It runs in families

40%  One parent wet bed.

70%  Both parents wet bed.

% = Chance child will wet the bed.
- **Genetics** - The field of biology that studies how characteristics are passed from one generation to another.

- **Heredity** - The passage of traits from one generation to the next.

- **Characteristics** - A quality of an organism like eye color.

- **Trait** - A particular characteristic of an organism blue eyes and brown eyes.

- **Punnett Square** - Diagram that predicts the outcomes of crossing two known parents.
These two chicken breeds were developed by choosing for very different traits.
• Mendel chose pea plants as a study subject because they were quick growing, they had a lot of opposing traits, they were easy to control breeding for.
• **Gregor Mendel**- Austrian Monk who originally supported the existence of genes and identified how parents donated their traits to offspring. He used Pea plants with opposing traits to identify genes.

• **Gene**- A section of DNA on a chromosome that codes for a trait (protein)

• **Loci**- The specific spot on a chromosome where the genes for a specific characteristic are found.

• **Alleles**- the genetic material that we have which codes for one half of a characteristic at one loci (1 allele=1trait)

• **Cross-pollination**- results when another plant's anther is used to pollinate the stigma
• Gregor’s strength was his OCD. He wrote down tons of data. Many modern scientists think he was just a cheat who found the relationship then manufactured data.
• **Pure**- an organism that will always pass on the same trait for a given characteristic (the organism only possesses one type of trait for that characteristic) Strain and Homozygous are synonyms.

• **Dominant Alleles** (traits)- Alleles that when present are the allele that is expressed regardless of what other allele is present.

• **Recessive Alleles** (traits)- Alleles present in the heterozygous condition that are not seen. Recessive genes are only expressed when in a homozygous condition.
**Heterozygous**- means that there are two different alleles present for a characteristic. Ex. Aa, Pp

- **Homozygous**- means that there are two identical alleles present and coding for the same characteristic. Ex. PP, pp, AA, aa

- **Law of Segregation**- states that two alleles are present for each characteristic at one locus, one on each homologous chromosome, and only one of those alleles can be passed on by a parent

- **Law of Independent Assortment**- each allele segregates independently, the allele at one locus has no effect on the alleles of another locus.
Molecular genetics - The study of chromosome structure and function

- **Genotype** - What alleles are present for which traits in an organism

- **Phenotype** - How the organism appears due to its genotype

- **Monohybrid cross** is when only one pair of contrasting traits is considered.
  - All of our examples so far; pea color or flower color

- **Genotypic ratios** - the ratios of possible allele combinations; PP: Pp : pp
  \[ \frac{1}{4} : \frac{1}{2} : \frac{1}{4} \]
• **Phenotypic ratios** - the ratio of expressed traits. Purple:White 3:1

• **Testcross** - Breeding an individual with an unknown genotype to an individual with a known homozygous genotype to acquire data that indicates the unknown individual’s genotype.

• **Complete dominance** - an allele relationship that results in only one allele being expressed in the phenotype. Pp = Purple

• **Incomplete Dominance** - When two alleles share influence in the phenotype of a heterozygous individual. (results in blended traits)
  – R = red, R’ = white, the heterozygote RR’ = pink
Test Cross II:
You are presented with a red flower and asked to give the genotype…
After crossing the red flower with a white flower, you produce an F1 generation with all pink flower plants.
Describe the genotypes of the P1 and F1 generations and the dominance.

<table>
<thead>
<tr>
<th>Test Cross with White Flower</th>
<th>Red Flower</th>
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Incomplete Dominance
• **Codominance**- When two alleles are each expressed in the phenotype of a heterozygous individual. (spotted, striped, alternating colors)
  - R=red, R’=white, The heterozygote RR’ is roan

• **Dihybrid Cross**- a cross which includes two characteristics (four traits). This requires a 16 cell punnett square.

• **Genetic disorders**- diseases which are caused by DNA or chromosome irregularity

• **Single allele trait**- a characteristic that will be displayed by offspring through the inheritance of a single dominant allele. Example: Huntington’s Disease
Codominance
Blue and Red Roan Horses

![Horses in a field](image-url)
• **Polygenic traits**- Characteristics that are coded for by two or more genes resulting in a greater variation for that trait.

• **Multiple allele traits**- These are genes where there are more than two possible alleles that can code for traits at one loci. IB codes for type B blood, IA codes for type A blood, and i codes for type O blood.

• **Sex influenced traits**- these may have identical genotypes in males and females but be expressed differently due to sex hormones

• **X-linked traits**- are traits that are coded for on the X chromosome meaning that it is found more prevalently in males if it is X-linked recessive.
Dihybrid Cross: AaBb x AABB
Down syndrome = extra chromosome 21

Microcephaly = genetic abnormality that interferes with development of cerebral cortex
Huntington’s Disease

Each child has 1 in 2 chance of inheriting the non-HD allele. This is a 50% risk.

This diagram shows how HD may or may not be passed from parent to child. The HD allele is the gene that causes HD, and the non-HD allele is the alternative gene that does not cause HD.
Polygenic Trait: Height

Fig. 9.18  (a) Continuous variation in human height.  
(b) Bell-shaped curve typical of continuous variation in a trait.
Canine Hip Displasia

- Polygenic trait
- Difficult to control with breeding
- Influenced by several genes so difficult to identify in a pedigree style
• Pedigree- a family tree that shows the passage of a trait through multiple generations.

• Multiplication rule- The likelihood of two independent events occurring together is equal to the likelihood of each independent event multiplied together.

• Addition rule- the likelihood of a given outcome is the sum of all the independent ways that outcome can occur
Pedigree

Key:
- Male
- Affected Male
- Deceased Male
- Female
- Affected Female
- Deceased Female
X-Linked Pedigree
Muscular Dystrophy is X-Linked
The Genetics of Balding

• X-linked gene
  – Codes for androgen receptors in scalp
  – Androgens (T) cause balding

• Sex-influenced gene
  – Men have more testosterone than women
  – Castrated men don’t go bald

• Polygenic trait
  – Autosomal genes influence the level of testosterone in men and women
Who’s my daddy?