thighs granular. Grey above, with six dark brown longitudinal stripes, the median pair narrowly separated; a dark brown canthal streak; limbs with regular dark brown crossbars; lower parts white.

From snout to vent 46 millim.

A single female specimen from McCarthy Island, Gambia, presented by Mr. J. S. Budgett.

In form and markings this frog bears a remarkable similarity to *Cassina senegalensis*, D. & B., from which it is, however, easily distinguished by the terminal disks of the digits and the presence of a short web between the toes.

LV.—*On* Haddonella Topsenti, *gen. et sp. n., the Structure and Development of its Pithed Fibres.* By Igerna Sollas.

[Plates XXVIII. & XXIX.]

Owing to the kindness of Dr. Harmer I have had the opportunity of looking through a collection of corals and sponges brought home by Dr. Haddon from Torres Straits. Amongst these was a single specimen of a ceratose sponge belonging to the Dendroceratina.

The sponge has been torn away from its earliest support, but remains attached to a piece of coral to which its distal parts have secondarily adhered. The proximal ends of the fibres project from the flesh, which has been dragged away from them; they are flattened and disk-like. The surface of the sponge is raised into conuli, which are widely separated at unequal distances from one another; a little below the summit of each the fibre which supports it can be seen through the flesh as a dark line. The general colour is a dull grey, tinged with pink (in spirit).

The oscula are covered by a sieve-like membrane. I prefer this method of stating the facts to saying that "the oscula occur in groups," seeing that each group of apertures leads into a single continuous cavity. The dermal ostia occur in patches, separated from one another by anastomosing strands of fibrous tissue, in close contact with the dermal membrane. The whole sponge is very cavernous. A six-rayed Ophiuroid was found in one of the internal passages.

The flagellated chambers measure about ·07 × ·04 mm. on an average and are elliptical in form, with wide mouths opening directly into the excurrent canals.

The general anatomy of the skeleton is shown in Pl. XXVIII. fig. 2; it consists of a number of separate fibres arising either singly or two or three together, from each disk of attachment. The fibres branch at intervals, the ultimate twigs either terminating within conuli or expanding, at the tip, into disks of attachment similar to those found at the proximal ends of the fibres. The minute structure of the fibres recalls that of *Ianthella*-fibres, for cells are present within their outer layers.

The diameter of the fibres in their oldest portions, near the base, is 0·72 mm.; commonly in the upper parts they measured 0·4 mm. in diameter.

As the genus *Ianthella* is the only sponge hitherto known to contain cells in the cortex of its fibres, I may here recall the more striking of the other characters common to all its known species. These are: the arrangement of the fibres into a regular square-meshed framework, horizontal fibres crossing others which rise vertically from a single basal disk, and secondly the restriction of oscula and ostia respectively to opposite sides of the plate-like sponge. Evidently the sponge now described cannot be included under the generic name *Ianthella*; I therefore propose to call it *Haddonella Topsenti*. Naturally up to the present *Ianthella* has afforded the only available material for studying the development of pithed sponge-fibres with cell-containing cortex. The first worker to give an account of the minute structure of the fibres and to discover the cells contained therein was Flemming (6) in 1872. The species he examined were *I. basta* and *I. flabelliformis*. He describes the fibres in each of these as consisting of a rose-red finely granular pith, surrounded by an amber-coloured cortex in which are embedded beautifully contrasting violet-red cells. The pith showed a lumen of small dimensions which was not a continuous canal, but occurred chiefly at the points where the fibres branch. The "Dornen" (small branches arising from the main fibres where these cross one another) were constantly free from cells at their apices. Flemming does not consider the question of the origin of the fibres or of their parts, but he goes only so far as to ask whether the cortical cells are proper to the sponge, or whether they are parasites, and decides that they are proper. In discussing the problem how, if they were parasitic, they could have got in, he mentions casually that the pith is naked at the apices of the "Dornen." He considers that the presence of cells in its fibres places the sponge in a very isolated position.

Carter (7) gives a general account of the skeletons of horny sponges and discusses *Ianthella* at some length. He speaks of the cells in the fibres as "pigmented cells," and at one stage of his argument comes to this conclusion: "the horny laminæ were not only deposited on the grey granuliferous axis, but the horny material itself was formed by the pigmented cells." Carter, however, considers he is bound to reject this conclusion, because such a mode of formation of spongin is not known in other horny sponges, and he thinks that his choice of a spongin-former lies between the axis of the fibre and the surrounding "sarcode." He chooses the latter alternative. He has not seen, nor apparently sought, the fibre-tips.

Polejaeff (2) examined the species *I. flabelliformis*. He states that the cells in the fibres occur between the laminæ of spongin, as Carter had described it, the laminæ being concentric cylinders about the axis of the fibre, and he shows this well in his fig. 5, pl. 2. He speaks of the cells as in all probability spongoblasts, and he seems to have been the first to take this view. He failed to find any part of the fibre without cells or without spongin cortex, and consequently there was a difficulty in accounting for the origin of the pith. Polejaeff's work, 'On the Structure and Classification of Horny Sponges,' 1886, being written in Russian, was not accessible to me. In the 'Challenger' report Polejaeff speaks of the inclusion of spongoblasts in the horny substance of the fibres as a peculiarity of which the systematic importance is "rather ambiguous." He then remarks that "if we should in time find Ianthellidæ, *i. e.*, horny sponges whose skeletal fibres are charged with true cells, of thoroughly different organization, we should be obliged to elevate the character in question to the rank of that of a subfamily, or even family" (p. 12).

Von Lendenfeld (3) describes three species, *I. flabelliformis*, *I. basta*, and *I. concentrica*. He criticizes Polejaeff's account and especially his fig. 5, pl. 2, which he says is very incorrect, and adds:—"The cavities" (*i. e.*, the cell-containing cavities in the cortex of the fibre) "are embedded in spongin which is clearly stratified in such a manner that the layers are *determined by the cavities* and strictly parallel to their surfaces" (the italics are his). The fig. 1, pl. 49, of the Monograph illustrates this statement clearly and shows a structure such as one might perhaps have expected on *à priori* grounds. The structure I have observed in the skeletal fibres of *Haddonella* agrees well with Polejaeff's figures, and with those published earlier by Flemming and Carter (6 and 7).

Von Lendenfeld describes the stratified spongin as passing without any sharp limit into the granular pith which forms a thin layer. The inner surface of the pith is sharply defined: the pith is a hollow cylinder in which no cells of any kind can be distinguished. The difficulty of pith-formation he overcomes by a theory: he asserts that a cap of spongoblasts over the tip of the fibre secretes spongin, thus adding to the length of the fibre. This is afterwards destroyed by cells, the process being comparable to the formation of bone-marrow by osteoclasts, and the active cells are consequently termed "spongoclasts."

Minchin (4) relegates the whole matter of occurrence of cells in spongin-fibres to a footnote, saying that it is in need of re-investigation.

My own observations are as follows:—

The adult fibre shows, in cross or longitudinal section, three well-marked zones—(1) outermost, the cell-containing spongin-cortex, followed by (2) a layer of altered spongin-cortex, which surrounds (3) the pith: this may be solid, or having apparently yielded to tension may show a cleft-like cavity. (1) The cortex consists of cylindrical laminæ of spongin, which are all concentred about the axis of the fibre, and of cells lying between the laminæ. The youngest cells on the periphery of the fibre are of large size, in close contact on all sides with spongin. They are of the same colour as the spongin, but many shades darker; the contrast which so pleased Flemming is absent here: the whole cortex is of the rich brown of spongin with a distinct tinge of violet superposed. The young cells are densely packed with spherical bodies; the nucleus is central and lies in a small clear space, which gives the cell the appearance of being perforated (fig. 6). The outer surfaces of the cells are convex. Proceeding from the periphery of a section towards the interior, the cell-bodies become continually smaller and the spherules in them less numerous, consequently the cells in the inner layers are no longer in close contact with the spongin, but come to lie in cavities. In the innermost layers there seems to be little besides nucleus remaining in these cavities, which, however, are never quite empty. (2) The second zone might be called a transition-layer: it is more or less granular, at the same time somewhat fibrillated and contains cells, or at any rate nuclei (figs. 8 & 9). It is easy to convince oneself that it is formed by alteration of the innermost cortical layers, and that the nuclei are the nuclei of cortical cells. (3) The pith is granular, homogeneous, and destitute of cells.

In the distal end of a growing fibre there are three regions distinguishable, succeeding one another along its length. At the extreme apex is a region where the pith lies naked in the cap of spongoblasts. That Polejaeff overlooked this may be due either to the fact that the fibres he examined had ceased to grow, or it may be explained by irregularity of form or change of direction of the fibre. In the present material it is easy to obtain sections of an apparent apex (fig. 7), while the true growing point lies bent to one side and would appear many sections further on. I cannot say whether the same would be true of *Ianthella*.

In the second region, which is of varying length, the pith is covered with a single layer of spongin without cells embedded in it. This passes, by no means abruptly, into the cell-bearing region, which includes the whole of the older parts of the fibre. At first the cells are very sparsely scattered (figs. 4 & 7) and may be found outside the first-deposited layer of spongin, then included between the first two layers, with a second set of cells on the outside, and so on —always with cells on the outside as long as the fibre is still growing in thickness; when this growth has ceased the outermost layer is of spongin. From the rarity with which one finds cells on the outside of a fibre quite uncovered by spongin, one concludes that the deposition of this substance must take place rapidly.

The fibre-tips which are going to form adhesive disks differ from the ordinary tips in the great broadening of the pith at the apex and in the fact that the pith is quite without cell-covering over its flat distal surface. Accordingly, in the fully formed disk, the spongin which closes in the pith-cylinder at the extremity shows manifest signs of having arisen from secondary ingrowths from the spongin-cortex (Pl. XXIX. fig. 10).

The spongoblasts are many layers deep (Pl. XXVIII. fig. 5). Lower down on the fibre the layers are fewer and the cell-bodies larger, but still very much smaller than those of the cells applied to or included in the fibres and charged with spherules, between which cells and the ordinary spongoblasts outside the fibre I have looked for transition-forms in vain.

In material stained in bulk with Ehrlich's hæmatoxylin and afterwards well washed out with acid alcohol the spongin did not stain and lost its violet tinge, while both pith and transition-layer were well stained, particularly the latter.

In sections stained with iron hæmatoxylin (Heidenhain) the whole fibre was stained, and the nuclei in the transition-layer show up well after this treatment.

Summary.

(1) The new genus *Haddonella* has its nearest allies in the species of *Ianthella* (Gray); these two genera share the peculiarity of having cells in the cortex of their pithed fibres.

(2) The fibre-tips or growing points consist of naked pith alone, secreted by a many-layered cap of spongoblasts.

(3) Spongoblasts apply themselves sparsely to the sides of this pith, pouring out upon it a layer of spongin; upon this layer again spongoblasts settle and repeat the process of spongin deposition, and so on repeatedly till ultimately the pith is included in many successive sheaths of spongin, in the intervals between which the spongoblasts lie.

(4) The spongoblasts diminish in size and lose their granular contents in the process of forming the spongin layers.

The presence of cells in the spongin of sponge-fibres is a character of subfamily or family value (Polejaeff).

Literature consulted.

(1) Vosmaer.—Zeitschr. f. wiss. Zool. 1871.
(2) Polejaeff.—'Challenger' Reports, vol. xi. 1884.
(3) Von Lendenfeld.—Monograph of Horny Sponges. 1889.
(4) Minchin.—Text-book of Zoology, edited by E. Ray Lankester. 1902.
(5) Gray.—Proc. Zool. Soc. p. 49 (1869).
(6) Flemming.—Verh. d. phys.-med. Gesell. Wurzburg, vol. ii. p. 1 (1872).
(7) Carter.—Ann. & Mag. Nat. Hist. ser. 5, vol. viii. p. 111 (1881).
(8) Von Lendenfeld.—Zeitschr. f. wiss. Zool. vol. liv. p. 275 (1892).

EXPLANATION OF THE PLATES.

All the figures refer to *Haddonella Topsenti.*

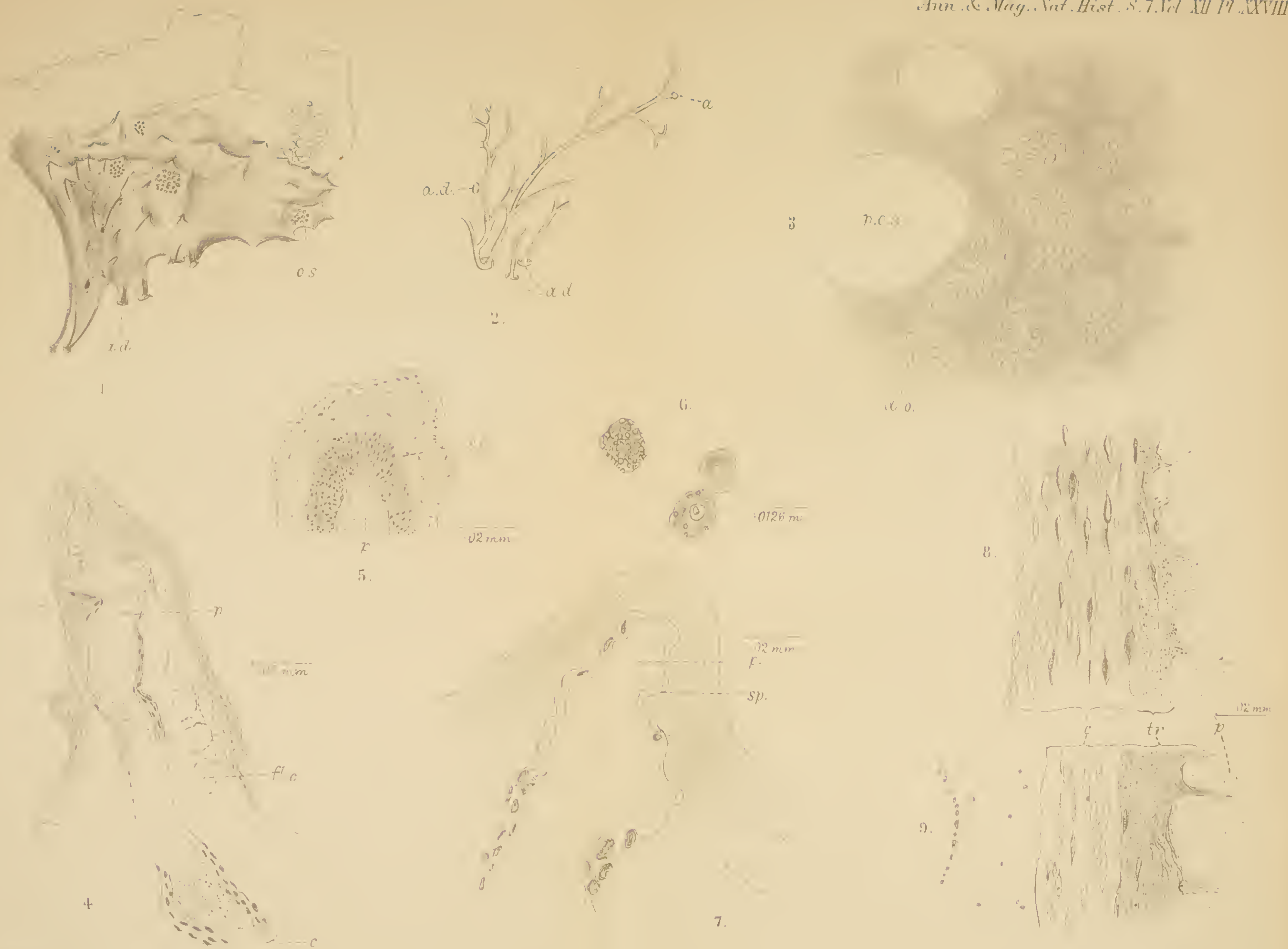
Plate XXVIII.

Fig. 1. Entire specimen, natural size, attached to a piece of coral.
Fig. 2. Some skeletal fibres, partly diagrammatic.
Fig. 3. Piece of the dermal membrane with dermal ostia and perforations of the oscular membrane.
Fig. 4. Younger parts and apex of a growing fibre *in situ.*
Fig. 5. Extreme tip of a growing fibre with spongoblast cap.
Fig. 6. Cells from outer layers of the cortex of a fibre.
Fig. 7. Longitudinal section of a fibre near the apex.
Fig. 8. One side of the longitudinal section of a fibre.
Fig. 9. Similar part of a section of an older fibre.

Plate XXIX.

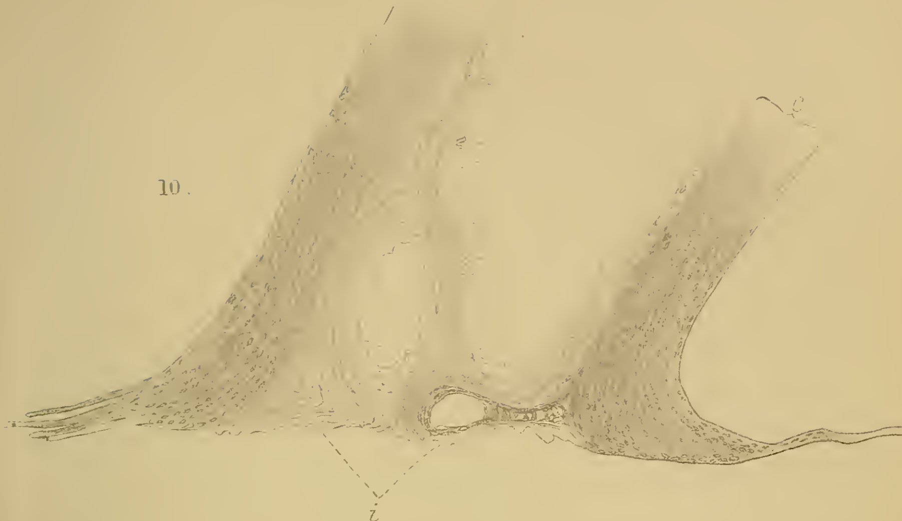
Fig. 10. Longitudinal section of an adhesive disk.
Fig. 11. Longitudinal section of a young stage in the development of an adhesive disk.

a., algal cells which formed part of the surface of support; *a.d.*, disk



I. Sollas del.
Mintern Bros. lith.

10.



11.