Untersuchung gänzlich ausgebildeter Statoblasten führte mich zu dem Schlusse, welchen ich schon früher folgenderweise mitgetheilt habe: »Was die Statoblasten der *Cristatella* anlangt, so bestehen dieselben, wie es auf den von mir gemachten Durchschnitten zu sehen ist, aus einer einförmigen körnigen Masse, welche mit dem aus cylindrischen Zellen bestehenden Ectoderm bedeckt ist. Unter dieser Schicht ist eine Kernschicht zu bemerken. Später vergrößert sich die Zahl der Zellschichten und man erkennt auch die Anwesenheit der Tunica muscularis. Die zarten Zellen des Entoderms konnte ich nicht unterscheiden, da der körnige Inhalt der Statoblasten dieselben gänzlich verdeckte[1].«

Indem ich seit jener Zeit meine Untersuchungen über die *Cristatella* fortsetzte, verfertigte ich zahlreiche Schnitte aus Statoblasten, welche auf allen möglichen Entwickelungsstufen standen. Ich kam dabei zu der Überzeugung, dass die Leibeswand des künftigen Cystides nicht nach der vollständigen Ausbildung der Statoblastenhülle, sondern bedeutend früher entsteht, und dass sie eigentlich eine Fortsetzung der inneren Schicht von Nitsche's »cystogener Hälfte« darstellt. Diese innere Schicht verschwindet also gar nicht, wie es Nitsche behauptet und muss für die eigentliche Bildungsschicht gehalten werden. Die körnige Centralmasse des Statoblasten füllt fast gänzlich das aus demselben heraustretende Cystid aus und kann deshalb nicht als Bildungsmasse angesehen werden; eher hat sie eine Bedeutung für die Ernährung desselben. Es ist aber auch möglich, dass jene körnige Masse sich an der Bildung des inneren Epithelium betheiligt, doch habe ich diese Frage noch nicht aufgeklärt. Obgleich ich also im Allgemeinen Nitsche's Beobachtungen bestätige, komme ich dennoch zu etwas abweichenden Folgerungen.

Charkow, den 17./29. März 1881.

2. On Thalassema neptuni Gaertner.

By E. Ray Lankester, Professor in University College, London.

A careful study of the Gephyraean *Thalassema Neptuni* with the use of fresh and living specimens has never yet been carried out. Professor Greeff in his recent valuable monograph on the Echiuridae states that he has not been able to procure specimens of this form. I therefore took an opportunity of visiting a locality on the South Coast of Devonshire at the end of March of this year (1881) where this interesting worm had been discovered in abundance by Mr. J. E. Blomfield.

With Mr. Blomfield's aid I found *Thalassema* in quantity on this

[1] Zoolog. Anzeiger, No. 54. p. 212.

coast in galleries excavated in the red sandstone (not limestone) which is exposed by the springtides. The galleries appear to be those formed by the Lamellibranch *Gastrochaena*, which the *Thalassema* appropriates. It is not difficult to collect from fifty to a hundred specimens of the worm in the course of an hour, so abundant are they.

The more interesting results which I obtained from the study of these specimens are as follows.

Colour. The general coloration is correctly described by Forbes. The proboscis is of a fine golden yellow colour which gives place to an orange yellow tint about the anterior region of the body. The middle region of the body is pink (due to the presence of Haemoglobin in the muscular tissue of this region of the body-wall) whilst the hinder part of the body is white.

Perivisceral or coelomic liquid and haemoglobinous corpuscles. When the body-wall of a living specimen is cut through a liquid issues from the body-cavity of a very remarkable character. It is opaque and of a very dark red or madder-brown colour. Professor Greeff who has examined *Echiurus Pallasii* and his new species *Thalassema Baronii* in the living state, gives no description of any such intense colouring of the perivisceral fluid in those species, and I conclude from his statements as to the appearance of the perivisceral corpuscles that the liquid in those species appears colourless.

As is well known the perivisceral liquid of another Gephyraean, viz. *Sipunculus nudus*, is of a delicate rose colour and opaque on account of its abundant corpuscles. The pink colouring matter of *Sipunculus nudus* impregnates the substance of special corpuscles which seem to exist for the express purpose of carrying this colouring matter. The same coloured body also impregnates a band of tissue running along the intestine and also the inner sheath of the nerve-cord.

I examined this pigment in 1871 at Naples and found it to be soluble in water but not giving any absorption-spectrum. Krukenberg (Vergleich.-physiol. Studien, 3. part p. 86) has recently proposed to call it Haemerythrin and assumes that it has (as I had already suggested) properties similar to those of Haemoglobin. Dr. Krukenberg goes further than this. I had carefully proved by examination with the spectroscope and super-position of spectra, that the red colour of the corpuscles of *Phoronis* was due to Haemoglobin and similarly that the colour of the perivisceral corpuscles of the Chaetopods *Capitella* and *Glycera* was due to Haemoglobin (Proceedings of the Royal Society, 1873). Krukenberg without having examined any one of these animals, states that probably Haemerythrin and not Haemoglobin is the cause of the red colour of the corpuscles of the first-named (*Pho-*

ronis) and perhaps of that of the corpuscles of the other two worms also. Such a suggestion is devoid of justification. The presence of Haemoglobin was determined by me in these cases by means of the spectroscope and there is simply no possibility of doubting the fact of its occurrence.

I am induced to insist upon the accuracy of my previous statements which Dr. Krukenberg so strangely calls in question, since in the case of *Thalassema Neptuni* I have to bring forward a new and very remarkable instance of the presence of Haemoglobin.

The dark red or brown liquid from the perivisceral cavity of *Thalassema Neptuni* is found on examination with the microscope to contain an immense abundance of perfectly smooth spherical corpuscles, each of which is deeply impregnated with Haemoglobin and also contains one or more dark granular masses of brown pigment. The granular brown pigment is so intense as to appear quite black under the microscope, and may form a single mass in the centre of the corpuscle about one fifth of the diameter of the corpuscle or may be scattered in it in the form of two or three masses. The dark pigment has no relation to the nucleus which is not visible in the living condition but is seen when dilute acids are added.

The red element in the colour of the perivisceral liquid is due to the Haemoglobin of the corpuscles, the more or less brown shade which is observed and which varies in different specimens so that the liquid is sometimes blood red and sometimes quite a deep vandyke brown, is due to the greater or less abundance of the dark brown masses of pigment in the corpuscles.

The two pigments are easily separated by the action of fresh-water. This dissolves the Haemoglobin which is then filtered off from the stroma of the corpuscles and brown granular pigment. In this way I obtained the Haemoglobin in quantity in perfectly clear solution, and determined its character with the spectroscope. I obtained it both in the reduced and oxydized condition. The brown granular pigment is not soluble in distilled water, nor in absolute alcohol, nor in chloroform.

Besides the haemoglobinous corpuscles the perivisceral liquid of *Thalassema* contains the usual amoeboid corpuscles which sometimes contain a few orange-coloured granules and very readily aggregate and form masses consisting of a hundred or more such cells. No corpuscles corresponding to the »Töpfchens« of *Sipunculus* and *Phascolosoma*, are present. In March the genital products (ova and spermatozoa) of *Thalassema* are not developed. I found no young ova in the perivisceral liquid, but in some specimens I found a few mulberry-spheres which were young sperm-polyplasts.

Presence of Haemoglobin in other regions of the body, and of an orange-coloured pigment.

The dark red perivisceral liquid may be completely washed away from the *Thalassema* which has been opened in a dissecting trough so as to permit of the examination of the natural colours of the chief organs. It is then seen that certain parts are coloured with a bright orange-red pigment which is similar to that described by Greeff in *Echiurus* and has a similar disposition. This orange pigment occurs on the surface of 1) the vascular trunks where it is most intense, 2) on the sheath of the nerve-cord, 3) on a median line extending along the intestine from the termination of the chief vascular trunk, 4) on the surface of the four genital pouches (anterior nephridia), 5) on the surface of the cloacal pouches (posterior nephridia), 6) and less abundantly scattered on the surface of the intestine. The pigment is in the form of granules which are scattered in the cells of the coelomic epithelium where it invests the parts just named. This pigment is not soluble in distilled water and has no relation to Haemoglobin or apparently to any such body, but is comparable to the yellow pigment of the coelomic investment of the intestinal wall and large vessels of *Lumbricus*.

Besides this orange pigment, it is found that Haemoglobin is present in certain organs. viz.

1) The muscles of the middle region of the body are coloured pale-red by Haemoglobin.

2) The thick coelomic epithelium which covers the numerous mesenterial membranes attached to the intestine and body-wall, is pale red owing to the presence of Haemoglobin.

3) Similarly the coelomic investment of the genital pouches in the reduced inactive condition which they exhibit in the spring contains, in addition to the orange-coloured pigment granules, a considerable quantity of diffused Haemoglobin which gives a deep crimson tint to these parts.

The cells of the coelomic epithelium, which are thus found in various regions of the body to contain diffused Haemoglobin, are clear spherical cells with few granules. They contain much less Haemoglobin than the floating corpuscles of the perivisceral liquid but the latter are undoubtedly derived from the former: the fixed haemoglobinous cells at certain places become detached and constitute the floating haemoglobinous cells whilst acquiring a deeper colour.

The presence of Haemoglobin in the parts just named was determined by means of the spectroscope namely by the super-position of the spectra of their colouring matter and that of human Haemoglobin.

The vascular system. The vascular system of *Thalassema Neptuni* is essentially the same as that described by Greeff in *Echiurus*. The same loop is formed around the oesophagus, and a second around the muscles of the setae as in *Echiurus*, and the same main trunks are present, but the trunk which runs along the posterior part of the intestine is in *Thalassema* degenerate if not actually obliterated. The brilliant orange colour of the outer wall of the vascular trunks renders them very obvious as in *Echiurus*. The fluid within the vessels is colourless and does not contain corpuscles similar to those of the perivisceral fluid. Claus states that the vascular liquid is coloured in some Gephyraeans, but if we except *Phoronis*, I known of none in which this is the case, for in *Sipunculus* the liquid of the short vascular trunks is not a special liquid but identical with the perivisceral liquid.

Cloacal pouches. A chief object which I had in view in examining living specimens of *Thalassema* was to determine whether Greeff is justified in stating that the »ciliated funnels« or »cups« on the coelomic surface of the cloacal pouches do not open into the cavity of those pouches. The cloacal pouches of *Thalassema* are exceedingly irritable and contractile, so that alcohol causes them to shrink and further when a piece is cut out from a living specimen for examination under the microscope, the pieces immediately contract. This contraction necessarily prevents one from seeing the funnels opening on the inner face of the pouch, supposing such to exist. At the same time very frequently when I had pinned out a *Thalassema* in sea-water, with the body-wall reflected so as to expose the viscera, the cloacal pouches were seen to be greatly distended and their walls quite transparent instead of thick and corrugated as they are when contracted. I found that by injecting osmic acid solution (2%) into the expanded pouch through the cloaca it was possible to arrest all movements of contraction and thus to obtain the wall of the pouch in an extended condition for examination with the microscope. I found on careful study of preparations obtained by this method that each of its funnels does most certainly open into the cavity of the cloacal pouch by a very minute pore, which it would be impossible to see unless the wall of the pouch were fully extended so as to make it smooth and transparent. The diameter of the aperture which lies at the base of the cup or funnel on the inner surface of the pouch was in *Thalassema Neptuni*, only $^1/_{6000}$th of an inch. Consequently though liquid passes through these stomata driven inwards by the action of the cilia, none of the corpuscles of the perivisceral liquid can traverse them.

The canal system which Greeff has supposed to exist in

connection with the ciliated cups or funnels of the cloacal pouches of Echiuridae, has certainly no existence in *Thalassema Neptuni*. I reserve a more detailed description of these organs for another occasion.

Genital Pouches. In *Thalassema Neptuni* there are two pairs of genital pouches (anterior nephridia) which serve as reservoirs and ducts for the generative products. In the month of March these pouches were in an extremely reduced conditions in nearly all the specimens examined. They consisted of very short reddish yellow bodies placed in pairs behind the bases of the two setigerous sacs. They were in a state of complete contraction so that no internal cavity could be seen. At the base of each is a semicircular frill, covered with cilia and leading to the internal opening of the sac. In this condition they resemble the genital pouches of *Echiurus* as figured by Greeff (Plate I, Fig. 12 of his Monograph).

This semicircular frill is in certain species both of *Thalassema* and of *Echiurus* greatly increased in size and its angles elongated and twisted cork-screw-wise.

In *Echiurus unicinctus* from Japan (collected by the ‚Challenger' expedition) I find the twisted elongated condition of the frill which leads to the inner orifice of the genital pouches. In *Thalassema Moebii* Greeff has figured the elongated twisted condition of the frills of the genital pouches (Pl. VIII, Fig. 69) whilst in *Thalassema Neptuni*, which I have studied in both the sexually ripe and the unripe condition, as also in *Echiurus Pallasii* and *Thalassema Baronii*, in the specimens figured by Greeff, they are not present; so that there appear to be some species of *Thalassema* and some of *Echiurus* with a simple inner mouth to the genital pouch, and some of each genus with a cork-screw-like funnel.

Although normally *Thalassema Neptuni* appears to be in a sexually undeveloped state in the month of March, yet I found two specimens amongst a hundred opened by me, in which the genital pouches were distended with genital products. One of these was a male, and the other was a female. The genital pouches in both cases were stretched to such a degree that their walls were quite transparent and their volume immensely increased. Instead of being little sausage-shaped bodies one twelfth of the length of the worm from mouth to anus, they now extended over three fourths of the length of the body, and were proportionately broad.

In both male and female all four sacs were equally distended with a white creamy substance, which on examination proved to be in the

male fully developed separated living spermatozoa, in the case of the female ova, in a state of decomposition and infested (to the number of about one in five) by a *Gregarina*. The liquid of the body cavity was in both cases almost completely devoid of genital products which had been all gathered up by the pouches.

Kowalevsky appears to have studied a *Thalassema* with three pairs of genital pouches; three pairs are also present in the *Thalassema Moebii* of Greeff, whilst the *Thalassema Baronii* of Greeff and *Thalassema Neptuni* Gaertner (as identified by me with the Devonshire species) agree with *Echiurus Pallasii* in having but two pairs of these pouches.

April 25th 1881.

3. Vorläufige Notiz über die Bedeutung der »Steifsdrüsen« bei Atax crassipes (Müll.).

Von F. Koenike in Bremen.

Atax crassipes (Müll.) zeichnet sich bekanntlich durch den Besitz von einem Paar stark hervortretender Papillen am Hinterrande des Körpers aus. Dieselben wurden schon genau vor hundert Jahren von dem überaus scharfsichtigen Naturforscher O. F. Müller[1] abgebildet und beschrieben. C. L. Koch nennt diese Gebilde bald »zahnartige Hinterrandswinkel«[2], bald »vorstehende Beulen«[3]. Auch Prof. E. Claparède[4] schenkt ihnen seine Aufmerksamkeit; er thut in seinen musterhaften »Studien an Acariden« dar, dass ihr Gewebe eine areoläre Anordnung zeige, indem es aus großen, spindelförmigen, kernführenden Zellen mit dazwischen liegenden eine klare Flüssigkeit enthaltenden Räumen bestehe. Die Function der Drüsen blieb ihm indess unbekannt; er bezeichnete dieselben als räthselhaft und führte für sie den Namen »Steißdrüsen« ein. Ausführlicher als Claparède verbreitet sich P. Kramer[5] über den fraglichen Gegenstand.

Schon im Sommer des vorigen Jahres hatte ich Gelegenheit, zu beobachten, dass vor eine Steißdrüse des *Atax crassipes* eine weißliche

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[1] Hydrachnae quas in aquis Daniae palustribus etc. Lipsiae, 1781. p. 41. tab. IV, Fig. 1 und 2.

[2] Deutschlands Crustaceen, Myriapoden u. Arachniden. Nürnberg, 1835—1841. Heft 7. Taf. 21.

[3] loc. cit. Heft 7. Taf. 22. Während sich die erste Koch'sche Benennung auf *Atax crassipes* bezieht, hat letztere auf *Atax truncatus* Koch Bezug, welch letzterer indess nach R. M. Bruzelius (Beskrifning öfver Hydrachnider, som förekomma inom Skåne. Lund, 1854. p. 10) mit jenem synonym ist.

[4] Zeitschr. f. wiss. Zool. 1868. Bd. XVIII. p. 472—473.

[5] Wiegmann's Archiv f. Naturgesch. 1875. Bd. I. p. 267—268.