Work of Gregor Mendel

Mendel took plants, (In the P generation or Parent) that were homozygous recessive and homozygous dominant-pure-bred **hh** and **HH** and crossed them first and produced the first generation or F1

(***F= filia or in latin daughter and son).***

After Mendel crossed plants w/ diff. traits to see what traits the offspring would have.

These offspring are called hybrids – offspring of parents w/ different traits



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Principle of Segregation

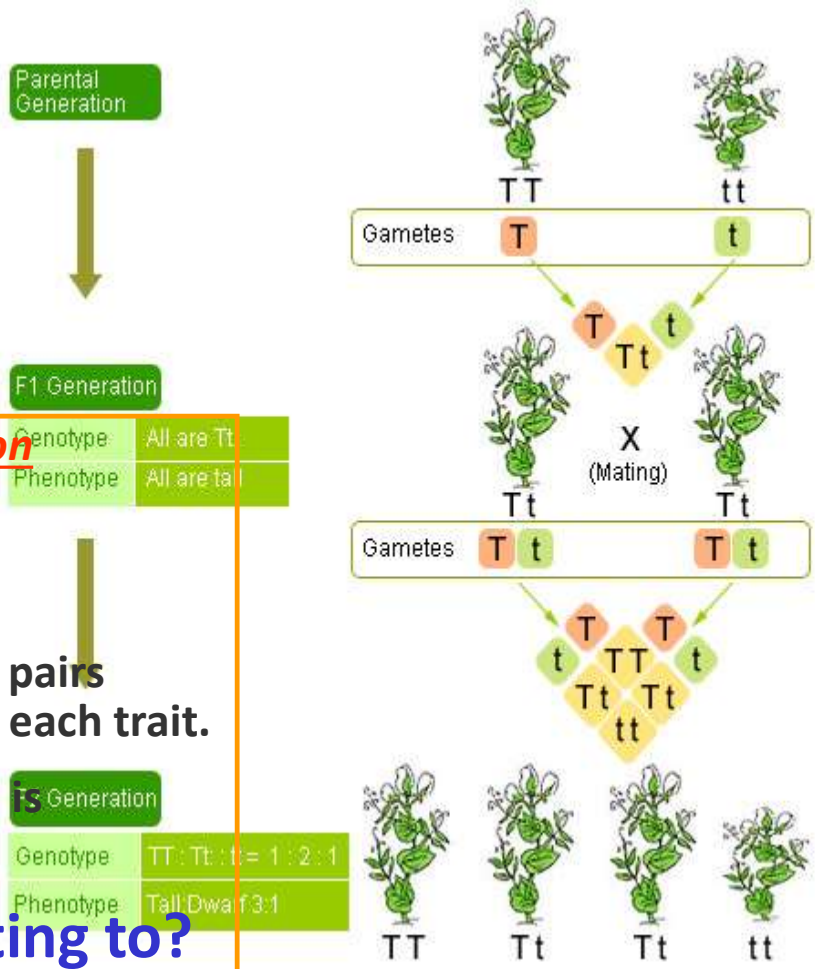
Mendel's Law of Segregation: (monohybrid crosses)

How are different forms of the same gene distributed to offspring?

Segregation- or *separation* of alleles during gamete formation during meiosis, so that each gamete only carries one allele for each gene .

Example: the genotype Tt: T the allele for tall plants and t the allele for short plants.

Each allele will separate during gamete formation an randomly unite during fertilization.



Four concepts that relate to Principle of Segregation

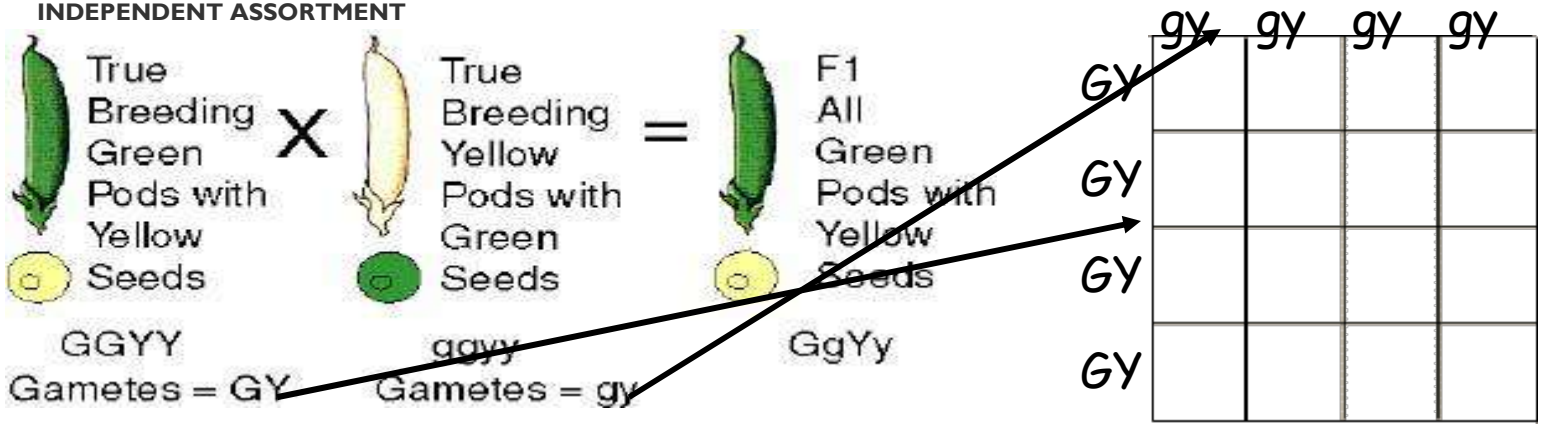
- **A gene can exist in more than one form.**
- **Organisms inherit two alleles for each trait.**
- **When gametes are produced, (by meiosis) allele pairs separate leaving each cell with a single allele for each trait.**
- **When the two alleles of a pair are different, one is dominant and the other is recessive.**
- **What one trait is this drawing relating to?**

Mendel's

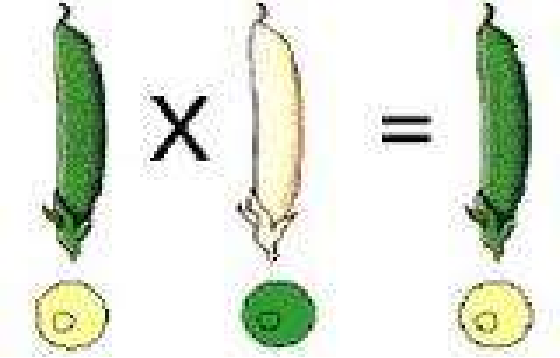
Principle of Independent Assortment

Principle of Independent Assortment deals with Dihybrid crosses

Different gene pairs assort independently in gamete formation.



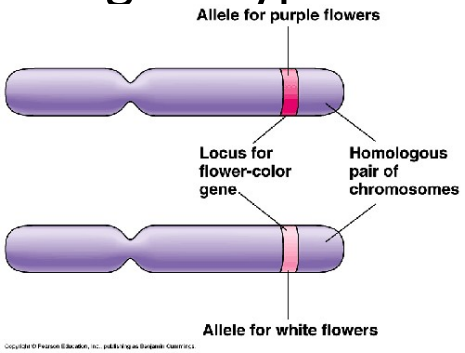
There is an exception to the *law of independent assortment* for genes that are located very close to one another on the same chromosome because of genetic linkage, sometimes they will assort together.



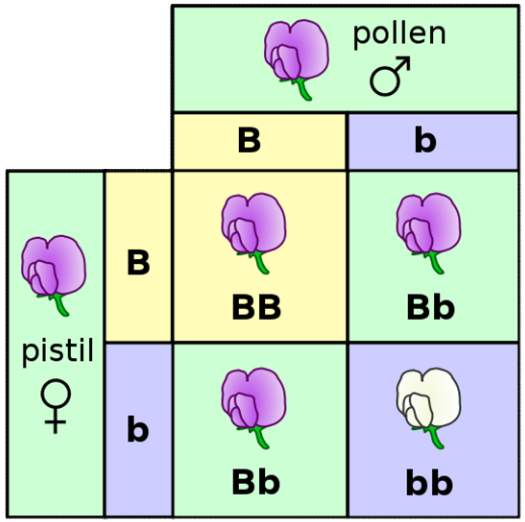
Independent Assortment: The traits of pod color and seed color are transmitted to the offspring independently of one another.

Chromosomes, Punnett Squares & Probability

Chromosomes hold the traits or genotypes that we test in punnett squares.



Punnett Squares allow us to predict what traits will be expressed in each generation of offspring, dealing with monohybrid or dihybrid crosses. .



A *punnett square* helps to predict possible patterns of inheritance, often expressed in ratios.

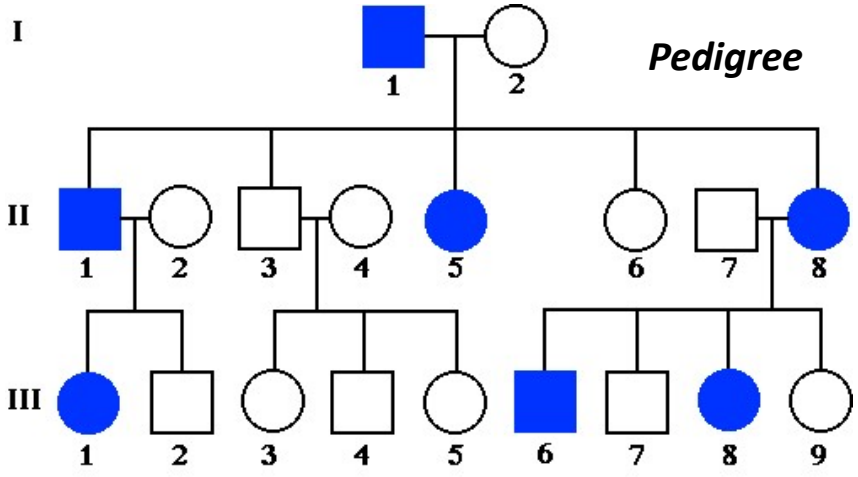
***Example*: in this monohybrid cross for flower color is 3:1**

Probability of Traits

A *pedigree* allows us to see the inheritance of these traits in multiple generations, and is a map of that gene through the generations

We want to predict patterns of inheritance of traits and diseases in pedigrees.

We want to know the likelihood that a dog chosen at random from the study population will have blue eyes.



Pedigree 1. An idealized pedigree of a family with hypercholesterolemia, an autosomal dominant disease where the heterozygote has a reduced number of functional low density lipoprotein receptors.