ochraceous, very slightly irrorated with grey towards the base; the remainder of the wings pinkish grey, crossed with an indistinct irregular dark band, bordered externally towards the apex with pale pinkish grey; the spot at the end of the cell is bright ochraceous.

Expanse of wings $2\frac{5}{8}$ inches.

Ragadia annulata.

Upperside. Both wings stramineous, with the band, costal margin of anterior wings, and exterior margin of both wings broadly ashy brown, crossed near the apex as far as the first median nervule by an ashy-brown bar; beyond that nervule the bar is discontinued on the upperside, but it shows through from the underside, where it is prolonged across both wings to the inner margin.

Underside. Anterior wings crossed by three ashy-brown bands, the submarginal band having eight ocelli; costal and outer margins ashy brown. Posterior wings with three bands, the middle band concave and the outer one with six ocelli, the second, third, and fourth being the largest. All the ocelli are black, with silver pupils, the iris ochraceous, the second and third on the posterior wing enclosed in one iris.

Expanse of wings $1\frac{1}{2}$ inch.

LXIV.—*On the Development of the Sexual Products in* Spongilla. By Karl Fiedler *.

Since Lieberkühn † in 1856 discovered both spermatozoa and ova in *Spongilla*, and thus for the first time demonstrated the presence of these important structures in the sponges, the history of their production has been treated of in a long series of spongological memoirs. The further development of the freshwater sponge has also been of late years repeatedly made the subject of investigation. The results

* Translated from a separate copy from the 'Zoologischer Anzeiger,' no. 266, 1887, communicated by the Author.

† N. Lieberkühn, "Beiträge zur Entwicklungsgeschichte der Spongillen," in Müller's Archiv für Anat. und Physiol. 1856, p. 17, and also "Zusätze zur Entwicklungsgeschichte der Spongillen," *ibid.* p. 501.

obtained by the two most recent observers, Ganin * and Gœtte†, however, do not agree in many points.

Therefore, as my honoured master Prof. F. E. Schulze recommended me to make a fresh investigation, I entered upon it willingly, in the hope, if possible, of contributing something to the clearing up of the affair. The chief part of the work was executed during the summer term of the present year in the Zoological Institute of the University of Berlin, and I would in this place express my most sincere thanks to Prof. Schulze for his assistance therein. As material I had at my disposal *Spongilla fluviatilis*, which abounds in the Spree. A detailed statement of my results I hope to be able to publish shortly; here I shall only briefly indicate what relates to the formation of the ovum and semen.

In the first place, in opposition to Gœtte's notion I must maintain the unicellularity of the ovum of *Spongilla*. Gœtte's own figures furnish no absolute proof of his view, according to which from the primordial ovum there proceed several cells, one of which grows to a large size, while of the others some take part in the formation of the follicle, and the rest become amalgamated again with the large cell. Thus "only is the foundation of the ovum completed." In the ovicell I have always found distinct cell-limits, and, what appears to be conclusive, only a single nucleus. I lay the more stress upon the latter circumstance, because I have succeeded, by double-staining, in clearly distinguishing the nuclear and vitelline formations. In single-stainings a confusion in this respect is almost inevitable, and Gœtte may in this way have been led astray. The method of double-staining with picro-carmine and bleu de Lyon, introduced by Maurice and Schulgin ‡ and recently advocated by Blochmann §, gives, after a short washing of the sections with a little ammoniacal alcohol, a fine red coloration of the nuclei and a brilliant blue coloration of even the smallest particles of the vitellus.

Thus also it appeared that in the ovum the large round vitelline globules do not, as Gœtte thinks, make their appear-

* M. Ganin, "Zur Entwicklung der *Spongilla fluviatilis*," in Zool. Anz. i. 1878, pp. 195–199, and 'Beiträge zur Kenntniss des Baues und der Entwicklung der Schwämme' (in Russian), Warsaw.

† A. Gœtte, "Untersuchungen zur Entwicklungsgeschichte von *Spongilla fluviatilis*," in 'Abhandl. zur Entwicklungsgeschichte der Thiere,' Heft 3 (Hamburg and Leipzig, 1886).

‡ Maurice and Schulgin, "Embryogénie de l'*Amouroucium proliferum*," in Ann. Sci. Nat. Zool. sér. 6, tome xvii. p. 6 (1884).

§ F. Blochmann, "Ueber die Reifung der Eier bei Ameisen und Wespen," Festschr. zur Feier des 500 jähr. Bestehens d. Ruperto-Carola, issued by the Naturh. Ver. zu Heidelberg, 1886, p. 118.

ance at first, but that they are preceded by all possible stages of smaller vitelline elements. A regular arrangement, such as that the vitelline globules increase in size from the periphery to the centre, is not, however, to be observed.

The follicle-cells I regard simply as parenchyma-cells pressed against each other by the pressure of the growing ovum, and so flattened against each other. Some of them I would characterize as specific nutritive cells, taking this notion more in the sense adopted by F. E. Schulze, Keller, &c., than by Gœtte. Thus in preparation with Flemming's chrom-osmium-acetic acid mixture, besides the vitelline granules of the ovum, many of the cells surrounding the ovum undergo an intense blackening of their contents. The number of cells of this kind which also occur isolated in the rest of the sponge-body constantly increases up to a certain time exactly in the neighbourhood of the ovicells. Frequently they penetrate with their amœboid processes between the ordinary follicle-cells and towards the ovum itself, but without uniting with the latter. They do not contain ready-made vitellus, as the above-mentioned blue staining material does not produce in them the same reaction as in the ovum. On the other hand, they prepare in their bodies a material which is to be regarded as a fore-stage of the vitellus, and which is given off to the ovum by the process of diffusion. Even after the first segmentations we notice a distinct diminution in the number of such blackened cells, and the ordinary follicle-cells also become fainter, if I may so express myself. Finally, the products of segmentation are surrounded only by a very delicate follicular membrane, which certainly has no longer any actively nutritive function. But even if, at first, several cells contribute to the nourishment of the ovum, the latter, as Korschelt* aptly remarks in a similar case, "does not, by the inception of secretion-products of other cells, lose its own cell-nature any more than an *Amœba* loses its unicellularity by the inception of food. The characteristic is the living capacity of assimilation of both towards the nutritive material offered to them."

We have to distinguish from the nutritive cells above described certain amœboid wandering cells of another kind, the bodies of which are filled, not with irregular granulations, but quite uniformly with particles of considerable size; only occasionally a perfectly hyaline marginal zone occurs. These

* E. Korschelt, "Ueber die Entstehung und Bedeutung der verschiedenen Zellenelemente des Insectenovariums," in Zeitschr. für wiss. Zool. Bd. xliii. p. 690 (1886).

correspond to the cells described by Poléjaeff* in his 'Challenger' Calcarea, to which he ascribes "nutritive functions," and, indeed, in the sense of "reception of nourishment." In *Spongilla* they were first observed by Weltner (of Berlin) and subsequently, but independently, by myself. They are also diffused through the whole sponge-body, but are particularly abundant beneath and even between the cells of the cuticle, and here again often in the vicinity of the inhalant apertures. Their regularly granulated plasma then contains further more intensely coloured particles of irregular form. If the latter, as seems most probable, are incepted nutritive constituents, this would be in agreement with the above-cited notion of Poléjaeff, and would also explain von Lendenfeld's† statements with regard to the inception of nourishment through the external surface of the sponges, without the ectodermal cells needing to take part in the operation. As Weltner proposes to make further communications upon the peculiarities of these cells, I shall confine myself to these indications. Only I may say further that the ovicells are not to be referred to these uniformly granulated cells, but to the wandering cells of the ordinary kind.

The growing ovum, which, in earlier stages, sometimes shows a remarkable radiation of the plasma, now becomes gradually more and more filled with vitelline granules. The nucleus, however, never entirely disappears. But while at first it always occupies the middle of the ovum, we find it now most frequently removed close to the surface. In both cases it is surrounded by a circle of plasma comparatively poor in vitelline material. There can be no doubt that this remarkable change of position in the nucleus is connected with the elimination of the so-called direction-corpuscles. In fact I repeatedly observed in the neighbourhood of the nucleus two considerably smaller but no less vividly coloured chromatin-particles, which are probably to be characterized as the abconstricted direction-corpuscles. Thus this important process, recently interpreted with so much genius by Weismann‡, is rendered probable even for the lowest group of the Metazoa. Unfortunately I did not succeed in tracing, on the one hand the formation of the direction spindles, or on the other the process of fertilization. It is clear, however, that the nucleus

* N. Poléjaeff, "Report on the Calcarea dredged by H.M.S. 'Challenger,'" in Report, vol. viii. p. 6 (1883).

† R. von Lendenfeld, "Neue Cœlenteraten der Südsee, II. Neue Aplysinidæ," in Zeitschr. für wiss. Zool. Bd. xxxvii. p. 234 (1883).

‡ A. Weismann, "Ueber die Zahl der Richtungskörper und über ihre Bedeutung für die Vererbung," Jena, 1887.

of the mature ovum is smaller and poorer in chromatin than that of the immature ovum. Even in the former, however, it never becomes "a perfectly homogeneous vesicle" (Gœtte); it always contains a distinct nucleolus, in a nuclear space which is certainly large and clear.

Similar nuclei may be detected by means of double-staining in all segmentation-spheres. Even in rather thick sections of the younger stages they shine out red from the blue vitelline masses. In older stages they are the more easily visible, because they are surrounded only by a single layer of vitelline globules. Finally, not only the number but also the size of the vitelline elements diminishes still more by disintegration. But I must decidedly deny any new formation of nuclei by direct transformation of vitelline globules. The cell-nuclei of the young *Spongilla* are rather derived in uninterrupted sequence from the nucleus of the fecundated ovum, and here also, as Ganin indeed conjectured, the principle applies:—"Omnis nucleus e nucleo."

Although, in the course of the process of segmentation, I was unable to observe any karyokinetic figures (no doubt in consequence of the quantity of vitellus in the ova), they forced themselves upon me in the greatest abundance and multiplicity during the spermatogenesis. The extraordinary minuteness of the object certainly added considerably to the difficulty of the investigation; nevertheless, besides the commonest coil-form, representatives of the star-, spindle-, and barrel-forms could be recognized. Without going further into details, I may remark that the sperm-formation takes place in accordance with the second type established by Poléjaeff* for the sponges. I can therefore confirm the short statement made by F. E. Schulze† in his classical "Investigations upon the Structure and Development of the Sponges," according to which *Spongilla* approaches *Halisarca* as regards these peculiarities. There is therefore no formation of a special covering-cell or of a primordial seminal cell. On the contrary, a cell distinguished by its particularly large, strongly colourable nucleus, being converted into the sperm-mother-cell, divides repeatedly and, indeed, always with formation of filaments, while surrounding parenchyma-cells close together to form a follicle, as in the case of the ovum. The follicle is, how-

* N. Poléjaeff, "Ueber das Sperma und die Spermatogenese bei *Sycandra raphanus*," in Sitzb. der Akad. Wiss. in Wien, Bd. lxxxvi. p. 276 (1882).

† F. E. Schulze, "Untersuchungen über den Bau und die Entwicklung der Spongien, II. Die Gattung *Halisarca*," in Zeitschr. für wiss. Zool. Bd. xxxviii. (1877).

ever, not so strongly made as in the latter, and if its cells furnish nutritive material to the sperm-cells, their importance is probably only that of an intermediate station. After the last division the coil form of the nucleus passes into a perfectly dense chromatin-globule. This becomes the head of the spermatozoon, and the scanty clear protoplasm which surrounds it is drawn out into the filament. Sometimes within the same follicle the development of the spermatozoa goes on at different rates, so that, for example, one half of it appears filled with mature spermatozoa, the tails of which are all directed towards the centre, while the other half still shows different stages of division.

The development of the ova, as of the spermatozoa of *Spongilla*, consequently approaches in a most satisfactory manner to the processes repeatedly observed in higher animals, although many peculiarities cannot be denied.

LXV.—*Diagnoses of two new Central-African Mammalia.*

By Oldfield Thomas.

The two following new species occur in the collection recently sent to the Natural-History Museum by Emin Pasha.

Dendrohyrax Emini, sp. n.

Allied to and of about the size of *D. arboreus*, Sm., but, instead of greyish brown, uniformly pale yellowish white all over above and below, very much the colour of the centre of the belly of *D. arboreus*.

Hab. Tingasi, Monbuttu, Central Africa.

Anomalurus pusillus, sp. n.

Allied to and coloured above like *A. Beecrofti*, Fraser, but differing markedly by its much smaller size (hind foot 42 millim., molar series 9·5 millim. long) and by its greyish-white instead of rufous underside.

Hab. Bellima and Tingasi, Monbuttu.