REFLECTIONS ON CHELONIAN EVOLUTION

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The age of reptiles had been a dynamic era during which evolution proceeded in many diverse directions and produced manifold types of them, of which only a few succeeded in surviving upto the present day. The present study is an attempt to assess the specific features of chelonian evolution, both morphological and physiological.

Morphological aspects:

Structurally the chelonian is an animal in which the trunk has been abbreviated and broadened in relation to the generalised condition met with in the lizards, crocodiles and Sphenodon. The opposite evolutionary tendency had resulted in the elongated and narrow trunk in the Ophidian.

The occurrence of only a few vertebrae - less than ten - in the chelonian trunk in comparision with other reptilian orders shows that that region had undergone a remarkable shortening. This shortening could have taken place only by a secondary fusion of the segments ultimately resulting in the production of eight or nine segments. A very large number of trunk vertebrae in the snakes on

the other hand shows that a great elongation of that region had taken place on them, which means a secondary duplication of segments. The transverse straight direction of the ribs in the chelonian and their inability to reach the sternal elements on the ventral side shows that during the course of evolution they had been released from the sternum and straightened up. On the contrary the numerous curved ribs in the snakes which terminate on the ventral scutes show that they had also been released from the sternum during evolutionary progress and their insertion had been shifted to the scutes of the body wall. In the latter process the sternum had been entirely lost in the snakes.

The lateral expansion of the lung in the chelonian and the posterior elongation of it in the snake are evidences in support of the above supposed changes. The disposition of the chelonian and the ophidian muscular system such as the muscular covering around the lung in Lissemys and Geomyda which must have given the early chelonians their survival value and the formation of the retrachens capitis collique, the longest muscle in the Chelonia, and also the attachment of the transverse abdominis and subcostal muscles in the snakes amply support this thesis.

Another morphological evidence in support of the abbreviation of the trunk in the Chelonia is the presence of large sinuses formed to accomodate the blood accumulated due to the shortening of arteries and veins consequent on the restriction of the trunk region.

Physiological aspects:

In the evolution of the Chelonia, as far as the skeletal system is concerned, the development of the exoskeleton is the most characteristic feature. During the process of evolution the emergence of the endo-skeleton as the store-house of calcium from where this material is transported to the exterior for building up the rigid armour, has been a significant phase in the evolution of these animals. From the present study there is no evidence of a similar transport of the organic part of bone from the endoskeleton to the exoskeleton.

In the water content of the muscle the chelonians Lissemys and Trionyx and the the amphibian frog (George, 1952) and the fish Batrachus (George, 1952) show similar percentages. This shows that in the water balance of the muscular tissue there is a reversion to the aquatic condition. In the tortoise, Testudo, however, the percentage of the water is at the same level as in the

terrestrial reptiles such as Calotes and Naja. Correspondingly the total solids are either decreased or increased as the case may be. The protein percentages take the same trend as the total solids.

The amphibious chelonians like Lissemys can remain out of water for some months and during this time the only tissue that undergoes a considerable reduction in the water content is the skin whereas in all the other tissues water is conserved. This is made possible by the break down of the large amount of fat which renders the metabolic water available to the various tissues. The acquisition of large fat bodies in the Chelonia in general, considerably more in the amphibious forms, became necessary.

The muscle sheath on the lung present in the primitive chelonians like Lissemys which gave the early chelonians their survival value, was lost in the advanced forms like Testudo, Trionyx and Eretmochelys. This loss had to be compensated by certain adjustments in the blood system. The acquisition of a higher oxyphoric capacity denoted by the iron and haemoglobin contents of the blood of the advance chelonians has been a major physiological feature in the evolution of these animals.