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I. Wissenschaftliche Mittheilungen.

1. On some Points in the General Morphology of the Metazoa considered in connection with the physiological processes of Alimentation and Excretion.

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(Schluß.)

We are now in a position to return to the Arthropoda, and other Coelomata, and to give a physiological interpretation to the peculiar history and fate of the coelom in these groups[60]. The root of the whole matter, as already said, is the elaboration of polycytic digestive processes, which again is due to the fact that the organism impresses into its services the products of the excretory activity of the endodermal cells. Thus the successive steps in the elaboration of polycytic digestion, and its results may be tabulated thus:

1) Utilisation of liquid excretory products of endoderm cells (Formation of secretory glands).

2) Absorption of the liquid nutritive fluid so obtained through the endoderm into blood system.

3) Rise of blood system, as predominantly nutritive in function. (Differentiation of whole blood system and of respiratory carriers, i. e. red corpuscles.)

4) Loss of nutritive function of coelomic fluid, consequent upon reduction of monocytic digestive processes. (Reduction in size and morphological importance of coelom, and of nephrostomes.)

[60] A. Sedgwick, loc. cit. — E. R. Lankester, loc. cit.

5) Transference by secondary adaptation of the remnant of monocytic ingestive cells (fat absorbers) to the vascular system.

All these several processes depending upon general laws and upon fundamental properties and activities of protoplasm will proceed upon parallel lines in all the great branches of the Metazoa.

One need not recapitulate in detail the morphological facts of the origin and fate of the coelom shewn especially in the developement

Fig. 4.

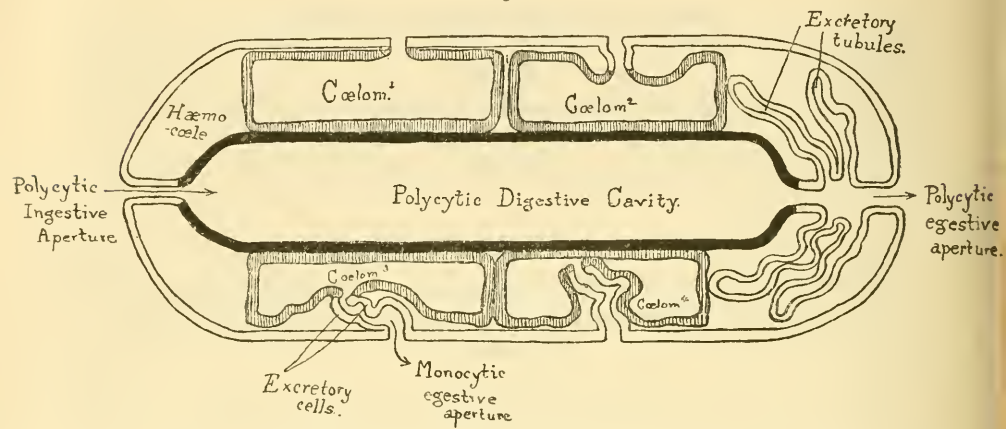

Fig. 4. Longitudinal section throug a triploplastic coelomate Metazoan with two pairs of mesoblastic pouches, showing the stages in evolution of excretory cells around the monocytic and polycytic egestive apertures. This form with a coelomic prostomial area probably represents the primitive ancestor of the Coelomata. Endoderm black, mesoderm shaded, ectoderm white.

of Peripatus [61] and other forms and in the morphological comparison of the coelom [62] in different types which is well known to all zoologists.

So far as I am aware, no theory prior to this has been suggested to account for the facts from a physiological basis.

Returning for the moment to the consideration of excretion, reasons have been given for connecting excretion primitively with the general ectoderm, and the organs for excretion of salts and water appear to remain in this diffuse condition even in the highest Vertebrates [63], in the case of respiration the respiratory organ is formed in each group

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[61] In Peripatus »the functions of a perivisceral (or body) cavity are discharged by the vascular system, in which indeed the coelom is contained«. A. Sedgwick, Q. J. M. S. XXVIII. — A. Sedgwick, Developement of Peripatus. Q. J. M. S. XXV etc.

[62] E. R. Lankester, Q. J. M. S. XXXIV.

[63] In frog, waste respiratory pigment is got rid of through the skin (melanin). J. H. List, Biol. Centralbl. 1890 etc.

of organisms at whatever part of the animal is most suitable for interchange of the gases, so that the anatomical comparison of respiratory organs shows a very diverse and heterologous set of ectodermal and endodermal organs which, morphologically, have rarely any connection.

In the case of »Nitrogenous« waste products a somewhat different state of affairs holds. These poisonous products must be got rid of as speedily as possible, so that excretory organs will tend to be developed at any point of the ectoderm, at which a current leaves the organism. The chief points fulfilling this requirement are the monocytic egestive

Fig. 5.

Fig. 6.

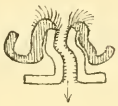

Fig. 7.

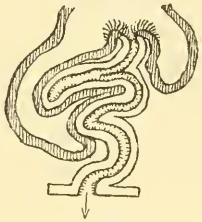

Fig. 5. This and the figures (8—10) represent the relationship of the organs of excretion and monocytic egestion, shown in phylogeny of nephridia. The complications in connexion with the sexual function have been ignored.

A coelomic pore for monocytic egestion (primary function). (Hemichorda and Cephalochorda.)

Fig. 6. Commencement of location of excretory cells on walls of ectodermal invagination.

Fig. 7. Increase of excretory surface by coiling as found in typical nephridium.

aperture (nephrostome) and the polycytic anus (Fig. 4) so that around each nephrostome and in the proctodaeal area nitrogenous excretory organs usually occur in the former case forming the main part of the nephridium, arising ontogenetically from the ectoderm, and consisting of active cells discharging their nitrogenous products into the nephrostomial duct, and in the latter case in the Malpighian tubules, arising ectodermally[64] and falling into the proctodaeum having precisely the same relationship to the polycytic anus as the nephridial cells to the nephrostomes (Figs. 5 to 10).

The same principles are involved in the excretory system of Amphioxus, where excretory cells[65] (ectodermal) are said to line the atrial cavity, where, of course, there is a current to the exterior not only from the nephrostomial openings, but from the branchial apertures.

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[64] »The Malpighian bodies arise as two pairs of outgrowths the epiblast of the proctodaeum.« F. M. Balfour, Comp. Emb. Vol. I. p. 414.

[65] P. Langerhans, Arch. für mikroskop. Anat. XII. 1876.

From what has been said a »nephridium« must be regarded as a compound organ consisting of 1. An egestive aperture which is mesodermal in origin belonging to the coelom and egestive in function, the nephrostome, and 2. the true ectodermal excretory cells, lining a more or less complicated tube leading from the nephrostome to the exterior.

This is borne out by ontogeny[66] in so far as the nephridium appears to arise normally, partly, the nephrostome, from the mesoblast, and partly, the tube, from the epiblast.

The history of the two series of organs can be traced from the diffuse egestion and diffuse ectodermal excretion of the sponges (and partly the Echinoderma) to the eventual extinction of the monocytic egestive organs and a perfection of the excretory organs till the Vertebrate kidney shews its nephrostomes only in ontogeny in the highest forms, whereas the excretory ducts and their connection with the vascular system are elaborated to a high degree of perfection (Figs. 5 to 10).

The Relationship to Ontogeny.

Note I. Reasons have been given for regarding the modifications of the alimentary processes to be the direct originators of other sets of organs, the instances of skeletal and pigmentary organs being taken as typical.

If in phylogeny the various organs arise from and are intimately connected with, the alimentary processes, then in ontogeny the same will result. The first signs of differentiation will appear in connection with the sustentative function, and mechanical ingestive processes will lead the way.

Thus ingestive cells wandering in from the monoblastic single layer will give rise to the inner layer, and the diploplastic form. From this inner layer again the ingestive cells give rise to the mesoblast or third layer, and again in the triploblastic type, — by further in-wandering from the mesoblast the skeletal, connective tissue, sexual and egestive organs arise. If all the organs of a type were monocytic throughout life, we might expect this form of development to prevail, but treading as it were upon the heels of the monocytic organs are the polycytic. Thus the polycytic digestive cavity is formed immediately and consequently upon the monocytic ingestion and again, upon this succeeds the polycytic ingestive area or stomodaeum. In a young form in which the monocytic ingestion and digestion can be dispensed with, the monocytic mechanical inwandering is hastened out of existence and a complete and direct formation of the polycytic organ (archenteric cavity) takes place.

Thus the complete invagination of a tissue of cells represents the formation of the higher type (polycytic) of organ.

It follows that the highest type of Metazoan ontogeny is represented by such a form as Amphioxus in which nearly the whole development proceeds upon the principle of tissue invagination, the lowest type being a form in which the organs are differentiated by successive migrating of single cells.

[66] E. B. Wilson, Journ. of Morphology. 1887. — Ed. Meyer, Mitth. Zool. Stat. Neapel. VII. 1887.

In the case of degeneration, if an organ degenerates, it will advert in mode of origin and in function to a simple type so that the polycytic digestive cavity atrophies in endoparasites; and, in the Tunicata can be selected instances shewing a gradation in the degeneration of the body-cavity, migratory cells replacing a solid proliferation of cells[67].

This theory at least offers an explanation of the mechanical ontogenetic processes, supposing them to be of a like nature as the mechanical processes involved in the successfully maintained mechanical processes of ingestion, digestion and egestion in the parent organism.

Note II. Of other theories of the derivation of the diploblastic form, that of delamination[68] and also that of derivation from a syncytium[69] (granting the truth of the cell-theory) have a common drawback in that they assume that a division of cells follows, and is consequent upon, a physiological division of labour. There is no proof for this assumption, but, on the contrary, most known facts of karyokinesis and other phenomena of cell-division tend to shew that a normal cell divides into two like parts, and that after cell-division, a difference in form and function arises, due primarily to a difference in environment.

2. »Regni Animalis Appendix.« Eine in Vergessenheit gerathene Schrift Linné's.

Von Dr. Georg v. Seidlitz, München.

eingeg. 14. März 1896.

Habent sua fata libelli! Wenig über 100 Jahre ist der große Reformator, der Begründer unserer heutigen Systematik, todt, und schon konnte eine seiner zoologischen Publicationen in Vergessenheit gerathen! Linné hat dieselbe aber auch so gut zu verbergen gewußt, daß sie weder im Engelmann[1], noch im Hagen[2], noch im Carus[3] aufgeführt wurde. Nicht der Zufall, sondern das zur Gewohnheit gewordene Streben, jede zu citierende Beschreibung stets im Original zu prüfen, ließ mich diese alte Abhandlung, die letzte, die Linné selbst publiciert hat, auffinden. So mühsam und langweilig dieses Streben meist ist, da die alten Originalbeschreibungen oft nur unerfreuliche Zweifel hervorrufen, so sehr hat es sich in diesem Falle glänzend belohnt; denn ein solcher Fund ist für den Systematiker eine Freude, wie man sie nicht alle Tage erlebt, und wie sie nur Wenigen beschieden ist. Der alte Linné selbst hätte seine Freude daran gehabt. Die Handhabe zum Nachforschen boten die Citate der früheren Autoren, z. Th. der Zeitgenossen Linné's. Diese alten Citate, die dann

[67] A. Willey, Amphioxus and the ancestry of the Vertebrata.
[68] E. R. Lankester, Q. J. M. S. XVII.
[69] A. Sedgwick, Q. J. M. S. XXV. etc.
[1] Engelmann, Bibliotheca historico-naturalis. 1846.
[2] Hagen, Bibliotheca entomologica. 1862.
[3] Carus und Engelmann, Bibliotheca zoologica.