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CLASS 11&12th

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CLASS 12th

Principles of Inheritance

01. Introduction

The transfer of characters from parents to offspring is known as inheritance. Progeny produced resembles the parents closely but is not identical in all the respects. The reason behind is variation. The branch of science which deals with the inheritance as well as the variation of characters from parents to offspring is Genetics.

02. Mendel's Laws of Inheritance

Mendel was born on July 22, in 1822. He worked on Pisum sativum (Garden pea of Edible pea) for 7 years (1856–1863) and proposed the law of inheritance in living organisms.

03. Selection of Pea Plant

The main reasons for adopting garden pea for experiments were as follows :

(i) Pea has many distinct alternative traits (clear contrasting traits).
(ii) It produces a large number of seeds and completes its life cycle in one season.
(iii) Flowers show self (bud) pollination, so are true breeding.
(iv) It is easy to artificially cross-pollination the pea flowers. The hybrids thus produced were fertile.

04. Reasons for Mendel's Success

(a) Mendel applied statistical method and mathematical logic for analysing his results.
(b) He kept accurate records of his experiments, giving all the details of number and type of individuals, which are a necessity in the genetic studies.
(c) Mendel experimented on a number of plants for the same trait and obtained hundreds of offspring. A large sampling size gave credibility to his results.
(d) He tried to formulate theoretical explanations for the observed results. These explanations were further tested by conducting experiments for successive generation of the test plants.

05. Inheritance of One Gene

Study of inheritance of single pair of contrasting traits of a character at a time is called **one gene inheritance.** Mendel crossed true breeding tall variety (6–7 ft.) and true breeding dwarf variety (0.75–1 ft.) pea plants to study the inheritance of one gene. The plants used in initial cross are referred to as **P_1 and P_2 or parents.** Since pea is self-fertilising, the anthers should be removed from the female parent before maturity for the purpose of cross pollination. The method of removal of anthers from bisexual flowers of female parent plant is called

emasculation. The pollens, then at the dehiscence stage, is brought from the male parent and is dusted on the stigma or emasculated flower. He collected the seeds produced as a result of this cross and grew them to generate plants of the first hybrid generation. This generation is also called the **filial$_1$ (offspring) progeny** or the **F_1**.

06. Concept of Factors

Mendel proposed that something was being stably passed down, unchanged, from parent to offspring through the gametes, over successive generations. He called these things as '**factors'.** We now call these factors as **"genes".** Genes which code for pair of contrasting traits are known as **alleles** i.e. they are slightly different forms of the same gene. For example, if **T** is used for the 'tall' trait and **t** for 'dwarf' then **T** and **t** are alleles of each other.

07. Homozygous and Heterozygous

Mendel proposed that in true breeding, tall or dwarf pea variety the allelic pair of genes for height are identical, **TT** and **tt**, respectively. This condition was termed as 'homozygous' by Bateson and Saunders. An individual having two different alleles (**Tt**) will be called gybrid. Bateson and Saunders termed this condition as 'heterozygous'.

08. Genotype and Phenotype

Genotype is representation of genetic complement of an individual with respect to one or more characters. e.g., **TT, Tt, tt. Phenotype** is observable morphological appearance. The phenotypes of an individual is determined by different combinations of alleles e.g., tallness, dwarfness.

09. Dominant and Recessive

The one that expresses itself is called dominant factor while which fails to express is termed as recessive factor. In other words we can say that a dominant allele influences the appearance of the phenotype even in the presence of an alternative allele.

10. Concept of Segregation

The segregation of alleles is a random process and so there is a 50% change of a gamete containing either allele. In this way the gametes of the tall **TT** plants have the allele **T** and the gametes of the dwarf **tt** plants have the allele **t**.