

"The External Features in the Development of *Lepidosiren paradoxa*, Fitz. By J. GRAHAM KERR. Communicated by A. SEDGWICK, F.R.S. Received April 11,—Read May 4, 1899.

(Abstract.)

The paper opens with a short account of the habits of *Lepidosiren* as observed in the Gran Chaco. A description is then given of the external features in the development. The more important points in this may be summarised as follows.

The egg is very large, 6·5—7 mm. in diameter. It is surrounded by a special capsule at first thick and almost jelly-like in appearance, later on (after fertilisation) thin and horny. Outside this was found in rare cases a thick jelly resembling that of the common frog's egg. The egg is without a trace of dark pigment. Segmentation is complete, resembling most nearly that of the egg of *Amia*, and leads to a condition with an upper hemisphere of small cells with large segmentation cavity, and a lower of large yolk cells. Gastrulation begins with the appearance of a row of depressions, or a continuous groove along about one-third of the whole extent of the margin between small and large cells. During its progress the small-celled portion spreads over the lower yolk cells by the addition to its margin of small cells split off from the yolk cells. As the groove referred to deepens into a slit to form the archenteron, it becomes gradually shorter, and the eventual complete blastopore is a crescentic slit only about a quarter of the length of the original groove. The medullary folds soon appear running forwards from the blastopore. There is no trace externally of a blastoporic or *protostomal* seam running along the back between the medullary folds. The folds are low and inconspicuous, and they are continued into one another behind the blastopore, which becomes the anus. There are only slight traces of overarching of the medullary folds to enclose a neural canal. During the later stages of intraoal development, the posterior end of the body becomes much more conspicuously folded off the yolk than the head end. The *Lepidosiren* hatches out as a tadpole-shaped larva, still completely devoid of dark pigment. Just about the time of hatching the cloacal opening closes temporarily. As the larva develops it becomes extraordinarily amphibian-like. It possesses large pinnate external or somatic gills, four on each side, corresponding to branchial arches I, II, III, and IV. A large cement organ is also present, which during its early stages is of the characteristic crescent shape so usual in the embryos of Anura. Pigment begins to appear about ten days after hatching—first in the retina, then over the dorsal surface, especially anteriorly. The larval condition lasts during the first six weeks after hatching. Towards the end of this period the cement organ undergoes atrophy. The somatic

gills atrophy later. During the process of their doing so, the *Lepidosiren* passes through a condition in which the stumps persist evidently corresponding to that well known in the young *Protopterus*, the group of external gills with their common stalk having come by differential development to be situated immediately above the fore limb. After the close of the larval period the *Lepidosirens* become much darker in colour and more lively in their movements. Young were obtained from the nest up to a length of 60 mm. About this time the cornea begins to assume the white unhealthy appearance that it has in the adult. In the young of this size, small yellow spots appear, and in the young of 90 mm. these are conspicuous. Occasional yellow blotches persist in the young *Lepidosiren* of eighteen months, but in the adult they disappear.

The paper concludes with general remarks on the phenomena described. The segmentation approaches most closely that of *Ganoids*. The shortening up of the invaginating groove is considered to illustrate a process which has taken place in phylogeny in the passage from the primitive holoblastic egg to the meroblastic condition. The continuity of the medullary folds behind the anus is adduced, together with the evidence accumulating of the prolongation of the blastopore along the floor of the medullary groove in other forms (*Amphibia*, *Ceratodus*, *e.g.*) as affording potent evidence in favour of the hypothesis which derives the *Vertebrata* from ancestral forms as primitive as the *Cœlenterata*, and possessing a nelongated mouth traversing the neural surface. The occurrence of external gills in the young of three so comparatively primitive groups of *Vertebrata* as *Crossopterygians*, *Dipnoans*, and *Amphibians*; their occurrence on four branchial arches in *Lepidosiren*, and on at least the hyoid arch in *Crossopterygians*, and the occurrence of a probable homologue on the mandibular arch in *Urodela*, are taken as suggesting that these structures are organs of great antiquity in the *Vertebrate* stem, and that there was formerly one present on each visceral arch. It is pointed out that were this so, it would afford a theory of the origin of the vertebrate limb, which would be supported by much of the evidence brought forward by the supporters of the Gegenbaur view, and which at the same time would avoid the most important difficulties in the way of this view.

“The Thermal Expansion of Pure Nickel and Cobalt.” By A. E. TUTTON, B.Sc. Communicated by Professor TILDEN, D.Sc., F.R.S. Received April 18,—Read May 4, 1899.

(Abstract.)

The author has carried out a series of re-determinations of the coefficients of thermal expansion of these two metals with the aid of the interference dilatometer described in a former communication to the