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Course -	**Elements of Genetics**
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Unit-	**2**
Topic-	**Mendel's Law**
Sub-Topic-	**Mendel's Law of heredity, Mendel's terminology, Objectives.**
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Mendel's Law of heredity:

The principles of Mendelian inheritance were named for and first derived by Gregor Johann Mendel, a nineteenth-century Moravian monk who formulated his ideas after conducting simple hybridization experiments with pea plants (*Pisum sativum*) he had planted in the garden of his monastery.[4] Between 1856 and 1863, Mendel cultivated and tested some 5,000 pea plants. From these experiments, he induced two generalizations which later became known as *Mendel's Principles of Heredity* or *Mendelian inheritance*. He described his experiments in a two-part paper, *Versuche über Pflanzen-Hybriden* (*Experiments on Plant Hybridization*), that he presented to the Natural History Society of Brno on 8 February and 8 March 1865, and which was published in 1866.

Mendel's results were largely ignored by the vast majority. Although they were not completely unknown to biologists of the time, they were not seen as generally applicable, even by Mendel himself, who thought they only applied to certain categories of species or traits. A major block to understanding their significance was the importance attached by 19th-century biologists to the apparent blending of many inherited traits in the overall appearance of the progeny, now known to be due to multi-gene interactions, in contrast to the organ-specific binary characters studied by Mendel.[4] In 1900, however, his work was "re-discovered" by three European scientists, Hugo de Vries, Carl Correns, and Erich von Tschermak. The exact nature of the "re-discovery" has been debated: De Vries published first on the subject, mentioning Mendel in a footnote, while Correns pointed out Mendel's priority after having read De Vries' paper and realizing that he himself did not have priority. De Vries may not have acknowledged truthfully how much of his knowledge of the laws came from his own work and how much came only after reading Mendel's paper. Later scholars have accused Von Tschermak of not truly understanding the results at all.

Regardless, the "re-discovery" made Mendelism an important but controversial theory. Its most vigorous promoter in Europe was William Bateson, who coined the terms "genetics" and "allele"

to describe many of its tenets. The model of heredity was contested by other biologists because it implied that heredity was discontinuous, in opposition to the apparently continuous variation observable for many traits. Many biologists also dismissed the theory because they were not sure it would apply to all species. However, later work by biologists and statisticians such as Ronald Fisher showed that if multiple Mendelian factors were involved in the expression of an individual trait, they could produce the diverse results observed, and thus showed that Mendelian genetics is compatible with natural selection. Thomas Hunt Morgan and his assistants later integrated Mendel's theoretical model with the chromosome theory of inheritance, in which the chromosomes of cells were thought to hold the actual hereditary material, and created what is now known as classical genetics, a highly successful foundation which eventually cemented Mendel's place in history.
Mendel's findings allowed scientists such as Fisher and J.B.S. Haldane to predict the expression of traits on the basis of mathematical probabilities. An important aspect of Mendel's success can be traced to his decision to start his crosses only with plants he demonstrated were true-breeding. He only measured discrete (binary) characteristics, such as color, shape, and position of the seeds, rather than quantitatively variable characteristics. He expressed his results numerically and subjected them to statistical analysis. His method of data analysis and his large sample size gave credibility to his data. He had the foresight to follow several successive generations (P, F_1, F_2, F_3) of pea plants and record their variations. Finally, he performed "test crosses" (backcrossing descendants of the initial hybridization to the initial true-breeding lines) to reveal the presence and proportions of recessive characters.

Mendel’s terminology:

- True breeding: When the plants self-pollinate, all their offspring are of the same variety.
- Hybridization: Mating, or crossing, of two varieties.

- Monohybrid crosses: A cross between two parents that breed true for different versions of a single trait.
- The genotype refers to the entire set of genes in a cell, an organism, or an individual. A gene for a particular character

There are three basic genotypes for a particular character characters:

- AA = homozygous dominant
- Aa = heterozygous
- aa = homozygous recessive

Objectives:

- Explain Gregor Mendel’s laws of inheritance
- Discuss the difference between genotypes and phenotypes
- Label the three types of genotypes

- Draw and label a Punnett square and Predict outcomes of a Punnett square

Three law of Mendel's:

- Law of Dominance
- Law of Segregation
- Law of Independent Assortment

Law of Dominance:

- Traits are controlled by two factors that can be called "dominant" or "recessive."
- A "dominant" trait shows if the offspring inherits at least one dominant factor from one parent.
- A "recessive" trait shows only if the offspring inherits two recessive factors, one from each parent.

Law of Segregation:

- Each individual has a pair of factors controlling each trait, one inherited from each biological parent.
- During the formation of gametes (sex cells) these two factors separate. Only one ends up in each sex cell.

Law of Independent Assortment:

- When genetic factors segregate in the gametes, they segregate independently of one another. A dominant allele for one trait does not guarantee inheritance of a dominant allele for a different trait.

Book References:

1. *Plant Biotechnology and genetics (2018), C. Neal Stewart Jr.*
2. *Principles of plant breeding and Genetics (2000) , B.D Singh and B.K Prasad*
3. *Genetics(2016), Omkar Singh, R.K PG, College of Shamali (U.P)*