

Pre-AP Biology Unit 7 Genetics Notes

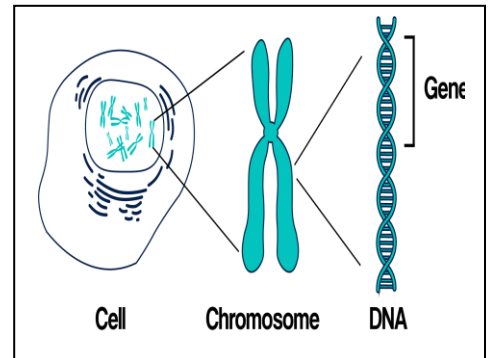
Topic 1 Mendelian Genetics & Monohybrid Cross

Objectives:

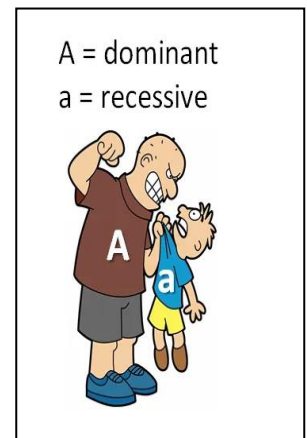
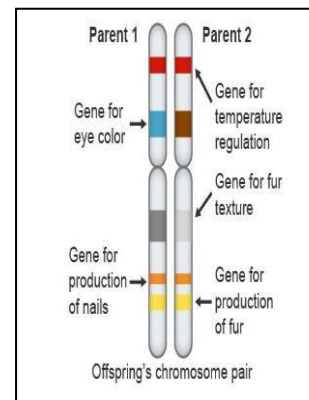
Students will be able to:

- ❖ Explain Mendel's 3 laws of inheritance
- ❖ Differentiate between genotypes and phenotypes
- ❖ Draw and label a Punnett square to show a monohybrid cross
- ❖ Predict the outcomes of a monohybrid cross by using Punnett square

Genetic Vocabulary



- Genetics:** Science that study _____
- Heredity:** Passing on _____ from parent to offspring through the _____
- Trait:** a specific _____ that affect the way we look and how our bodies function. Example: handedness, skin color, and blood group type.
- Genes:**
 - Sequence of _____ that controls the traits.
 - Located on specific places on homologous chromosomes called locus.
 - Come in _____ and offspring inherit _____ copy of each gene from each parent.
- Alleles:** Alternative or different forms of _____
 - Gene: eye color
 - Alleles: brown & blue
- Dominant trait**
 - Trait that is always _____(expressed).
 - Represented by _____ for example **A** or **B**.
 - Expressed when _____ alleles are dominant (BB).
 - Or when _____ allele is dominant (Bb).
- Recessive trait**
 - Trait that is _____ (masked) when dominant allele is present (Bb).
 - Represented by _____ letter for example **a** or **b**.
 - Expressed only when _____ alleles are recessive (aa) or (bb).
- Homozygous:**
 - When the two alleles are _____ for example AA or bb.
 - Also called _____
- Heterozygous:**
 - When the two alleles are _____ for example Aa or Bb.
 - Also called _____



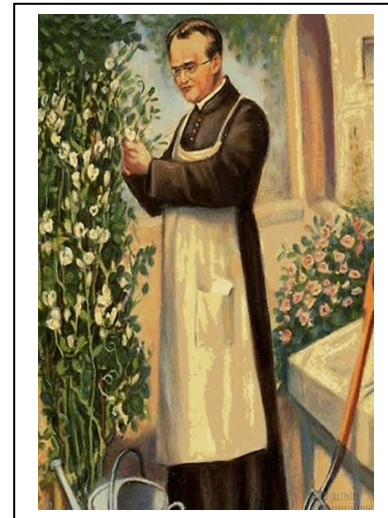
- **Phenotype** is the _____ physical or biochemical characteristics of the organism (example: purple or white flower).
- **Genotype** is the _____ of the organism (alleles like pp or Pp).
 - Each trait requires 2 alleles
 - Dominant trait will show up if genotype is homozygous (AA) or heterozygous (Aa)
 - Recessive trait can be ONLY show up when the genotype is homozygous (aa)

Vocabulary Check

- Transmission of characteristics from parents to offspring is called _____
- The alternative form of a single gene is called _____
- An organism with two of the same alleles for a particular trait is _____
- An organism with two different alleles for a particular trait is _____
- A _____ trait is expressed when the individual is homozygous dominant or heterozygous for the trait.
- The physical appearance of individuals is called _____

Gregor Mendel

- Called the _____
- Austrian monk who worked in the monastery garden.
- His early work is the basis for much of our current understanding of genetics
- He used mathematical concept to analyze his data
- Mendel's data revealed patterns of inheritance

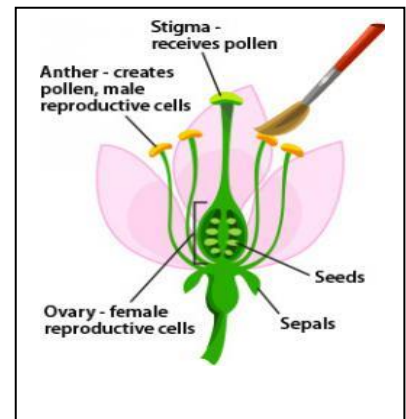


Why Mendel chose pea plants to do his experiments?

- Grow _____ and produce _____ number of offspring in a small area.
- Come in _____ features that can be easily distinguished.
- _____ reproduce.
- Fertilization and pollination process can be _____

Reproduction in Flowering Plants:

- Pea flower has both _____ and _____ reproductive structures.
- Pollen carries sperm to the eggs for fertilization.
 - **Self-pollination** can occur in the _____ flower.
 - **Cross-pollination** can occur between _____ flowers.



Mendel's Experimental Methods

- Mendel noticed that some plants always produced offspring that had a trait exactly like the parent plant, he called these plants _____ plants.
- Mendel produced pure strains by allowing the plants to self-pollinate for several generations.
- **True breeding** produces offspring that carry the same _____ and _____ as the parents who are homozygous for certain traits.
- **Purebred** offspring resulting from a true breeding.

Mendel's laws

1. Law of dominance
2. Law of segregation
3. Law of independent assortment

Mendel's One Factor Cross Experiments: F1 Generation

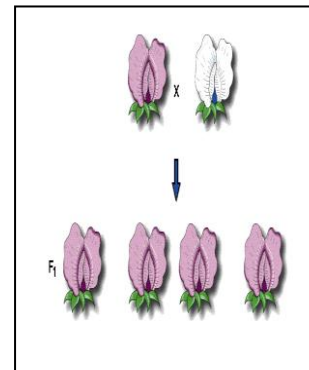
- **Monohybrid cross:** crossing parent differing in only _____ trait (example flower color).
- Mendel cross-fertilized two purebred pea plants with opposite traits like purple and white flowers. He called them the _____ generation (P generation).
- He got the first _____ generation (F1).

Mendel's One Factor Cross Experiments: F2 Generation

- Mendel let F1 generation self-fertilize.
- Got F2 generation.
- Mendel did this experiment with all the different traits.
- He noticed the trait that _____ in F1 _____ in F2 (example white flower).
- He always saw a **~3:1 ratio** in the F2 generation.

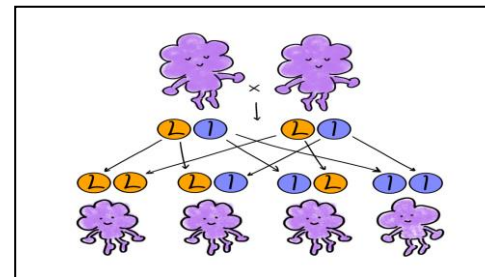
#1 Law of Dominance

- Mendel realized that _____ factors (genes) control each trait.
- Each heritable factor has _____ (alleles).
- Alleles can be either _____ or _____
- Mendel concluded that one allele in a pair may mask, or hide, the other allele.
- Alleles that _____ other alleles are **dominant**.
- Alleles that are _____, whenever the dominant allele is present are **recessive**.



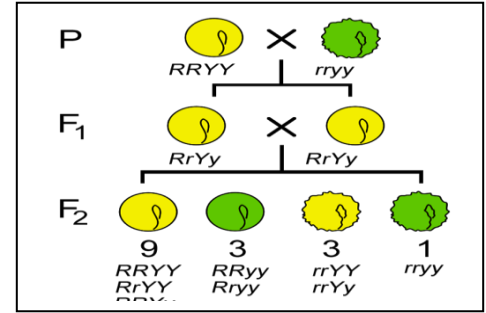
#2 Law of Segregation

- In _____ the two alleles for a trait _____ (separate). Each egg or sperm receives a copy of one of the two alleles
- There is a 50% chance that a copy of that allele will end up in the gamete.



Mendel's Two Factors Cross Experiments

- Mendel repeated the experiment but this time with **two** different traits
- Parental generation were purebred for 2 different traits
- F1 :All show the same phenotype
- F2: Appearance of **4** different phenotypes with the ratio of **9:3:3:1**



#3 Law of Independent Assortment

- Mendel noticed that traits (like flower color, height) are inherited _____ (not together as a one unit).
- Mendel concluded that _____ distribution of alleles occur during gamete formation.
- Each pair of alleles (for different traits) on separate chromosomes sort independently during meiosis

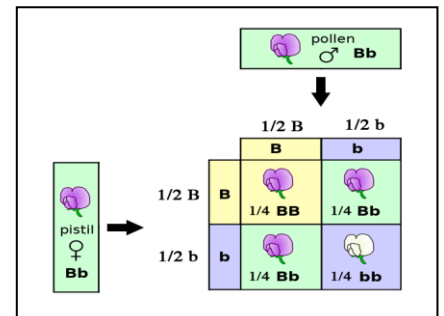
Question

Why siblings do not look exactly alike even though they have the same parent?

Analyzing Inheritance

A. Probability

- _____ that event may occur
- Due to the law of segregation, if you know the genotype of the parents, you can predict the likelihood of a trait occurring in the offspring.
- Probability can be written 3 ways:
 - Fraction 1/2
 - Ratio 1:2
 - Percent 50%
- Probability of F2 generation in Monohybrid-Cross is **3:1** (purple to white)
- Probability of F2 generation in dihybrid-Cross is **9:3:3:1**

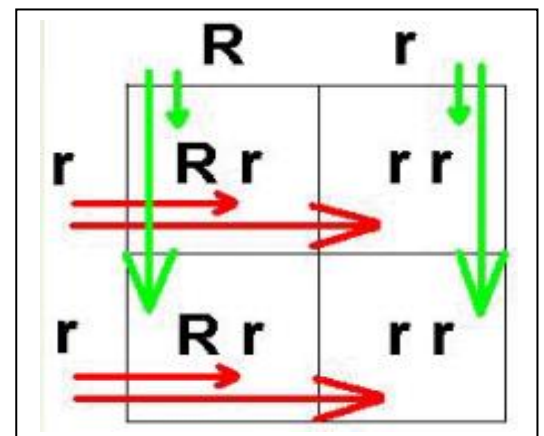


B. Punnett Square

- A mathematical model that shows the probability of certain genetic combinations and traits in offspring.

Example #1:

- Cross heterozygous round father with wrinkled mother:
- R= round (dominant)
- r = wrinkled (recessive)
- Father genotype is Rr
- Mother genotype is rr



Remember:

- Dominant can be homozygous (RR) or heterozygous (Rr)
- Recessive can be only homozygous (rr)

Offspring genotype

- $\frac{1}{2}$ heterozygous dominant
- $\frac{1}{2}$ homozygous recessive

Offspring phenotype

- 1:1 (round to wrinkled)

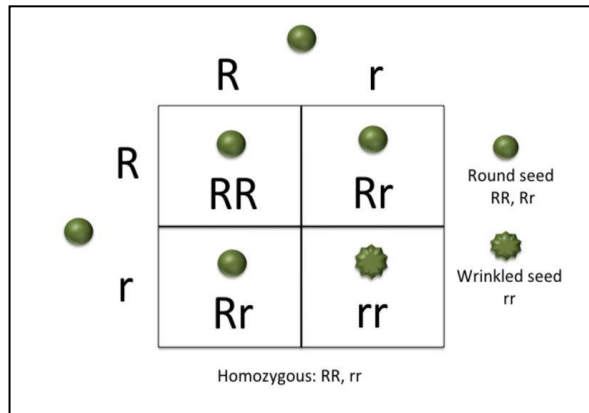
Example #2

Offspring genotype:

- $\frac{1}{4}$ homozygous dominant
- $\frac{1}{2}$ heterozygous dominant
- $\frac{1}{2}$ homozygous recessive

Offspring phenotype

- 3:1 (round to wrinkled)



Solve the following crosses:

Cross 1

- Black Labrador is dominant trait B
- Chocolate Labrador is recessive b
- Cross homozygous black Labrador with chocolate Labrador
- Draw a Punnett square
- Record the genotype of the black Labrador
- Record the genotype of the chocolate Labrador
- What is the predicted offspring genotype(s)?
- What is the predicted offspring phenotype(s)?

Cross 2

- Cross heterozygous black Labrador with chocolate Labrador
- Draw your Punnett square
- Record the genotype of the black Labrador
- Record the genotype of the chocolate Labrador
- What is the predicted offspring genotype(s)?
- What is the predicted offspring phenotype(s)?

Cross 3

- Cross two heterozygous black Labrador
- Draw you punnett square
- Record the genotype of both black Labrador
- What is the predicted offspring genotype(s)?
- What is the predicted offspring phenotype(s)?

Test Cross

- Process of crossing an unknown genotype individual to a homozygous recessive individual to determine what the unknown genotype is.
- Why it is done?
 - To find out the unknown genotype (homozygous or heterozygous)of an organism with a dominant phenotype
- How it is done?
 - By crossing the unknown organism with a homozygous recessive one
- How a conclusion is drawn?
 - By looking at the ratio of the offspring

Example:

We need to find out the genotype of a purple pea flower

- There are two genotype possibilities:
- Homozygous PP
- or heterozygous Pp
- Cross each possible genotype with a recessive white pea flower
- Look at the phenotype ratio of the offspring
- If all are showing dominant trait (purple) we can conclude that the unknown genotype is homozygous PP
- If the ratio is 1:1 (purple to white) we can conclude that the unknown genotype of the parent is heterozygous Pp

