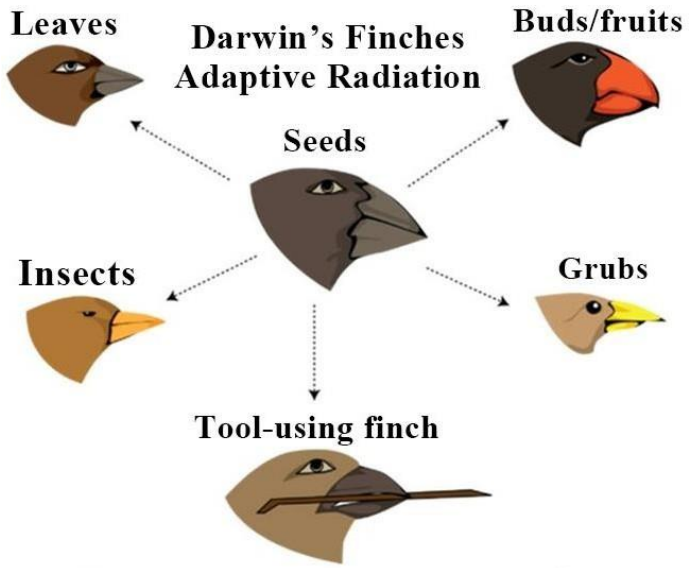
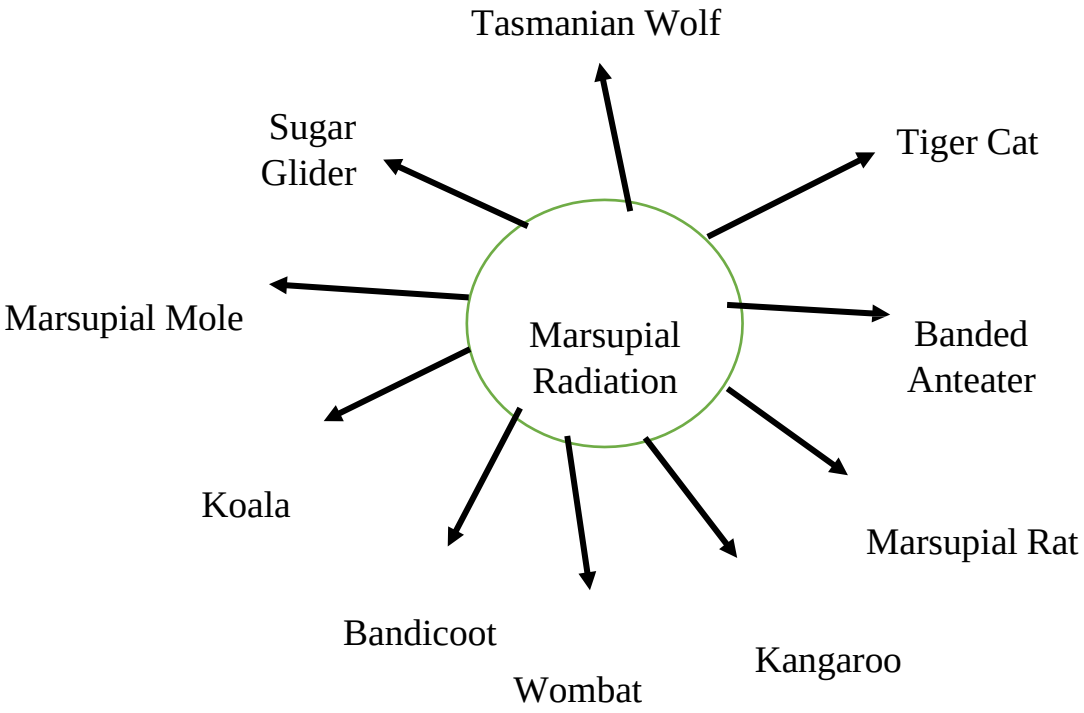


Australian Marsupials (Convergent Evolution): A number of marsupials, each different from the other evolved from an ancestral stock, but all within the Australian island continent.



Note: When more than one adaptive radiation appeared to have occurred in an isolated geographical area(representing different habitats), one can call this **convergent evolution**

Parallel Evolution - Independent development of similar characters in two animal groups of commonancestry living in similar habitats of different continents. Examples-
Marsupial evolved from placental mammals. All these resemble closely.

Placental Mammals	Australian Marsupial
Mole	Marsupial Mole
Anteater	Numbat (anteater)
Mouse	Marsupial Mouse
Lemur	Spotted Cuscus
Flying Squirrel	Flying Phalanger
Bobcat	Tasmanian Tiger Cat
Wolf	Tasmanian Wolf

III. Convergent evolution is development of similar adaptive functional structures in unrelated groups of organisms. Examples are:
(i) Wings of insect, bird and bat.
(ii) Spiny anteater and scaly anteater belong to different orders of class-Mammalia. They have acquired similar adaptations for food, e.g. leg ants, termites and insects.

(v) **Embryological evidences** -proposed by Ernst Haeckel. It shows common patterns of development.
(a) The theory of recapitulation or Biogenetic law which states that an individual organism in its development (ontogeny) tends to repeat the stages passed through by its ancestors (phylogeny), i.e. ontogeny recapitulates phylogeny.
(b) This means that the life history of an animal reflects its evolutionary history.
Eg: Frog's tadpole larva resembles fishes (ancestors of amphibia)
The presence of gill clefts in all vertebrate embryos including human provides a strong evidence in support of organic evolution.
Karl Ernst von Baer rejected this proposal. He noted that embryos never pass through the adult stages of other animals.

(vi) **Anthropogenic evidences** - Excess use of herbicides, pesticides, etc has resulted in selection of resistant varieties in a lesser time scale. This is also true for microbes against which antibiotics or drugs have been used. All these evidences tell us that 'Evolution is a stochastic process based on chance events in nature and chance mutation in the organisms'.

Darwin theory of **Natural Selection**

Before Industrialisation in England-1850

More white-winged moths on trees than dark-winged or melanised moths.
Reason: White-coloured lichen covered the trees - in that background the white winged moth survived but the dark as predators will spot a moth against a contrasting background.

After Industrialisation in England-1920

More dark-winged moths in the same area
Reason: After industrialisation, the tree trunks became dark due to industrial smoke and soots.
Hence white-winged coloured moth were picked out by predators.
Conclusion: In a mixed population, those that can better-adapt, survive and increase in population size.
Remember that no variant is completely wiped out.

Que: Why lichens are known as pollution indicators?
Ans: Lichens do not grow in polluted areas.

Theory of Biological Evolution
Microbes that divide fast have the ability to multiply and become millions within hours.

Lamarckism-Theory of Inheritance of Acquired Characters-by a French naturalist Lamarck

Acquired characters are developed by use and disuse of organs.
Use:- Long neck of Giraffes is due to continuous elongation to forage leaves on tall trees. This acquired character passed on to succeeding generations.
Disuse: Disappearance of limbs in snakes.

Nobody believes this conjecture any more-
(i) It was proved that characters are inherited only through gene.
(ii) Weismann cut off the tails of mice for many consecutive generations but could not get a tailless mice.

Darwin Theory

Branching Descent: The process of evolving a new species from a single common ancestor. As new species emerged, they became regionally adapted to their new surroundings. All the organisms are modified descendants of previous life forms. Eg: Darwin's finches

Natural Selection : Nature selects for fitness.
Colony A of bacteria grows on a given medium. A change in the medium composition results in only that part of the population (say B) that can survive under the new conditions. Hence ne population i.e. Colony B of bacteria emerges as new species that survives better under new condition.

This would happen within days. For the same thing to happen in a fish or fowl would take millions of years as life spans of these animals are in years.

Thomas Malthus works on populations influenced Darwin.
Natural Selection is based on following facts:

- **Heritable minor variation:** It is either beneficial or harmful to the organisms.
- **Overproduction:** Population size grows exponentially due to maximum reproduction. Eg: Bacterial population. Populations are stable in size except for seasonal fluctuation.
- **Limited Natural Resources**: Resources are not increased in accordance with the population size.
- **Struggle for Existence:** Competition for resources results in limited size of population.
- **Survival of the Fittest** (Fitness refer to reproductive fitness): Beneficial variation results in utilization resources better. Survive & reproduce better.
- Members of a population vary in characteristics (infact no two individuals are alike) even though they look superficially similar

Note: Darwin ignored about origin of variation and mechanism of evolution or speciation even though Mendel talked about 'factor' influencing phenotype.

Mechanism of Evolution:
Hugo de varies proposed Mutation Theory of Evolution based on his experiments on evening primrose (Oenothera lamarckiana) & believed that evolution takes place through mutation and not by minor variation. Darwinian variation is minor, slow & directional results in Gradual Evolution while Mutational variation (origin of evolution)- it is sudden random and directionless. Here, speciation is by **saltation** (single step, large mutation).