A Double-Headed Larva of Hynobius naevius (Schlegel). 1)

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Two Text Figures and One Plate (1).

In his recent paper Politzer 2) (1926) enumerates the cases of urodelan double monsters hitherto known, besides his own. Similar cases have been found in two species of Japanese urodeles, and described by me in two separate papers. 3) Last year (1928) I got once more a double-headed larva, of another Japanese species. This is the fourth case of a double-headed urodelan found in Japan, and may be worth recording here, as occurrence of such double monsters in nature among Amphibia is very rare.

The urodele among whose embryos the monster was found this time belongs to Hynobius naevius (Schlegel), a salamander peculiar to the southern part of Japan proper. It lives near mountain streams and spawns in late March. Some fourteen or fifteen eggs are usually contained in an egg sac, and a pair of such egg sacs are laid by a female at one time. The eggs are yellowish white in color, measuring about 5 mm in diameter. Wrapped within their own jelly envelope, they are lined up in a row in the egg sac.

The monstrous larva was found in an egg sac which had been

1) Contributions from the zoological laboratory, Kyūshū Imperial University No. 21. Read before the fifth annual meeting of the Zoological Society of Japan held in Tōkyō on April 5, 1929.
2) Roux' Arch. 108. Bd.
collected and brought to the laboratory from Mt. Wakasugi, near Fukuoka, on March 20. I happened to find on April 2 a duplicate structure on an embryo, which was just at the stage of the fusion of the neural folds. At that time the anterior half of the embryo was bifurcated symmetrically, making an angle of about 45° between the two axes of the bifurcated parts. In the subsequent development, each of the bifurcated parts became a distinct head. But while the left head grew quite normally, the growth in the right one was delayed and deformation occurred. This retardation of growth and the deformation of the right head continued so far that at last the right head became a small deformed parasite attached nearly at right angles to the right side of the neck of the left head. Thus the left head became the main one, taking up the normal position. Owing to the presence of the right head on its right side, however, this main (left) head had to bend a little to the left and slightly upward, while, on the other hand, the right head itself came to point a little downward. Both the heads had their own external gills, but had the fore limbs only on their outer sides, on the left side of the left head and on the right side of the right head. On the inner sides, that is, on the right side of the left head and on the left side of the right head, fore limbs were lacking. The left fore limb was larger than the right one. The abdomen was common to the two heads from the first, but its anterior portion became broader and more distended than that of the normal control animals. This tendency of distension of the abdomen became remarkable after hatching, and accordingly the external gills and the fore limb of the left side had to shift a little downward. All the other hind parts of the body remained normal.

By April 30, all the embryos in the egg sacs, except this monster,
hatched out. Despite frequent trials to get out from the egg envelope the monster could not succeed, so that on May 2 I made it hatch out. At that time it measured only 25 mm in total length while the other larvae were 27-30 mm long. The hind limbs were then about 1 mm long both in the monster and the normal larvae. The monster gradually became so weak after hatching that I, since its natural death would soon occur, killed it on May 8 in Bouin's fluid, together with some control larvae. The monster was in some degree behind the normal animals in its general development.

The specimen was then sectioned horizontally and stained with hematoxylin-eosin for a study of the internal structures. The left head is quite normal in structure but in its neck region the notochord bends slightly toward the left, and there is a cartilaginous rudiment of the right fore limb on the right side. There is no trace of a fore limb on the left side of the right head, and the right fore limb projecting behind the right head, is the right one belonging to the right head. The structure of the right head is very curious. It utterly lacks nostrils, eyes and notochord, and the mouth is not opened through. The narrow pharynx is present and it is provided with gill slits. The hyobranchial apparatus is incomplete and shrunk. The skull consists of small fragments of cartilage and the pair of auditory capsules fused together along the inner sides of their posterior parts. The brain is also very incomplete. It is represented only by the very deformed hind brain and is utterly devoid of any anterior part. The spinal cord runs backward, but after passing the outer side of the right pronephros it disappears in the hypodermal tissue. There is no pronephros assignable to the right head. The abdomen is single as stated above and the visceral organs are common to both heads. From each head, however, the oesophagus leads into the common stomach, and two arterial trunks run out from the heart into each head. The right Cuvierian duct leaves the base of the right head and runs into the venous sinus. There are two lungs at an early stage of development, belonging to each head respectively. The internal structures of the other parts seem to be all normal.

As to the cause of the genesis of this monster nothing is known.
But, in view of the facts that the conditions of the eggs after spawning seem to have all been equal and that all the other embryos developed quite normally, the cause of the malformation does not seem to be attributed to external conditions. It is suggested, therefore, that the cause had been concealed within the egg itself.

Concluding this note I express my thanks to Prof. H. Ohshima for his kind criticism.

Explanation of Plate (I).

Figs. 3-11. Photomicrographs of some of the horizontal sections of the anterior half of the double monster picked out from the serial sections. The figures of smaller numbers are dorsal to that of larger ones. ×8.

Abbreviations.

an, auditory capsules of the right head;
b, brain of the right head;
bal, branchial arches of the left head;
bar, branchial arches of the right head;
cl, left Cuvierian duct;
cr, right Cuvierian duct;
fl, left fore limb;
fr, right fore limb;
h, heart;
hl, hyoid of the left head;
hr, hyoid of the right head;
l, liver;
ll, lung of the left head;
lr, lung of the right head;
ol, oesophagus of the left head;
or, oesophagus of the right head;
pa, pancreas;
phl, pharynx of the left head;
phr, pharynx of the right head;
pl, left pronephros;
pr, right pronephros;
r, cartilaginous rudiment of the right fore limb of the left head;
sk, skull of the right head;
sp, spinal cord of the right head;
st, stomach;
tl, arterial trunk to the left head;
tr, arterial trunk to the right head.