

XXI. *On the Double Metamorphosis in the Decapodous Crustacea, exemplified in Cancer Mænas, LINN.* By J. V. THOMPSON, F.L.S. Deputy Inspector-General of Hospitals. Communicated by Sir JAMES MACGRIGOR, Bart. M.D. F.R.S.

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IN the Memoir published in my Zoological Researches, p. 1, with its sequel, p. 63, having first made known the fact of the *Brachyura* of the *Decapoda* (Crabs) passing through the intermediate form of *Zoea*; I have now to announce that they undergo another metamorphose, no less singular and unlooked for, in which they assume the form of the genus designated by the name of *Megalopa* by Dr. LEACH, from the disproportionate size of the eyes. This second stage we may therefore consider analogous to that of pupa in the class *Insecta*.

By the former memoir it appears that the young of *Cancer Pagurus*, the common market Crab, first presents itself as a *Zoe**, and that a full-grown *Zoe* was observed passing into some other more perfect form †, which at that time was considered to be that of some species of Crab: the discovery now first detailed, however, shows that it must have been only passing into that of a *Megalope*.

The first proof I had of this new and extraordinary fact, which cancels another anomalous genus of the *Crustacea*, was obtained by keeping in regularly renewed seawater a number of individuals of a *Megalope* ‡ which makes its appearance in the river Lee, just below the city of Cork, in considerable abundance every summer: these, to my very great surprise, began, after a short time, to change into a minute Crab §, until the whole of them, to the amount of about two dozen, were so metamorphosed. I have frequently since observed the same circumstance, and came to the conclusion that these must be the progeny of the only Crab that is ever found in the higher parts of the river, where these *Megalopæ* were taken, viz. *Carcinus Mænas*, our common Shore Crab. The young Crab, it will be noticed, has not the distinctive characters of its parent, which it probably acquires only after several casts of its shelly covering.

To complete the series of metamorphoses in this species of Crab now became a matter of research; and I have been so fortunate as to succeed in hatching its mature spawn, so as to be enabled to give a representation of its *Zoe* ||, or first stage, and thereby render complete its natural history. In this stage it does not appear to differ materially from that of *Cancer Pagurus*, formerly figured in Zoological Researches

* Pages 9 and 64.

† Page 8.

‡ Fig. 2.

§ Fig. 6.

|| Fig. 1.

Pl. VIII. fig. 1. It is, however, certainly much smaller, and of a greenish tinge, with a few darker spots.

If the above facts do not warrant the conclusion I have drawn, what other proof can be required? Is it necessary that the young Crab should be traced through its subsequent changes until the character of the species becomes more apparent? or that the grown *Zoe* should be actually seen to change into a *Megalopæ*? Neither of these is impracticable, but may yet for a long time elude the most zealous and scrutinizing observers.

It appears, then, that the animals of this division of the *Crustacea* not only undergo metamorphosis, as formerly stated, but that they even undergo a double metamorphosis, being hatched from the ova under the singular and grotesque form of *Zoea*, then assume that of *Megalopæ*, and finally that of their parent Crab. How long they remain in each of these two intermediate states it may be difficult to determine with exactitude; but judging from the very considerable size of the *Zoe* I observed about changing its condition*, compared with their very minute size when first hatched, and also from *Megalopæ* not appearing before May or June, while *Zoea* are seen so early as March and April, I think a month may be assigned as the probable duration of the *Zoe* stage. The other, or *Megalopæ* stage, is less within the scope of observation; but as there is not that very great disparity of size between young and full-grown *Megalopæ*, it is likely that it does not exceed half that of the former.

If further proof of this double metamorphosis be desired, I have been so fortunate as to trace it, but not in quite so satisfactory a manner, in one of the Swimming Crabs, or *Portuni*, and also in *Inachus*, belonging to the section of Triangular Crabs. These examples, derived from some of the principal groups of the *Brachyura*, may be supposed quite sufficient to satisfy the most scrupulous, as to their metamorphosis; I propose, however, in future memoirs, to bring under the notice of the yet sceptical, proofs of the same thing in the following genera, viz. *Eriphia*, *Thelphusa*, *Gegarcinus*, and *Pinnotheres*†. The three former genera, it may be observed, are foreign, which friends in the East and West Indies have enabled me to add to the first proofs of metamorphosis, by having females with ova on the point of hatching, sent home in spirits: the larvæ of these, consequently, have not been seen in the living state; but by examining such as have burst from their envelopes, without being completely developed, it is quite evident that they are *Zoea*.

With regard to the other great division of the *Decapoda*, viz. the *Macroura*, or those with extended tails, I shall only now say, that as far as my observations have gone they also undergo metamorphosis, being *Ipizopoda* when first hatched, and during the whole of their progress to the perfect animal; such is the case in *Astacus marinus*, *Palinurus*, *Palæmon Squilla*, *Crangor*, *Galathea*, *Pagurus*, and *Porcellana*.

To return to the immediate subject of the present memoir, the *Carcinus Mænas*. In its first or *Zoe* stage it is wholly natatory from structure, while in its second it

* Zoological Researches, p. 8.

† This has since been published in the Entomological Magazine.

occasionally walks by means of its thoracic members, now become simple, but more commonly swims by the motion of its subabdominal fins, which are greatly developed for this purpose*. In both stages it is therefore a *Macroura*, but only in the latter evidently related to the *Decapoda*.

It will be quite superfluous to enter into a minute detail of the structure of this *Megalope*, further than may be collected by a reference to the figure and its accompanying explanation.

It must certainly be considered surprising that so many curious facts should have remained until the present time undiscovered; but still more, that from the first announcement of metamorphosis no person has attempted to follow it up; so that I have not only the honour of the discovery, but also the entire merit of having rendered this interesting part of the natural history of the *Crustacea* nearly complete, as the announcements in the previous part of this memoir testify, and my subsequent memoirs will prove.

The facts connected with the metamorphosis in the *Crustacea* and the *Cirripedes* are indeed so much at variance with our previous knowledge, with the dicta of some of our leading naturalists, and of so very extraordinary a nature, that the scepticism which still exists with regard to them may admit of some excuse. The approaching summer I hope will put it in my power to remove all doubts upon the subject, by submitting such of them as offer themselves to the scrutiny of *other observers*, a circumstance which never occurred to me as necessary beyond the circle of my own family; had there been any zoologists in my neighbourhood the case would have been different, but in respect of this branch of science I here unfortunately stand alone.

Whatever indifference may be charged to our own zoologists in regard to these important discoveries, we must do our scientific neighbours the French the justice of noting, that they immediately took up the subject, and two naturalists were selected and deputed to spend a summer at Isle Ré, to make their observations. However, by a subsequent report of one of these gentlemen, M. MILNE-EDWARDS, to the French Institute, it appears that so far from verifying the metamorphosis in *Crustacea*, he pronounced that they were hatched with the form and structure of their adult parent! The observations upon which this decision was based I have not seen stated; but whatever they may have been, they are completely invalidated by the positive proofs I have given and enumerated in the present memoir.

The animals of this class are so recondite in their habits, so difficult to preserve alive for any time, so little known to naturalists beyond the more common species, that the investigation is necessarily attended with great difficulty and frequent disappointment. It must be allowed that I have been peculiarly fortunate; and I am so sensible of the obligation I owe to that Source from whence springs all our

* Fig. 3.

knowledge and intelligence, that I hasten to acquit myself of so sacred and valuable a trust with all the ability I am yet permitted to retain.

PLATE VI.

- Fig. 1. *Zoe* of *Carcinus Mænas*, magnified, and also of its natural size.
Fig. 2. *Megalope* of the same, magnified, and also of its natural size. The terminations of three pair of the subabdominal fins are only seen in the figure.
Fig. 3. One of its subabdominal fins more highly magnified.
Fig. 4. The posterior pair of fins magnified.
Fig. 5. One of its inner antennæ, highly magnified.
Fig. 6. The Young Crab, resulting from the above *Megalope*, magnified, and also of its natural size.

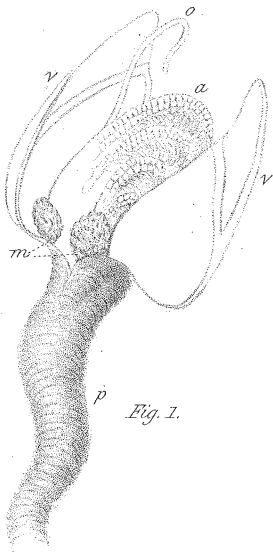


Fig. 1.

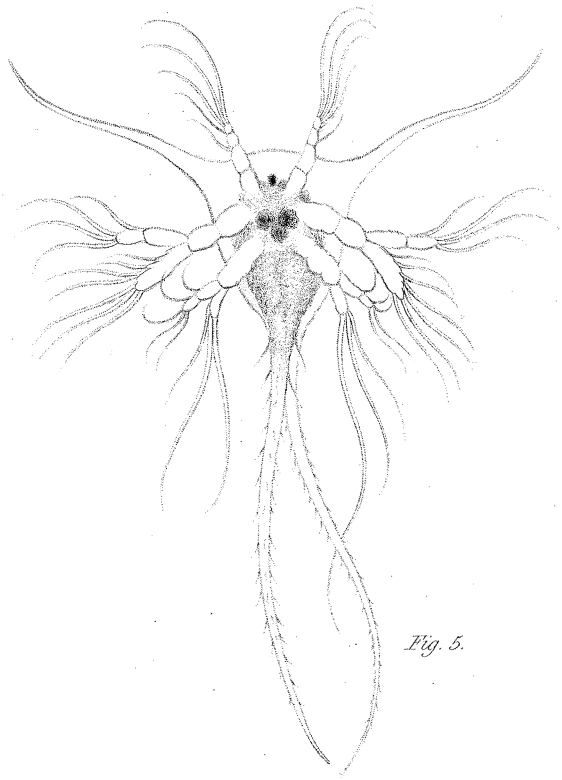


Fig. 5.

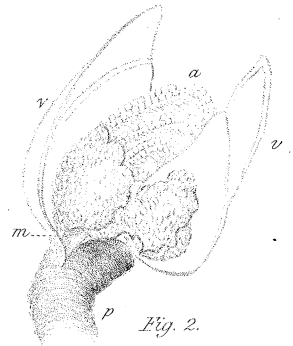


Fig. 2.

Fig. 3.



Fig. 4.



Fig. 6.

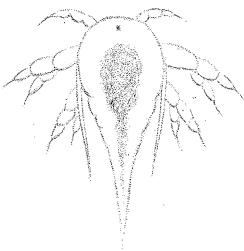


Fig. 8.

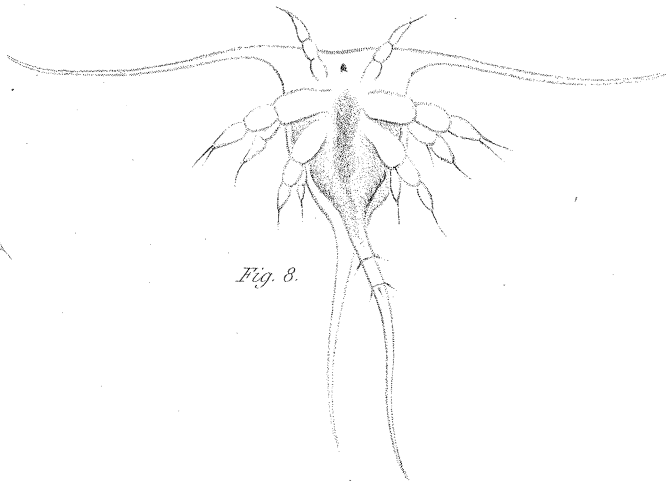


Fig. 7.

