Ich will eine Angabe von Moniez nicht verschweigen, welche dieser Ansicht widerspricht. Moniez hat den vermeintlichen Parasiten auch bei *Chydorus sphaericus* und *Daphnia sima* gefunden. Da die genannten Cladoceren keine Drüse mit ähnlichem Secret besitzen (die Nackendrüse kommt nicht in Frage), so muß der Ursprung des *Schizogenes* hier ein anderer sein. Ich habe bei beiden Cladoceren vergeblich danach gesucht; auch Moniez fand ihn nur bei Individuen einer bestimmten Localität.

Trotz dieser Schwierigkeit wird Niemand, der einmal die vom Secret der Schalendrüse der Ostracoden gebildeten Ringe etc. mit Moniez' Abbildungen verglichen hat, daran zweifeln, daß der *Schizogenes* weiter nichts ist als jenes Secret.

Greifswald, 14. Juni 1895.

4. Note on the Development of the Lungs, Entapophyses, Tracheae and Genital Ducts in Spiders.

By Fred. Purcell, Ph.D., Berlin.
(From the Zoological Laboratory in Berlin.)

eingeg. 21. Juni 1895.

Lungs. — If we compare the earliest development of the lungs in Arachnids with that of the gills in *Limulus*, as far as our knowledge at present goes, it will be seen that in *Limulus* the gill-leaves arise as outgrowing folds on the posterior side of the abdominal appendages, while in the Arachnids the lung-leaves are formed as ingrowing folds on the anterior wall of a sack-like invagination at the posterior base of the appendage. This wall is, it is true, the direct continuation of the posterior side of the appendage, and is generally considered as merely a part of this side, sunken below the level of the body-surface. The significant fact that the earliest lung-leaves appear on the exposed posterior sides of the appendages before the latter have commenced to sink below the surface into the body, and completely outside of the basal sack, — has hitherto escaped the notice of investigators[1].

My investigations were conducted on the eggs of *Attus floricola* C. K. with the aid of a number of wax reconstructions of the pulmonary appendages. Fig. 1 is an outline of such a reconstruction seen

[1] Including the three latest authors on the subject: Simmons, O. L., Development of the Lungs of Spiders. Amer. Journ. Science and Art, 3. ser. Vol. 48. 1894. Also in: Tufts College Studies, No. 3. 1894. — Jaworowski, A., Die Entwicklung der sogenannten Lungen bei den Arachniden und speciell bei *Trochosa singoriensis* Laxm. etc. Zeitschr. f. wiss. Zool. 58. Bd. 1894. — Brauer, A., Beiträge zur Kenntnis der Entwicklungsgeschichte des Scorpions. II. Zeitschr. f. wiss. Zool. 59. Bd. 1895.

from behind. It represents a transverse section through the body epithelium (*ep*) just posterior to the appendage [the line of section is indicated in Fig. 2 by the line marked (Fig. 1)], and also gives a view of the posterior side (*ap*) of the latter. This side is well defined, nearly perpendicular to the body-surface, and quite free and exposed. The epithelium, *ep*, which represents the level of the body-surface, is invaginated, in the form of a little pocket, *p.s*, lying nearer to the lateral than to the medial part of the appendage, and situated at the base of the latter. This is the well-known pulmonary sack.

Fig. 1.

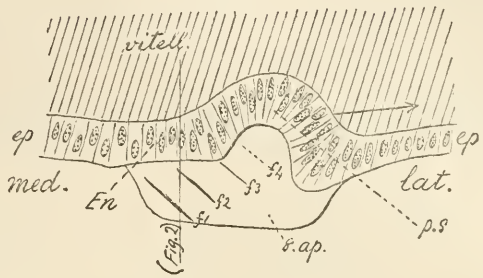

Fig. 2.

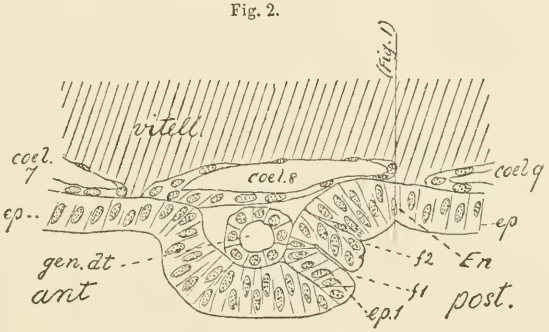

Fig. 1. Outline of posterior side of 1. abdominal appendage drawn from a wax reconstruction, shewing some of the pulmonary furrows (*f*1—*f*4) and the body-epithelium (*ep*) in transverse section just posterior to the appendage.

Fig. 2. Longitudinal section through same appendage, cutting the 1. furrow and the medial end of the 2. furrow.

Letters to both figures: *ant*, *post*, *lat*, *med* = anterior, posterior, lateral, and medial sides of the appendage. *coel* 7—9, 7—9th coelomic sack. *En* region of the epithelium at base of appendage, which produces the entapophysis. *ep* body epithelium. *ep1* epithelium of distal wall of 1 furrow. *f1*, *f2* two oldest pulmonary furrows. *f3* commencement of 3rd furrow. *f4* position of the 4th furrow (not yet present in this stage). *gen.dt* genital duct, in section. *p.s* pulmonary sack.

On the posterior surface of the appendage towards its medial part two oblique and parallel furrows, *f*1 and *f*2, appear, neither of which, however, reach quite to the base. They are so situated that, if produced, the medial and deeper furrow, *f*1, would lie more distal than the lateral one, *f*2. In the following stages new furrows (two of which, *f*3, *f*4, are sketched in the figure) are successively added, parallel to and resembling the first two, but all situated within the pulmonary sack, — except, perhaps, the third, *f*3, which ist just on the edge of the

latter. The cells of the thick epithelium, which contains the furrows, shorten considerably and rearrange themselves in the form of a much thinner and folded epithelium (*ep* 1, Fig. 2), so that the furrows come to lie between the two walls of a fold directed inwards, while the tissue between two furrows is that of a fold directed outwards. Of the inwardly directed folds the oldest is the most medial and distal one (*ep* 1, *F*ig. 2); it is already present in the stage of Fig. 1, and is represented in the adult by the most ventral of the hollow, air-containing lung-leaves. The next lateral fold is the second oldest, and so on. All grow inwards and subsequently nearly fill out the cavity of the appendage.

Hand in hand with the formation of folds, the pulmonary sack (*p.s*, Fig. 1) proliferates along the inner surface of the adjacent epithelium in the direction of the arrow in Fig. 1, thus providing material for the new folds. Finally, the whole appendage gradually sinks to the level of the body-surface, whereby the region of the two oldest furrows, *f*1, *f*2, becomes included in the enlarged pulmonary sack.

Entapophyses and Tra'cheae. — The region (*En* Fig. 1 and 2) of the epithelium adjoining the medial basal part of the posterior side in all the abdominal appendages, forms the point of attachment of a mesodermal, intermuscular tendon (endosternite), onto which are inserted the ends of the longitudinal ventral muscles and the ventral ends of the dorsoventral muscles. The ectoderm at each point of attachment becomes drawn out in the form of a hollow process, lined with chitin, and projecting into the abdomen. These are the entapophyses or ectodermal muscular tendons, and are serially homologous with one another.

The entapophyses connected with the first (pulmonary) pair of appendages serve in the adult as the points of attachment of the most anterior of the three well-known pairs of abdominal endosternites, and may be quite separate from the pulmonary chamber (*Lycosa*); or they may be connected with the latter and with one another by means of the canal in the transverse fold joining the pulmonary spiracles.

The entapophyses connected with the second (tracheal) pair of appendage become each drawn out into a long tube, to or near the blind, inner end of which the middle pair of endosternites is attached in the adult. These long tubes are represented by the two large trunks which form the tracheae in the Attidae, and by the medial pair of the four trunks which compose the tracheæ in most other Spiders (Agelenidae, Drassidae, Epeiridae, Lycosidae etc.) The homologon of the lung is represented in the latter groups by the lateral pair of

tracheal trunks, but in the Attidae by a mere rudiment in the form of a short lateral process on each side at the base of the two large trunks. In the Attidae, therefore, by far the greater part of the tracheal system is nothing else but a pair of modified. ectodermal tendons, which are serially homologous with the entapophyses connected with the pulmonary appendages. In the Dysderidae the entapophyses do not form a part of the tracheae, which must, therefore, be here considered as the homologa of the lungs alone. In a Tetrapneumonous Spider I find the four entapophyses quite separate from the four lungs, and provided with four stigmata distinct from the spiracles, — a condition which must be considered as the more primitive.

The remaining appendages also give rise to entapophyses, to which the posterior endosternite in the adult is attached.

Genital Ducts. — Into the cavity of each abdominal appendage a hollow process from the corresponding coelomic sack is protruded. Just where the medial side of this coelomic process passes over into the wall of the sack itself a fold of the mesoderm is formed, which grows in a lateral direction, cutting off the medial part of the intra-appendicular coelomic cavity in the form of a short tube. This tube, which is shewn in section in Fig. 2, ends blind at its medial end, while laterally it widens funnel-shaped and opens into the coelomic sack. At first the tubes are of equal size in all the appendages, but later on those of the pulmonary appendages develope vigorously, so that their open ends grow some distance into the abdomen and finally attach themselves to the anterior ends of the two chords of genital cells, which have grown forwards from their point of origin at the posterior end of the germinal band. The blind ends of this pair of tubes, which gives rise to the genital ducts, approach one another, growing along the inner surface of the hypodermis towards the medial line, and finally communicate by means of a single, transverse cleft with the ectodermal genital opening.

The tubes of the three remaining appendages become rudimentary. Their presence tends to shew that the genital ducts had originally some other function, and the similarity of their development with that of the coxal glands in Arachnids generally indicates their nephridial origin. The genital ducts in the Scorpions have recently been shewn by Brauer[2] to be also of nephridial origin.

It remains only to be noticed that the genital segment in the *Araneina* is the eigth post-oral (or second abdominal) segment, not the seventh as previously supposed, and this brings the segmentation of

[2] loc. cit.

the Spider into harmony with that of the Scorpion according to Brauer[3], and with that of *Limulus* according to Kishinouye[4] and Packard[5], in both of which forms the genital segment is the eigth postoral one.

Further, the 8th and 9th postoral segments, which bear the lungs in Spiders, possess no lungs in the Scorpions, while the 10—13th segments, which bear the lungs in the latter animals, are devoid of these organs in the Spiders. The view, generally held hitherto, that the second pair of lungs of the Spiders is the homologon of the first pair of lungs of the Scorpions, is, therefore, erroneous.

Berlin, June 20, 1895.

5. Bemerkungen zu den von v. Erlanger veröffentlichten »Études sur le développement des Gastéropodes pulmonés«.

Von Dr. Richard Heymons, Berlin.

eingeg. 25. Juni 1895.

In den Archives de Biologie (Tom. XIV. 1895) theilt v. Erlanger seine neuesten Untersuchungen über die Urnieren der Gasteropoden mit.

Der Verfasser bespricht unter Anderem die Bedeutung eines bei zahlreichen Opisthobranchierembryonen an der rechten Körperseite befindlichen Excretionsorgans.

Die Entwicklung dieses Organs war von mir seiner Zeit bei *Umbrella* in eingehender Weise studiert und beschrieben worden (Ztschr. f. wiss. Zool. 56. Bd. 1893). Ich gelangte zu dem Resultat, daß das betreffende Organ ectodermaler Natur sei und daß es möglicherweise mit gewissen sogenannten äußeren Urnieren von Prosobranchierembryonen in Vergleich gesetzt werden könne.

Gegen meine Deutung (»cette manière de voir«) glaubt der genannte Autor Einspruch erheben zu müssen, nicht etwa, wie man erwarten könnte, auf Grund selbständiger Nachuntersuchungen, sondern weil seiner Ansicht nach die Lage des fraglichen Organs und dessen Unpaarigkeit gegen die obige Annahme spricht.

Beide Einwände hatte ich, wie dem Autor entgangen zu sein scheint, in meiner Arbeit (p. 293) bereits berücksichtigt. Eine eingehendere Lectüre meiner Arbeit hätte ihn jedenfalls auch wohl be-

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[3] loc. cit.

[4] Kishinouye, On the development of *Limulus longispina*. Journ. College Sci. Univ. Japan, Vol. 5. Tokyo, 1891.

[5] Packard, A. S., Further Studies on the brain of *Limulus polyphemus*, with Notes on its embryology. Mem. Nation. Acad. Sci. Washington, Vol. VI. 8. Memoir.