



Synthetic Theory of Evolution

Darwinism

- ▶ Charles Darwin's important postulates

- ▶ Over production
- ▶ Struggle for existence
- ▶ Variations
- ▶ Survival of the fittest

- ▶ Origin of species

- ▶ Darwinism

- ▶ Origin of species by means of natural selection

Modern synthesis (Neo-Darwinism)

- ▶ The fusion of Mendelian genetics and Darwin's natural selection
 - ▶ Produce a more comprehensive evolutionary theory than either can offer separately
 - ▶ Darwin showed that evolution involves selection interacting with variation within populations
 - ▶ Mendel that the bases of this variation are discrete units of heredity (genes)
- ▶ Neo Darwinism Supporters
 - ▶ Romanes, Wallace, Fisher, Huxley, Ford, Haldane, Goldschmidt, Sewall Wright, Ernst Haeckel, August Weismann, Mendel, Dobazhansky, Kettlewell and Herbert Spencer

Darwinism vs Neo-Darwinism

➤ Darwinism

- Considers all inheritable favourable variation
- Does not explain the reason for variation
- The basic unit of evolution is an individual
- Does not consider reproductive isolation as a major factor in new species formation.
- Natural selection is the survival of the fittest and removal of the unfit ones during the course of time

Darwinism vs Neo-Darwinism

➤ Neo-Darwinism

- The modification of original concept postulated by Darwin and Wallace based on data obtained from genetic research
- Considers only inheritable genetic variation (mutations) for evolution
- Explains the reason for variations
- The basic unit of evolution is a population
- Consider reproductive isolation as a major essential factor in speciation
- Natural selection refers to the differential reproduction leading to the changes in gene frequency

The Synthetic Theory

- Further synthesis of Neo-Darwinism
 - Coupled with the knowledge of evolution at the molecular level (DNA, RNA, Genes, Genome etc.)
- Pioneer of the synthetic theory
 - T. Dobzhansky, R. A. Fisher, J. B. S. Haldane, Swall Wright, Ernst Mayr, and G. L. Stebbins
- Factors involved in synthetic theory
 - 1) Gene mutations
 - 2) Variation (Recombination)
 - 3) Heredity
 - 4) Natural selection
 - 5) Isolation

Accessory Factors in Synthetic Theory

- ▶ Interrelated Accessory Factors
 - ▶ Migration of individuals from one population to another
 - ▶ Hybridization between races or closely related species
 - ▶ Increase the amount of genetic variability available to a population
- ▶ Influence the effects of chance acting on small populations
 - ▶ May alter the way in which natural selection guides the course of evolution

Mutation

- Alteration in the chemistry of gene (DNA) is able to change its phenotypic effect
 - Called point mutation or gene mutation
- Mutation can produce drastic changes
 - May be deleterious or harmful and lethal or can remain insignificant
- There are equal chances of a gene to mutate back to normal
- Most of the mutant genes are recessive to normal gene
 - Able to express phenotypically only in homozygous condition
- Thus, gene mutation tends to produce variations in the offspring

Variation or Recombination

- ▶ New genotypes from already existing genes of several types
- ▶ The production of gene combinations
 - ▶ The same individual with two different alleles of the same gene, or the production of heterozygous individuals (meiosis)
- ▶ The random mixing of chromosomes from two parents during sexual reproduction to produce a new individual
- ▶ The exchange between chromosomal pairs of particular alleles during meiosis
 - ▶ Called crossing over, to produce new gene combinations.
- ▶ Chromosomal mutations
 - ▶ Deletion, duplication, inversion, translocation and polyploidy also result in variation.

Heredity

- The transmission of variations from parent to offspring is an important mechanism of evolution
- Organisms possessing helpful hereditary characteristics are favored in the struggle for existence
- The offspring's are able to benefit from the advantageous characteristics of their parents

Natural selection

- ▶ Brings evolutionary change by favouring differential reproduction of genes
 - ▶ Produces change in gene frequency from one generation to the next
- ▶ Does not produce genetic change, but once it has occurred it acts to encourage some genes over others.
- ▶ Creates new adaptive relations between population and environment
 - ▶ By favouring some gene combinations, rejecting others and constantly modifying and molding the gene pool

Isolation

- Isolation of organisms of a species into several populations or groups
 - Under psychic, physiological or geographical factors is supposed to be one of the most significant factors responsible for evolution
- Geographical barriers include physical barriers
 - Rivers, oceans, high mountains which prevent interbreeding between related organisms
- Physiological barriers help in maintaining the individuality of the species
 - The isolations known as reproductive isolation
 - Do not allow the interbreeding amongst the organisms of different species

Speciation (origin of new species)

- ▶ An isolated population of a species independently develops different types of mutations. The latter accumulate in its gene pool.
- ▶ After several generations, the isolated population becomes genetically and reproductively different from other so as to constitute a new species.

