

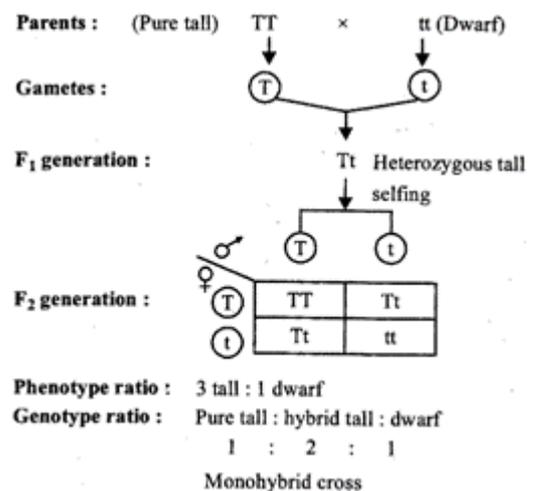
HEREDITY

- Heredity** - The transmission of characters (or traits) from the parents to their off-springs is called heredity.
- Variation**- The differences in the characteristics (or traits) among the individuals of a species is called variation.
- Genotype and phenotype** mean different things. The **genotype** is the set of genes in our DNA which is responsible for a particular trait. The **phenotype** is the physical expression, or characteristics, of that trait.
- Gene** is the unit of inheritance. Gene is the part of a chromosome which controls the appearance of a set of hereditary characteristics.
- Chromosomes** are long thread like structures present in the nucleus of a cell.
- Deoxyribonucleic Acid (DNA)** is a chemical in the chromosome which carries the hereditary characters or traits in a coded form from one generation to the next in all the organisms. It is a section of the gene.
- DNA → Gene → Chromosome**
- We study the mechanism by which variations are created and inherited.
- The **long-term consequences of the accumulation of variations** are also an interesting and we shall be studying it under evolution.
- Heredity** is the transmission of characteristics, physical or mental from parents to offspring that is, from one generation to the successive generation.
- The **reproductive processes** give rise to new individuals that are similar, but subtly different. These differences shown by the individuals of a species are termed as variations.
- Some amount of variation is always seen and these appear more pronounced for species that reproduce sexually, when compared to those having asexual reproduction. The **second generation** will have differences that they **inherit from the first generation**, as well as **newly created differences**.
- Depending on the nature of variations, different individuals would have different kinds of advantages. Bacteria that can withstand heat will survive better in a heat wave. **Selection of variants by environmental factors forms the basis for evolutionary processes.**

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- The **rules of heredity** determine the process by which traits and characteristics are reliably inherited. Let us take a closer look at these rules.
- Inherited Traits** – It is the transmission of particular characteristics from parents to their offspring, generation to generation, which bear all basic features with great deal of variation. Inherited trait is therefore, a genetically determined characteristic that distinguishes a person.

- Mendel's Contributions**
 - Gregor Mendel, an Austrian monk was the first to carry out scientific studies on transmission of characteristics from the parent to the offspring.
 - He did this by using different varieties of pea plant (*Pisum sativum*) which he grew in his garden.
- Mendel chose pea plants** for studying inheritance because –
 - Pea plants had **a number of clear cut differences/ contrasting character** which were easy to identify.
 - Pea plants were self-pollinating which enabled them to **produce next generation early**.
 - Many generations of pea plants can be produced in a comparatively **short time span**.
- Mendel used a number of **contrasting characters** of garden peas- **shape of seeds** (round and wrinkled), **colour of seeds** (yellow and green), **height of pea plants** (tall or dwarf), **colour of flowers** (white or violet) and so on.
- Hybrid** - A new form of plant resulting from a cross (or breeding) of different varieties of a plant is known as hybrid.

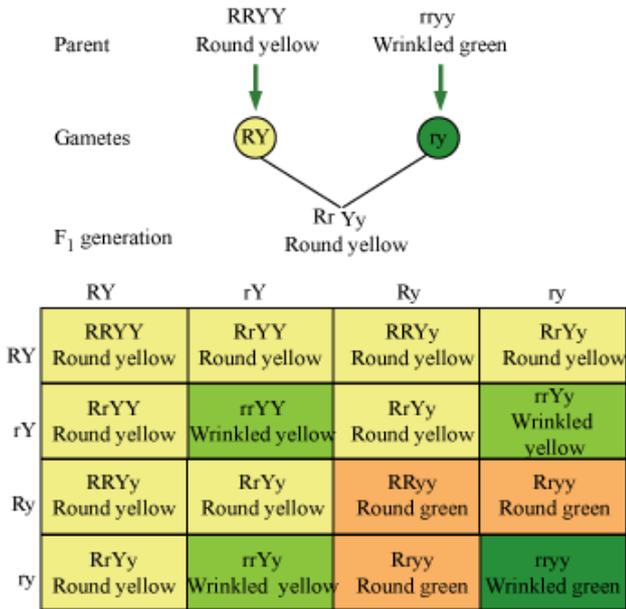


- Monohybrid cross**- When we breed two pea plants having one contrasting characteristic each (of one trait each) to obtain new plants, then it is called monohybrid cross.
 - In the first experiment, Mendel considered the phenotype - an externally exhibited trait only one at a time.
 - He first ensured pure-bred tall and pure-bred short plants. He selected one tall and one short plant from the pure-bred. He called this the P or **parental generation**.
 - He **cross-pollinated** the **tall** and **short plants**.
 - In the first generation, **he got all tall plants**. This generation was called the **first filial or F₁ generation**. The plants that are produced in the **F₁ generation are called hybrids** as they have a mixture of traits of both the parents.
 - Then the plants from F₁ generation were self-pollinated and the next generation was called the **second filial or the F₂ generation**. In this generation, the **ratio of tall to short plants was found to be 3:1**.

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- (vi) Of the tall plants, one-third was found to breed true and the other two-thirds on self-pollinating again produced plants in 3:1 ratio of tall and short plants.
- (vii) Here **tallness was dominant character** and **shortness was recessive character**.
- (viii) Since, in this case **only one trait, i.e., height was considered**; this cross is called the **monohybrid cross**.

21. **Dihybrid cross-** When we breed two pea plants having **two contrasting characteristic each (of two traits each)** to obtain new plants, then it is called dihybrid cross.



- (i) **Two pairs of contrasting character** were taken (i) **Round/Wrinkled** and (ii) **Yellow/Green**.
- (ii) **Round and Yellow are dominant characters** and **Wrinkled and Green are recessive characters**.
- (iii) In **F₁ generation** we only obtain **Round and Yellow Seeds**.

	R	r
Y	RY	rY
y	Ry	ry

- (iv) In **F₂ generation**, the phenotype seed obtained were in the ratio **9:3:3:1 [Round and Yellow seeds (9): Round and Green seeds (3): Wrinkled and Yellow seeds (3): Wrinkled and Green seed (1)]**
- (v) Thus, the tall/short trait and the round seed/wrinkled seed trait are independently inherited.

22. **Mendel's 3 Principles of Inheritance** - Based on his experiments Mendel Laws inheritance as: -

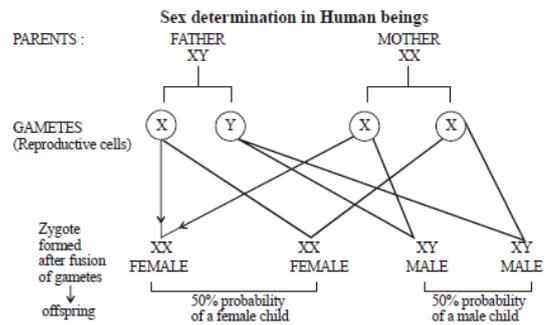
- (i) **Law of Segregation** - According to this law allele pairs **separate or segregate** during gamete formation, and randomly unite at fertilization.

- (ii) **Law of Independent Assortment** - According to this law when two or more characteristics are inherited, individual hereditary factors assort **independently** during gamete production, giving different traits an equal opportunity of occurring together.
- (iii) **Law of Dominance** - It states that states that one of the factors for a pair of inherited traits will be **dominant** and the other recessive, unless both factors are recessive

23. Cellular DNA is the information source for making proteins in the cell. A section of **DNA that provides information** for one protein is called the **gene for that protein**. If the gene for an enzyme has an alteration that makes the enzyme less efficient, the amount of hormone will be less, and the plant will be short. Thus, **genes control characteristics, or traits**.

SEX DETERMINATION

- 24. In some animals, the **temperature at which fertilised eggs are kept determines whether the animals developing in the eggs will be male or female**.
- 25. In other animals, **such as snails, individuals can change sex, indicating that sex is not genetically determined**.
- 26. In human beings, the **sex of the individual is largely genetically determined**.
- 27. Most human chromosomes have a maternal and a paternal copy, and we have 22 such pairs. But one pair, called the **sex chromosomes, is odd in not always being a perfect pair**. Women have a perfect pair of sex chromosomes, both called X. But men have a mismatched pair in which one is a normal-sized X while the other is a short one called Y. **So women are XX, while men are XY**.



28. Half the children will be boys and half will be girls. All children will inherit an X chromosome from their mother regardless of whether they are boys or girls. **A child who inherits an X chromosome from her father will be a girl, and one who inherits a Y chromosome from him will be a boy.**

