

①

History of genetics (pre Mendelian era)

- * Term genetics used first time by W. Bateson in 1905.
- * Genetics is a science which deals with - heredity and variation.
- * Heredity includes those traits or characteristics which are transmitted from generation to generation and fixed for particular individual.
- * Variations are mainly two types - hereditary and Environmental.

* Hereditary variations refer to differences in inherited traits, such variations are found not only the progeny of different parents but also among the progeny of same parents.

Traits which are present in parents can re-assort ^{randomly} and give rise to different combinations which are responsible for hereditary variations. (Identical twins is exception where no hereditary variations exist)

* Environmental variation arise due to environment. It is temporary.

hereditary variation with in a progeny result due to
Sexual reproduction (Except mutation). Because due to
asexual reproduction, the population appear fairly
Uniform. Hence sexual reproduction plays important
role in evolution.

* Sexuality :- (1) Animals :- Before the development
of light microscope the idea about the
sexuality in animals was based on speculation -
rather than fact.

W. Harvey :- (1578-1657) :- All animals arise
from eggs and male semen only play vitalizing -
role.

Craaf (1641-1673) :- the progeny would have
characteristics of father as well mother. Both -
the parents has contribute the progeny.

* Vom Beer :- discovered mammalian egg.

* In plants :-

N. Cuvier (1682) reported first time in reproductive
part of plants.

* Camerarius (1694) :- sexual reproduction in plants arise

* Ideas on heredity :-

By Hippocrates :- (400 B.C) - Believed that
characters are inherited from parents because reproduction
material is handed over from all parts of the body
of an individual.

Ex - elongated nose of human Macrophali

By Aristotle :- (350 B.C) - He is not agree with
Hippocrates because this could not explain inheritance -
characters like nails, hairs, voice, grey, because
most of these are dead tissue and could not
be in heredity. According to J.B. Lamarck characters

(2)

(3) contributed to reproductive tissue. He believed that reproductive material was not derived from different part but for nutrient substances meant for different part and diverted to the reproductive path. He also believed that female contributed the material and male sex contributed something to define the forms of embryos.

Both believed in direct inheritance of traits which are handed over from parents to offspring through the reproductive material. This is the simplest theory of inheritance.

* Epigenesis :- K.F. Wolff (1738-1794) who proposed that neither egg nor sperm had a structure like homunculus but that the gamete contains undifferentiated living substances capable of forming the organizing body after fertilization. It is called Epigenesis but characteristics are predetermined by the sperm and ovum taking part in fertilization.

* Pangenesis and acquired characters :- It is pointed out earlier that environmental variations have nothing to do with heredity. According to J.B. Lamarck characters

Which are acquired during the lifetime of individual are inherited. This concept is known as Lamarckism or The theory of inheritance of Acquired characters. But it did not point out the physical basis of heredity.

Charles Darwin (1809-1882)

try to explain physical basis of heredity. His view was that every part of body produced very small invisible bodies called gemmules or pangenes which is transmitted through the blood system to the sex organs and assembled into gametes. During fertilization, gemmules from the both parents are brought together for redistribution to different organs during development, thus determining different characters.

then detailed study of cell structure

and function earlier's pangenes was also based on imagination than facts.

* Experiment of Knight and Gross on pea.
(1799) (1824)

Knight - pigment crossed with unpigmented.
Gross - green seeded cross with yellow seeded.

Knight only concluded that

there was a 'stronger tendency' to produce pigmented plants than unpigmented. Reciprocal cross gave similar result.

main reason for failure of Knight and Gross in understanding the mechanism of inheritance was firstly lack of numerical treatment of data and was secondly due to their main concern for the improvement of peas rather than understanding the mechanism.

ye
mitochondria

5 (B)
* Germplasm theory and genotype, phenotype concept

A Weismann (1834-1914)

demonstrated that 'pangenesis' could not be verified. His popular experiments consisted of cutting metapods of mice and then studying the inheritance. Repeating such a treatment for 22 generations. Weismann found that complete tail structure was still inherited.

Germplasm theory of

inheritance proposed by Weismann. According to his theory the body of individual can be divided into two types of tissues: germplasm and somatoplasm.

the somatoplasm was not able to enter the sex cell. the variation present in somatoplasm will not be transmitted to next generation.

the germplasm was meant for reproductive purpose only. so that any change occurring in germplasm will influence the progeny.

germplasm theory of Weismann was very significant advancement for understanding heredity. This was the first time that a distinction between hereditary and environmental variation could be made on sound basis. Recent years hereditary characters have been found in chloroplast and mitochondria.

6

4

Johansen in 1909 formulated the 'genotype-phenotype concept' make distinction between the hereditary and environmental variation

Genotype of an individual represents sum total of heredity

phenotype represent feature which are produced by interaction between genotype and environment

thus A genotype can exhibit different phenotypes under different conditions. This is known as 'individuals' norms of reactions to the environment. Similar genotype may not have the same phenotype and similar phenotype do not necessarily mean the same phenotype

To study the interaction of environment and heredity following methods - utilized.

(1) Study of individual have same genotype

by -

(a) * Clones :- A clone is the progeny of a single plant reproduced asexually.
e.g - Bacterial population derived from single cell.

(b) A pure line is the progeny of a single plant obtained due to continuous self fertilization

(c) Inbred line :- It is obtained in cross-fertilizing individuals due to fertilization among closely related lines. e.g - Brother and sister

* phenocopy :- When two genotypes produced the same phenotype due to different and one is called phenocopy of other.