dition the animal remains for some time, increasing in size, until it is about an eighth of an inch long, the proboscis being about half the total length of the body. The tip of the proboscis is used by the larvæ to attach themselves by suction to foreign bodies, though apparently no special suctorial organ exists. As the body grows, the posterior band of cilia becomes wider and the cilia themselves longer and coarser, while the direction of the band alters slightly. From the appearance of fresh specimens in this stage, treated with acetic acid, I believe that several pouches arise from the gut which probably are destined to form the other gill-slits; but this is quite uncertain, though of course sections will at once decide this question. I have been unable to procure any specimens older than these, and of the changes by which this larva becomes converted into *Balanoglossus* I can therefore say nothing. Possibly the animal remains in this condition during the winter and awaits the spring for its final development. I hope to be able to observe the subsequent stages at some future season.—*Johns Hopkins University Circulars*, Nov. 1883.

On the Development of the Branchia in the Cephalopoda.

By M. L. Joubin.

The investigations of Kölliker upon the development of the Cephalopoda, while throwing much light upon the embryogeny of those animals, have nevertheless left in obscurity the origin of the organ of respiration. I have set myself, in the laboratories of M. de Lacaze-Duthiers, to fill up this gap by studying principally the *Sepia officinalis*, the eggs of which are easily procured.

The branchiæ of the embryo make their appearance at the beginning of the development in the form of two small buds, situated symmetrically with relation to the antero-posterior plane upon the middle of what will eventually become the posterior wall of the palleal cavity. The bud, produced by a pushing forth of the epithelial layer by the cells of the subjacent layer, soon elongates and forms a small well-differentiated eminence, rounded at the apex and attached by a broad base. I found it impossible, even in the youngest embryos that I could obtain, to ascertain the presence of vibratile cilia upon the branchia, although the palleal cavity is lined with them. The bud afterwards flattens so as to present two surfaces—a posterior one, applied against the visceral mass, and an anterior one, which is subsequently covered by the mantle which bounds the respiratory cavity superiorly.

Upon this little lamina, which is about $\frac{1}{3}$ millim. in length, a first horizontal fold appears towards the middle, then a second nearer to the point, then a third still nearer to the free extremity, and so on.

These folds form depressions upon one of the surfaces corresponding with elevations upon the other surface; the branchial bud has therefore become an undulated lamina; gradually other folds appear, always towards the point, while the whole organ at the same time increases in dimensions, so that a length of $1\frac{1}{2}$ millim. corresponds with a dozen folds. But the latter do not occupy the whole surface

of the young branchia; a space is reserved along its two margins (the external and the internal), in one of which will be formed the efferent vessel, and in the other the special gland of the branchia.

One of these undulations, considered in its totality, may be regarded as a semicircle formed by three parallel curves of cells, a middle one enclosed between an external convex and an internal concave one. Supposing the two extremities of this arc fixed in the same plane, if growth took place with equal rapidity in the three layers of cells, we should soon have a large *cul-de-sac*, no longer a semicircle, but more or less conical and deep; but things go on otherwise—the cells of the middle layer increase in number, and push before them the epithelium forming the convex surface, while that which forms the concave layer is not modified. By advancing more and more by means of a terminal focus of cell-division, the median layer gives rise to a lamina clothed on its two faces by the convex epithelium. The cells of this lamina, which are at first contiguous, soon separate from each other, so as to form lacunæ, and, at certain points, vessels. From this it results that, as this process is repeated alternately to the right and left of the primary undulated lamina, we obtain sections of the branchia composed of a slightly undulated axis, from which issue, to the right and left alternately, laminæ which become longer and longer the further we go from the extremity of the branchia. A little later we easily distinguish a small muscular band, which follows the inferior margin of each of the laminæ composing the branchia and fixes it.

Each of the laminæ formed as I have just stated produces in its turn a series of undulations by becoming folded in the direction of its width. But in this case the undulations are much hollowed, and correspond with strong eminences on the other side; no new productions are formed at the expense of the median layer, which remains even throughout and preserves its two epithelia. These undulations start from the point of attachment of the lamina, to run, gradually diminishing, to the point where is the focus of increase and where the new folds are formed.

Lastly, in the adult we observe a third system of undulations, consequently of the third order, situated perpendicularly to the point of inflexion of the laminæ, the formation of which I have just described. These series of new folds only appear very late in the embryo; at the moment when, being on the point of quitting the egg, it measures about 15 millim. in length, we only see scarcely perceptible traces of them, but they become quite distinct when injections of the branchia are made, which, however, is a very delicate operation.

As regards the vessels of the branchia, the one which conveys the blood to it appears early at the commencement of the formation of the laminæ; it occupies nearly the centre of the organ, and is comprised within the base of the laminæ and the gland of the branchia, which is also distinctly marked at this period. The efferent vessel is formed upon the crest of the branchia and on the outer border of the laminæ; it is undulated, like the parts which bear it, and issues

from the branchia at the base, to be continued by the auricle of the heart.—*Comptes Rendus*, November 12, 1883, p. 1076.

Injury sustained by the Eye of a Trilobite at the Time of the Moulting of the Shell. By Charles D. Walcott.

Mr. William P. Rust, of Trenton Falls, N. Y., called my attention some time since to the eyes of a small but very perfect specimen of *Illœnus crassicauda*, from the Trenton Limestone, that he has in his beautiful collection of Trenton fossils.

The left eye is perfect: the visual surface is clearly defined, and in the sunlight almost translucent between the darker base and the curve of the facial suture above. The right eye at first sight appears to have been broken in working away the matrix; but a close examination shows, as Mr. Rust expressed it, that the eye had been put out while the animal was living. This is shown by the peculiar growth of the shell about the aperture formerly occupied by the visual surface of the eye. The margins are turned in, rounded, and contracted, and the size of the palpebral lobe materially lessened. An injury to the visual surface would scarcely produce this effect if the shell was hard. If slightly injured before the moulting of the shell the separation would be imperfect and the visual surface carried away with the old shell would leave a cavity around which the new shell would form, as in the eye before us. If injured before the new shell had hardened, that effect might be produced; but the probabilities are, that the loss of the visual surface occurred at the time of the moulting of the old shell.

Among the thousands of trilobites that have passed through my hands in which the eyes were preserved I have never noticed any distortion or injury that occurred during the life of the animal. In a few instances the shell of the pygidium of *Asaphus platycephalus* has shown evidence of local fracture that appears to have occurred during the life of the animal, but these were very unsatisfactory. To Mr. Rust's skill in working out the specimen described, and also in detecting the character of the injured eye, we are indebted for some positive information of an injury sustained during the moulting of the shell of a trilobite.—*Amer. Journ. Science*, Oct. 1883, p. 302.

The Pelagic and Deep Faunas of the two Lakes of Savoy (the Lac du Bourget and Lac d'Annecy). By Dr. O. E. Imhof.

The Lac du Bourget is 17 kilom. long and about 5 kilom. broad, and its depth is stated at 80–100 metres. The Lac d'Annecy measures 14 kilom. in length, and its greatest breadth is $3\frac{1}{2}$ kilom.; its greatest depth is estimated at 62 metres.

In the Lac du Bourget on the 5th October the author obtained at 20 metres *Daphnella brachyura*, Liev., *Leptodora hyalina*, Lillj., a