# *Genetics

*Gregor Mendel

* 1st Person to predict how **traits** (characteristics that are inherited) would be transferred from one generation to the next.
* Studied how **heredity** (passing on of characteristics from parent to offspring) using pea plants.
* Pea plants have two distinct **sex cells**- ovule (female) and pollen grain (male)
* Male and female **gametes** in the same flower; usually reproduce by self-pollination (male and female gametes are in the same plant)
* Mendel used cross-pollination (from plant to another)
* Studied one trait at a time (ONE variable)
* Analyzed his data mathematically
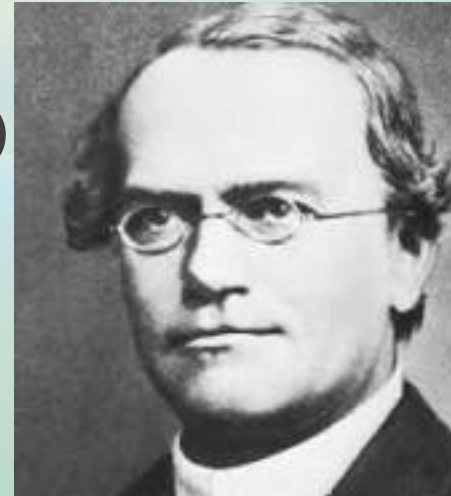
Monohybrid Crosses "one trait cross"
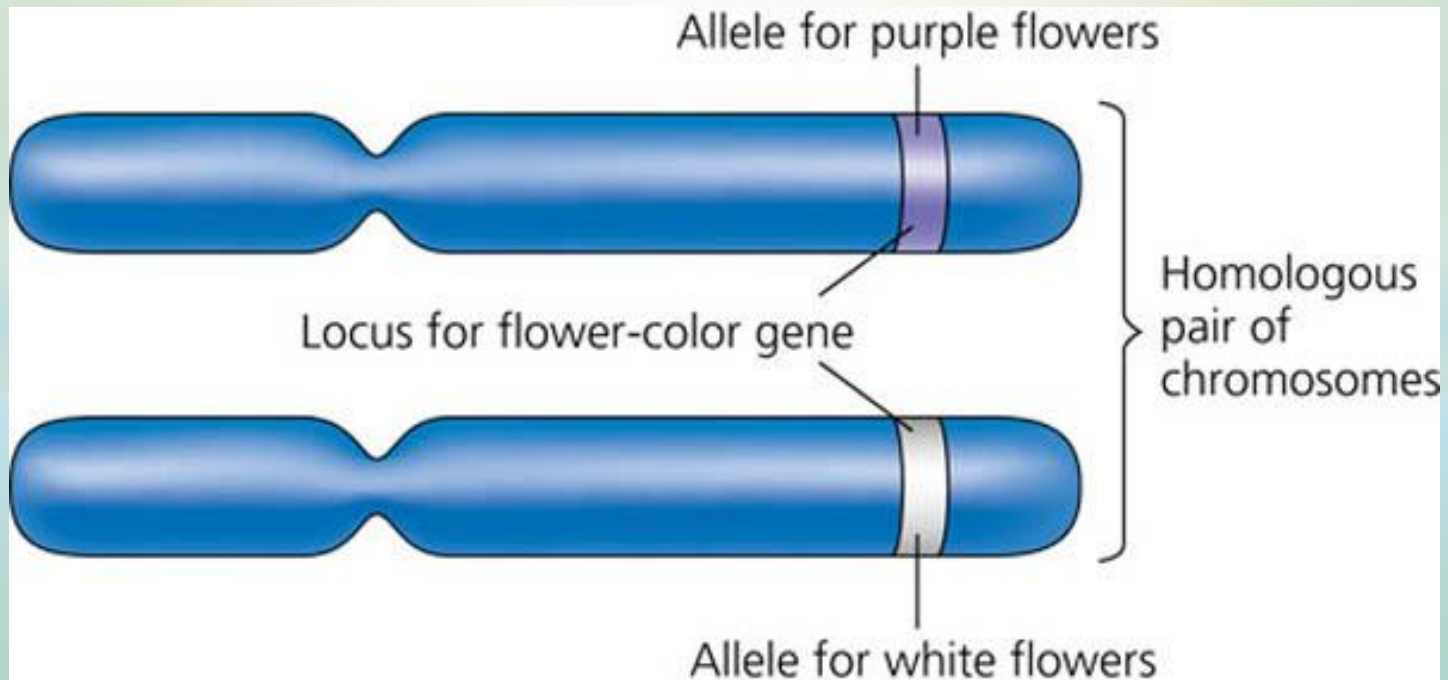
* First Generation (F_1):
  * Mendel crossed a tall pea plant with a short pea plant = P_1 Generation (Parents)
  * All resulting plants were tall (F_1 Generation)
* Second Generation (F_2):
  * Mendel allowed tall plants from F_1 generation to self pollinate
    * ¾ tall offspring
    * ¼ short offspring
    * Short trait reappears
* Mendel studied 7 traits (one at a time) and noticed in all crosses one trait disappears in the F_1 generation, only to reappear in the F_2 generation ¼ of the time.

*Rule of Unit Factors

*Each organism has two factors symbolized by letters.

*Genes exist in alternative forms (alleles).

*An organism's two **alleles** are located on different copies of a chromosome (one from mom and one from dad)

Allele for purple flowers

Locus for flower-color gene

Homologous pair of chromosomes

Allele for white flowers

*Rule of Dominance

Hybrid: offspring of parents that have different forms of a trait

Dominant:

* Traits that shows in a hybrid
* Will be visible
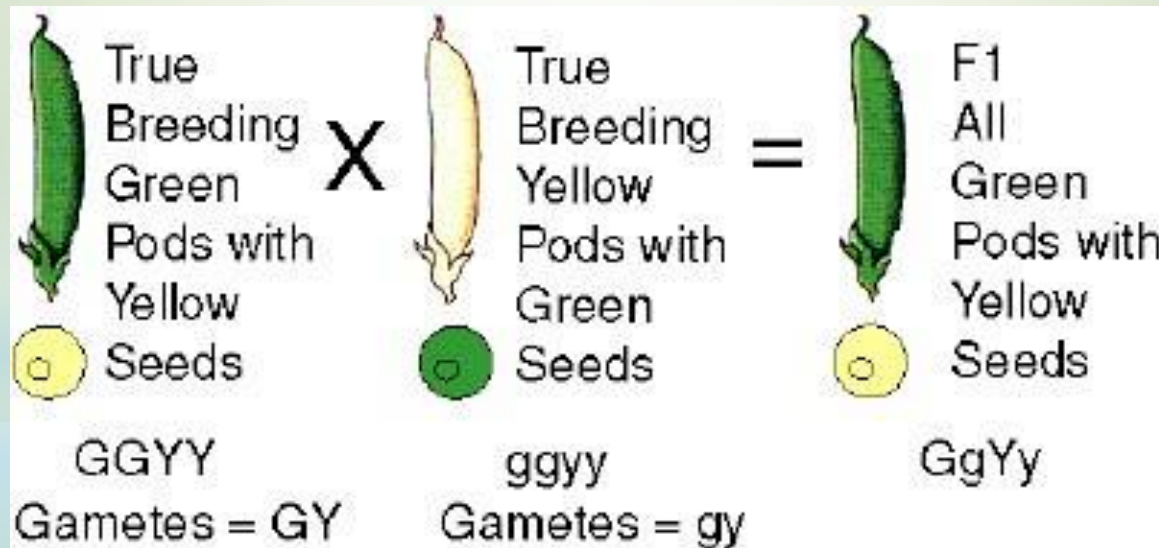* Use uppercase letter (H)
* Always written first

Recessive:

* Trait that does not show in a hybrid
* Gets covered up
* Use lowercase letter (h)

Ex. Hair color→   Hh
Which one is dominant?
Recessive?

*Principle of Segregation

*Mendel concluded that the 2 alleles for each trait must separate when gametes form

*A parent passes on at random only one allele to each offspring

True Breeding Green Pods with Yellow Seeds **X** True Breeding Yellow Pods with Green Seeds **=** F1 All Green Pods with Yellow Seeds

GGYY   ggyy   GgYy
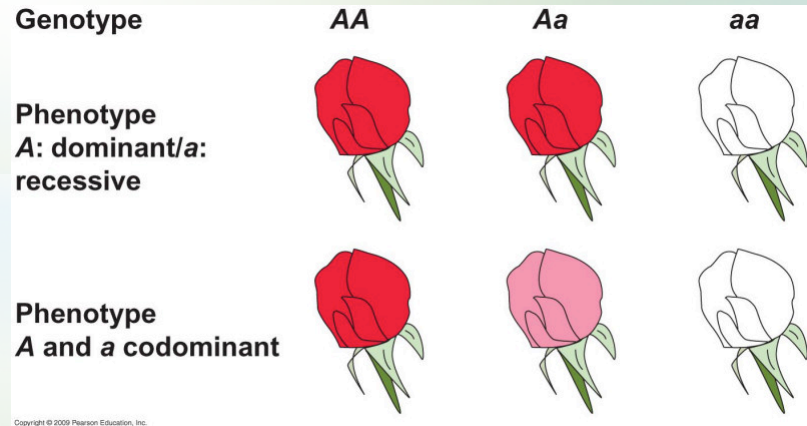Gametes = GY   Gametes = gy

*Phenotype vs Genotype

Phenotype:

* The form of a trait that is observed
* The way an organism looks or behaves
* Ex. Hair color, eye color, skin color

Genotype:

* The gene combination an organism contains
* Can't always know an organism's genotype by looking at it's phenotype.

Homozygous:

* An organism is homozygous for a trait if its two alleles for the trait are the **same**
  * Homozygous Dominant: HH
  * Homozygous Recessive: hh

Heterozygous:

* An organism is heterozygous for a trait if its two alleles for the trait **differ** from each other
* Hh

Principle of Independent Assortment:

* Genes for different traits are inherited independently of each other.
* When a plant with the genotype RrYy produces gametes, the alleles R and r will separate from each other (**principle of segregation**) as well as the Rs from the Ys (**independent assortment**)

*Punnett Squares

*Short hand way of finding the expected proportions of possible genotypes of offspring in a cross.

*1 parent listed on the top of the square; the other parent is listed on the side of the square.

*Each box is filled in with the gametes or letters listed above and below the square (offspring)

*Then you can determine the phenotypes!

*Five Steps to Punnett Squares:

1. Key or Legend
2. Cross of Parents
3. Punnett- show work
4. Phenotype
5. Genotype

*Genotypic and Phenotypic Ratios

	R	r
R	RR 25%	Rr 25%
r	Rr 25%	rr 25%

*Genotype Percentage –
  *25% Homozygous   Dominant
  *50 % Heterozygous
  *25 % Homozygous Recessive
*Genotype Ratio
  *1:2:1
*Phenotype Percentage –
  *75% Red Flower
  *25% White Flower
*Phenotype Ratio
  *3:1

*Ratios in Large Populations

Data Table 2: Selfing Dominant F2's to produce F3 rows:

F2 type	Mixed rows	True breeding	ratio
Round seed	372	193	1.93 to 1
Yellow cotyledon	353	166	2.13 to 1
Gray seed coat	64	36	1.78 to 1
Inflated Pod	71	29	2.45 to 1
Green Pod	60	40	1.50 to 1
Axial flower	67	33	2.03 to 1
Tall plant	72	28	2.57 to 1

Average ratio to heterozygote F2 to homozygote F2 was 2.06 to 1