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Biomechanics-corresponding Morphology of the Viscerocranium Evidence-Based Phylogenetics: Divergence between Reptiles and Mammals

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Artificial bone marrow chambers with hemopoiesis made of sintered hydroxyapatite and artificial dental roots with cementum, periodontal ligament as well as the alveolar bone proper made of bioceramics is developed by means of biomechanical stimuli by the authors. Through these researches the authors evidenced that the bone marrow hemopoiesis as well as the gomphotic tooth of mammals evolved by biomechanical stimuli in phylogenetics. Based on these studies, the authors have proposed Biomechanics - Corresponding Evolutionary Law. Not only the viscerocranium but also all parts of the structure of vertebrates correspond to biomechanical stimuli which influence the organisms internally or externally. The system of metamorphosis of skeletons in vertebrates is according precisely to the Wolff's Law. Therefore, through comparative morphology we can know past environmental biomechanical changes by the metamorphosis in phylogenetics. From the standpoint of the Biomechanics-Corresponding Evolutionary Law, the origin of mammals and reptiles in chondrichthyes can be found by means of not only comparative morphological methods, but also experimental evolutionary studies.

Key Words: Biomechanics, EBP, Reptile, Mammal, Chondrichthyes, Evolution, Wolff Law

INTRODUCTION:

Through development of artificial bone marrow chambers as well as artificial dental roots the authors can evidence that the morphological changes in evolution has been caused by biomechanical stimuli just like use and disused theory of Lamarck within the same genetic characteristics. Therefore, the authors developed experimental evolutionary research methods applying biomechanical stimuli to archetype vertebrates chondrichthyes to induce anatomical changes in organisms. In this paper anatomical differences between reptiles and mammals are compared by comparative morphological methods and the origin of mammals and reptiles in chondrichthyes are evidenced morphologically as well as by experimental evolutionary study methods. The following five points are mainly found as the difference between mammals and reptiles in their structures.

1. Heterodontia concomitant with simplification in mandibular structure
2. Formation of the tongue as well as the masticatory system and prehension system
3. The auditory sono-conductive ossicle system derived from visceral skeleton of the gills
4. Formation of the diaphragm
5. Formation of the heart and lung

In this paper, (1), (2), and (4) are studied and reported.

MATERIALS AND METHODS:

1.

(1) Experimental Evolutionary Study
Two Triakis and two Heterodantus are artificially terrestrialized by landing 40minutes a day for 9 days. After that they are dissected and compared.

(2) 15 Mexican Salamanders (aholotol) are artificially terrestrialized by reducing water levels continuously for 2 months. Three out of 15 salamanders are anatomically dissected one month after terrestrization. Each 3 of the 12 salamanders are recovered for morphological observation 2months, 3 months 4 months and 5 months after landing and histological specimens are prepared.

2. Chondrichthyes Triakis (Dochi shark) and Heterodantus japonicus (Dog shark) are morphologically compared through anatomical dissection.

RESULT:

1.

(1) At the caudal side of Pericardial sac of two artificially terrestrialized Heterodantus japonicus, two air sacs resembling air bladder are observed between inside and outside of the serous pericardial membrane, of which the one on the right side is larger than the one on the left. (Fig.1). On the contrary, control Heterodantus japonicus without landing has no air sac between either inside or outside of pericardial sac (Fig. 2 arrow). Triakis after landing has intact pericardial sac, but marked formation of air sacs are observed between fin muscles and pericardial sac of the heart.

(2) Morphology of viscerocranium of Heterodantus quite resembles that of mammals in the teeth and the nose. The caput of human embryo 32 days after fertilization is almost the same as adult dog shark just like the recapitulation theory of Haeckel (Fig.3). On the contrary, the gill system of Triakis is quite similar to reptiles, which fuses to close fenestration of waterway of the branchial system to form the tongue in landing

(Fig.4). These morphological changes occurred through billion years can be observed by neoteny-type aholotols through 5 months, which are artificially landed by reducing water. Drastic changes of the gill system can be seen to form the tongue (Figs. 5, 6). The formation of the lungs from branchial glands is quite different between reptiles and mammals.

2. Heterodantus have not only 3 kinds of tooth type, but the masticatory system. The nose shape quite resembles that of mammalians (Fig. 3).

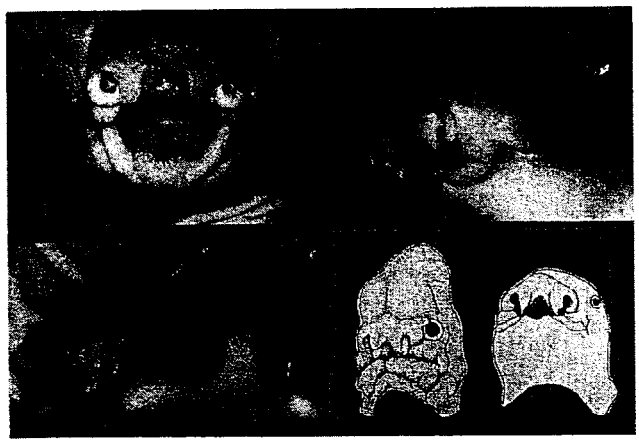

Fig. 3 Feature of dog shark and human embryo

Fig. 1 Air bladder formation in pericardial membrane of terrestrialized dog shark

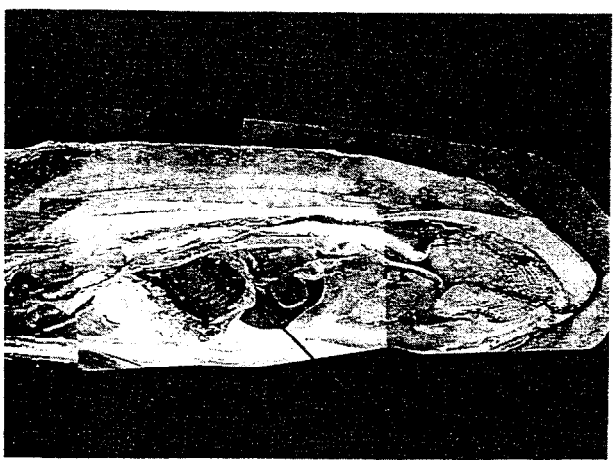

Fig. 2 Pericardial membrane without air bladder (arrow)

Fig. 4 The gill system of Triakis resembles that of amphibians, which fuses to form the tongue

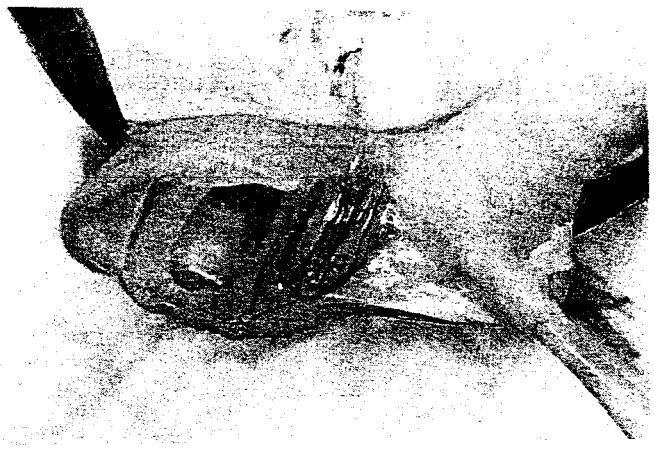

Fig. 5-A Tongue formation of aholotol during landing

Fig.6 Gill of aholotol fusing in landing

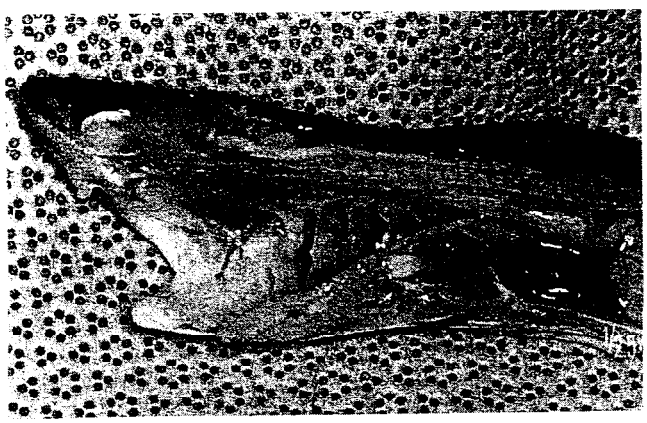

Fig. 5-B Tongue and gill in Triakis

DISCUSSION:

Conventional phylogenetics tells us that the reptiles evolve into the mammals. However, the vertebrates evolve by biomechanical stimuli which influence the organisms throughout phylogenic time span. Evolving modality by biomechanics is in accordance with the Wolff's Law. Therefore, reptile lungs, which have no muscles around, never induce diaphragm. In this research through comparative studies on ontogeny of mammals (rats) and amphibian (salamanders), the development of the lung system between them is observed completely different. From developmental studies on mammalian embryo, it is known that the lung buds extend into pericardial sac of the archetype vertebrates. On the contrary, those of reptiles extend across the esophagus dorsally to the iliac bone. The differences of the lung development between reptiles and mammals are known by comparative anatomy of landed aholotols with developing embryo of rats. From these research it is known that, divergence between reptiles and mammals had started in the stage of terrestrialization. By newly developed experimental research methods, the authors can evidence Heterodantus to be archetype of the mammals.

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