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II. Wissenschaftliche Mittheilungen.

1. On the Spinal and Visceral Nerves of Cyclostomata.

By W. B. Ransom, Fellow of Trinity College, Cambridge, and D'Arcy W. Thompson, Professor in University College, Dundee.

eingeg. 2. Mai 1886.

The following preliminary note relates to work begun in the spring of last year, but unfinished for lack of fresh material. Recent supplies of *Petromyzon fluviatilis* and *Myxine* have enabled us to continue our previous work, and while reserving details and the discussion of previous views, we publish this statement on account of the support some of our facts lend to certain of Onodi's results, and the bearing of others on Gaskell's researches on visceral nerves.

Spinal cord: *Petromyzon.* The grey matter is not divided into anterior and posterior cornua, nor does it show any trace of segmental arrangement. It presents medianly, *a.* large ovoid cells, the so-called hind-cells. *b.* small multipolar cells: and laterally *c.* large multipolar cells; and *d.* a small group of large multipolar cells, placed at

intervals in the extreme lateral region of the cord, isolated from the rest of the grey matter. *a.* and *b.* are connected with fibres of the posterior roots, *c.* and apparently also *d.* send processes to the anterior.

On entering the cord, the anterior roots decussate considerably; the posterior roots do not.

Spinal nerves: *Petromyzon.* The posterior and anterior roots leave the spinal cord not in the same plane but alternately. There is considerable want of regularity in their arrangement, and often the two posterior roots are themselves not in the same plane.

The anterior and posterior roots remain separate throughout the body: the former are placed opposite the myomeres, the latter opposite the intermuscular septa. The fibres of both roots are non-medullated, but possess a nucleated sheath; the anterior-root fibres are much the larger.

No ganglion cells exist in the anterior roots.

On each posterior root, outside the neural arch, is a ganglion, composed of large bipolar ganglion-cells each of which possesses a nucleated capsule continuous with the sheath of the nerve. The peripheral fibre of each ganglion-cell is somewhat larger than that running to the cord. In the ganglion the nerve-root bifurcates into a smaller dorsal and a larger ventral ramus, and the ganglion presents a corresponding bilobed form, since its cells continue some little way along each ramus.

Each anterior root similarly divides into a dorsal and a ventral ramus.

The dorsal rami of the anterior roots pass up over the lateralis nerve to the muscles of the dorsal region.

The dorsal rami of the posterior roots likewise pass up to the skin of the back, but appear also to send fibres into the lateralis. (For this statement we at present rely only on sections; but me hope shortly to test it by dissections of the large *P. murinus.*)

The Xth cranial nerve (Vagus) arises by four posterior roots, (identical in appearance with the other posterior roots), which unite to form a large bilobed ganglion from which proceed a ventral and a dorsal ramus exactly as in the case of the spinal ganglia.

The VIIth nerve (Facialis) presents also a ganglion from which a strong branch winds round the ear-capsule to join the ganglion and dorsal ramus of the Vagus. The ganglion on the VIIth is also said (Ahlborn) to be joined by a branch to the ganglion of the Vth nerve.

Lateralis. This nerve consisting of small fibres like those of posterior roots, and containing (except at one point) no ganglion cells,

has its main origin from the dorsal rami of the seventh and tenth nerves. It leaves the vagus at the junction of its ganglion and dorsal ramus, where the vagus receives its loop from the seventh nerve: and some cells from the dorsal half of the vagus ganglion pass into the lateralis here. If we look then upon the lateralis as forming posteriorly a commissural system connecting dorsal rami of posterior spinal roots, we may say that this commissural system is continued forward, cranially at least as far as the seventh, and possibly even the fifth nerve.

Although the Lamprey presents a well-marked lateralis nerve, it has not also a regular lateral line, for the sense-organs of the skin are scattered and without segmental arrangement.

The sense-organs do not therefore appear to be in direct relation with the spinal ganglia, and the view of the close connection between them (Spencer, Beard, Froriep) does not receive support.

The recent work of Onodi, according to whom, in the Fish and Lizard, the spinal ganglia are purely proliferations of the dorsal part of the medullary tube, casts further doubt upon this view.

It seems more natural to consider the lateralis as a relic of the extensive and irregular commissural system connecting the posterior roots of *Amphioxus*.

The scattered hair-cells of *Amphioxus* are irregularly grouped in *Petromyzon*, and it is only in higher Chordata that a definite segmental arrangement obtains and a corresponding relation to the spinal ganglia. The close relation of ganglion to sense-organ, which is asserted in some developmental histories, is probably therefore secondary. And if we remember how in Selachii the lateralis nerve, still lying deeply seated and close to the spinal nerve-roots, sends long branches through the intermuscular septa to the sense-organs of the skin, we perhaps get an idea of a condition contributing to the segmental arrangement of the latter.

Bdellostoma. The anterior and posterior roots are distinguished as in the Lamprey by the size of their fibres, but they unite to form mixed nerves.

In some regions of the body, if not throughout, there are two anterior roots for each posterior root: — a fact of interest as tending towards the condition found in *Amphioxus*. The two anterior roots send up each a dorsal ramus, and these unite into a single branch for the back. The posterior root presents a distinct spinal ganglion, and divides into a dorsal and ventral ramus. The ventral ramus unites with the corresponding rami of two anterior roots. We have not yet traced a junction of the dorsal ramus with that of the anterior roots. The dorsal rami of posterior roots have no commissural connections.

Myxine is quite similar to *Bdellostoma*.

Vagus. *Petromyzon*.

1) The spinal nerves of the branchial region in passing over the vagus nerve send down branches into it, their anterior and posterior roots entering the nerve separately. (So long ago as 1827 Born noted the existence of communications between spinal nerves and vagus.)

2) The nerve-fibres of the vagus trunk are very various in size: We may trace

a. certain very large fibres, identical with the fibres of the anterior spinal roots, and forming for the most part a distinct bundle on the side of the vagus in contact with the roots:

b. a large bulk of small fibres, precisely like those of an ordinary posterior spinal root:

c. certain exceedingly small fibres, apparently destitute of a sheath. These are the fibres which pass to the heart, jugular veins, etc.: that is to say, the endocardial nervous system is not independent of the central nervous system as Owsjannikow maintains it to be.

Of these three groups of fibres we may say that

a. enter by the anterior spinal roots, leave the vagus soon after entering it, and pass to muscles of the body-wall. They are never found in the small visceral branches of the vagus, but are ordinary motor fibres.

b. alone constitute the cranial root of the vagus; but enter from the posterior spinal roots as well.

c. arise by division of *b.* and probably come in like manner both from the cranial and from the posterior spinal roots.

The Vagus of *Petromyzon fluviatilis* contains in its trunk abundant ganglia.

The nerve-fibres *a.* are never connected with ganglion-cells.
b. enter ganglion-cells similar exactly to those of the spinal ganglia.
c. are connected with smaller ganglion-cells, destitute of a nucleated sheath, and found also in the heart.

The ganglion-cells in the trunk of the vagus have a rough segmental arrangement, being numerous near the points of contact with posterior spinal roots: facts which suggest the possibility of their origin from the spinal ganglia.

In *Bdellostoma* and *Myxine* the following differences are to be remarked:

1) The vagus has no communication (as in the gill-region of *Petromyzon*) with the spinal nerves; and correspondingly

2) the large fibres *a.* are entirely absent, and

3) the ganglion cells in the trunk of the nerve lack the segmental arrangement.

Thus the Vagus is inherently compound in its nature.

Firstly, in *Petromyzon* it contains large motor anterior-root fibres, comparable to a spinal accessory (in part). The difference in this respect between the vagus of *Petromyzon* and the Myxinoids is referable to the different function of the branchial skeleton. In *Petromyzon* the water both enters and leaves by the external branchial orifice moved by a pump-action of the branchial basket: in *Myxine* it is inspired through the nose, by the agency of the cilia therein.

Secondly, apart from this, in *Petromyzon* the vagus in the branchial region includes small commissural (?) fibres derived from posterior roots, and clumps of ganglion cells derived (?) from posterior-root ganglia (cf. Onodi), that is to say the typical elements of a ‚sympathetic'.

No segregated parts of spinal ganglia, and no such commissural fibres of posterior-root origin occur in the post-branchial region of *Petromyzon*. The ‚sympathetic' is in this animal not only associated closely with the vagus, but, it is furthermore peculiar in not extending as a commissural system, backwards beyond the branchial region.

In *Bdellostoma*, though a nerve from the vagus reaches back to the anus, even the branchial region is devoid of communications between successive spinal posterior roots, that is to say of a commissural sympathetic system.

But the cranial origin of the vagus in *Petromyzon* is from the fusion of four gangliated dorsal roots, which according to Ahlborn, are likewise connected with the four similar roots of the glossopharyngeal, and in turn with the origins of the seventh and (though less certainly) of the fifth also.

Now the fibres of these vagus-roots are as has been already said exactly similar to those of spinal posterior roots; and the vagus ganglion (g. jugulare) is in its bilobed form precisely like a large spinal ganglion. So all the visceral fibres in the vagus, whether cranial or spinal in origin, arise from precisely similar posterior roots, — a fact with important physiological bearings.

We suppose the connections between the (5th) 7th, 9th and 10th nerves and between the successive roots of the two latter to be in part commissures of visceral fibres.

In the embryo dog-fish the second or ventral commissure de-

scribed by Balfour as uniting the roots of the vagus ventral to the ganglia, is essentially a ‚sympathetic' commissure: whose [visceral] fibres pass on as described by Balfour to form the ‚intestinal branch of the vagus'. In that intestinal ‚branch' we have an outflow of visceral fibres, quite comparable to e. g. a splanchnic branch of the dorsal sympathetic system. The connection between the origin of the lateralis and this ventral commissure connecting the vagus roots in the dog-fish, and similarly the relation of the lateralis to the loops uniting the ganglia of the 5th, 7th and 10th nerves in *Petromyzon* may probably be described as indicating a fusion in this region of the two great commissural systems which posteriorly are separate, viz. that of the sensory branches (lateralis) and the visceral or ‚sympathetic'.

We agree with Gaskell that the term ‚sympathetic' should be suffered to fall into disuse, as tending to perpetuate the old conception of the primary importance of the longitudinal nerve-tract; whereas the leading fact is the metamerically recurring outflow of visceral fibres, which may or may not be united together by successive longitudinal commissures.

2. Bemerkungen über Lacerta melisellensis Br.

Von Prof. Dr. M. Braun.

eingeg. 12. Mai 1886.

Im Jahre 1877 beschrieb ich in meiner philosophischen Dissertation[1] unter dem Namen *Lacerta melisellensis* eine schwarze Eidechse, die mir von Herrn Dr. Steindachner in Wien in einigen Exemplaren überlassen worden war; die Art stammte von einer kleinen, adriatischen Insel (Melisello), über deren Beschaffenheit ich damals nichts Sicheres angeben konnte, doch sprach ich die Vermuthung aus, daß dieselbe wohl wie andere dalmatinische Inseln aus hellem Kalk bestehen würde, demgemäß auch hier die schwarze Farbe dieser Eidechse eben so wenig auf Anpassung an ein dunkles Gestein zurückgeführt werden könnte, wie bei der balearischen *Lacerta Lilfordi* Gthr.

Wie ich nun persönlich erfahren habe, sind die Verhältnisse auf Melisello (illyrisch Brusnik) doch anders und einer Anpassung scheinbar günstig. Die fragliche Insel liegt ziemlich in der Mitte der ganzen Adria (43° N. Br.), etwa 13½ Seemeilen WSW. von Comisa auf der Insel Lissa, von wo aus ich zu Boot Brusnik besuchte. Alle Fischer

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[1] *Lacerta Lilfordi* und *Lacerta muralis* etc. Würzburg 1877. (S.-A. a. d. Arb. a. d. zool.-zoot. Inst. Würzburg II.)