

Welcome Students to Molecular Biology and Evolution paper. Title of the unit is Concept of Evolution, Origin of Life and Speciation, the module name is Macro -Evolution and Mega -Evolution and the module number is 23.

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The Outline of this content is to define Macro- Evolution, Mega- Evolution, Know features of Macro-Evolution, Mega -evolution, Mechanism of Macro- Evolution, Mega evolution with examples.

At the end of the e-content completion, the students should be able to define the term macro-evolution, mega evolution, describe macro evolution and mega evolution, explain the mechanism of macro evolution and mega evolution, distinguish between macro evolution and mega evolution and discuss common features of macro evolution and mega evolution.

Macro- Evolution is also termed as Adaptive Radiation. Macroevolution refers to the alteration in organisms and these changes gradually give rise to completely new species which is different from their ancestors. Evolution which results in the production of new adaptive types through a process of population fragmentation and genetic divergence, it operates above the species level, it occurs on account of macro mutations, it occurs in those populations which have entered or acquired a new adaptive zone, it results into evolutionary divergence the pre-existing population divides into many diverging descendant populations by acquiring special adaptations. Among divergent stocks, macroevolution produces groups of parallel special adaptations and it leads to specialization in a particular direction, forms with special adaptations reach the adaptive peak and this often leads to over specialization and finally extinction because over specialized forms are unable to modify when they come to the new adaptive zone.

Mechanism of Macro-Evolution - Macro-Evolution occurs in a group of individuals which have entered a new adaptive zone, free of competition. In a new adaptive zone the number of individuals are less, availability of new habitats are more, intraspecific struggle is less, new zone is free from enemies, newly adapted entered population enters all available habitats, adapt themselves according to the conditions and needs, one population which have acquired the new zone gets split up into several sub-populations, each sub-population accumulates mutations, evolves independently but simultaneously in different directions, on account of different environmental conditions, natural selection operates, adaptive modifications occurs. - Examples of macro evolution- evolution of Reptiles. Mesozoic Era is the age of reptiles. They diversified to occupy all the possible available habitats, exhibited morphological or structural modifications in different habitats which led to the evolution of arboreal reptiles - the jackals and the chameleons, aerial - the flying reptiles, amphibious reptiles - the turtles and crocodiles, aquatic reptiles- the sea lizards, the sea crocodiles and fossorial reptiles the snakes and the limbless lizards. Evolution of modern horse is another example of macro evolution. Evolution of Equidae from Hyracotherium is the evolution between species. Gradual changes in the structure of teeth, limbs and the hoof from a small dog like browsing creature with padded feet to modern horse with the large size, grazing habits and hooved feet. Summary - Macroevolution is the evolutionary change happening at or above the species level, it occurs between species. The evolutionary changes are massive involving macromutations, genetic divergence and adaptive radiation producing major changes above species level.

Mega- Evolution is the origin of new types of biological organization of general adaptation from its predecessor, resulting in the formation of new classes groups of phyla. Mega evolutionary changes are rare, occurred only a few times in the evolutionary history of living beings. All these biological

organizations persist without extinction except a few. All the phyla and most classes of microorganisms, plants and animals represent their separate organizations and are produced as a result of mega evolution.

Mechanism of Mega Evolution - the ancestral stock attempt to enter a new zone which is uninhibited by these forms. Mega evolution includes experimentation and exploration of the new zones. mega evolution operates on individuals which have developed some general adaptations for the new zone, the pre-adapted individuals then crosses the ecological barrier and enters into a new zone which is always accessible and devoid of competition thereby develops more specialized adaptations termed post adaptations. Examples are origin of plants, animals and microorganisms; all these divisions are unique evolution of amphibians from fishes evolution of reptiles from amphibians evolution of birds and mammals from reptiles. Origin of Reptiles from Amphibians - Amphibians lived in aquatic habitats as well as moist places, reptiles evolved completely into terrestrial forms and need not depend on aquatic medium however some of them have reverted back to aquatic medium by secondary adaptations. The terrestrial zone is unoccupied devoid of competition and accessible, the pre-adaptations with the help of which some of the ancestral amphibians which entered into the terrestrial zone are as follows the development of exoskeleton in the form of scutes, plates and scales which prevented desiccation of the adults, the appearance of large cleidoic eggs which enabled the young to develop on land. Amphibians appeared first 370 million years ago amphibians probably evolved from lobe-finned fish that came to the land from water. Lobe finned fish gave rise to early amphibian and this gave rise to prehistoric amphibians(Ichthyostega), the prehistoric amphibian gave rise to frogs and salamanders.

Summary - mega evolution is the forming of new classes or division; fish to amphibians, amphibians to reptiles. It is the large scale evolutionary change happening at the level of class and phyla or division. It is a rare phenomenon which have occurred only a few times in the entire evolutionary history of life the actual process leading to mega evolution is not known as the phenomena is extremely rare.

Common features of macroevolution and mega evolution- developing new general adaptations for entering into new adaptive zones are termed as pre-adaptations. Invasion of the new zones or sub-zones within the new adaptive zone by the development of special adaptations are termed as post adaptations. Loss of evolutionary flexibility and generalization into greater and greater specialization for the ecological conditions of subzones. Reinvention of the zones and subzones which become partially unoccupied on account of the specialization of the original occupants .