

# Vorträge

## der Naturforschenden Gesellschaft in Zürich

23. Februar 1953: Prof. D. M. S. Watson, London:

The Transition from Fish to Amphibia  
(mit Lichtbildern)

With only few exceptions all living amphibia, frogs and salamanders alike, hatch from eggs which are laid in water, and then for a time live in the water, feeding there and breathing by gills, which in them are delicate feathery organs—usually three pairs—projecting behind the head. Then suddenly under the influence of the thyroid gland they rapidly change their structure, absorbing their gills and changing their body shape so that they are fitted for life on land. Then they come out of water and spend their adult life in air.

After the acceptance of an evolutionary view of the origin of animal species this life history of amphibia was always regarded as a repetition in a modified form of the transition from fish to a full land life. Even before this time H. von Meyer had shown that an ancient Lower Permian amphibian, «*Archegosaurus*», had a similar life history, though the presence of gills was an inference.

Some thirty years ago my students, Bulman and Whittard, first found actual external gills in a Permian amphibian. But these discoveries left unsolved the real problem, from what fish, under what circumstances, and how did the event take place.

The solution of the problem is not yet complete, but new and more searching studies of the Devonian "Old Red Sandstone" fish have given us a place of departure, and the discovery and description of more ancient amphibia have reduced the gap, especially when Dr. Säve-Söderbergh found many splendid skulls in the Upper Old Red Sandstone of Greenland. Unfortunately he was ill for many years and died young before he gave us more than a preliminary account of his remarkable finds.

The present position of the story is this: There lived in Old Red Sandstone times a group of fish, the *Osteolepids*, of which one member has twice been found living in the

sea off the East African coast, the famous *Latimeria*. These fish are found in rocks which were laid down in an arid land where rain only fell at certain seasons, and the streams probably dried up between the rare rains.

We know that such streams today are usually so polluted by dead plants and animals that their water contains no oxygen, and all the fish which live in them have special devices to allow them to breathe air.

We know from the evidence of fossils that the *Osteolepids* had nostrils of a kind proper to an air breather, and that they had an air bladder which is, as morphologists say, homologous with a lung, and therefore capable of becoming that organ. Thus these fish, whilst they still lived all their life in water, were already able to breathe air when conditions made it necessary to do so.

Most of them did not leave the water because, before they could do so, it was necessary for them to lose their scales and to remake their skin so that it could stand exposure to air; they had to readapt their eyes and nose for use in air instead of water. And they had to so alter their back-bone and convert their fins into legs that they could support their weight in air and walk on dry earth.

The skull is remarkable because there is a hinge across its roof which makes the whole head flexible, but the arrangement of the bones over the outside of the head is obviously related to that found in fossil amphibia. And Dr. Westoll found in Canada a fossil skull roof which is exactly intermediate between the two groups.

The skulls of the fish and amphibian differ in proportion, and these differences exist because when gills were lost the nerves which ran to them were lost as well, and the whole hinder part of the brain in amphibia is greatly lessened as a result, so that the hin-

der part of the brain case and the bones which covered it became relatively shorter.

The changes in the fins to convert them into walking limbs are comparatively small but only last year did Dr. Jarvik, of Stockholm, describe magnificent specimens from Greenland which show us a true land-living amphibian with five toed feet, and real arms and legs, which retains a true fish tail. It is

in many ways a perfect "missing link", which is no longer missing.

But we do not know how this strange animal is related to the earliest ancestors of the other known early fossil amphibia and reptiles.

Like many other discoveries it solves one problem, and raises many new ones.

(Autoreferat)

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