

# Evolution

## Summary:

**Acquired and inherited traits, Speciation, Evolution and classification, Evolution by stages, Human evolution.**

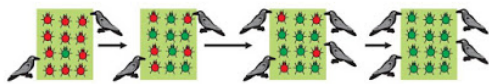
**Evolution:** It is the sequence, of gradual, irreversible changes which took place in the primitive organisms over millions of years to form new present-day species.

- Variations that resulted in formation of new species occurred basically due to errors in DNA copying as well as due to sexual reproduction.

## An Illustration to show variations in a population:

A group of twelve red beetles live in green bushes and reproduce sexually so are likely to develop variations. There are the following possibilities

### **Situation I (Group of red and green beetles)**



- Colour variation arises during reproduction

All beetles red except one that is green → Crows feed on red beetle → No. of beetles reduces

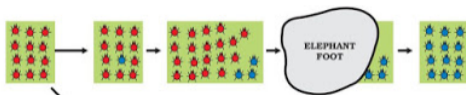
One beetle green → Progeny beetles green → Crows could not feed on green beetles as they got camouflaged (hide) in green bushes → Number of green beetles increases

### **Conclusion**

→ Green beetles got the survival advantage or they were naturally selected as they were not visible in green bushes.

→ This natural selection is exerted by crows resulting in adaptations in the beetles to fit better in their environment.

### **Situation II (Group of red and blue beetles)**



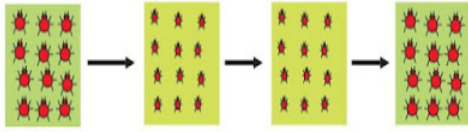
Reproduction in group of red beetles → All beetles are red except one that is blue → Number of red beetles increases as they reproduce → One blue beetle reproduces and no. of blue beetles also increases → Crows can see both blue and red beetles and can eat them → Number reduces but still red beetles are more and blue ones are few → Suddenly elephant comes and stamps on the bushes → Now beetles left are mostly blue

### **Conclusion**

→ Blue beetles did not get survival advantage. Elephant suddenly caused major havoc in beetles population otherwise their number would have been considerably large.

→ From this we can conclude that accidents can change the frequency of some genes even if they do not get survival advantage. This is called **genetic drift** and it leads to variation.

### Situation III (Group of red beetles and Bushes)



Group of red beetles → Habitat of beetles (bushes) suffer from plant disease → Average weight of beetles decreases due to poor nourishment → Number of beetles kept on reducing → Later plant disease gets eliminated → Number and average weight of beetles increases again

#### Conclusion

No genetic change has occurred in the population of beetle. The population gets affected for a short duration only due to environmental changes.

#### Acquired and Inherited Traits

Acquired Traits	Inherited Traits
These are the traits which are developed in an individual due to special conditions.	These are the traits which are passed from one generation to the next.
They cannot be transferred to the progeny.	They get transferred to the progeny.
They cannot direct evolution. Example: Low weight of starving beetles.	They are helpful in evolution. Example: Colour of eyes and hair.

**Speciation:** The formation of new and distinct [species](#) in the course of [evolution](#).

#### Speciation takes place by the following ways:

**Gene flow:** It means the exchange of genetic material by interbreeding between populations of the same species or between individuals within a population. It increases the variation in the genetic composition of a population.

**Genetic drift:** It is random change in the frequency of alleles in a population over successive generation due to errors in the gametes. The process is rapid in smaller population. Genetic drift can lead to accumulation of changes in the generations.

**Natural selection:** According to Darwin, natural selection also plays an important role in bringing about evolution of new species of plants and animals. According to him variations existed between the individuals of a population and some natural phenomena eliminated those individuals which were less adapted. The surviving population would pass the hereditary advantageous features to their offsprings. With time this process would give rise to organisms different from the original population and new species are formed.

**Isolation:** When a population of a species splits into two, it cannot reproduce with each other and forms a new species, for example; when a population of beetles feed on bushes on

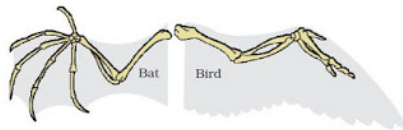
a mountain range, some may start feeding on nearby bushes finding entry into a new subpopulation. They reproduce with them so genes enter in a new population. Ultimately the two groups will be incapable of reproducing with each other and new species will be formed.

### Evidences of Evolution

#### (i) Homologous Organs (Morphological and anatomical evidences).

→ These are the organs that have same basic structural plan and origin but different functions.

→ Homologous organs provides evidence for evolution by telling us that they are derived from the same ancestor.



#### **Example:**

Forelimb of horse (Running)

Wings of bat (Flying)

Paw of a cat (Walk/scratch/attack)

Same basic structural plan, but different functions perform.

#### (ii) Analogous Organs: These are the organs that have different origin and structural plan but same function.

→ Analogous organs provide mechanism for evolution.

#### **Example:**

Wings of bat → Elongated fingers with skin folds

Wings of bird → Feathery covering along the arm

→ Different basic structure, but perform similar function i.e., flight.

#### (iii) Fossils: (Paleontological evidences)

→ The remains and relics of dead organisms of the past.

→ They are preserved traces of living-organisms.

→ Fossil Archaeopteryx possess features of reptiles as well as birds. This suggests that birds have evolved from reptiles.

#### **Example:**

Ammonite: Fossil-invertebrate

Trilobite: Fossil-invertebrate

Knightsia: Fossil-fish

Rajasaurus: Fossil-dinosaur skull

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## Age of the fossils

→ Deeper the fossil, older it is.

→ Detecting the ratios of difference of the same element in the fossil material Radio-carbon dating [C-(14) dating]

## Evolution by Stages

Evolution takes place in stages i.e. bit by bit generations.

### (i) Fitness Advantage

**Evolution of Eyes:** Evolution of complex organs is not sudden. It occurs due to minor changes in DNA, however takes place bit by bit over generations.

- Flat worm has rudimentary eyes. (Enough to give fitness advantage)
- Insects have compound eyes.
- Humans have binocular eyes.

### (ii) Functional Advantage

**Evolution of Feathers:** Feathers provide insulation in cold weather but later they might become useful for flight.

## Molecular Phylogeny

→ It is based on the idea that changes in DNA during reproduction are the basic events in evolution.

→ Organisms which are most distantly related will accumulate greater differences in their DNA.

## Human Evolution

**Excavating, Time dating, Fossils and Determination of DNA sequences** are the tools to study Human evolutionary relationship.

→ Although there is great diversity of human forms all over the world, yet all humans are a single species.

→ All humans come from Africa. The earliest members of the human species, Homo sapiens, can be traced there. Our genetic footprints can be traced back to our African roots.

→ The residents spread across Africa, the migrants slowly spread across the planet from Africa to West Asia, then to Central Asia, Eurasia, South Asia, East Asia. They travelled down the islands of Indonesia and the Philippines to Australia, and they crossed the Bering land bridge to the Americas.

→ They did not go in a single line.

→ Sometimes came back to mix with each other.