NEO- DARWINISM

B (3)

Introduction: Darwinism denotes the type of evolutionary mechanism as organic changes. No doubt, it was hugely favoured by many biologists (Wallace, Henry, Huxley, Haeckel, Mendel etc.) but was attacked by few scientists eg., Owen, Sedgwick etc. due to following objections (= shortcomings, drawbacks etc):

1. It did not distinguish between heritable(= germinal) and non-heritable(=somatic) variations. But, it stated that all the variations are heritable, however, the origin and transmission of variations are not explained.
2. It is unable to explain origin of new characters.
3. It did not explain actual process of inheritance.
4. It did not give any idea about useless variations. It stressed upon small fluctuating variations(principal factor for natural selection). Darwin explained that sports(= Saltation variations) or mutations are infrequent and did not provide basis for selection.
5. Darwinism did not recognize intermediate forms(= connecting links).
6. It is unable to explain over specialization of certain structures. eg., Irish Elk has large size of horns. Enormously overgrown and over specialized dinosaurs became extinct, spiral tusk of Jefferson mammoth.
7. It did not explain neutral flowers and sterility of hybrids.
8. Degeneration of organs are not explained.
9. It is too much based on Lamarckism in use and disuse concept(Weismann). It also utilized giraffe.
10. It did not explain effect of use and disuse and presence of vestigial organs eg what would be the advantages of feathers in a bird and when these were begin to diverge from their reptilian ancestor?
11. It could not explain whether the instinct are acquired and modified through natural selection or not.
12. It is unable to explain survival of fittest.
13. It could not explain evolution of land plants from aquatic ones.
14. It believed in blending inheritance.
15. Darwin stated that the parts of body give off pangenes, which are collected in eggs and sperms. The pangene is responsible for a particular character but the hypothesis of pangene is untenable
16. Darwin does not mimicry, though it is of elaborate use in Kalima butterfly
17. Darwin dealt with quantitative approach of variation but the interspecific variations are qualitative
18. It is unable answer the following questions:
    (a) Why has not the ostrich acquired power of flight?
    (b) Why some animals have mental power more developed, whereas the development is advantage ous or not?
19. How some species, when crossed produce sterile offsprings, whereas when varieties are crossed they produce fertile offsprings?
20. Artificial selection to improve races of domestic plants and animals can never lead to definite or permanent specific variations
21. It appears somewhat absurd that variations tend infinitesimal degree of preservation
22. Intraspecific struggle among bees are not explained
23. Darwin believed that man could produce varieties are changed conditions hastened and simulated

variability to formulate artificial selection ideas.

24. Origin of adaptations and co-adaptations can't be explained by natural selection. eg, electric organs of fishes.

25. How some structures became rudimentary? Darwin explained that first whale ancestors were handicapped by hind legs and that way any decrease in size which would be enhanced by disuse disuse will be advantageous. It was explained by Weismann in term of panmixia hypothesis.

26. Special objections are attributed to the subsidiary sexual selection theory, which involves passivity on the part of male, active choice on part of female for more attractive and handsome males.

Later with more recent works, certain ideas were dropped off or certain were added and substituted by Dobzhansky, Stebbins, Mayr, Cantor, Romanes, Fischer, Ford, Haldane, Goldschmidt, Wright, Kettlewell, Spencer etc. These scientists are called Neo-Darwinians and the concept as Neo-Darwinism (= Defence of Natural Selection).

Experimental ideas of Neo-Darwinism:

1. Industrial melanism in moth: It is the development of black colour (melanin pigment) by the p moth living in the industrial areas to match their body to soot-covered background on the bark of trees. It has been reported in peppered moth (Biston betularia or light variety and B. carbonaria or dark variety), 70 other species of ~~moths in Great Britain, 100 species~~ Great Britain of moths in United states etc. It has been discussed by Fisher, ~~Ford, Kettlewell, Bishop and Cook (1971)~~ etc.

Ford, Kettlewell, Bishop and ~~work~~ researches on industrial melanism ~~reflect the operation of directional~~ reflect the operation natural selection and example of origin of adaptation. The development of dark melanic species of moths in industrial regions of Western Europe furnishes the most striking example of evolutionary changes. Before industrialization in Manchester, B. betularia was prevalent but B. carbonaria was absent in 1848AD. In 1910, both the species shared equal proportion but today only B. carbonaria is present due to rapid industrialization.

It seems that both the species differ in single Mendelian gene of which dark variety is usually dominant. It is actually the mutant of lighter form caused by deposition of melanin. Cross breeding experiments indicate that the melanic genes follow the Mendelian inheritance. The change in gene, genotype and phenotype frequencies beautifully corresponds to the spreading of industries in Great Britain. Therefore, it may be concluded that nature favours black moths which match the dark background.

2. Resistance of insects to pesticides: In agriculture, pest are controlled by spraying of pesticides like DDT (Dichlore-diphenyl-trichloroethane). However, DDT cannot bring about 100% deaths in any species of insects. Sacca (1947) first reported that few Musca domestica became resistant to DDT and then about 225 species of insects and other arthropods became resistant.

The resistance is a character controlled by genes and so they reproduce more and more resistant insects. Resistant is specific to one/a group/other pesticides but multiple resistance is also reported. The resistant populations are evolved as a selective advantage against insecticides.

Australian rabbits: resistance for virus. In 1859, 24 wild rabbits (oryctolagus cuniculus)

3. Resistance of mammals to chemicals: Warfarin destroys rats acting on blood as a coagulant and interfering with vitamin K. Warfarin resistant mutant rats were first observed in England. It was observed that resistant rats were replacing ordinary ones. Therefore, struggle has survival value in an altered environment.

4. Resistance of Bacteria to antibiotics: The effectiveness of Penicillin, Sulphonamide, streptomycin, Chloramphenicol-250 has been reduced by the emergence of resistant strains of bacteria. Cavalli and Macacro (1952) proved that Escherichia coli develop resistance to Chloramphenicol 250 times as great as that tolerated by normal bacteria by exposure to increased concentration of drug. Leaderberg (1952) used replica plating technique with an antibiotic free medium (master plate) and explained that drug resistant mutations arise in bacteria either in presence or absence of drug. The crossing experiments prove that resistance has been inherited on Mendelian principles. It concludes that population can be made to respond adaptively.

5. Heavy metals resistance in plants: Bradshaw et al. (1971) have studied that plants are able to grow on soils contaminated with Cu, Zn, Pb etc. Such varieties maintain themselves on soil with concentration of pollutants that are lethal or at least stressful for ordinary members of such species. The resistant and non-resistant varieties meticulously confined to their respective contaminated and uncontaminated soils.

6. ~~Australian rabbits: In 1859, 24 wild rabbits (Oryctolagus cuniculus) were brought~~ from Europe to Victoria (Australia). In 1928, it was found that rabbits caused ~~enormous damage~~ to sheep grazing pastures and to wheat cropfields. In 1950, long after employing trapping, poisoning of waterholes, fumigation etc, a virus was inoculated to cause myxomatosis. By 1953, about 95% of rabbits in Australia had been eradicated. Then evolutionary changes occurred in both myxoma virus and rabbit. Fenner (1959) suggested that viruses undergone genetic changes to form less virulent strains of virus by which population of rabbits further increased.

7. Infectious diseases in men: Haldane suggested that some diseases (Tuberculosis, plague, phthisis etc.) were agents of natural selection in men. During 18th and 19th centuries, tuberculosis spread with the growth of cities and created havoc throughout the industrialized world. It has been established that minute droplets of sputum contain thousands of Bacillus mycobacterium tuberculosis which can survive in air for several hours. Even though sputum dried, the bacteria are infective. It caused death in New York, Philadelphia and Boston in early 1800s, which lowered to 40 per 10×10^4 population by 1915. It seems that severity of infections has most likely been diminished by genetic selection and has been essentially independent of public health medication.

8. Sickle cell Anaemia: HbS is responsible for sickle cell anaemia. Homozygous individual dies at an early stage. In heterozygous condition, RBCs containing HbS become sickle shaped and are unable to bind oxygen efficiently but kill parasite (say Plasmodium) effectively. Therefore, heterozygous individual with sickle-shaped Hb cope up with malarial infection much better than HbA.

These examples represent current (= progressive) selection.

9. Differential mortality in babies: According to Karn and Penrose, birth weights of newborns, provide a good example of a human character subjected to stabilizing selection. The optimum birth weight is 7.3 pounds. newborns infants <5.5 and >10 pounds have the highest probability of mortality.

10. Differential mortality in sparrows: Bumpus brought 136 stunned English sparrows under the exposure of severe snow, rain and sleet storm into his laboratory at Brown University. Of these, 64 birds died and 72 revived. He measured the weight and length of body, wings, head and beak of all the dead and living birds and concluded that death was due to deviation in length and weight of sparrows.

11. Differential appearance of colour in moth: Ford raised pale wings as an abnormal character in Panaxia dominula (red checker moth) by artificial selection. These moths were true breeding for pale wings but they contained genes for normal wings. These moths were released in an area where none of this species existed. After 5 years, descendents produced a population of normal wings to show stabilizing selection.

12. Differential mortality of starlings: David lack observed that optimum and model number of eggs in the nest of starlings is 5. He reported that higher mortality occurs in the nests where there were >5 fledgelings. The mortality was probably due to poor nutrition when there was more fledglings. It seems that optimum number of nestlings was always maintained even though the reproductive activity was greater.

These examples represent stabilizing (= Normalising) selection.

13. Dispersive selection in butterfly: The males of Papilio dardanus (African swallowtail butterfly) have yellow and black wings with tails. They resemble the similar animals of US. The females do not have tails. These are characterized by mimicry shown by females only in different ways. They mimic distasteful species of butterfly and is associated with adaptive value of protection during the period when female is laying eggs.

14. Weldon's experiment on shore crab (Carcinus maenas): Weldon laid a large breakwater in the mouth of river Plymouth sound to slow down rate of water flow. It results in deposition of silt which causes death of crabs. He analysed that living crabs were provided with narrow carapace and the dead ones with broad carapace.

It shows that changed environment produces minute changes and natural selection operates in changed environment to select narrow carapaced crabs with little deposition of silt.

15. Davenport's experiment on Chicks: Davenport painted chicks with black, grey, white along with bars on some and allowed to wander freely in the fields. He observed that most of the chicks except bars were captured and killed by hawks, kites, etc. It was probably due to colour of bars merges with the surroundings and nature selects animals with favourable characters.