

ANATOMY OF A CÉLACANTH

Anatomie de *Latimeria chalumnae*

Par J. Millot et J. Anthony. Tome 1: Squelette, Muscles et Formations de soutien. Pp. i+122+80 planches. (Paris: Éditions du Centre National de la Recherche Scientifique, 1958.) 9,800 francs.

IF we have had long to wait for the detailed account of the anatomy of *Latimeria*, at least the first instalment handsomely justifies the gestation-period. It is, moreover, the part which will be of greatest interest to palaeontologists, who have so patiently and skilfully unravelled the structure of the long-extinct relatives of this anachronistic fish. There is an æsthetic pleasure in seeing how, in detail after detail, *Latimeria* takes its place in the evolutionary pattern already outlined by the study of the difficult fossil material. There are some surprises. The nature of the rostral organ and the lack of relationship between the endocranial cast and the shape of the brain have been dealt with in earlier papers, though it must be said that palaeontologists have been cautious in their claims for such casts. The pectoral girdle was not well known in any fossil and it proves to have no skeletal connexion with the head. The urohyal has both endochondral and dermal components. Some arguments have been settled; for example, a cavity which in a fossil *Stensiö* interpreted as lodging the fixed end of the eye-muscles turns out to be occupied by cartilage, as Watson surmised, and the eye-muscles excavate no myodome.

The general structure of the head had been outlined in an earlier paper, but now a series of photographs of dissections and of sagittal, parasagittal and transverse sections, each with its explanatory diagram alongside, makes every detail clear. We see the structure of the intracranial hinge, the pair of apophyses of the anterior half sliding in long oblique grooves in the posterior half; and the pair of huge subcranial muscles bulging the lining of the roof of the buccopharynx. These last originate on the base of the prootic mass and are inserted by broad aponeuroses on the sides of the parasphenoid, and must restore the two parts of the cranium to the position in which the apophyses of the hinge lie at rest in their sockets at the tops of the grooves. They recall the forward extension of the hypaxial body-muscles of the teleost *Chauliodus* (Tchernavin, V. V., 1953, and Günther, K., and Deckert, K., 1955). In *Chauliodus* the hinge lies between the occiput and the modified anterior vertebral region and is, of course, not intracranial, but, as in *Latimeria*, it is at the anterior limit of the persistent notochord. In *Chauliodus* the whole neurocranium is moved down and up by the subcranial extension of the hypaxial muscles and their antagonists the epaxial muscles, which send aponeuroses forward on to the cranial roof and act in conjunction with the complicated apparatus which opens the mouth. Millot and Anthony have searched in vain for a simple antagonist to the subcranial muscles, for there is in *Latimeria* no dorsal extension of the epaxial muscle or its tendons on to the anterior cranial half. They find an indirect antagonist, however, in the coracomandibular muscle, which lowers the mandible and at the same time transmits its force through the palatoquadrate arch to push the front of the cranium upwards and forwards, so that the hinge-apophyses slide forwards and downwards in their grooves. From Fig. 20 and others it would seem that this might be reinforced by the upward push of the hind end of the lower jaw on the symplectic, which (as in

Amia) articulates with it behind the quadrate, on which the mandible is pivoted. In advanced teleost fishes, where processes of the premaxillaries slide upon the ethmoid, the upper jaw moves forwards relative to the cranium instead of the fore-cranium to the hind-cranium. In this action the fibrous skin of the lip plays a part, and this may be so in *Latimeria*, too.

More than the functional analogies and contrasts, however, most vertebrate zoologists will look for the deployment of the basic vertebrate morphology in the sixth of the main vertebrate evolutionary lines which were already recognizable in the Devonian, and which survive to-day as Selachii, Holocephali, Actinopterygii, Dipnoi, Tetrapoda and *Latimeria*. A feast is spread for us in this field, of which no reviewer's sample can give an adequate idea.

Great interest is attached to the paired and median pediculate fins. Any hope that the paired fins might conform to the theoretical (and rhipidistian) precursor of the limbs of land vertebrates is soon dispelled. Not only is there nothing to compare with the radius and ulna (or tibia and fibula), but the pectoral girdle provides the apophysis, and the basal joint of the fin-lobe the socket, for the pectoral fin-joint, instead of vice versa as might have been expected. This is one of several features which underline the early separation of the cœlacanth stock from the rhipidistian.

The fin-rays, called lepidotrichia by the authors, are not exactly like actinopterygian lepidotrichia, being forked only at their bases and single for the greater part of their length (although one would like to see this confirmed by a transverse section). The dorsal and ventral lobes of the 'caudal fin' have radial supports and only the rays of the terminal lobe conform to the restricted definition of a caudal fin in articulating directly with the neural and hæmal arches, here much reduced and, of course, not broadened into hypurals.

Le Centre National de la Recherche Scientifique has given this book an unusual form worthy of its unusual subject. The volume is first opened in the middle and the pages of each half are hinged along the top, so that the reader can have a two-column page of text on the left, and on the right can turn to any plate with its accompanying explanatory diagram. The photographers, radiographer and draughtsmen have done a magnificent job and we have nothing but gratitude and admiration for the authors, both busy men whose normal occupations had to be continued while they explored this precious material and made themselves familiar with the literature in a field which was hitherto the speciality of neither of them.

The price will strain most private purses and may well make librarians blench, but buyers may be assured of good value and should then start saving for the next volume.

E. TREWAVAS

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