ORIGIN AND EVOLUTION OF BIRDS

B.Sc. Part II

Paper III

INTRODUCTION:- In searching the origin of the birds a naturalist's journey to this voyage is halted with the arrival of the reptilian age. The study of those days reptiles reveals that they were the dominant form of animals existing in the vast arena of this living universe, but today these are doomed to their rapid inferiority in comparison to the highly evolved birds. Hence their inglorious present is quite a contrast to their glorious past. T. H. HUXLEY while studing the birds on the basis of too much similarities with the reptiles called the birds are the glorified reptiles, and placed both of these under a single sub-class sauropsida. Woodrich was also of opinian that the birds are originated from the reptilian base- Sauropsida.

Origin & evolution of birds:-

In tracing the origin and evolution of birds as well as in the favour of Huxley's statement two points can be highly discussed i.e-

[A] The evidences that the birds are originated from the reptiles.

[B] Group of the reptiles ancestral to the birds.

[A] The evidences that the birds are originated from the reptiles:-

To fulfill the demand of this point, the evidences from the comparative anatomy embryology and palaeontology can be discussed.

(a) Evidences from the Comparative anatomy:-

(1) The feathers of the birds are the modified

reptilian scales. The tarsometatarsus of birds is also provided the scales.

(iii) The scleroplates of the eyes of birds can be comparable to those of the Crocodiles and Sphenodon

(iii) pecten is present in eye of both.

(iv) The ribs are provided the uncinate process in birds & Sphenodon.

(v) The limbs are clawed and the 1st claw is rotated towards the tarsometatarsus in birds and Archaeopteryx.

(vi) The air sacs of birds can be comparable to those of chameleon.

(vii) The heart is four chambered in birds & in Crocodiles.

(viii) Scott reported that the serological examination of the blood in both shows close approximities.

(ix) Single facet for occipital Condyle.

(x) 12 pairs of Cranial nerves in both.

(xi) The cloaca is divided into the proctodaeum urodaeum and Coprodaeum in both.

(xii) Bean like structure is also reported in Certain reptiles.

(xiii) The number of vertebrae is variable in both.

(xiv) The trachea is composed of the tracheal rings.

(xv) The kidney is metanephric in both.

(xvi) Both are oviparous (except (Sea snake and vipers)

(xvii) Lower Jaw is composed of 4-6 bones in both.

(xviii) Urinary bladder is absent in birds and snakes.

(B) Evidences from the embryology:-

The embryology of birds maintains the Haeckel's law of biogenesis i.e "the ontogeny repeats phylogeny". The developmental history of birds and the reptiles shows close affinities:-

(i) As it is earlier mentioned that the birds and the reptiles (except sea snakes & vipers) are oviparous.
(ii) The eggs are telolecithal and the cleavage is meroblastic.
(iii) The blastoderm is present containing an area pellucida towards the centre and an area opaca towards periphery.
(iv) On the surface of the area pellucida is found an embryonic shield.
(v) Behind the embryonic shield is situated a primitive streak.
(vi) Amnion, chorion and allantois are present.

[C] EVIDENCES FROM THE PALAEONTOLOGY:-

The evidences from the comparative anatomy and embryology are the supplement to the more valuable palaeontological evidences. The fossil records of the birds is incomplete and fragmentary; only two fossils of the birds are recorded from the Jurassic period of Bavaria. These are the Archaeopteryx pithographica, found by Andreas Wagner (1861) and is kept in the British Museum (London) where as the second is the Archaeornis which found in 1877 and is kept in the Berlin's museum.

Recently in 1986 a third fossil is discovered by Mr. Shamkar Chatterjee (a palaeontologist in the texas university chicago). This fossil is named as the protoavis and is supposed to be occured in the living form in the triassic period 225 millions years ago about 75 million years ago than (Archaeopteryx (The times of India) Dated oct 8 1986.

All these fossils posses the reptilian as well as the avian character both-

REPTILIAN CHARACTERS:-

(i) The body is lizard in Archaeopteryx and Archaeornis with a tail consists of 23 caudal vestebrae and deroid of the pygostyle.
(ii) The bones are nonpneumatized.
(iii) The sclerotic plates is comparable to that of the sphenodon.
(iv) Jaws homodont deutition.
(v) The ribs are deroid of the uncinate processes.
(vi) Elongated ileum and baekwardly directed pubes.
(vii) Presence of abdominal ribs.

AVIAN FEATURE:-

(i) The shape of the protoaix is like a crow.
(ii) The body is completely covered by the feathers.
(iii) The forelimbs modified into wings.
(iv) presence of a Y-shaped chevron bone.
(v) large brain case by large orbits.
(vi) Pubes is baekwardly directed.

Thus the above given three fold evidences suggest about the reptilian origin of the birds, but what are the steps and in what circumstances. These birds are originated from the reptiles is still in the lap of Confusion.

[B] **The group of reptiles ancestral to birds:-**

Now we come to the second aspect for solving the riddle of this phenomenon, that there were certain reptiles which are ancestral to birds. Two theories are put forward regarding this views. These are—

[a] **Flying birds are evolved from the flying reptiles pterosaurs:-** pterosaur was probably a flying reptile. the remains of which indicate that it was found in the Mesozoic era, about 40 million years ago. It shows the following avian features:-

(i) The skull is present at right angle to the body.
(ii) The bones are pneumatic.
(iii) Presence of the conical teeth in the early stages of development.
(iv) The brain is much alike the birds.

In spite of these avian resemblances the body of the pterosaurs was devoid of the feathers and 2nd finger was enormously elongated so that it is discarded from the main ancestral line of the birds.

[b] Birds are evolved from the bipedal Dinosaurs:-

Certain bipedal Dinosaurs were supposed to be the connecting link between the birds and reptiles due to their diverging characteres.

(i) Bones are pneumatic.
(ii) The toes are four clawed, the 5th is absent and the first is rotated towards the tarsometatarsus.
(iii) The body is quadrupedate in both.
(iv) The sacrum is composed of the 8 sacral vertebrae in both.

Raymond (1938) suggested that these bipedal Dinosaurs show similarities with the birds only due to the bipedality, cursoreality and semierect posture.

Heilmann stated that the pseudosuchians of Triassic period were supposed to be the ancestors of these bipedal Dinosaurs are the ancestral to birds. This view was based on the skull of Archaeornis which was badly crushed and liable to deceive.

Later on, Heilmann constructed a hypothetical connecting link between the birds and the reptiles i.e 'proavis' which was neither a bird nor a reptiles and stated that the birds are evolved fr

He further added that the long stretched arms of these biped Dinosaurs are modified into the wings due to the demand of the arboreal mode of life.

But recently after the discovering of protoavis by Mr Shamkar Chatterjee (1986) all the previous views are fallen into the lap of Confusion. This protoavis possesses the following features.

① The body is Crow sized.
② pneumatic bones and furcula.
③ sternum & keel.
④ Brain has avian features.

On the basis of the fore said accounts, it can be concluded that the protoavis was ancestral to birds which occured in the living form in the Triassic period, 225 million years ago, about 75 million years ago than the first found fossil ie Archaeopteryx. This protoavis was supposed to be of the reptilian stock and hence it can be told in favour of Huxley's view that the birds are originated from the reptiles or the birds are the glorified reptiles.

Evolution of Birds in the different geographical eras:-

[A] Triassic Birds:- (225 million years ago)

[a] Suppared triassic birds:- The occurances of the suppared triassic bird was as assumptions. Hitchcock (1836) found the foot prints of these birds on the banks of the Connecticut river in madagascar. later on the remains of this bird were reported by simpson (1857) from the red sand stone of Gondwana.

[b] Laopteryx:- The earliest oldest bird was considered as the Laopteryx, which was first of all studied by Marsh (1881) & Simpson (1926). Later on, this bird was named as the Laopteryx prisca.

[c] Protoavis:- The remains of this bird are found by Mr. Shankar Chatterjee (1986). It is supposed to be occured in triassic period 225 Million year ago about 75 Million years old than Archaeopteryx.

[B] Cretaceous Birds:- (135 million years ago)

The cretaceous era was responsible for the origin of the flightless birds & Ratites, which after certain radiations gave rise to the flying birds.

[a] Early Cretaceous birds:- The early cretaceous bird was Gallornis which was reported in the Aurere Dept of yonne (France). The detailed account of this bird is lacking.

Enaliornis was also reported from the upper green sands of the lower cretaceous period.

[b] Late Cretaceous birds:- Only two birds are reported from the late cretaceous period viz Ichthyornis & Hesperornis.

[b1] Ichthyornis:- It was the large sized bird the body of which was covered by the feathers but could not fly due to its large body wt. formerly it was believed that it possessed the pointed teeth, but Gregory reported the presence of toothed beak.

[b2] Hesperornis:- At the time of the occurrence of Ichthyornis, Hesperornis was also reported from the south America.