Short Questions

1. Define genotype and phenotype.

Ans. Genotype:

The specific combination of genes in an individual is known as genotype

Types:

It is of two types i.e. homozygous and heterozygous

Concept of Genotype:

In order to understand the concept of genotype let us consider an example trait i.e. albinism (a condition in which normal body pigments are absent) Like other traits, it is also controlled by one pair of genes. We can represent the two alleles of the pair as 'A' and Three combinations i.e. genotypes are possible for these two alleles i.e. AA Aa and aa. These genotypes can be grouped into two types

Phenotype:

A phenotype is the composite of an organism's observable characteristics or traits, such as its morphology development biochemical or physiological properties phenology, behavior and products of behavior (such as a bird's nest)

Phenotypes result from the expression of an organism's genes as well as the influence of environmental factors and the interactions between the two.

The physical appearance or biochemical characteristic of an organism as a result of the interaction of its genotype and the environment.

The expression of a particular trait, for example, skin color, height, behavior, etc, according to the individual's genetic makeup and environment.

genotype + environment + random variation → phenotype

2. What do you mean by dominant and recessive alleles?

Ans. Dominant alleles:

When in the heterozygous condition one allele masks or prevents the expression of the other it is called the dominant allele.

Recessive alleles:

The allele which is not expressed is called recessive. The dominant alleles are represented by capital letters and recessive alleles by lower case letters.

3. What are the homozygous and heterozygous genotypes?

Ans. Homozygous genotypes:

The genotype in which the gene pair contains two identical alleles (AA or aa) is called homozygous genotype.

Heterozygous genotypes:

The genotype in which the gene pair contains two different alleles (Aa) is called heterozygous genotype.

4. Differentiate between natural and artificial selection.

Ans. Artificial and natural selection are key components of genetic and evolutionary theory Darwin coined the term natural selection to help describe the process that species go through to create new species. But before natural selection was discovered, humans had been using artificial selection to selectively breed livestock and plants. Today, artificial selection has grown to include direct genetic manipulation of organisms to produce specialty plants and animals.

OR (Second Answer)

Natural selection:

Natural selection is the process by which favorable heritable traits become more common in successive generations of a population of reproducing organisms and unfavorable heritable traits become less common, due to differential reproduction of genotypes.

Examples:

Breeding for a small dog such as a chihuahua

Artificial selection:

Artificial selection is the intentional breeding for certain traits or combinations of traits, over others, and is synonymous with "Selective breeding"

Examples:

Bird whose beak after a generation or more changes so it can feed on the food available to survive

UNDERSTANDING THE CONCEPT

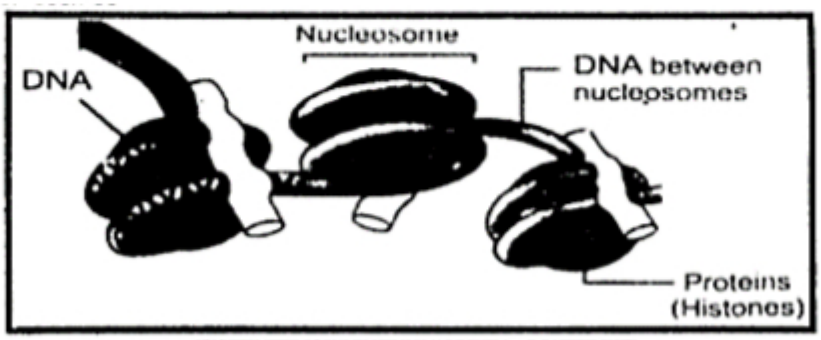
1. Describe the structure of chromatin.

Ans. Structure of chromatin:

Chromosome is made of chromatin material (simply as chromatin). Chromatin is a complex material made of DNA and proteins (mainly histone proteins)

Nucleosomes:

DNA wraps around histone proteins and forms round structures called nucleosomes. DNA is also present between nucleosomes in this way the nucleosomes and the DNA between them look like "beads on a string". The fibers consisting of nucleosomes condense into compact forms and get the structure of chromosomes.



Chemical compostion of chromosome

2. Describe Mendel's law of segregation.

Ans. Mendel's Law of Segregation:

Mendel's law of segregation states that alleles of genes separate when gametes are formed. This applies to the segregation of alleles of one gene.

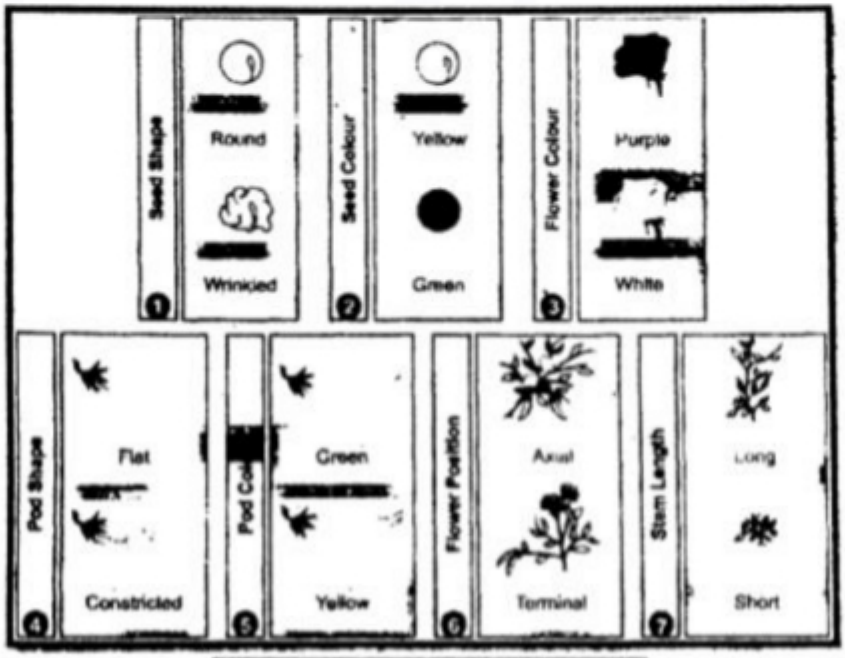
Mendel's Law of Segregation applies to two for more) alleles (alternative versions of a gene). The law says that alleles segregate separates at some point before the formation of gametes and are combined randomly at fertilization.

Explanation:

Mendel studied the inheritance of seed shape first. For this purpose he crossed (reproduced) two plants having one contrasting trait i.e. seed shape

Monohybrid cross:

A cross in which only … studies at a title … as a monohybrid cross.

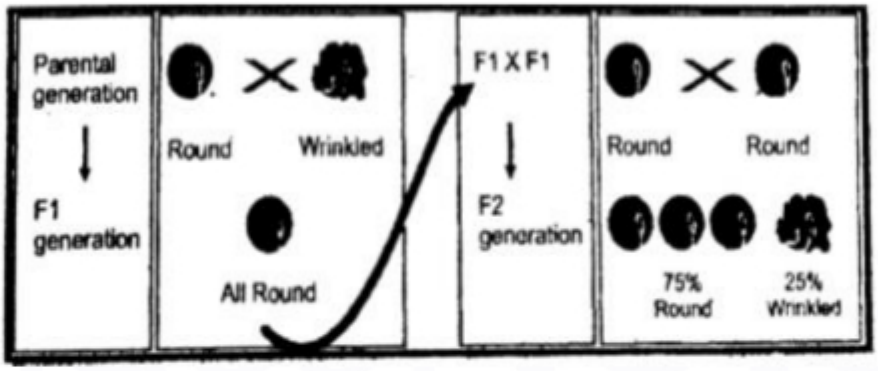


Traits in pea plant studied by mendel

Case 1:

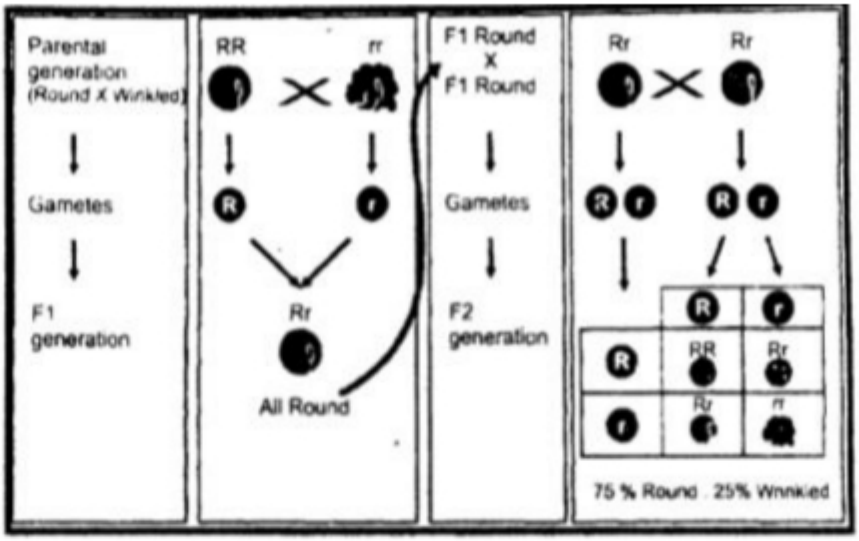
Mendel crossed a true-breeding round-seeded plant with a true breeding wrinkled-seeded plant. All resulting seeds of the next generation were round Mendel declared the trait "round seeds as dominant, while "wrinkled seeds" as recessive. The following year, Mendel planted these seeds and allowed the new plants to self-fertilize. As a result, he got 7324 seeds: 5474 round and 1850 wrinkled (3 round: 1 wrinkled)

The parental generation is denoted as P1 generation. The offspring of P1 generation are F1 generation (first filial). The cross in F1 generation produces F2 generation (second filial)



Case 2:

Similarly, when "true-breeding" tall plants were crossed with "true-breeding short plants, all offspring of F1 were tall plants i.e. tallness was a dominant trait When members of F1 generation were self-fertilized. Mendel got the ratio of tall to short plants in F2 as 31



Conclusion:

Mendel concluded that the traits under study were controlled by discrete (separable) factors or genes. In each organism, the genes are present in pairs During gamete formation, the genes (alleles) of each pair segregate from each other and each gamete receives one gene from the pair

When the gametes of male and female parents unite, the resulting offspring again gets the genes in pairs. These conclusions were called the Law of Segregation.

3. Explain how Mendel proved the law of independent assortment.

Ans. Mendel's Law of Independent Assortment:

It states as "the alleles of a gene pair segregate (get separated and distributed to gametes) independently from the alleles of other gene pairs"

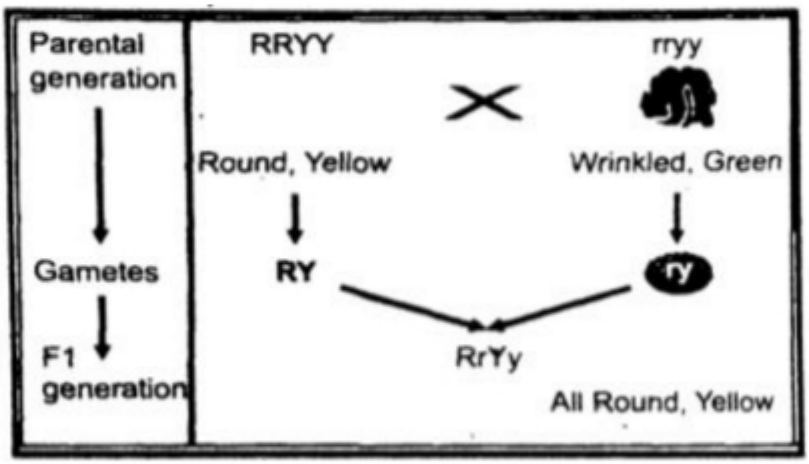
Explanation:

Dihybrid crosses:

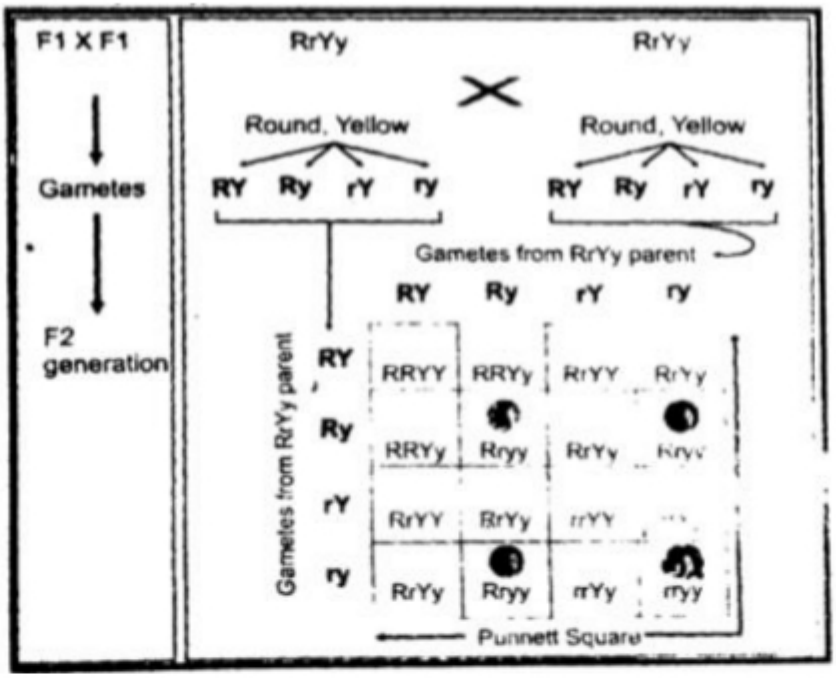
in the next crosses, Mendel studied two contrasting traits at a time Such crosses are called dihybrid crosses. He performed experiments on two seed traits i.e. shape and colour

The trait of round seeds (controlled by allele R) was dominant over wrinkled (controlled by allele 1) seeds Similarly yellow seed colour (controlled by Y) was dominant over green (controlled by y).

Mendel crossed a true-breeding plant that had round yellow seeds RRYY) with a true-breeding plant having wrinkled green seeds (ryy) All seeds in F1 generation were round yellow



When F1 seeds grew into plants, they were self-fertilized. This cross produced seed with four phenotypes. There were 315 round yellow seeds 108 round green seeds, 101 wrinkled yellow seeds and 32 wrinkled green seeds. The ratio of these phenotypes was 9:3:3:1



Conclusion:

Mendel explained that the two traits i.e. seed shape and seed colour are not tied with each other. The segregation of 'R' and Y alleles happens independently of the segregation of 'Y' and 'y alleles.

From his second experiment, Mendel concluded that different traits are inherited independently of one another. This principle is known as the law of independent assortment.

4. How would you prove that variations lead to evolution?

Ans. Variations lead to Evolution:

Organic evolution (biological evolution) is the change in the characteristics of a population or species of organisms over the course of generations. The evolutionary changes are always inheritable. The changes in an individual are not considered as evolution, because evolution refers to populations and not to individuals

Organic evolution includes two major processes:

i. Alteration in genetic characteristics (traits) of a type of organism overtime, and

ii. Creation of new types of organisms from a single type.

Theory of special creation:

The study of evolution determines the ancestry and relationships among different kinds of organisms. The anti-evolution ideas support that all living things had been created in their current form only a few thousand years ago. It is known as the "theory of special creation". But the scientific work in eighteenth century led to the idea that living things might change as well

The Theory of Natural Selection:

Charles Darwin (1809-1882) proposed the mechanism of organic evolution in 1838, it was called as "The Theory of Natural Selection". Darwin proposed this theory after his 5-year voyage on the HMS (His Majesty's Ship) Beagle. He also published a book "On the Origin of Species by means of Natural Selection" in 1859

Darwin's theory of evolution:

Darwin's theory of evolution was not widely accepted because of lack of sufficient evidence. Modern evolutionary theory began in the late 1920s and early 1930s. Some scientists proved that the theory of natural selection and Mendelian genetics are the same ideas just as Darwin had proposed.

OR (Second Answer)

Natural selection (the driving force of evolution) is the selection of genetic variations by how they effect the organism's chances of survival or reproduction. If they diminish its chances, the organism or its immediate offspring die and the gene is gone. If the genetic variations increase its chances, then it survives

Without genetic variations there can be no evolution Natural selection is the selection (by environmental pressures) of those variations.

5. Explain the phenomenon of incomplete dominance with the help of example.

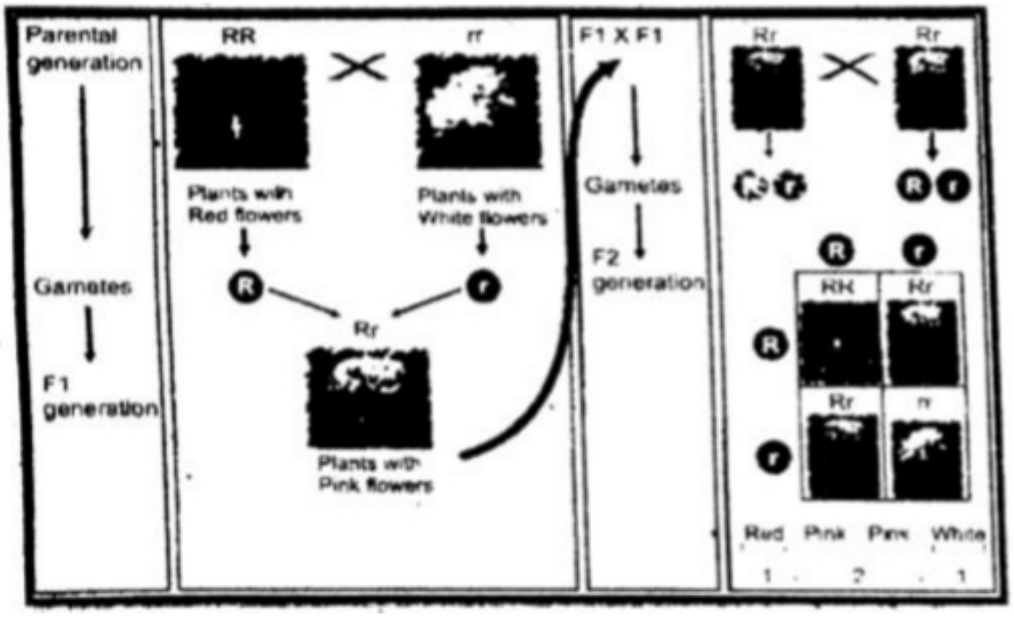
Ans. In-complete dominance:

Incomplete dominance is the situation where, in heterozygous genotypes both the alleles express as a blend (mixture) and neither allele is dominant over the other. As a result of this blending, an intermediate phenotype is expressed

Example:

Following is the familiar example of incomplete dominance

In Four. O clock plant, the trait of flower colour is controlled by two alleles (let us say them R and r). The true breeding plants RR and rr have red and white flowers, respectively. When a homozygous red flowered plant (RR) is crossed with homozygous white flowered plant (rr), the heterozygous (Rr) plants of F1 generation produce pink flowers (pink is a blend of red and white colours). This result clearly indicates that neither of the red flower allele (R) and white flower allele (0) is dominant. However, when two heterozygous plants with pink flowers (Rr) are crossed, F2 generation shows phenotypes of red, pink and white flowers in the ratio 1:2:1.



6. What do you mean by co-dominance? Give an example.

Ans. Co-dominance:

Co-dominance is the situation where two different alleles of a gene pair express themselves completely, instead of showing a dominant-recessive relationship. As a result, the heterozygous organism shows a phenotype that is different from both homozygous parents.

Example:

An example of co-dominance is the expression of human blood group AB. The ABO blood group system is controlled by the gene T. This gene has three alleles i.e., and i. The allele produces antigen A in blood and the phenotype is blood group A. The allele produces antigen B in blood and the phenotype is blood group B. The allele i does not produce any antigen and the phenotype is blood group O. The alleles and are dominant over i. When there is a heterozygous genotype of 41€, each of the two alleles produces the respective antigen and neither of them dominates over the other.

Genotype	Antigen produced	Phenotype	Relation between alleles
$I^A I^A$ or $I^A i$	Antigen A	Blood group A	Allele I^A is dominant over
$I^B I^B$ or $I^B i$	Antigen B	Blood group B	Allele I^B is dominant over
ii	No Antigen	Blood group O	Allele I is recessive
$I^A I^B$	Antigen A & Antigen B	Blood group AB	Alleles I^A and I^B Are co-dominant