confluent, and becoming deeper beyond the middle; beneath sparsely pubescent, somewhat densely, moderately coarsely punctured, the metasternum more finely punctured in the middle.

Length 12, breadth 4½ millim.

Hab. N.E. Tasmania, Gould's Country.

I have seen three specimens of this species: two recently brought from Tasmania by Mr. J. J. Walker, late of H.M.S. 'Penguin,' to whom they were given by Mr. A. Simson, of Launceston, from one of which the above description is taken (the other having been deposited by Mr. Walker in the British Museum), and a third in Mr. F. Bates's collection. Mr. Bates's specimen is lighter in colour, it being reddish brown, with the broad marginal stripe of the elytra stramineous.

Sept. 23, 1893.

LV.—*On the Nutrition of the* Salpa *Embryo.*

By W. K. Brooks*.

As the mammalian placenta nourishes and aerates the blood of the fœtus by the diffusion of gases and food in solution through the walls of the blood-vessels, it has been generally taken for granted that the placenta of *Salpa* performs its function in the same way; and it has been described as divided into a fœtal chamber and a maternal chamber, although its cavity is in reality part of the body-cavity of the chain-Salpa, and the blood which circulates in it that of the chain-Salpa. The *Salpa* embryo is bathed by the water which is constantly flowing past it, and it is therefore in very much closer relation to the external world than a mammalian embryo shut up in the interior of a large thick-walled body. There does not seem to be any need in *Salpa* for a respiratory placenta, and its thick spongy walls seem to indicate that it is not respiratory. We find in its structure nothing like the interlacing villi of the mammalian chorion, and the sections show that the embryo is nourished in a way quite unlike anything which has been described in the Mammalia.

The subject is a very interesting one. The rapid growth of the *Salpa* embryo is one of its most conspicuous characteristics, and the nutrition which this rapid growth demands

* From the 'Johns Hopkins University Circulars,' vol. xii. no. 106, pp. 97, 98.

is secured by two very peculiar organs, the follicle and the placenta.

While the egg at the time of fertilization is very minute, the embryo at the time of birth is enormous as compared with the size of the chain-Salpa which carries it, and it certainly increases many thousandfold during development. The growth is only partially due to cell-multiplication, and it is in part a result of the growth of the individual cells, for, instead of growing smaller with repeated division, they actually increase in size in all parts of the body.

This growth of the cells is one of the most notable peculiarities of the *Salpa* embryo, and in many parts of its body cells as large as the original ovum are found. The growth sets in very early, and it goes on uninterruptedly throughout the whole fœtal life, so that the embryo becomes gigantic as compared with the body of the chain-Salpa which contains it. Quoy and Gaimard describe an embryo 2 inches long at birth in a Salpa (*S. Forskalii*) a foot long, and Leuckart says that the embryo of *S. democratica* at birth is two fifths as long as the chain-Salpa which carries it. The fully grown embryo of *S. hexagona* is almost as long in comparison with the chain form of the same species.

It is not unusual for the embryos of viviparous animals to gain slightly in size and weight before birth; but, as Leuckart points out, the mammals are the only animals which exhibit anything comparable to the rapid growth of the *Salpa* embryo from a minute egg, and the history of the *Salpa* embryo at once calls to mind that of the placental mammals; nor is this resemblance entirely superficial, for in both the mammal and in *Salpa* we find an especial fœtal organ, the placenta, for the purpose of affording to the growing embryo an abundant supply of nutriment.

The resemblance between the fœtal life of *Salpa* and that of a mammal is most remarkable, and it is all the more noteworthy since we may be absolutely confident that the placenta of *Salpa* is an independent acquisition, entirely without genetic relation to that of mammals.

No modern writer except Todarro has ventured to regard the two structures as homologous, and their phylogenetic independence is so obvious that it is not necessary to discuss it, although a greater physiological and anatomical resemblance than the facts warrant has usually been assumed.

We should hardly expect fundamental similarity in structures of diverse origin. On the contrary, we might reasonably look for profound differences between the placenta of *Salpa* and that of the mammals.

The various writers on *Salpa*, while recognizing this fact and while pointing out the great differences in the way in which the placenta is formed in the two cases, have nevertheless assumed, either explicitly or by implication, a much greater resemblance to the mammalian placenta in structure and in function than actually exists. The later writers say very little about the function of the placenta of *Salpa*, but they assume a fundamental similarity to its function in mammals.

So far as it is in both cases an organ for supplying the embryo with nutritive matter derived from the blood of the supporting organism, the resemblance is real; but it goes no further than this, and the way in which the nourishment is conveyed to the embryo is totally unlike, a fact which has never been described or even noted.

In the mammalian placenta the blood of the embryo, as it circulates through the villi of the chorion, is brought into such close contact with the blood of the mother, that diffusion takes place through the separating walls, and thus the blood of the fœtus is oxidized, relieved of its waste products, and supplied by diffusion with nutritive matter in solution.

Notwithstanding the very intimate union between the blood-vessels of the fœtus and those of the mother, there is no direct communication between them, and nothing except gases and liquids can pass from the body of the parent to the body of the child without the violent rupture or perforation of the walls of the vessels, unless perhaps some very minute Bacteria are an exception.

It has been generally assumed that this must be true of *Salpa* also. Thus, Barrois says incidentally and very briefly (p. 495) that the function of the placenta of *Salpa* is to bring about by osmosis an interchange of fluids between the blood of the parent and that of the embryo, as in the placenta of a mammal.

The subject has received very little attention; but as no one has ever commented upon the view set forth at considerable length by Leuckart (pp. 61 and 62), this may be regarded as the accepted view. He says:—"The histological differentiation of the organs and tissues of the embryo is accelerated to a high degree by the circulation in the body of the young *Salpa*, which is completely separated from the circulation of the mother. At no time does the blood of the mother pass through the wall of the placenta into the body of the embryo. The transfusion between the mother and the fœtus is, as in the mammals, purely endosmotic, through the substance of the placenta, and it is most essentially facilitated

by the movement of the blood, both in the embryo and in the chain-Salpa.

"The upper wall of the placenta, which is the peculiar seat of the process of diffusion, projects into the body of the embryo and is surrounded by the median ventral blood-sinus. As the blood-corpuscles of the embryo are much smaller than those of the chain-Salpa, it is easy to see that no mingling takes place."

It is probably true that no transfusion of blood-corpuscles takes place, and it is difficult to show from the study of sections of hardened specimens that no serum from the blood of the chain-Salpa is diffused through the wall of the placenta, although its great thickness seems to be a very unfavourable condition for this purpose; and I shall show further on that the mechanism of nutrition is very different from that of mammals, that this is effected by the actual migration of great placenta-cells into the body-cavity of the embryo. The placenta is an organ for the nourishment of the placenta-cells by the blood of the chain-Salpa, and the subsequent degeneration of these cells, after they have migrated into the body of the embryo, supplies the material for the growth of the embryo. This is in all probability the only function of the placenta, for there does not seem to be any need for an especial apparatus for oxidation or for the removal of waste products. The *Salpa* embryo stands in much more direct relation to the external world than the mammalian embryo. It projects into the cloaca of the chain-Salpa, and is freely exposed to the constant current of fresh sea-water which flows around it, and its thin surface seems to be much more favourable than the thick wall of the placenta for the diffusion of gases. During the later stages of fœtal life its own mouth is open, its muscles contract, and there is no reason why it should not breathe for itself exactly like an adult. I therefore regard the placenta as a nutritive organ pure and simple, and it serves its purpose not by the diffusion of a fluid, but by the transportation of solid food into the body of the embryo. From this point of view it is clear that those investigators who have described it as divided into a fœtal chamber and a maternal chamber have been misled by an erroneous notion of its function.

The detachment of the placenta-cells has been observed and noted by both Salensky and Barrois, but it has been regarded as a destructive change and as a sign that the organ has served its purpose and has become superfluous.

It has been assumed that it reaches its perfect form and serves its purpose, and that it then degenerates and breaks

down, and no importance has been attached to the process of degeneration, as it has not been regarded as significant.

No note has been made of the very early stage at which degeneration begins, nor of the fact that it is initiated as soon as the embryo begins to grow and long before it has reached half or a quarter of the size which it is to have at birth.

This is hard to explain so long as the disintegration of the placenta is regarded as its destruction, but it becomes quite intelligible as soon as we learn that the detachment of the placenta-cells, instead of marking the end of its functional life, is actually a manifestation of its useful activity.

These strings of cells multiply at their lower ends by direct division of their nuclei, and as the new cells which are thus formed push up towards the top they grow very large, while their nuclei become filled with diffused chromatin granules. In *Salpa hexagona* these cells ultimately reach the top of the placenta, where they gradually become elongated and irregular, and then break through into the body-cavity of the embryo as the migratory follicle-cells.

While the details are slightly different in *Salpa pinnata*, placenta-cells migrate bodily into the embryo in the same way.

The rapid growth of the embryo seems to be most important to *Salpa*, and while we know almost nothing of its birth-rate, the quickness with which the surface of the ocean becomes covered with *Salpæ* of all ages in a long calm shows that the animals are most prolific, and the complicated structure of the organs for nourishing the embryo shows that every provision is made for rapid growth.

The placenta is not the only nutritive organ, for the follicle also makes most important contributions to the supply of material which is available for the construction and rapid completion of the body of the embryo; and while I have spoken of the segmentation and the formation of the blastodermic germ-layers as retarded, the retardation is probably not actual but only relative, and the process of development is, on the whole, accelerated by the presence of the follicle and by its share in the growth of the embryo.

The ultimate fate of all the follicle-cells is the same, and they may be found in the sections, detaching themselves and degenerating, first, in the somatic layer of the embryo; secondly, in the somatic follicular lining of the perithoracic structures; thirdly, in the cavity of the pharynx; fourthly, in the visceral mass outside the digestive cavity; and, last, in that part of the placenta which is derived from the somatic layer of the follicle.

While it is not possible to trace the history of every cell from first to last, we have as ample evidence as we could hope from sections that the function of the follicle of *Salpa* is exclusively nutritive, that it is transitory and embryonic, and that the tissues of the embryo are not built up out of follicle-cells, but from blastomeres, after the analogy of all the rest of the animal kingdom.

LVI.—*Descriptions of new Coleoptera from New Zealand.*

By Captain Thos. Broun.

[Continued from p. 302.]

Group **Cryptorhynchidæ**.

Acalles integer, sp. n.

Convex, piceous, variegate; squamosity hair-like, mostly yellowish red; at the base of the thorax, near each side and near each shoulder, there are pale streaks, and there is a similar but less distinct and much interrupted one between the hind thighs; near the top of the posterior declivity there is a large dark band which does not reach the middle; there are also numerous erect, not coarse, variegate setæ on the legs as well as on the body; antennæ and tarsi reddish.

Rostrum shorter than the thorax, with a median carina, more or less squamose and punctate. *Antennæ* implanted behind the middle; scape short, incrassate towards the apex; funiculus elongate, second joint as long as the first but much more slender, 3 to 7 decrease in length; club elongate-ovate. *Thorax* longer than broad, widest behind the middle, more (but very gradually) narrowed towards the front than it is near the base, its punctuation close and rugose; the apex is rounded, the base truncate. *Scutellum* absent. *Elytra* very slightly broader than the thorax at the base, widest and much rounded between the middle and hind legs, from thence they are gradually but a good deal narrowed; the hind declivity is not at all abrupt; they are rather deeply and regularly striate, the punctuation (owing to the clothing) is indefinite. *Legs* robust, elongate; femora long and thick, not dentate; front tibiæ incurved, the others flexuous; tarsi slender, third joint a good deal expanded and bilobed.

Underside with depressed, tawny, hair-like scales. *Meta-*

Brooks, William Keith. 1893. "LV.—On the nutrition of the Salpa embryo." *The Annals and magazine of natural history; zoology, botany, and geology* 12, 369–374. https://doi.org/10.1080/00222939308677636.

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