

TOPIC 1- GENETICS

Definition

- Genetics is the study of heredity and variation.
- Heredity is the passing on/ transmission of characteristics/ traits from the parents to the offspring/ young ones.
- Variation refers to observable differences that are seen in organisms of the same species or differences between organisms.
- Species refers to a group of organisms that are able to freely and naturally interbreed to give rise to a viable offspring.
- The offspring show slight differences from their parents. For example in human beings, members of the same family differ in shape of nose, skin colour and height.
- This is because of hereditary factors/ genes each of them acquires from parents and the effect of environment.

VARIATION.

- This is the differences among organisms of the same species.
- Variations in human beings are shown in tongue rolling, fingerprints, height, and type of earlobes (attached or free), sex, blood groups, skin colour, and weight.
- In plants variations are observed in length of leaves and internodes and size of fruits.

Types of variation.

- Discontinuous variation.
- Continuous variation.

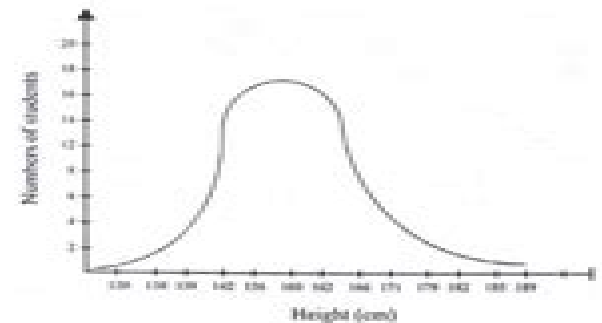
A. Discontinuous variation

- This is a type of variation where there is a distinct/ definite difference in a given characteristic/ without intermediates.
- It is controlled by genes and the environment has no effect.
- Examples include:
 1. Ability to roll the tongue.
 2. Sex i.e. male or female.
 3. ABO Blood groups/ ABO Blood group system.
 4. Presence of hair in the nose or ear pinna.
 5. Fingerprints.
 6. Free or attached earlobes.
 7. Wing length, size of abdomen, eye color in *Drosophila melanogaster*.
 8. Smooth/wrinkled seed coat, green/yellow color in garden peas.
 9. Melanic/light forms in moths.

B. Continuous variation.

- This is a type of variation which shows a wide range of differences for the same characteristic/ trait from one extreme end to the other with intermediates.
- It is controlled by both genes and environment.
- Examples include:
 1. Height.
 2. Weight.
 3. Stem diameter.
 4. Skin colour in humans.
 5. Size of seeds and fruits.
 6. Length of fingers in humans.
 7. Milk yield in cows.
 8. Length of leaves.

- For example, when the number of students is plotted against height it gives a **normal distribution curve**.



Causes of variation

- Gamete formation**—during gamete formation/ meiosis, the following meiotic processes cause variation namely:
 - Crossing over**—exchange of chromatid segments cause new gene combinations which causes variation.
 - Independent assortment**—this is the arrangement of homologous chromosomes at the equator of the spindle during metaphase I.
 - This is followed by segregation/ separation into different daughter cells. The resulting daughter cells/ gametes contain different genetic combination which brings about variation.
- Fertilization**—it allows parental genes to be brought together in different combination.
 - This causes different qualities of parents to be combined differently in the offspring.
- Mutations**—mutation is the spontaneous change in the genetic make-up of an organism. These changes may be inherited by the offspring causing variations.

Importance of variation

- Organisms/ individuals with advantageous traits/ variations are favored/ selected by nature and survive to pass on the traits to their offspring.
- It ensures propagation of favorable/ advantageous traits to the future generation/ offspring ensuring quality population/ species.

THE CHROMOSOMES

- They are thread-like structures found in the nuclei of plant and animal cells.
- They contain genetic material called **DNA (Deoxyribonucleic acid)**.
- Each chromosome is made up of two parallel strands called **chromatids**.
- Each pair of chromatids is connected at one point by a structure called **Centromere**.
- In body/ somatic cells each pair of chromosomes has the same length and shape but different versions of the same genes. They are therefore called **homologous chromosomes**.
- During sexual reproduction, each parent contributes one of the chromosomes of the homologous pair.

Form 4 Genetics

P. K. Gupta



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