

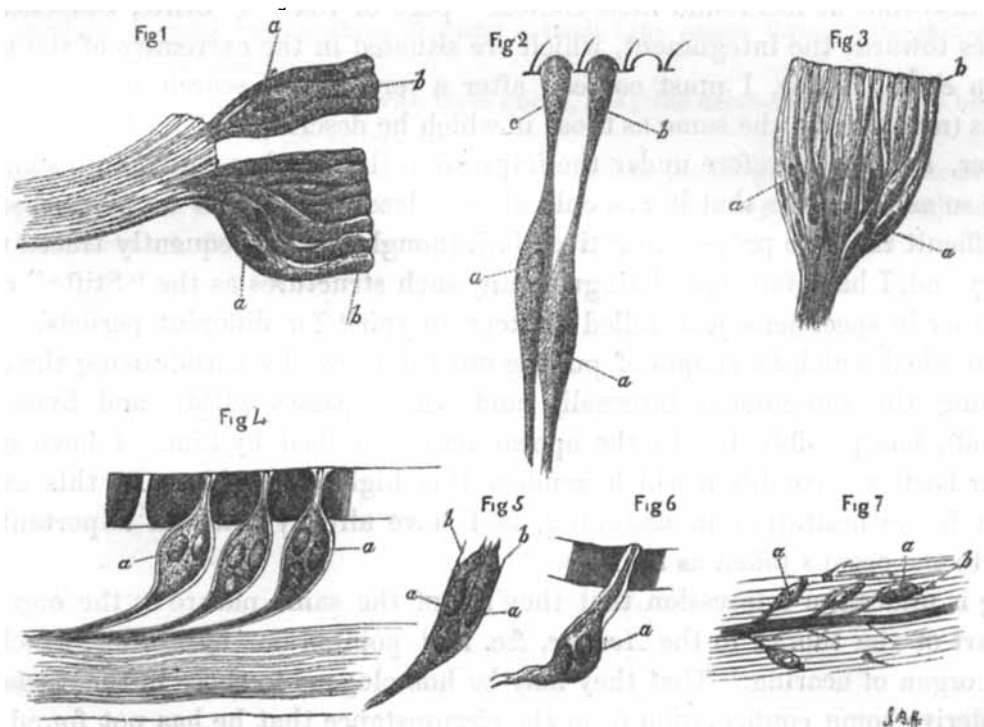
XXII. *On the Nerve proceeding to the Vesicles at the Base of the Halteres, and on the Sub-costal Nervure in the Wings of Insects.* By J. BRAXTON HICKS, M.D. Lond., F.L.S.

Read June 20th, 1861.

IT is unnecessary to enter into any description of the vesicles of the halteres and wings, as I have already fully noticed them in former pages of the Transactions and Journal. I showed first, also, of any observer, that to them a very large nerve proceeds, next in size to the optic, and that the divisions of this nerve pass to the base of the vesicles.

The additional information, which it is my desire now to lay before the Society, is, that a bipolar ganglionic cell is to be found just beneath these organs.

If, instead of viewing the parts intact, the base of the haltere be broken up, it will be found that, shortly before arriving at the position of these vesicles, the nerve enlarges in the following manner:—Each fibril is developed into an elongated ganglionic cell, generally with a large nucleus (*a*, figs. 1, 2, 3). The distal end becomes contracted again



for a short space, but finally and gradually dilates, until it comes in contact with the inner surface of the vesicle (*b*, figs. 1, 2, 3). In this terminal expansion I have sometimes observed a nucleus (*c*, fig. 2); sometimes, however, the contents have been granular; whether there be a small cell at the very extremity, I am unable to say with any certainty, but comparing it with its homologue in the subcostal nervure, I am inclined to think the existence of such a structure doubtful.

This can be well observed in *Rhingia rostrata* and *Eristalis tenax*. (See figure.)

The nerve in the subcostal nervure is disposed in a somewhat similar manner. But in many instances I have found the ganglionic enlargement to possess more than one nucleus; two or three apparently coexist in the *Coleoptera* (see *a*, figs. 4, 5, 6). The distal end of this enlargement tapers off to a rather fine extremity, so that it may pass up through the canals which pierce the integumental layers.

The mode of termination in these nerves points out a homology to the termination of the optic nerve, as seen in its development in insects, and is, indeed, probably the method by which all nerves of sensation end, as has been shown by M. N. Jacobovitsch in the *Comptes Rendus*, May 7, 1860, p. 859. (See 'Microscopical Journal,' April 1861.)

In some—the Saw-flies for example—the ganglionic enlargement is not elongated, but applied immediately beneath the canals; so that, crowding as they do together, the whole seems as a compact layer of ganglionic cells.

The outer nerve-sheath is attached to the edge of the skin-canal, as is shown in figs. 4, 5 & 6, reminding one of the condition of the nerve-sheath of the compound eyes by which it attaches itself to the faceted cornea.

We are indebted to Leydig for the additional knowledge of the ganglionic enlargement at the termination of the nerve supplying these structures*. Upon reviewing my papers, he states also that he has found little conical "pegs or rods" ("Stifte, Stäbchen") with their bases towards the integument, which are situated in the extremity of the nerve, one or two in each. These, I must confess, after a very careful search through numerous specimens (many being the same as those in which he describes them), I have been unable to discover, and am therefore under the impression that he has fallen into some error—the more so as he admits that it was only after a dozen trials that he himself succeeded. It is a difficult thing to prove a negative; but, though I have frequently traced the nerve to its very end, I have failed to distinguish any such structures as the "Stifte" or "Stäbchen," either in specimens just killed or kept in spirit for different periods. I suspect that the method which he adopts of pulling out the nerve, by withdrawing the organized layer lining the integument internally and which passes within and lines the tube (skin-canal), has possibly led to the appearances described by him. I have noticed in the larger beetles a condition which renders this highly probable. Be this as it may, there can be no hesitation in assigning, as I have already done, an important sensory function to the organs taken as a whole.

Leydig is under the impression that they are of the same nature as the organ in the hinder part of the thorax in the *Acridæ*, &c. first pointed out by Müller, which he considers an organ of hearing. That they may be homologous to those in the *Acrida*, would seem to derive some confirmation from the circumstance that he has not found Müller's organ in the same part in other insects, while I have not found those I have pointed out on the wings of the *Orthoptera*.

But are they, therefore, auditory organs? Have they any similarity to what we know of this organ in the *Invertebrata*? I confess my inability to see any resemblance beyond

* Reichert und Du Bois-Reymond's Archiv, 1860, No. 3, p. 299.

such as appertains to all sensory nerves. To what I have already advanced on this point I have nothing to add.

At the time of writing his article above mentioned, Leydig had not seen my second paper on the antennal organs. Nor had he been successful, as he owns, in applying the bleaching process I have recommended for their examination; consequently neither has he, nor indeed any writer (Lespès for instance, nor his critic in this subject, Claparède), as yet noticed properly the structures I have pointed out in the antennæ. Under these circumstances we must consider their opinion as to the seat of the auditory function liable to revocation.

EXPLANATION OF THE FIGURES.

- Fig. 1. Termination of nerve of haltere in *Rhingia rostrata*, showing a row of ganglionic cells, with nuclei *a a*, and their terminations *b, b*.
- Fig. 2. Two ganglionic cells *in situ* in halteres of *Eristalis tenax*: *a a*, ganglionic enlargement; *b*, terminal expansion with nucleus, *c*, passing to the interior of the vesicles, *d*.
- Fig. 3. Row of ganglionic cells, *a a*, in *Eristalis tenax*; *b*, their termination beneath the vesicles.
- Fig. 4. Ganglionic cells in a Beetle (one of the *Lamariæ*), the outer nerve-sheath attached to the skin-canal; *a a*, nuclei, two or three in each: a small tube passes through the skin-canal to the closing-in membrane.
- Fig. 5. Shows one of the ganglionic cells with three nuclei, *a a*; the nerve-sheath, *b b*, has been attached to the inner surface of the skin-canal.
- Fig. 6. Shows another form, where the ganglion, *a*, is not so near the integument as in the preceding.
- Fig. 7. Organs viewed *in situ* from above on the nervure of *Strangalia elongata*: *a a*, ganglionic swellings with nuclei; *b*, closing-in membrane and skin-canal.