Genetics Notes

Who is Gregor Mendel? "**Father of Genetics**"

Principle of **Independent Assortment** – Inheritance of one trait has **no effect** on the inheritance of another trait

https://www.youtube.com/watch?v=Ox4bHA9fGGY

Mendel's Experiments

Mendel noticed that some plants always produced offspring that had a form of a trait exactly like the parent plant. He called these plants *"purebred"* plants. For instance, purebred short plants always produced short offspring and purebred tall plants always produced tall offspring.


X

Purebred Short Parents


Short Offspring


X

Purebred Tall Parents


Tall Offspring

Mendel's First Experiment

Mendel crossed purebred plants with opposite forms of a trait. He called these plants the *parental generation* , or *P generation*. For instance, purebred tall plants were crossed with purebred short plants.

X

Parent Tall
P generation

Parent Short
P generation

Offspring Tall
F1 generation

Mendel observed that all of the offspring grew to be tall plants. None resembled the short short parent. He called this generation of offspring the *first filial* , or *F1 generation*, (The word filial means "son" in Latin.)

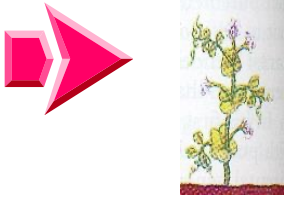
Mendel's Second Experiment

Mendel then crossed two of the offspring tall plants produced from his first experiment.

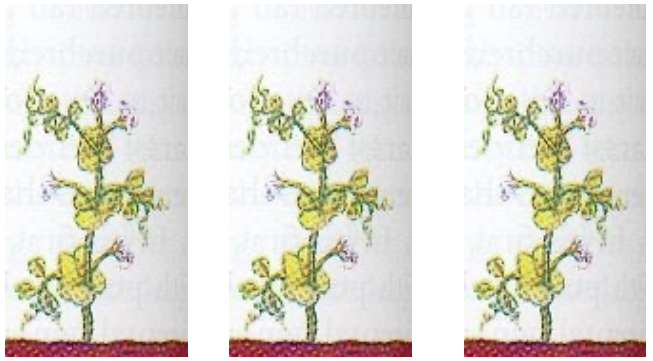
Parent Plants

X

Tall
F1 generation



Offspring

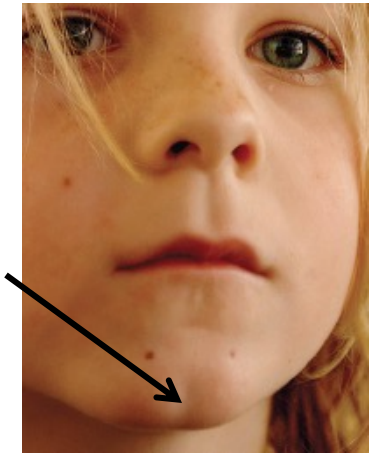


3⁄4 Tall & 1⁄4 Short
F2 generation

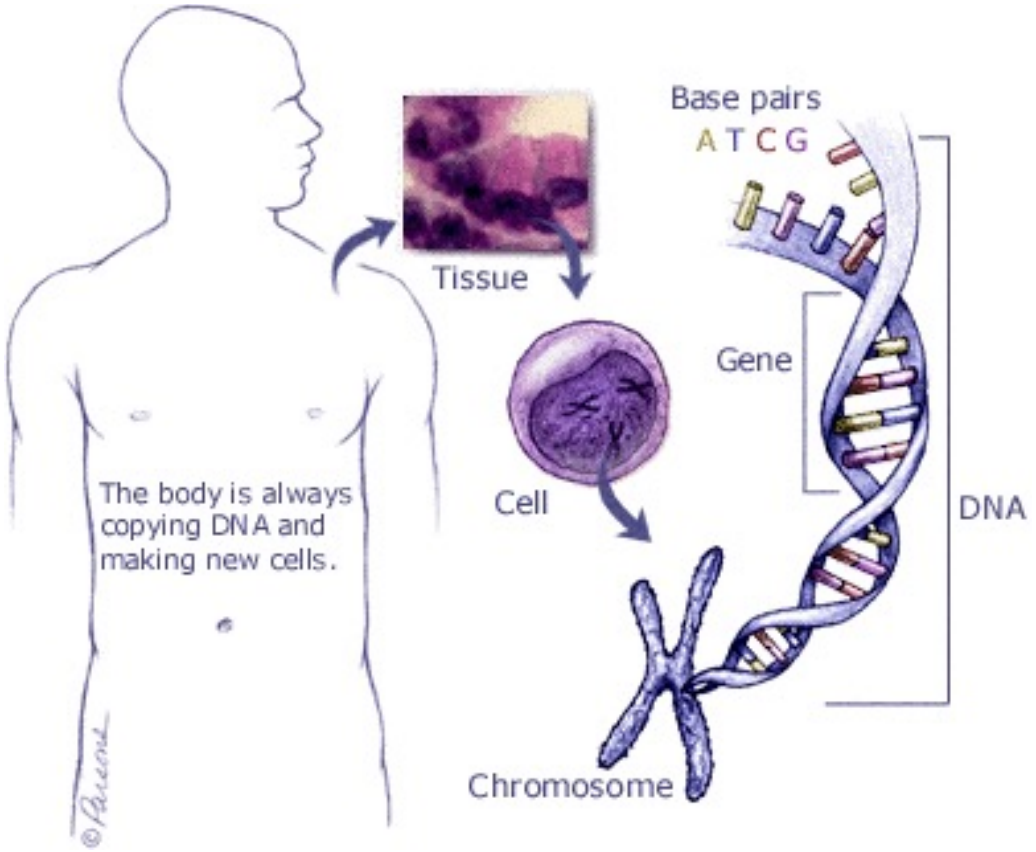
Mendel called this second generation of plants the second filial, F2, generation. To his surprise, Mendel observed that this generation had a mix of tall and short plants. This occurred even though none of the F1 parents were short.

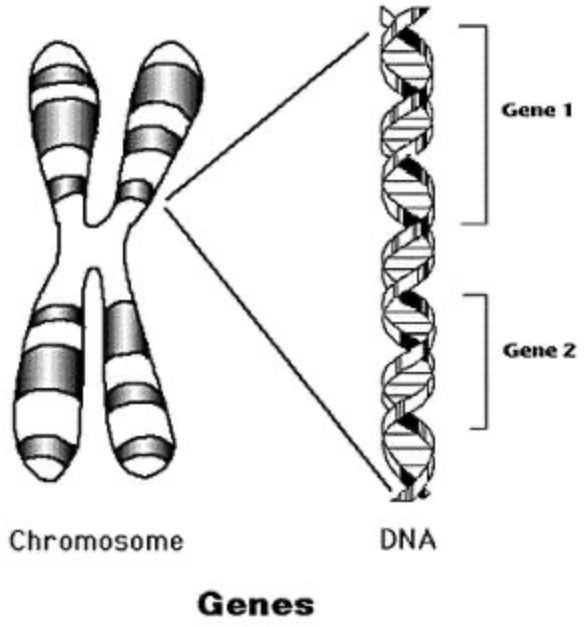
Traits

- Genetics – study of how **traits** are passed from **parent** to **offspring**

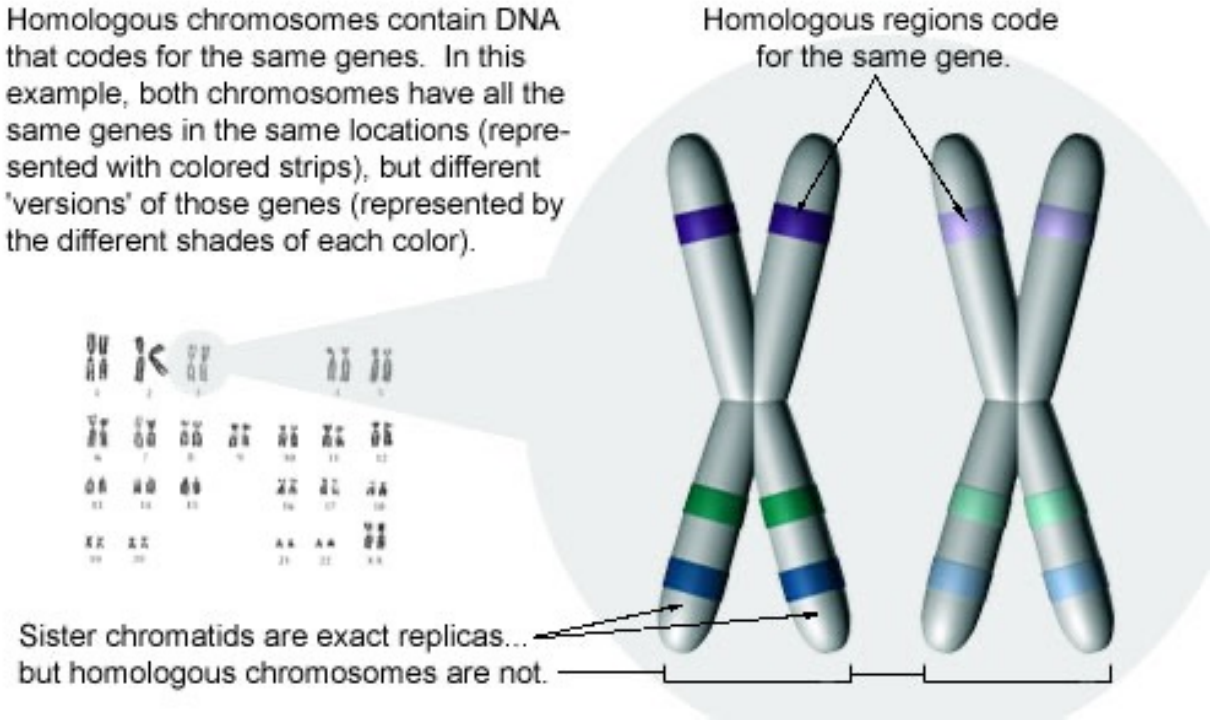


- Traits are determined by the **genes** on the **chromosomes**. A gene is a segment of **DNA** that determines a **trait**.



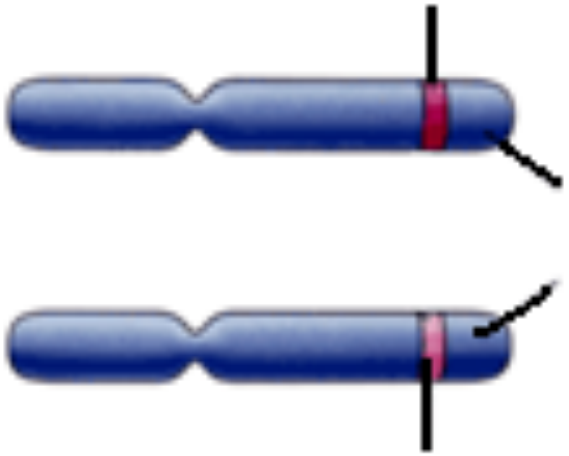


- Chromosomes come in **homologous** pairs, thus **genes** come in pairs.
  Homologous pairs – **matching** genes – one from female parent and one from male parent
- Example: Humans have 46 chromosomes or **23** pairs.
  One set from dad – 23 in **sperm**
  One set from mom – 23 in **egg**



- One pair of Homologous Chromosomes:

Gene for **eye color**
(**blue** eyes)



Homologous pair
of chromosomes

Gene for **eye color**
(**brown** eyes)

Alleles – different **genes** (possibilities) for the same **trait** –
ex: blue eyes or brown eyes

Dominant and Recessive Genes

- Gene that **prevents** the other gene from "showing" – **dominant**
- Gene that **does NOT** "show" even though it is **present** – **recessive**
- Symbol – Dominant gene – **upper** case letter – **T**
  Recessive gene – **lower** case letter – **t**

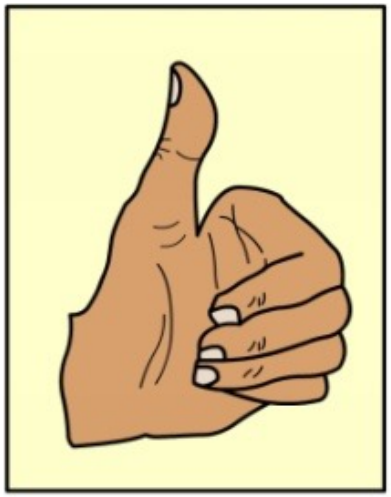
Dominant color

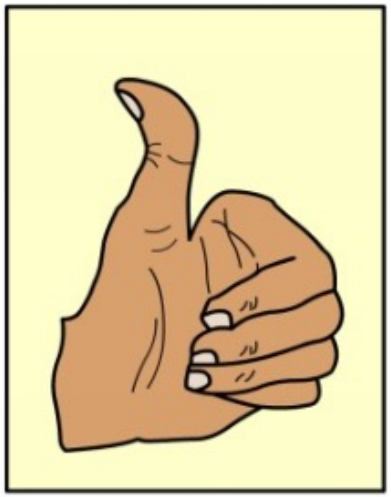
Recessive color

Example: Straight thumb is **dominant** to hitchhiker thumb

T = straight thumb **t** = hitchhikers thumb

(Always use the same letter for the same alleles—
No S = straight, h = hitchhiker's)





Straight thumb = TT

Straight thumb = Tt

Hitchhikers thumb = tt

* Must have **2** recessive **alleles** for a recessive trait to "**show**"

- Both genes of a pair are the same – **homozygous** or **purebred**

  TT – homozygous **dominant**

  tt – homozygous **recessive**

- One dominant and one recessive gene – **heterozygous** or **hybrid**

  Tt – heterozygous

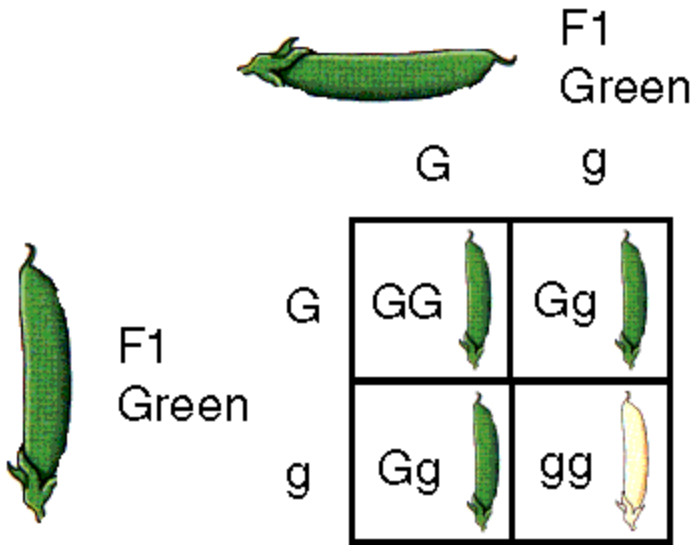
BB – Black

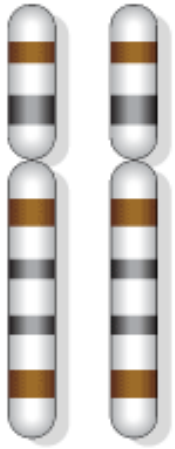
Bb – Black w/ white gene

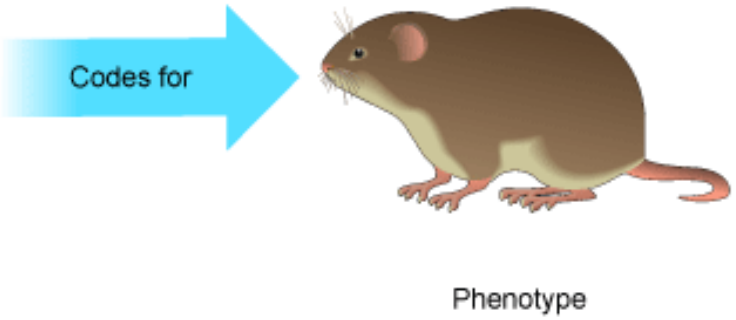
bb – White

Genotype and Phenotype

- Combination of genes an organism has (**actual gene makeup**) – **genotype**
  Ex: TT, Tt, tt
- **Physical appearance** resulting from gene make-up – **phenotype**
  Ex: hitchhiker's thumb or straight thumb



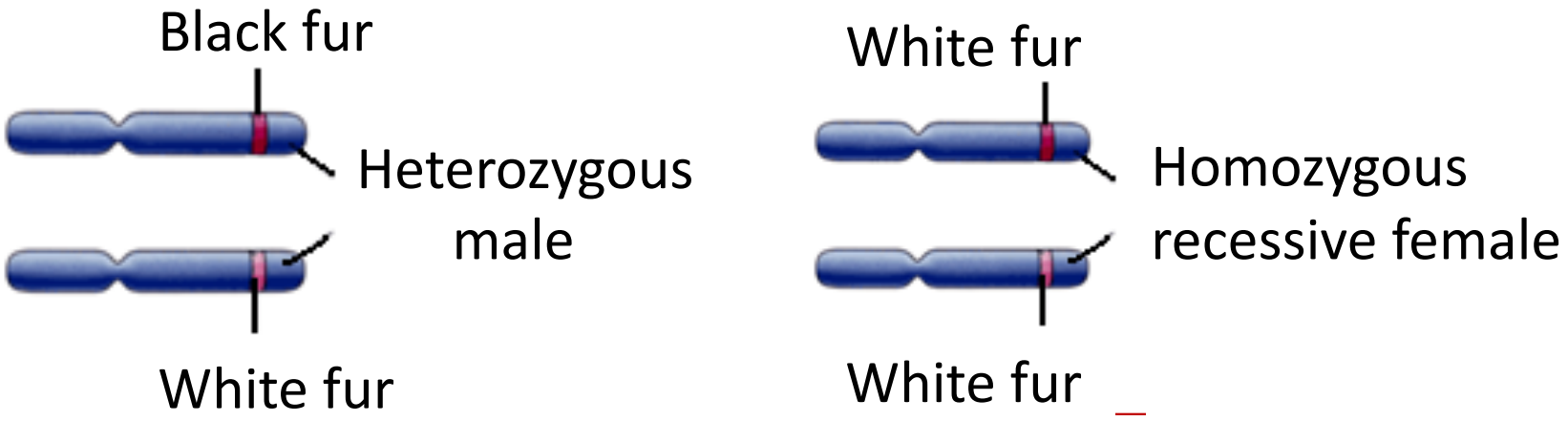




Punnett Square and Probability

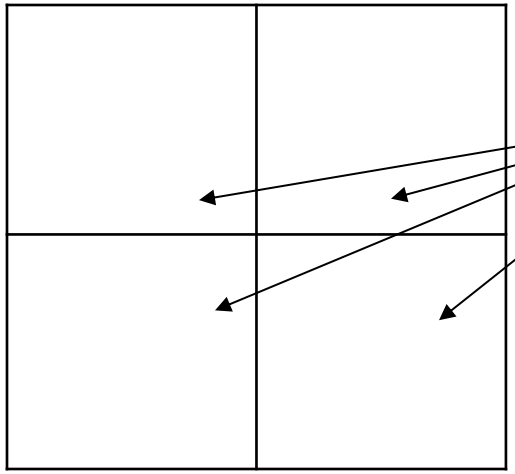
- Used to **predict** the **possible** gene makeup of **offspring** – **Punnett Square**
- Example: Black fur (B) is dominant to white fur (b) in mice

1. Cross a heterozygous male with a homozygous recessive female.



Male = **X** Female =

Female gametes – N
(One gene in egg)



Possible offspring – 2N

Male gametes - N
(One gene in sperm)

Genotypic ratio = 2 : 2
50% Bb : 50% bb

Phenotypic ratio = 2 : 2
50% black : 50% white

Write the ratios in the following orders:

Genotypic ratio

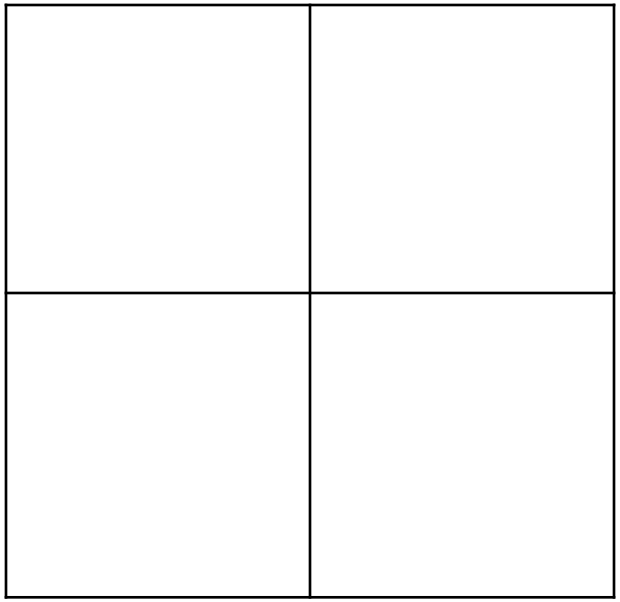
homozygous dominant : heterozygous : homozygous recessive

Phenotypic ratio

dominant : recessive

Cross 2 hybrid black mice and give the genotypic ratio and phenotypic ratio.

X



typic ratio = _____ : : _____

25% BB : 50% Bb : 25% bb

typic ratio = :

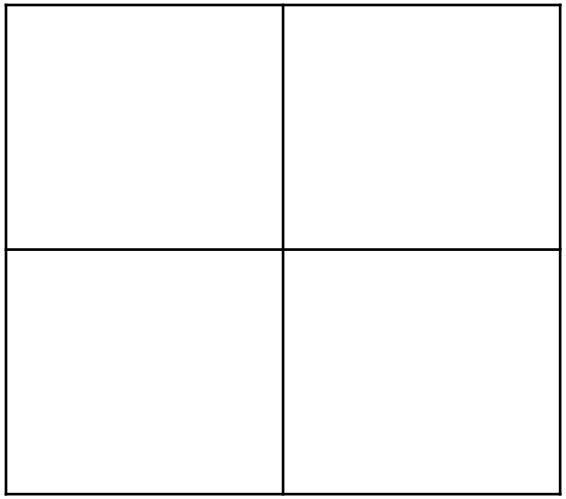
75% black : 25% white

Example: A man and woman, both with brown eyes (B) marry and have a blue eyed (b) child. What are the genotypes of the man, woman and child?

X

Man =

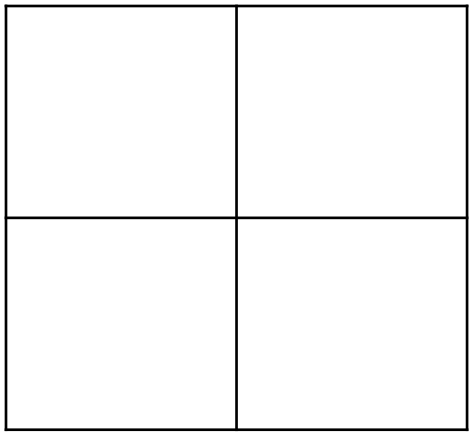
Woman =



- What is the probability of a couple having a boy? Or a girl?

Chance of having female baby?

male baby?



Who determines the sex of the child?