H. P. Johnson. 1908. *Lycastes quadraticeps*, an Hermaphrodite Nereid with gigantic ova. Biological Bulletin Vol. XIV. p. 371. (Voir pour Bibliographie.)
Korschelt, E. 1894. Über *Ophryotrocha puerilis* und die polytrochen Larven eines andern Anneliden (*Harpochoeta cingulata* n. g. n. sp.). Zeitschr. f. wiss. Zoolog. LVII.
Malaquin, A. 1895. La formation du Schizozoïte chez les Filogranes et les Salmacines. C. R. Acad. Sc. Paris T. 121.
—— 1903. La morphogénèse chez *Salmacina dysteri* Huxley. La métamérisation héteronome. C. R. Ac. Sc. Paris t. 136.
—— 1907. L'Histogénèse dans la reproduction asexuelle des Annélides. — Origine et formation de l'Epiderme. C. R. Association des Anatomistes. 9e Réunion. Lille. p. 172.

3. The Egg-Capsule of Glomeris.

By T. J. Evans, Lecturer in the University of Sheffield.

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In the issue of the Anzeiger for October the 11th Prof. K. Verhoeff, in the course of the last of his many valuable contributions to our knowledge of the Myriopoda, criticises the accounts given by vom Rath and Hennings of the way in which the egg-capsule of *Glomeris* is made, and deduces the sequence of events in the process from an examination of the completed capsule. His conclusion »daß zuerst diese (Kapsel) angefertigt werden und erst hinterher das Ei eingeschoben sind«, even if capable of demonstration by indirect evidence, cannot command the respect due to direct observation, and to this Verhoeff lays no claim.

Vom Rath, on the other hand, saw the conclusion of the process but his account starts with a »begonnene Kapsel« and he does not state how this was made or how the egg found its way into it. Indeed it is doubtful whether the conditions of partial darkness which he recommends for the observation of these animals are conducive to exact results. Vom Rath also denies Humbert's statement that the building material of the capsule comes out of the intestine on the slender ground that he was able to prove that the material of the capsule was always identical with the soil in which the particular female happened to be living at the time of laying. As we shall see later, this observation may be true but still admit of a different explanation. As Hennings adds nothing new on this point, it follows that our knowledge of the egg-laying of *Glomeris* is limited to vom Rath's account of the plastering of a capsulated egg by the everted rectum.

The present writer has already given a brief account of the process in a general article on the breeding habits of the British Diplopods[1],

[1] Bionomical observations on some British Millipedes. Annals and Magazine of Natural History. Ser. 8. Vol. VI. Sept. 1910.

but, in view of Verhoeff's recent contentions, a more minute account of this much-discussed problem may not be out of place here.

The observations were made on *Glomeris marginata* that had been accustomed to a good light for many months before the breeding period, some two hundred, females and about twice as many males being kept in a series of glass vivaria with different kinds of soil on the bottom. The whole procedure of capsule-making was watched several times with the aid of a lens. This is quite necessary as the delicate nature of the operation will show.

The results entirely bear out the statements of Humbert and von Schlechtendahl that the nests of *Glomeris* and *Polydesmus* are built entirely of material derived from the intestine. This is also true of *Brachydesmus superus* and of several Julids examined, with the reservation that in the latter case the excrement is used to line an underground space previously hollowed out by the female. During the laying period the female eats indiscriminately not only the staple food material, but the underlying soil of whatever nature it may happen to be. Examination of the intestinal contents of a laying female also shows that it consists largely of earth and varies with the nature of the substratum, whereas at other times of the year the intestine contains nothing but undigested vegetable particles. Moreover, the egg-capsule is found to consist of earth and a varying quantity of woody tissue bound together and hardened by a glandular secretion; there is none of that difference in consistency between the inside and outside which would be expected from vom Rath's account.

According to my observations, the method of procedure is as follows. The female rolls over on its back, the head and tail being more or less approximated. As soon as the egg appears through the vulva, it is taken up by the neighbouring legs and passed back to the anal region. There it is held by cooperation of the posterior legs, and the rectum everted underneath it bearing a blob of wet excrement on which the egg is placed as on a pad. This soon dries and forms the foundation round and over which the whole of the rest of the capsule is built. By moulding movements of the very mobile rectal walls it is made into a concavo-convex disc, the convexity being towards the egg as shown in Verhoeff's figure. It is thus seen that the egg is glued to one end of the capsule at the first moment of formation. This end may usually be recognised in finished capsules by its concave and truncated shape, especially in thinwalled ones. If, however, the thin first wall is submitted to much subsequent plastering, as often happens, the truncation may be obliterated. The rest of the capsule-wall is built in such a way as to leave a space between it and the egg. When the basal disc is firm it is

turned over through nearly a right angle. At the same time the rectum is drawn in and again everted with a fresh blob of excrement. This is added to the basal disc at the angle named. This process is repeated round the rim of the disc until the egg in the middle is hedged in by a low wall. The height of this wall is increased by an exactly similar process, fresh pieces being made to overlap the preceding ones like tiles in the roofing of a house. By appropriate gradation of angles the rounded end of the capsule is managed in the same way, and if it is taken from the grasp of the female at this stage, traces of the overlapping may be seen all over it. Usually, however, the whole is plastered over and over again in an irregular manner, the thickness of the wall depending on the extent to which this is done, which, in turn, perhaps depends on the intestinal content at the time being. This secondary plastering is that described by vom Rath in the excerpt quoted by Verhoeff. It is done much more rapidly than the actual building which is slow and very delicate work. It should be mentioned that the blob of excrement as first extruded appears largely liquid, but before use much of the liquid may be seen to filter back into the rectum.

As to the twin chambers, I have only seen the actual building of the latter half of the second chamber. Though this was done in exactly the same way as the single chambers, the observation threw no light on the cause of twin forms, and I am only able to offer an explanation obtained by indirect means. The fact that for three years I had not found a single double-chambered capsule among many thousands of eggs laid in my vessels, whereas I found them commonly out of doors, led me to suspect that I was not providing natural conditions in the vivaria. I noticed also that in nature the females receded into the loose earth to lay, while in captivity the laying was done on the surface. I, accordingly, gave them a greater depth of looser soil with the result that the double capsules soon began to appear in fair proportions, the number increasing towards the end of the laying season. From this I concluded that double-chambered capsules are only produced by females lying in among a number of capsules previously made. One of these might easily roll into the sphere of activity in the anal region, and, sticking to the capsule actually in process of formation, be incorporated with it so as to form a twin. The double capsule which I saw being made was »biskuitförmig« at first, but this shape was obscured by the secondary plastering. This view of the origin of twin forms is corroborated by the fact that the larvae they contain are never of the same age and may differ by several days. The empty chamber figured by Verhoeff may have been one from which the older larva had departed.

Though the foregoing account deals with *Glomeris marginata,* it

is scarcely likely that a mode of procedure essentially similar in members of three different families will vary very much within generic range. Moreover, it is significant that it is in keeping with all the facts observed by both vom Rath and Verhoeff as contrasted with their deductions with which alone it is at variance.

4. Über die Gonophoren von Hydractinia echinata.

Von H. C. Delsman, Zool. Station Helder, Holland.

(Mit 15 Figuren.)

eingeg. 10. Dezember 1910.

Als ich im Laufe dieses Sommers an der Zoologischen Station in Helder mit Hilfe optischer Schnitte — welche hier oft außerordentlich scharfe und deutliche Bilder liefern — an lebenden Objekten einen Einblick in die Entwicklung der Hydromedusen und sessilen Gonophoren der Hydropolypen zu gewinnen suchte, gelangte ich bezüglich der Gonophoren von *Hydractinia echinata* zu Resultaten, abweichend von denen Goettes und übereinstimmend mit den älteren Auffassungen van Benedens und Weismanns. Die Untersuchung einer großen Anzahl früher Entwicklungsstadien dieser Gonophoren, von denen besonders die männlichen im optischen Längsschnitt sehr scharfe Bilder liefern, als Folge der Anwesenheit der dünnen »Stützlamelle« zwischen Ecto- und Entoderm, zeigte in unzweideutiger Weise, daß die von den älteren Autoren beschriebene, den Glockenkern umwachsende Entodermlamelle, deren Anwesenheit von Goette[1] verneint wurde, indem er sie als ein Derivat seines Innenectoderms (d. h. des Glockenkernes) entstehen läßt, dennoch völlig zu Recht besteht. Sie wächst als eine dünneringförmige Lamelle vom Entoderm der Knospe aus, den Glockenkern umgebend. Freilich zeigt sich schon ziemlich frühzeitig eine scharfe Grenzlinie zwischen der Basis dieser Lamelle und dem Knospenentoderm, welche zeigt, daß die beiden nicht mehr kontinuierlich ineinander übergehen, sondern sich voneinander getrennt haben, indem sich die »Stützlamelle« zwischen beide geschoben hat. Dieser Umstand hat ohne Zweifel dazu beigetragen, Goette zu einer irrtümlichen Interpretation seiner offenbar nicht zahlreichen Schnitte zu veranlassen. Allein in noch jüngeren Stadien ist die Kontinuität immer ganz deutlich (Fig. 1—5). Bei der weiteren Entwicklung streckt sich die Knospe immer mehr in die Länge, wodurch sich der Glockenkern wie eine Kappe um den Spadix ausbreitet. Er wird von der Entodermlamelle, welche allmählich dünner wird, immer mehr umwachsen. Diese Umwachsung geht einiger-

[1] Goette, A., Vergleichende Entwicklungsgeschichte der Geschlechtsindividuen der Hydropolypen. Zeitschr. f. wiss. Zool. 87. Bd. 1907.