

**Article XXIX.**—ON THE HAIR-LIKE APPENDAGES IN THE  
FROG, *ASTYLOSTERNUS ROBUSTUS* (BLGR.).

BY BASHFORD DEAN.

The presence of hair-like appendages in a batrachian, first noted by Boulenger in 1900, is in itself so extraordinary a morphological fact, that we cannot wonder that it has already been commented upon by several observers,—especially as to the probable function of these organs. Thus Doctor Hans Gadow ('00) points out that the appendages could hardly have been sensory in function, for he found no nerve terminals in them: he noted, however, that they contain lymph spaces and insignificant blood vessels. He later states (1901) that they were studied by Mr. F. F. Laidlow, tells us that "their most remarkable feature is the presence in them of a great number of ordinary flask-shaped cutaneous glands, while such glands are scarce on the surrounding skin," and he repeats his statement that the hairs are lacking in sensory structures. Mr. Boulenger in a second paper ('02) makes it clear that the "hairs" occur only in the male, but he gives us no clue as to their significance. And very recently (Feb. 1912) Dr. Kükenthal, examining the specimens in the Museum of Comparative Zoölogy of Cambridge, Mass., states that the hairs are to be regarded as highly developed tubercles of the skin and he interpreted them "as secondary sexual organs, charged with sensory functions." He comments upon their appearance "only on those areas of the surface where, according to Merkel, in other frogs these tactile cells ('Tastflecken') form aggregations." Kükenthal gives in his paper a transverse section of one of the "hairs" in which appear blood-vessel, cutis and epidermis, and he figures also a portion of a longitudinal (radial) section in one of the cutis ridges: in this are seen chromatophore, nerve fiber, and "tactile cells." The last, we infer from his text, were noted only after impregnation of the tissue by Bielschowsky's method.

The American Museum has recently received from Doctor Thomas Barbour, in an exchange with the Museum of Comparative Zoölogy of Cambridge, one of the specimens of *Astylosternus*, which Kükenthal examined; and the study of the disposition of the "hairs" and of their structure has led to recording the present notes:

First of all, assuming that these "hairs" are developed by the male and only at spawning time, and that they attain, as Kükenthal's figure shows, great length in certain specimens, one is led to correlate this with a habit of

brooding not uncommon among amphibians generally. It is known, for example, that in various salamanders,—*Cryptobranchus*, *Amphiuma*,— in *Ichthyophis*, *Alytes*, in various Hylids and in *Rhacophorus reticulatus*, the eggs when extruded are wrapped about or attached to the body, in each species in one sex only, usually the male. In the case of the present frog, therefore, it is but necessary to compare the condition with that of such a form as *Alytes* (cf. Figs. 1 and 2) in which it is known that egg-strings are attached to the sides of the body and the thighs, to obtain more than a suggestion as to the function of these hair-like processes, *i. e.*, that they were

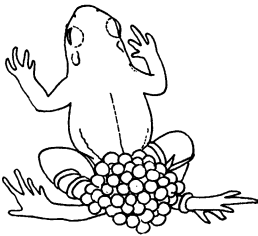


Fig. 1.

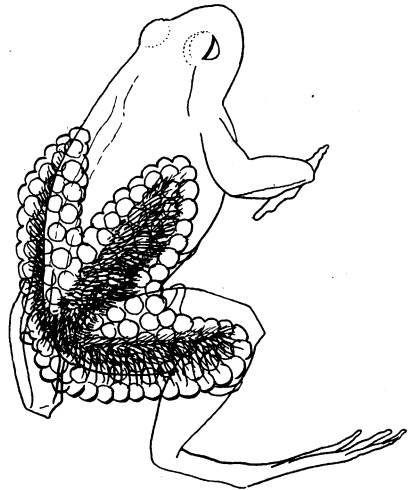


Fig. 2.

used for retaining the egg-strings in such position that they could be readily transported, guarded, and probably oxygenation as well. It will be recalled in this connection that the lungfish, *Lepidosiren paradoxa*, which has also the brooding habit, develops on its ventral appendages hair-like processes which are suffused with capillaries, and admirably adapted to bring oxygenated blood in close contact with the mass of eggs. In this instance we can safely conclude that the hair-like processes function as an accessory respiratory organ for the developing young.

In fact the histological notes which Kükenthal has given are not opposed to the present view. Each hair is vascular: its core of cutis is made up of spongy tissue; furthermore, from the arrangement of the surrounding epidermis in curious ridges, we suggest that the circumference of the hair could have been notably dilated; we note also that pigmentation is largely abandoned and that the number of delicate nerves with terminal cells, which

Kükenthal has described, would be no more than one would expect in a specialized structure of this kind,— for after all, the appendages are dermal and secretory and as such would be apt to be provided with nerves and sensory elements.<sup>1</sup> If, however, their function were exclusively or even largely sensory, as Kükenthal maintains, we would reasonably — by numerous analogies in the appendages of amphibia and fishes,— expect that the sensory organs should be far more conspicuous. Then too, if the former view is to be accepted, one would expect to find among amphibia sensory structures developed seasonably. But this is a condition which apparently does not occur.

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<sup>1</sup>My sections show that nerve endings are demonstrated only with difficulty — as one would expect in the case of nerve terminals in cutaneous glands.

