

Vidya Bhawan Balika Vidyapeeth Lakhisarai

Arun Kumar Gupta

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Principles of Inheritance and Variation –

16. Polygenic inheritance was given by Galton in 1833. In this, traits are controlled by three or more genes (multiple genes). These traits are called polygenic traits. The phenotype shows participation of each allele and is also influenced by the environment and is called quantitative inheritance as the character/phenotype can be quantified.

For example, human skin colour which is caused by a pigment melanin. The quantity of melanin is due to three pairs of polygenes (A, B and C). If it is black or very dark (AA BB CC) and white or very light (aa bb cc) individuals marry each other, the offspring shows intermediate colour often called mulatto (Aa Bb Cc). A total of eight allele combinations is possible in the gametes forming 27 distinct genotypes.

17. Complementary genes Complement the effect of each other to produce a phenotype. For example, in case of sweet pea, the flower colour is due to complementary genes. Here, one gene complements the expression of another gene.

18. Rediscovery of Mendel's Laws

(i) Though, Mendel published his work on inheritance of characters in 1865, it remained unrecognised for several reasons till 1900. Some of them are as follow:

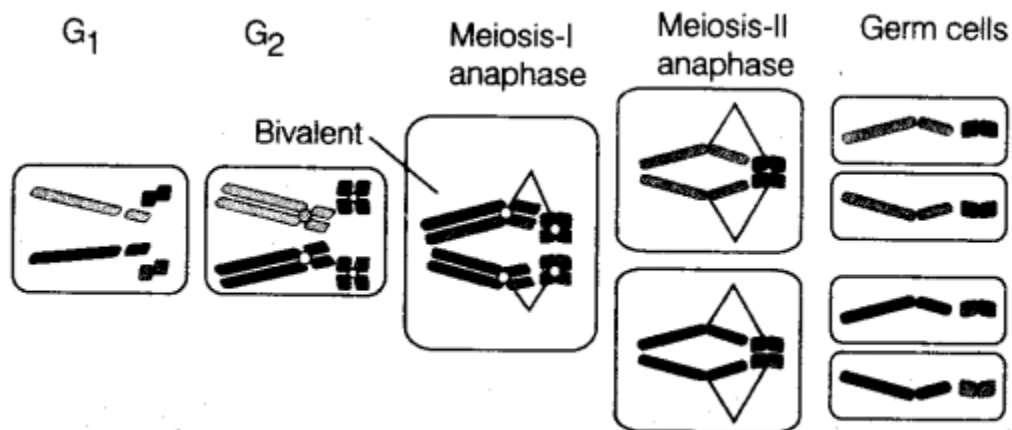
- (a) Communication was difficult, so his work could not be widely publicised.
 - (b) His concept of genes as stable unit that controlled the expression of traits and of the pair of alleles which did not blend was not accepted.
 - (c) His approach of using mathematics to explain biological phenomenon was new and unacceptable.
 - (d) He could not provide any physical proof for the existence of factors.
- (ii) In 1900, de Vries, Correns and Von Tschermak rediscovered Mendel's results independently. Due to microscopy, they carefully observed cell division.
- (iii) This led to discovery of chromosomes (structure in the nucleus that appeared to double and divide just before each cell division).

19. Chromosomal theory of inheritance was proposed independently by Walter

Sutton and Theodore Boveri in 1902. They united the knowledge of chromosomal segregation with Mendelian principles and called it chromosomal theory of inheritance.

The main points are as follow:

- (i) Gametes (sperm and egg) transmit hereditary characters from one generation to another.
- (ii) Nucleus is the site of hereditary characters.
- (iii) Chromosomes as well as genes are found in pairs.
- (iv) The two alleles of a gene pair are located on homologous sites on the homologous chromosomes.
- (u) The sperm and egg having haploid sets of chromosomes fuse to regain the diploid state.
- (vi) Homologous chromosomes synapse during meiosis and get separated to pass into different cells and is the basis of segregation and independent assortment during meiosis.



Meiosis and germ cell formation in a cell with four chromosomes