NEO-DARWINISM/SYNTHETIC THEORY OF NATURAL SELECTION/MODERN THEORY OF EVOLUTION

Darwin's theory of natural selection was accepted. The strong supporters of Darwinism are Wallace, Huxley, Haeckel, and Weismann. Darwin's theory lacked an input of modern concepts of genetics and the mechanisms how characters appear and persist in a population. In the light of recent researches the theory was modified. Several experimental evidences have gone in favor of Darwinism. Based on those facts and statistical data a synthetic theory of evolution was proposed. This is modified theory of Darwinism. This is called Neo-Darwinism.

The Synthetic theory emerged by the synthesis of the original idea given by Charles Darwin and addition of new knowledge of genetics, population dynamics, statistics, and heredity to the theory. This is the most modern theory of evolution and has been constantly improved during 20th century by the contribution of the following scientists such as R.A. Fischer, J.B.S. Haldane, Ernst Mayr, Julian Huxley, and G.G. Simpson contributed with their studies on population dynamics. T. Dobzhansky, H.J. Muller, H. DeVries, G.L. Stebbins added information on genetics and mutation. G.H. Hardy, W. Weinberg, Sewall Wright did extensive work on population genetics and statistics, which helped to understand the mechanism of heredity.

According to Neo-Darwinism the following factors operate for the formation of new species.

a) Variations
b) Mutations
c) Natural selection
d) Genetic drift
e) Isolation of species.

Over production, struggle for existence, and universal occurrence of variation will take place as usual. But in the synthetic theory the formation of variations and mutations were discussed with experimental evidence for evolution which Darwin was unable to explain.

a) Variations: During Darwin's time little was known about genetic variations. During Meosis and crossing over synapsis will take place. Because of this regrouping of genes will take place. Because of which genetic variation will appear or chromosomal

aberrations will take place. The chromosomes may loose a bit or gain in a bit or order may be changed, or chromosomal bits may be exchanged between two chromosomes. These aberrations will become heritable variations.

Now and then the sets of chromosomes will increases or decrease. This is called ploidy. Because of this polyploidy heritable variations will arise they will be carried to number of generations. This may result in the origin of new species.

b) Mutations: Any change in the nucleotide sequence of DNA and if one pair of nucleotides is replaced mutations will arise. These mutations are called point mutations. These are caused spontaneously in nature. They can also be brought by induction. Mustard gas, x-rays, gamma rays, electric shocks, temperature shocks etc. will bring mutations. These mutations are rare. They are sudden and heritable. They may be harmful or beneficial. Most of the mutant genes are recessive. They can be expressed only in homozygous state.

Because of these sudden mutations new species are formed. For evolution, variations and mutations will be the raw material.

c) Natural Selection: Natural selection includes aft forces both physical and biotic factors and determine how and in what direction an organism is to change. Natural selection has no favoritism. But it is obvious that the organisms which are suited for environmental conditions will survive over power in the force of competition. Because of this better survivors are retained in the nature.

d) Genetic Drift: In small inter breeding population heterozygous gene pairs will tend to become homozygous. Because of this, disadvantage characters may be expressed and those organisms will be weeded out. Such genetic drifts are not theoretical. They operate in small populations of Islands. This genetic drift will provide a way to determine the line of evolution.

a) **Isolation**: In Darwin's time nothing to known about isolation. Isolation is very important part in evolution. Usually the organisms of a population will be segregated into several populations because of physiological or geographical Isolation.

Mutations large stretches of water may separate a population in the separated groups one group may change. Because of this new species will be developed. Thus geographical isolation will bring evolution.

The effects of natural selection in different environments will give different species. Thus the old Darwin's concept is re-organised with experimental proofs, New-Darwinism was proposed.

Examples of natural selection

1. **The industrial melanic moth:** *Biston betularia,* the industrial melanic moth, is a gray colored moth that perfectly camouflages on tree trunks covered with lichen in England and escapes predation by birds. With industrial revolution in England in the middle of 19th century, lichens on tree trunks got killed due to smoke belching out of factories. Tree trunks were now bare and dark and made the light gray moth prominent to the predatory birds. Now natural selection favoured dark coloured moths, which could camouflage on bare tree trunks. Since the moth has only one generation in a year, in less than 50 generations, the natural selection replaced gray population with black population.

2. **Resistance in mosquitoes and houseflies**: DDT was used extensively, sometimes by airplanes over large areas. Initially it killed 99% of mosquito population but at the same time put a lot of pressure on the surviving individuals to mutate. Mutant resistant strains survived DDT application and became the parents of the next generation. Natural selection preserved the resistant populations and eliminated the susceptible ones. This can be called an artificial selection by man, due to which today not only mosquito and housefly but also many agricultural pests have become resistant to most of the available insecticides.

3. **Liederberg's replica plating experiment**: Liederberg (1952) conducted experiment on *Escherichia coli* by exposing the susceptible strains to penicillin repeatedly. As the generation time of the bacterium is 20-30 minutes only, hundreds of generations could be cultured and exposed to penicillin within a short time. He found that mutations for resistance appeared instantly and quickly replaced the susceptible populations by natural selection.

4. **Fluctuation test experiment**: Salvador Luria & Max Delbruck (1943) cultured a population of *E. coli* in one flask along with bacteriophage viruses. He then cultured samples from the flask on agar plates and found similar growth on all agar plates. He found that in some flasks instant mutations had appeared for resistance against viruses while in others susceptible strains died out. This experiment proved that in populations exposed to environmental extremes, either the mutants appear or hidden recessive mutations express and get exposed to natural selection and save the population from the possible extinction.

Natural selection is a phenomenon that forces the species to keep improving generation after generation so that they remain in the fittest state to survive in a particular environment. Random genetic changes provide raw material that causes variations and gives natural selection a chance to operate.