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lachiern nicht vor dem Acranienstadium [1] (vgl. meine Arbeit über die Nervenentwicklung der Selachier p. 3) hinweist.

Die ersten Cranioten besaßen keinen Vornierengang; die Vorniere mündete durch einen Porus lateral von der Drüse nach außen aus. Diese Öffnung rückte später nach hinten, und aus ihrem Außenrande entwickelte sich der Gang, der die Cloake erreichend in dieselbe einmündete.

Da die Entstehungsweise des Vornierenganges wahrscheinlich hauptsächlich den Anhängern der Lehre, nach welcher die Chordaten von Anneliden abstammen, willkommen sein wird, kann ich nicht umhin zu erklären, daß ich die Verwandtschaft dieser beiden Typen nicht einsehe. Die Idee derselben wurde durch die Entdeckung von Nephrostomen bei Wirbelthieren veranlaßt, diese scheinen aber erst im Stamme der Wirbelthiere selbst entstanden zu sein, weil sie bei *Amphioxus* fehlen und bei den Selachiern nicht vor dem Acranienstadium angelegt werden. Seit mehreren Jahren glaube ich an die Verwandtschaft der Chordaten mit *Balanoglossus* und den Echinodermen und wurde hierin hauptsächlich durch die Untersuchungen von Spengel und Bateson bestärkt. Es ist nicht mein Zweck hier die Gründe für diese Meinung aus einander zu setzen; zwei Puncte möchte ich aber hervorheben: 1) der Blastoporus wird, wo er offen bleibt, bei Echinodermen, *Balanoglossus* und Chordaten ohne Ausnahme zum Anus, bei Anneliden zum Munde; 2) das Coelom entsteht bei den primitiven Formen der drei ersterwähnten Gruppen als eine Darmausstülpung, bei den Anneliden nie.

3. Note on the ovarian ovum in the Dipnoi.

By Frank E. Beddard, M. A. Prosector to the Zoological Society of London.

eingeg. 8. October 1886.

In Number 225 of the »Zoologischer Anzeiger« I have given some account of the structure of the ovarian ovum in *Lepidosiren*. Since that paper was written I have been able to make some further observations upon the structure and development of the ovum in this fish and also, through the kindness of Mr. Howes and Prof Lankester, to extend my observations to *Ceratodus*. Although there are many points which require further clearing up, I have been able to make out certain facts which are to the best of my knowledge novel to the Vertebrata, and are of some interest from the general point of view of the constitution of the ovum.

[1] Außer der Abwesenheit einer Scheidung von Kopf und Rumpf, welche beide gleichartig segmentirt sind, kann ich jetzt zur Charakteristik dieses Stadiums noch die Anwesenheit des vorderen Neuroporus, den ich früher irrthümlich für identisch mit der Epiphysisanlage gehalten habe, hinzufügen.

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1. *Lepidosiren.* In my paper already referred to I have described the formation of yolk in the cells of the follicular epithelium, and the proliferation of these cells into the interior of the ovum. These facts have been confirmed by further researches, but the stage in the development of the ovum which is characterised by the enormous increase of the vascular sheath and the concomitant formation of yolk in the follicular epithelium, proves not to be a further development of the stage which I have described as the first. The ovary of *Lepidosiren* contains two kinds of ova which follow a different course of development. In the one kind the ovum is the equivalent of a single cell and its structure and development are so similar to what is found in the Amphibia that no further description is requisite here; Ayers has figured such ova in his account of the visceral anatomy of *Lepidosiren* and *Ceratodus*. The other kind of ova are present in the ovary in equal abundance, and each is the resultant of a number of distinct cells which combine to form the mature ovum. The earliest stage which I have been able to discover has the following structure; the germinal epithelium appears in patches, which are several cells thick, and in a condition of active multiplication; in connection with these aggregations of cells on the outside of the ovary (corresponding to the »Epithel-inseln« of Waldeyer?) is a hollow sphere of cells evidently derived from them; this forms the future follicular layer of the ovum as well as a layer lying outside the vascular sheath—the secondary follicle layer of Balfour—which is thus seen to be derived from the germinal epithelium. The interior of the sphere is partly occupied by a mass of cells rather different in appearance from those which constitute the follicle. The whole structure appears to be the equivalent of the »Ureiernest« of Semper and Balfour. It differs however in the details of its structure and more particularly in the course of its development. Instead of one or more of the central cells developing at the expense of the rest and separating off from the nest with some of the follicular cells to form as many distinct ova, the whole of the cells in the interior of the sphere combine to form one ovum. There is however not a direct fusion of all the central cells; round the periphery of the central mass there appears a layer of a more or less homogeneous substance which is deeply stained by Borax Carmine, and resembles closely the liquor folliculi of the Graafian follicle; this substance also appears in the interior of the mass of cells and divides it up into isolated groups of one or more cells. But this protoplasmic mass appears to be the result of a fusion of some of the central cells, and in any case yolk particles are deposited in it as well as in the remaining cells and in the cells of

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the follicular layer. In a later stage the ovum consists of a mass of yolk particles among which are scattered cells some of which are the remainder of the central cells and others have migrated in from the follicular layer. The formation of the yolk during this stage is still actively going on in the follicular layer. In later stages the activity of the follicular cells has ceased and they no longer contain yolk particles, though they are still somewhat large in comparison to the follicular cells of the other kind of ova; a delicate membrane divides the follicular layer from the ovum; the latter contains a very few cells in its interior, and these soon altogether disappear and the ovum is fully mature. I have not been able to detect any traces of a germinal vesicle.

At no period in the development of the ovum is it possible to recognize any single cell within the follicle, which is conspicuously larger than the rest, or different in any way; nor is there any break in the continuity of the follicular layers; the whole contents of the follicle ultimately become the ovum, and it seems impossible therefore to avoid the conclusion that the ovum has the value of more than a single cell. I am not aware of any Vertebrate in which a similar mode of Oogenesis has been stated to occur. Goette's description of the origin of the ovum in *Bombinator* by a fusion of cells has been contradicted by Nussbaum (Arch. Micr. Anat. 18. Bd.) and others. In *Apus* v. Siebold has described and figured the origin of the ovum from a fusion of two or three ova but there has been no confirmation or contradiction of his discovery. The consensus of opinion appears to be that throughout the animal kingdom the ovum represents a single cell. In considering the ovum it appears to me necessary to bear in mind the homology that exists between the ovum and its ancestor the Protozoon, to which Lankester (Notes on Embryology and Classification p. 7) has directed attention. Physiologically as well as structurally there is a close correspondence between the two, and I would suggest that the fusion of cells in the Myxomycete and *Protomyxa* to form the adult is perhaps recapitulated in the ovum of *Lepidosiren*.

2. *Ceratodus*. In *Ceratodus* as in *Lepidosiren* there are two kinds of ova; but the second kind of ova, those formed by the fusion of a number of cells, is very much rarer in the former, than in the latter type. Out of many hundreds of sections I only succeeded in discovering two unmistakeably of this kind; one was in the earliest stage found in *Lepidosiren*; a central mass of cells surrounded by a follicular layer, vascular sheath and secondary follicular layer; the second ovum was almost mature but the follicular cells not yet separated by a membrane from the ovum.

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