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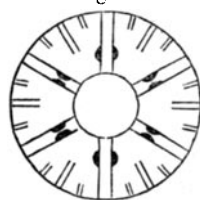
LIV.—On the Structure of the *Actiniæ* and Corals.

By Prof. A. SCHNEIDER*.

[This is a report by Prof. Schneider on the investigations made by him and M. Röttken in the Zoological Institute of the University of Giessen. Prof. Schneider's own investigations relate solely to the laws of the position of the septa and calcareous lamellæ.]

In the Hexactiniæ the septa always stand in pairs, as Hollar has already correctly indicated, so that the members of each pair are symmetrical in their formation. If we examine a transverse section below the stomachal tube, we may distinguish three kinds of septa merely from the measure of their radial diameter, which we may designate septa of the first, second, and third order. The smallest number that occurred consisted of six pairs of the first, six pairs of the second, and twelve pairs of the third order. The six pairs of the first order divide the circumference into six equal sectors, each of which is again halved by a pair of the second order; the space between a pair of the first and a pair of the second order is then again halved by a pair of the third order. As Hollar has already remarked, the septa bear upon the surfaces which are turned towards each other very prominent, thick longitudinal muscles, which we shall designate, for the sake of brevity, by the name of vanes (*Fahnen*). In some *Actiniæ* all the septa bear vanes, in others only those of the first order. But all the pairs by no means bear vanes on the surfaces turned towards each other, as Hollar thinks; there are always two diametrically opposite pairs of the first order which bear the vanes on the surfaces which are turned from each other (fig. 1). Whatever number of septa there may be in an *Actinia* (and their number may be hundreds), there are always only septa of the three orders; they all stand in pairs; and there are always two pairs of septa distinguished as above described, which indicate the bilateral symmetry of the Hexactiniæ.

Fig. 1.



Hitherto we have distinguished the septa of the three orders only by the size; but they are also distinguished by other peculiarities of structure, as appears from M. Röttken's accurate investigations.

In the Octactiniæ the septa do not stand in pairs; they also

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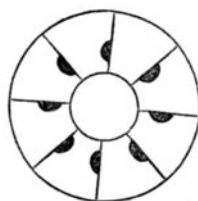
possess vanes, but in a totally different order. In *Veretillum cynomorium* (fig. 3) eight septa are present, and these are differently constructed according to whether they stand upon the left or the right half of the body. In the one half the vanes are turned in the opposite direction to those in the other.

How the calcareous lamellæ of the corals constructed in accordance with the number 6 originate has not yet been investigated. Certainly they do not originate by the calcification of the septa themselves; but it is very probable that they are produced in the inner space of each pair of septa. When the number of lamellæ does not exceed a certain limit (*e. g.* in *Galaxea*), we may easily find individuals with only six lamellæ of the first order, then older ones with six of the

Fig. 2.



Fig. 3.



second, and still older ones with twelve lamellæ of the third order. When more lamellæ make their appearance, the increase takes place as follows:—In the space between a lamella of the first and of the third, or of the second and of the third order, a new lamella of the third order arises, the old lamellæ of the third and second order grow further and become lamellæ of the next higher order (namely, second and first)—for example, in fig. 2, in which the sixth sector has enlarged and nearly become two new sectors. A new formation of this kind seems to be capable of taking place in any sector.

This very simple law of growth applies to all corals with the number 6, although it is more difficult to ascertain in such genera as *Fungia* &c., because, on account of the great size and gradual growth of the lamellæ, these occur of very different lengths. It has been tested on numerous specimens of corals and on many figures of living and fossil corals, and has always, without exception, been found correct. The well-known very complicated law of Milne-Edwards and Jules Haime can scarcely be verified, and is subject, as its inventors themselves say, to numerous exceptions. It cannot pass as the true expression of the facts.

For the corals with the number 8 (*e. g.* the *Rugosa*) another

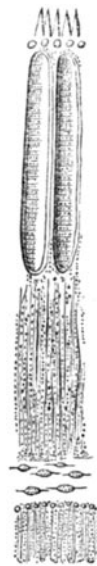
law of the origin and increase of the calcareous lamellæ must be adopted. Nevertheless it is important that we see, in the *Rugosa*, that the numerous calcareous lamellæ exhibit not only bilateral symmetry, but, as in the Octactiniæ, a distinction of back and belly. We cannot, however, at present define the dorsal and ventral surfaces.

The investigations of M. Röttken have been extended to the whole histology and anatomy of the Hexactiniæ, and have brought to light numerous new facts.

In the first place, he has found that the whole of them possess an annular canal which closely surrounds the mouth. This must not be confounded with the apertures of the septa, which occur frequently but not regularly, and which were discovered by Hollard. By this annular canal the Actiniæ approach the Medusæ more closely than has hitherto been supposed.

He has also discovered that the so-called "bourses marginales" (Hollard) are undoubtedly organs of sense, and, indeed, compound eyes. These organs are pyriform diverticula of the body-wall, standing between the tentacles and the outer margin of the peristome; they are constructed after the fashion of a retina, and allow the following layers to be distinguished in them (fig. 4):—1, externally a cuticular layer which is broken up into bacilli by numerous pore-canals; 2, a layer of strongly refractive spherules, which may be regarded as lenses; 3, cones, consisting of hollow, strongly refractive, transversely striated cylinders or prisms rounded at the ends, which have probably hitherto been confounded with urticating capsules: at the exterior end of each cone there is generally one lens, sometimes even two or three other lenses may stand in the interspaces; 4, a granular fibrous layer, which also occupies the interspaces of the cones; 5, a layer which is deeply coloured by carmine, and contains numerous extremely fine fibres and spindle-shaped cells, probably nerve-fibres and cells; 6, the muscular layer; 7, the endothelium. These observations were made on *Actinia mesembryanthemum*, Gosse. Only spirit-specimens were at command, so that nothing can be stated upon various points, such as the position of the pigment which these eyes have during life. M. Röttken has found the same cones and lenses in the tips of the tentacles of *Actinia cereus*, Ellis & Sol.; and he believes that their diffusion among the Actiniæ is very general.

Fig. 4.



With regard to the musculature, he has made out the following facts. Three body-layers may be distinguished—the ectothelium, the muscular layer, and the endothelium. In the foot-plate and in the body-wall there are exclusively annular fibres, in the septa longitudinal fibres, and in very limited spots radial fibres, and in the tentacles longitudinal fibres externally and annular fibres within. In a great number of *Actiniæ* the annular fibres are aggregated beneath the peristome into a strong annular muscle, which is either completely imbedded in the body-wall as a *diffused* annular muscle, or projects inwards into the chambers as a ridge, forming a *prominent* annular muscle. The peristome possesses radial and annular fibres, the stomachal tube an inner and an outer layer of longitudinal fibres, whilst an intermediate layer of annular fibres occurred only in a very limited space at the mouth. The muscular layer consists of the sarcolemma, the fibrillæ, and an interfibrillar layer containing nuclei. The sarcolemma, which forms the principal mass of the body of the *Actinia*, is called *connective tissue* by Kölliker. Fundamentally these designations do not contradict each other; but the term sarcolemma must be preferred, because, on the one hand, cells could only be detected in it in rare instances, and, on the other, it enters most intimately into the structure of the muscles. This layer is always characterized by its rapid and deep coloration in solution of carmine; it is either homogeneous or fibrous, and frequently includes fine horny spicula. The fibrillar substance consists of long prismatic or cylindrical fibres. These three members of the muscular layer are variously combined in the different *Actiniæ*, and, indeed, in such a manner that we can distinguish three grades of histological development. In the lowest grade the sarcolemma is bounded by a straight line on the side of the fibrillar layer, the fibrillar prisms are placed upon it (when seen in transverse section) in a straight line; the interfibrillar substance is in contact with the ectothelium and endothelium: the linear boundary between the thelial and interfibrillar layers is, indeed, always rendered distinct by an accumulation of dark granules; but it is impossible to detect a limiting membrane. In the second grade the boundary-line of the sarcolemma towards the fibrillar layer is more or less deeply undulated; the fibrillar prisms follow this line; and the limit of the interfibrillar layer towards the thelial structures remains rectilinear. In the third grade the summits of the undulations unite, and we have a sarcolemma-layer which is rectilinearly bounded towards the ectothelium and endothelium, and encloses cylindrical muscular primitive bundles consisting of a fibrillar cortical substance

and an interfibrillar central substance. The first grade occurs frequently in the inner tentacular layer, the second in the outer tentacular layer of *Actinia nivea*, Less., and *A. effeta*, and almost always in the muscles of the vanes, the third always in the diffused annular muscle of the body-wall, and on those points of it where the septa are attached, and also in the outer tentacular layer of *Tealia crassicornis*.

LV.—On the Development of *Echinorhynchus gigas*.

By Prof. A. SCHNEIDER*.

THE ova of this worm are scattered upon the ground by the pigs. Here they are eaten by the larvæ of *Melolontha vulgaris*, and thus arrive at their further development. The ova burst in the stomach of the larva; and the embryos contained in them can then penetrate, by means of their spines, through the intestine into the body-cavity of the larva; here they become developed, and again reach the intestine of the pig by the agency of the larva.

The larvæ infested with *Echinorhynchi* live on until their metamorphosis into cockchafers. As the thorax of the cockchafer is not unfrequently eaten by man, we can understand that *Echinorhynchus gigas* may also get into the intestine of man. It has once been found in that situation by Lambl. I have never succeeded in procuring the development of the embryos of *Echinorhynchus gigas* either in the larvæ of *Tenebrio molitor* or in *Asellus aquaticus*.

When the embryos have arrived at the body-cavity of the larvæ of *Melolontha*, they remain for some days unaltered and capable of motion; they then become rigid, acquire an oval form, and envelope themselves in a finely cellular cyst, which is formed of the connective tissue of the larva. The skin of the embryo, with its circle of spines at the anterior extremity, continues at first to be the skin of the growing larva; and it is only at a later period, when the formation of the hooks commences, that it is thrown off, when it forms a second cystic envelope.

The considerable size and perfect transparency of the larva of *Echinorhynchus gigas* permits its development to be more accurately traced than in other *Echinorhynchi*, the development of which was first investigated by Leuckart and afterwards by Greef. Here only those facts can be given which are intelligible without figures.

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