

Note on the MOVEMENTS of the VIBRACULA in CABEREA BORYI, and on the supposed COMMON NERVOUS SYSTEM in the POLYZOA. By the Rev. THOMAS HINCKS, B.A., F.R.S.

THE theory of a common or colonial nervous system in the *Polyzoa*, first propounded by Fritz Müller, must be regarded as still *sub judice*. The question may be approached on two sides, the histological and the physiological. Müller's attention seems to have been first drawn to the subject by the behaviour of the polypides in certain cases which, appeared to point to the existence of a system of nerves apart from the individual cells, by which the members of the colony are to some extent controlled, and brought into relation. He refers specially to the energetic movements of the peduncle of *Pediceolina*, after the fall of the body, and to the simultaneous movements of the cells in *Mimosella gracilis*, a fact which I had previously observed and recorded. He was thus led to investigate the stems and branches of some of the *Ctenostomata*, and demonstrated the existence of the (supposed) ganglia and trunks of the colonial system. Smitt adopted his views and made similar observations on the *Cheilostomata*.

Their conclusions have been criticised by Reichert and Nitsche, and more recently by Joliet. These writers are agreed in regarding F. Müller's doctrine as erroneous. Viewing the subject anatomically and histologically they arrive at the same result, that the structure which Müller and others have described as a colonial nervous system, has in reality has a very different significance. Reichert regards the cords and network of threads that occur in the stems of the *Ctenostomata* as a medium of communication between the polypides of a colony, and as a channel by which stimuli applied to the cœnœcium may be transmitted and diffused, but denies that they have the character of a true nerve-tissue. Nitsche takes much the same ground with reference to the *Cheilostomata*. Joliet, as the result of histological investigation chiefly, gives a decided verdict against F. Müller's interpretation. He also states that he has cut in two the supposed nerve-trunk pervading a branch, and that the polypides expanded on the same branch did not retract themselves, a fact which seems to tell with as much force against Reichert's view as against Müller's. He identifies the supposed nerve-threads passing to the body of the polypide from the stem with the *funiculus*.

I do not propose to enter at all into this branch of the subject in the present note, but merely to direct attention to a physiological fact, which naturally leads us to infer the existence of some such colonial nervous system as Müller has described, and of which indeed some such system seems to offer the only explanation. I refer to the *simultaneous movements* of the *vibracula*, which have been noticed in one of the Cheilostomatous genera, and which probably occur in others. This remarkable fact has hitherto attracted very little attention. About four years ago I had the opportunity, in Guernsey, of studying the *Caberea Boryi*, Audouin, in the living state, and was much surprised to find that the highly-developed vibracular appendages with which it is furnished, instead of acting independently, as these organs do in other *Polyzoa*, moved together with perfect regularity. I was under the impression at the time that the observation was as new as it was undoubtedly interesting; but I have since ascertained that the fact had not escaped Mr. Darwin's notice, but is mentioned briefly and quite incidentally in his work on the 'Origin of Species.' In that great storehouse of fact and observation it seems to have lain *perdu*, and I have never met with a reference to it in any writer on the *Polyzoa*.

Mr. Darwin has not given any detailed description of the species on which his observation was made; but it is evident from his brief notice of it that it was a *Caberea*, and it may very probably have been the *C. Boryi*, which is a cosmopolitan form.

In the genus *Caberea* the *Vibracula* are enormously developed, and give a very distinctive appearance to the zoarium. In *C. Boryi* they are long and slender and serrated along one side, while the grooves into which they fall when at rest stretch completely across the posterior surface of the cells. After a short interval of quietude all the *vibracula* on a shoot are seen, as if moved by one and the same impulse, to start into sudden activity, swinging themselves round simultaneously to the front of the cells, and then sweeping backwards again and resuming their former position. After another interval the same synchronous and perfectly regular movement takes place, and so on continually. The action is as orderly as that of a machine.¹ There is something positively startling, after the perfect quiet, in the sudden, simultaneous rush of the whole host of *vibracula* into energetic activity.

In this genus then the setiform appendages act not indi-

¹ This remark is intended to apply to the movements only and not to the intervals between them, which vary in length.

vidually but in companies, obedient to a common impulse; and in such a case it seems impossible to doubt that there must be some special nervous arrangement, apart from the zooecia, by which the vibracular zooids are brought into relation and their synchronous movements determined.

I have said that similar phenomena may probably have a place in the history of other genera. Amongst the family *Selenariadæ*, Busk, the *vibracula*, we know, are developed to an extraordinary extent, and attain a larger size than in the genus *Caberea*.

Their remarkable character, coupled with the fact that the members of this group are free in their adult state, led Mr. Busk to conjecture that these appendages might have a locomotive function. And he informs me that this conjecture has been verified by actual observation, and that some of the *Selenariadæ* at least do actually move about by means of their *vibracula*. If this be so, it is in the highest degree probable that those belonging to each colony act in concert, and that their movements are, as in *Caberea*, simultaneous.

However this may be, the case of *Caberea Boryi* seems to be conclusive, as far as it goes. It may be considered to prove that a nervous system, distinct from that of the individual polypides, by which certain zooids in the colony are brought into relation and common action, exists in one instance, at least, amongst the *Polyzoa*.¹ And this not unnaturally leads to the inference that a similar system, though perhaps in a less highly specialised form, may probably occur more widely in the class.

It is not my purpose however to theorise, but merely to direct attention to a very remarkable fact which has been strangely overlooked, and its relation to the interesting question raised by Fritz Müller's investigations.²

¹ It will be noticed that this goes much beyond the kind of communication between the various elements of the colony, which is supposed by Reichert to exist, and for which his "communale Bewegungsorgan" provides.

² Since the foregoing was written I have seen Joliet's later researches on the (supposed) Colonial nervous-system. ['Comptes Rendus,' Aug. 13th, 1877.] He finds it present in all the *Polyzoa* he has examined, and very largely developed. It is composed of fusiform cells. At the expense of this tissue, the polypide with its muscles is developed; and in its bosom the ova and the mother-cells of the spermatozooids are formed. He regards it as a distinct, constituent tissue of the *Polyzoon*, which he proposes to call the *Endosarc*. Its special function is the production of the polypides or the reproductive elements. It is itself derived from the Eudocyst. If these conclusions are confirmed, they will form a very important addition to our knowledge of the structural and physiological history of the *Polyzoa*. But they do not affect the significance of the fact to which I have directed attention in my paper.