

development is undergone within the ovum until the embryo has reached the Phyllosoma or Megalopa stage, it exists in the newly hatched animal. Whenever the two kinds are found together, the oculus is the first formed, and therefore, according to Professor Hartog,<sup>1</sup> who has given considerable attention to the development and structure of this organ, it must be regarded as the primitive eye of the Crustacea.

By investigating the anatomy of *Cyclops* and *Diaptomus* by the method of sections, he has ascertained that this organ is much more complicated in structure than was previously supposed. He says that Claus has demonstrated that it is formed in all cases of a central pigmented mass, in which are half immersed three lenticular bodies or crystalline spheres—two lateral and one central.

The pigmented mass is structureless; the colouring granules are situated at the surface contiguous to the crystalline spheres. Each sphere is composed of radiating elements or optical bacilli, the inner ends of which are applied against the pigmented mass, while the peripheral segments contain a nucleus.

He describes the oculus as being situated upon the terminal process of the brain, from which the optic nerves originate, one for each sphere; the nerve, instead of penetrating into the pigmented mass, surrounds the outer surface of the crystalline sphere and penetrates directly not far from its posterior margin.

Claus has figured an analogous structure in the unpaired eye in the Phyllopoda<sup>2</sup> but has not indicated its true significance.

Dr. Hartog concludes that the unpaired eye, in all Crustacea that possess it, is composed of three simple eyes placed anteriorly to the brain, with reversed optical bacilli, receiving conductive fibres of the optic nerve upon their outer margin, and brought so close together that these pigmented or choroid layers are combined into a single mass.

Dr. Hartog further says that the eye which most nearly approaches the unpaired eye in Crustacea seems to be that of the Planaria, and that according to Justus Carrière,<sup>3</sup> the structure of the two paired eyes in the Planaria is similar to that described by Dr. Hartog in the simple eyes united in the middle line of Crustacea. It is therefore, he says, more rational to refer the eyes of the Crustacea to such a primitive and ancestral group as the Turbellaria, than to seek direct approximation between higher groups.

It appears, therefore, that when the central eye is present in the embryo of the higher Macrura, as may be seen in that of *Crangon*, *Astacus*, *Palæmon*, and the Phyllosoma of the Palinuridæ (where it only exists as a deciduous organ, and disappears before the animal attains maturity), in most cases it is only represented by a mass of pigment and that the crystalline spheres are seldom developed. In Pl. XIIA. figs. 2, 4, a single sphere is shown in a specimen which was taken off Samboangan, in the Philippine

<sup>1</sup> De l'œil impair des Crustacés, *Comptes rendus*, t. xciv. pp. 1430-1432, 1882.

<sup>2</sup> Claus, Zur Kenntniss des Baues und der Entwicklung von *Branchipus stagnalis* und *Apus cancriformis*, *Abhandl. k. Gesellsch. Wiss. Göttingen*, 1873.

<sup>3</sup> *Archiv f. mikrosk. Anat.*, Bd. xx. p. 160.