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Theories of Evolution :-

1. Lamarkism
2. Darwinism
3. Hugo de Vries' mutation theory
4. Modern concept of evolution / synthetic theory of evolution

① Lamarckism :- Even before Darwin, a french naturalist Lamarck had said that evolution of life forms had occurred but driven by use and disuse of organs.

He gave the examples of Giraffes who in an attempt to forage leaves on tall trees had to adapt by elongation of their necks. As they passed on this acquired character of elongated neck to succeeding generations. Giraffes, slowly, over the years, came to acquire long necks.

So, two main postulatis of this theory is

- use & disuse of organs
- Inheritance of acquired characters

Mendel's law of inheritance and Weismann's Theory of continuity of Germplasm discarded Lamarck's concept of inheritance of acquired characters. Nobody believes this conjecture any more.

② Darwinism :- Theory of natural selection.

Salient features of this theory are as follows

1. over production (Rapid multiplication)
2. Struggle for existence
3. variation
4. Natural selection (survival of fettest)
5. speciation

* Evolution by natural selection, in a true sense would have started when cellular forms of life with differences in metabolic capability originated on earth.
* The rate of appearance of new forms is linked to the life cycle or the life span. Microbes that divide fast have the ability to multiply and become millions of the individuals within hours.
* A colony of bacteria (say A) - growing on a given medium has built-in variation in terms of ability to utilise a feed component.
* A change in the medium composition would bring out only that part of poplution (say B) that can survive under the new conditions.
* In due course of time this variant population outgrows the others and appears as new species. This would happen within days.
* For the same thing to happen in a fish or fowl would take million of years as life spans of these animals are in years.
* Here we say that fitness of B is better than that of A under the new condition. Nature selects for fitness.
* One must remember that the so-called fitness is based on characterstics which are inherited. Hence there must be a genetic basis for getting selected and to evolve. Another way of saying the same thing is that some organisms are better adapted

to survive in an otherwise hostile environment.

* Adaptive ability is inherited. It has genetic basis. Fitness is the end result of the ability to adapt and get selected by nature.

Branching descent and Natural selection are the two key concepts of Darwinian Theory of evolution.

* Another interesting observation supporting evolution by natural selection comes from England. In a collection of moths made in 1850s i.e. before industrialisation set in, it was observed that there were more white-winged moths on trees than dark-winged or melanised moths. However, in the collection carried out from the same area, but after industrialisation, i.e. in 1920, there were more dark-winged moths in the same area, i.e. the proportion was reversed.

* The explanation put forth for this observation was that 'Predators will spot a moth against a contrasting backgrounds'. During post industrialisation period, the tree trunks became dark due to industrial smoke and soots. Under this condition the white-winged moth did not survive due to predators, dark-winged or melanised moth survived. Before industrialisation set in, thick growth of almost white-coloured lichen covered the trees – in that background the white winged moth survived but the dark-coloured moth were picked out by predators. Lichens will not grow in polluted areas, Hence moths that were able to camouflage themselves i.e. hide in the background, survived. This showed that in a mixed population, those can better-adapt, survive and increase in population size. Remember that no variant is completely wiped out.

Evolution by Anthropogenic Actions:-

→ Selection of Pesticides & herbicides resistant variety in much lesser time scale because of excessive use of herbicides & Pesticides

→ Antibiotic resistant organism / cells appear in a time scale of months or years and not centuries.

Example of Artificial Selection.

→ Breeding of selected plants and animals for agriculture, horticulture, sport or security. Man has domesticated many wild animals and crops. This intensive breeding programme has created breeds that differ from other breeds (eg dogs) but still are of the same group. Man created these new breeds within hundreds of years.

*This Also tells us that evolution is not a directed process in the sense of determinism. It is stochastic process based on chance events in nature and chance mutation in the organisms.

* When we describe the story of this world we describe evolution as a process. On other hand when we describe the story of life on earth, we treat evolution as a consequence of a process called natural selection.

* It is possible that the work of Thomas Malthus on population influenced Darwin.

* Natural selection is based on certain observations which are factual for example :-

→ Natural resources are limited

→ Populations are stable in size except for seasonal fluctuation.

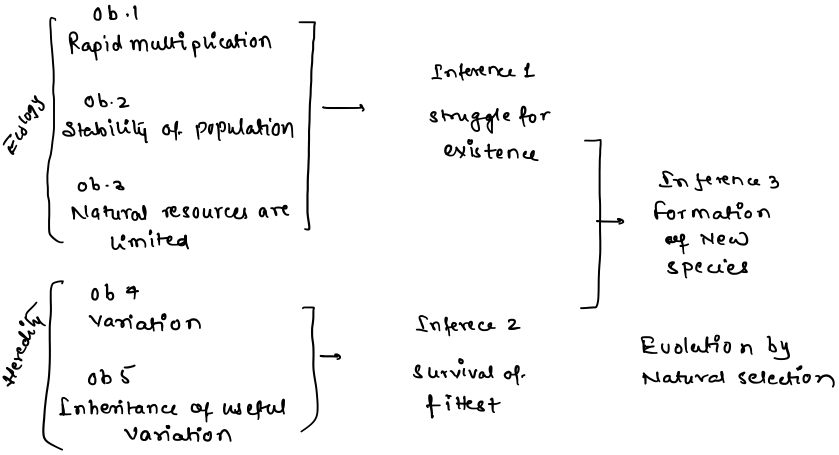
→ Members of population vary in characterstics even though they look superficially similar.

→ Most of the variations are inherited.

The fact that theoretically population size will grow exponentially if everybody reproduced maximally (this fact is seen in a growing bacterial population) and the fact that population sizes are limited, means there had been competition for resources. Only some survived and grew at the cost of others that could not flourish.

* The novelty an brilliant insight of Darwin was this: he asserted that variations which are inherited and which make resource utilisation better for few (Adapted to Habitat better) will enable only those to reproduce & leave more progeny. Hence for a period of time, over many generations, survivors will leave more progeny & there would be a chang in population characteristic and hence new forms appear to arise K/a speciation.

five observations & Three inferences of Natural selection by Ernst Mayr



(3) Hugo de Vries' Mutation Theory :-

* According to him, new species are not formed by continuous variations but by sudden appearance of variation, which he named as Mutation.

* Mutations are heritable and persist in succesive generations

(4) synthetic theory :- Most accepted theory of evolution

(i) Genetic variation in population → ⓐ Mutation ⓑ Recombination ⓒ Gene flow (Gene migration) ⓓ Genetic drift ⓔ Non random mating ⓕ Hybridisation.

(ii) Isolation → Pre zygotic, zygotic, Post zygotic

(iii) Heredity

(iv) Natural selection

(v) speciation