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## Competitive Exams: Evolution Time Scale: Pterosaurs

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### The Pterosaurs

But the birds were meantime developing from a quite different stock, and would replace the Pterosaurs at the first change in the environment. There is ground for thinking that these flying reptiles were warm-blooded like the birds. Their hollow bones seem to point to the effective breathing of a warm-blooded animal, and the great vitality they would need in flying points toward the same conclusion. Their brain, too, approached that of the bird, and was much superior to that of the other reptiles. But they had no warm coats to retain their heat, no clavicle to give strength to the wing machinery, and, especially in the later period, they became very weak in the hind limbs (and therefore weak or slow in starting their flight). The coming selection will therefore dismiss them from the scene, with the Deinosaurus and Ammonites, and retain the better organised bird as the lord of the air.

There remain one or two groups of the Mesozoic reptiles which are still represented in nature. The turtle-group (Chelonia) makes its appearance in the Triassic and thrives in the Jurassic. Its members are extinct and primitive forms of the thick-shelled reptiles, but true turtles, both of marine and fresh water, abound before the close of the Mesozoic. The sea-turtles attain an enormous size. Archelon, one of the primitive types, measured about twelve feet across the shell. Another was thirteen feet long and fifteen feet from one outstretched flipper to the other. In the Chalk period they form more than a third of the reptile remains in some regions. They are extremely interesting in that they show, to some extent, the evolution of their characteristic shell. In some of the larger specimens the ribs have not yet entirely coalesced.

The Crocodilians also appear in the later Triassic, abound in the Jurassic, and give way before the later types, the true Crocodiles, in the Cretaceous. They were marine animals with naked skin, a head and neck something like that of the Ichthyosaur, and paddles like those of the Plesiosaur. Their back limbs, however, were not much changed after their adaptation to life in the sea, and it is concluded that they visited the land to lay their eggs. The Teleosaur was a formidable narrow-spouted reptile, somewhat resembling the crocodiles of the Ganges in the external form of the jaws. The modern crocodiles, which replaced this ancient race of sea-crocodiles, have a great advantage over them in the fact that their nostrils open into the mouth in its lower depths. They can therefore close their teeth on their prey under water and breathe through the nose.

Snakes are not found until the close of the Mesozoic, and do not figure in its characteristic reptile population. We will consider them later. But there was a large group of reptiles in the later Mesozoic seas which more or less correspond to the legendary idea of a sea-serpent. These Dolichosaurs ( "long reptiles" ) appear at the beginning of the Chalk period, and develop into a group, the Mososaurians, which must have added considerably to the terrors of the shore-waters. Their slender scale-covered bodies were commonly twenty to thirty feet in length. The supreme representative of the order, the Mososaur, of which about forty species are known, was sometimes seventy-five feet long. It had two pairs of paddles--so that the name of sea-serpent is very imperfectly applicable--and four rows of formidable teeth on the roof of its mouth. Like the Dinosaurs and Pterosaurs, the order was doomed to be entirely extinguished after a brief supremacy in its environment.

From this short and summary catalogue the reader will be able to form some conception of the living inhabitants of the Mesozoic world. It is assuredly the Age of Reptiles. Worms, snails, and spiders were, we may assume, abundant enough, and a great variety of insects flitted from tree to tree or sheltered in the fern brakes. But the characteristic life, in water and on land, was the vast and diversified family of the reptiles.

In the western and the eastern continent, and along the narrowing bridge that still united them, in the northern hemisphere and the southern, and along every ridge of land that connected them, these sluggish but formidable monsters filled the stage. Every conceivable device in the way of arms and armour, brute strength and means of escape, seemed to be adopted in their development, as if they were the final and indestructible outcome of the life-principle. And within a single geological period the overwhelming majority of them, especially the larger and more formidable of them, were ruthlessly slain, leaving not a single descendant on the earth. Let us see what types of animals were thus preferred to them in the next great application of selective processes.

## **The Bird and the Mammal**

These two types of organisms were the bird and the mammal. Both existed in the Jurassic, and the mammals at least had many representatives in the Triassic. In other words, they existed, with all their higher organisation, during several million years without attaining power. The mammals remained, during at least 3,000, 000 years, a small and obscure caste, immensely overshadowed by the small-brained reptiles. The birds, while making more progress, apparently, than the mammals, were far outnumbered by the flying reptiles until the last part of the Mesozoic. Then there was another momentous turn of the wheel of fate, and they emerged from their obscurity to assume the lordship of the globe.

In earlier years, when some serious hesitation was felt by many to accept the new doctrine of evolution, a grave difficulty was found in the circumstance that new types--not merely new species and new genera, but new orders and even sub-classes--appeared

in the geological record quite suddenly. Was it not a singular coincidence that in ALL cases the intermediate organisms between one type and another should have wholly escaped preservation? The difficulty was generally due to an imperfect acquaintance with the conditions of the problem. The fossil population of a period is only that fraction of its living population which happened to be buried in a certain kind of deposit under water of a certain depth. We shall read later of insects being preserved in resin (amber) , and we have animals (and even bacteria) preserved in trees from the Coal-forests. Generally speaking, however, the earth has buried only a very minute fraction of its land-population. Moreover, only a fraction of the earth's cemeteries have yet been opened. When we further reflect that the new type of organism, when it first appears, is a small and local group, we see what the chances are of our finding specimens of it in a few scattered pages of a very fragmentary record of the earth's life. We shall see that we have discovered only about ten skeletons or fragments of skeletons of the men who lived on the earth before the Neolithic period; a stretch of some hundreds of thousands of years, recorded in the upper strata of the earth.

Whatever serious difficulty there ever was in this scantiness of intermediate types is amply met by the fact that every fresh decade of search in the geological tombs brings some to light. We have seen many instances of this--the seed-bearing ferns and flower-bearing cycads, for example, found in the last decade--and will see others. But one of the most remarkable cases of the kind now claims our attention. The bird was probably evolved in the late Triassic or early Jurassic. It appears in abundance, divided into several genera, in the Chalk period. Luckily, two bird-skeletons have been found in the intermediate period, the Jurassic, and they are of the intermediate type, between the reptile and the bird, which the theory of evolution would suggest. But for the fortunate accident of these two birds being embedded in an ancient Bavarian mud-layer, which happened to be opened, for commercial purposes, in the second half of the nineteenth century, critics of evolution--if there still were any in the world of science--might be repeating to-day that the transition from the reptile to the bird was unthinkable in theory and unproven in fact.

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