

as to whether she would have continued throughout her life to produce only females, or whether, at a more advanced age, her progeny would have been males, as was seen in the colony of *Trigona clavipes*, mentioned above. In any case the non-simultaneous production of individuals of the two sexes in one and the same colony points, in certain species of Meliponids, to the indispensable intervention of cross-fertilization, the advantages of which are well known to naturalists.—*Comptes Rendus*, t. cxx. no. 5 (February 4, 1895), pp. 273–275.

On the Development of the Body in the Prawn (Palæmon serratus, Fabr.) and the Crayfish (Astacus fluviatilis, Gesn.). By LOUIS ROULE.

For several years past I have prosecuted researches upon the development of the two crustaceans mentioned in the title of this note. The facts that I have observed are for the most part known; but several of the principal among them have not been described with great accuracy, and the interpretations that have been given of them seem to me to be incorrect.

The ovum of these animals is chiefly composed of food-yolk; the formative yolk, at the moment of fertilization, collects into a little cicatrice, which alone produces all the elements of the embryonic economy. Contrary to what happens in the case of *Porcellio*, to the embryogeny of which I have devoted a recently published memoir*, the cicatrice does not commence by surrounding the entire ovum, to give rise afterwards to the appendages; it develops on the spot and increases slowly, while giving rise in succession to the organs and the paired limbs. The ovum of *Porcellio* is globular; the young embryo is itself spherical from the very first; it subsequently elongates, increasing in size principally in the direction of the future longitudinal axis, and thus arrives at its definitive condition. The case is different both in the prawn and in the crayfish. At the very commencement of the embryonic development of these latter forms the cicatrice divides, following a plane almost tangential to the surface of the ovum, into two superimposed parts. This cleft commences as a superficial depression, which extends across and sinks little by little into the cicatrice, dividing it in such a way that the latter, instead of remaining full and compact, appears divided into two halves, one of which is folded back beneath the other. This arrangement persists, while the cicatrice increases in size, giving rise to the appendages and the organs; the halves enlarge and preserve their relations, one of them being tucked beneath the other. Finally, when the development is concluded and the body formed, the latter lies bent double; the portion folded back corresponds to the abdomen, and the other to the cephalothorax. At the moment of hatching the curvature is effaced by the straightening of the whole, and the abdomen, assuming its

* "Études sur le développement des Crustacés."—1^{re} Partie; 1^{re} Mémoire: "Étude sur le développement du Cloporte (*Porcellio scaber*, Leach)." Annales des Sciences naturelles, Zoologie, 1894.

ultimate position, extends in the direction of the longitudinal axis of the body.

The important fact in this series of phenomena is the singular manner in which the curvature is produced. The latter does not take place gradually, by the folding upon itself of the young embryo; it appears all at once, by means of a cleft, which penetrates into the cicatrice, divides it into two planes, and increases in size with the latter. This cleft does not enter into the composition of the body; it forms part of the surrounding space and is destined to disappear. Authors have already alluded to its presence; but in my opinion they have strangely mistaken its real value. They have considered the rudiment of it *as corresponding to a gastrular invagination*, and this as much on account of its very early appearance as of its origin and mode of growth. On carefully following the series of embryonic stages, we perceive that this invagination in no way contributes to the formation of the digestive cavities, it remains independent of these, preserves its autonomy while increasing in size, and finally becomes the cleft which, in the embryo doubled upon itself, separates the cephalothorax from the abdomen.

A division of this kind is not peculiar to certain of the higher Crustacea; it exists, although less pronounced, in other more simple representatives of the class—in *Asellus aquaticus*, Fabr., for example. The embryogeny of the latter proceeds, as regards the extension of the cicatrice, similarly to that of *Porcellio*, at least in its general features; only the body of the young embryo, which is at first spherical, assumes the definitive elongated form by cleaving in its dorsal region, leaving the ventral portion undivided and separating the halves one from the other after the manner of two valves. This phenomenon is most important, for it represents in a relatively simple condition and at an advanced stage of development the precocious fission of the cicatrice in the prawn.

With reference to comparative embryology, this fission corresponds to a displacement in space. The body of the embryo enclosed in its egg-shell comes all at once, by its means and without any other modification, to acquire a recurved shape, which enables it to be contained in the cavity limited by the shell. Undoubtedly the cause in such a case must be sought for in the abundance of the food-yolk: the latter renders the ovum very bulky and prevents all folding back. This displacement involves very remarkable consequences with respect to the position of the rudiments of several organs. Thus, the extremity of the abdomen arises beneath and in front of the head; the anus breaks through immediately behind the mouth, and so on. These phenomena proceed from the foregoing. All the organs are afterwards restored to their places by the straightening of the body, the effacement of the curvature, and the disappearance of the cleft. Among the alterations introduced into the embryonic processes by the presence in the ovum of a large quantity of food-yolk, the production on the spot of a doubling back of the entire animal, by means of the simple formation of the free space which separates the two folded portions, is one of the most curious.—*Comptes Rendus*, t. cxx. no. 5 (February 4, 1895), pp. 271-273.



Roule, Louis. 1895. "On the development of the body in the prawn (*Palæmon serratus*, Fabr.) and the crayfish (*Astacus fluviatilis*, Gesn.)." *The Annals and magazine of natural history; zoology, botany, and geology* 16, 127–128.

<https://doi.org/10.1080/00222939508680238>.

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