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THE VAGUS AND ANTERIOR SPINAL NERVES IN AMPHIUMA.

BY H. W. NORRIS.

After the recent excellent description of the cranial nerves in *Amphiuma* by Kingsley* it may seem hardly worth while to present any further account. But having the good fortune to possess some material in which the individual nerve trunks can be traced with great distinctness through the various plexuses the writer ventures to present the following brief account of the interrelationships of the vagus and anterior spinal nerves. The points wherein this paper is at variance with that of Kingsley are probably in most respects of not great importance, and possibly due to differences in the state of development of the specimens examined. This account is based on the structures studied in a specimen of 130 mm. in length.

From the glossopharyngeal-vagus ganglion I find eight nerves given off. The first and anterior of them, Jacobson's commissure⁽¹⁾, divides as it leaves the ganglion into two branches, one the commissure proper passing antero-ventrally around the ear capsule to unite with the hyomandibular branch of the seventh cranial nerve, the other a dorso-laterally directed branch that unites with a second vagus trunk⁽²⁾ at the lateral ventral border of the longissimus dorsi muscle. This off-shoot from Jacobson's commissure is probably the nerve described by Kingsley as given off from the first branchial nerve and passing to the digastric muscle. After its union with the small second vagus trunk the main part of the nerve runs anteriorly between the longissimus dorsi and anterior digastric muscles. It evidently supplies lateral line sense-

*KINGSLEY, J. S.—The Cranial Nerves of *Amphiuma*. Tuft's College Studies, No. 7, 1902.

organs in the occipital region. I find that it also gives off fibers to the digastric muscle. A short posterior branch seems to be distributed solely to the digastric muscle. The the small second vagus trunk seems to be the one described by Kingsley as arising from the posterior surface of the glossopharyngeal trunk and designated by him tentatively as the supratemporalis. I find that it arises from the ganglion entirely independent of the glossopharyngeal. It contributes most of the fibers of the combined nerve above mentioned. It probably corresponds to the branches supplying the sense-organs in the occipital region in *Cryptobranchus* as described by McGregor,* and considered by him as possibly representing the ramus supratemporalis.

A little posterior and ventral to the emergence of Jacobson's commissure from the ganglion arises a trunk⁽³⁾ that soon divides into glossopharyngeal nerve proper and the first branchial nerve. This account of the first three nerve trunks differs decidedly from that given by Kingsley. According to him Jacobson's commissure and the glossopharyngeal nerve arise by a common trunk, and the first branchial nerve leaves the ganglion as a separate trunk distinct from the glossopharyngeal. I find that Jacobson's commissure and the glossopharyngeal-branchial trunk both derive a portion of their fibers from the brain through the second vagus root, but they emerge from the ganglion distinct from each other, but very close together.

The second branchial nerve⁽⁴⁾ arises from the ganglion near its dorsal border close to the origin of the trunk termed provisionally the supratemporalis. The third branchial nerve⁽⁵⁾ according to Kingsley arises with the second from a common trunk. I find that it leaves the lateral border of the ganglion some distance ventral to the emergence of the second branchial nerve and remains distinct from it. The ramus lateralis superior⁽⁶⁾ arises close to the origin of the third branchial nerve, and as noticed by Kingsley ventral to the origin of the ramus lateralis medius. Leaving the ganglion the ramus latera-

*MCGREGOR, J. H.—Preliminary Notes on the Cranial Nerves of *Cryptobranchus Alleghaniensis*. Journ. Compar. Neurol., Vol. VI, No. 1, 1896.

lis superior rapidly ascends to the longissimus dorsi muscle and passes back to the posterior end of the body within the dorsal portion of the muscle. The ramus lateralis medius⁽⁷⁾ on leaving the ganglion at first turns ventrally to the level of the emergence of the remaining vagus trunk (ramus inferior) and runs parallel with it on its median border as far as the ganglion of the third spinal nerve. From this point the ramus lateralis medius ascends to the level of the longissimus dorsi muscle and in company with the ramus lateralis posterior of the seventh cranial nerve passes to the posterior region of the body, the greater part of the distance within the ventral portion of the muscle. The remaining trunk⁽⁸⁾ given off from the vagus ganglion is by far the largest of the eight. Between the ganglia of the second and third spinal nerves it divides into three main branches. The first of these after passing ventrally and receiving a branch from the first spinal nerve divides into the ramus intestinalis and a branch running along the outer border of the first branchial artery. A second division becomes the ramus lateralis inferior supplying the ventral series of the lateral line sense-organs. A third anterior portion divides into two parts, one supplying the dorsotrachealis muscle and the other running along the inner border of the first branchial artery.

In agreement with Kingsley I find that the hypoglossal nerve arises by four roots. The two dorsal and the anterior ventral roots are very rudimentary in the specimen studied. I found no ganglion cells on the hypoglossal. They had evidently degenerated along with the atrophy of the dorsal roots. The principal hypoglossal trunk runs posteriorly in the longissimus colli muscle and finally enters into close relationship with that branch of the ramus inferior of the vagus that gives rise to the ramus intestinalis. At one point there seem to be a few fibers passing from the vagus to the hypoglossal, but I was able to trace the hypoglossal as a distinct trunk through the vagus complex to the outer border of the sternohyoid muscle.

The main trunk of the first spinal nerve runs posteriorly to the level of the posterior border of the third spinal

nerve ganglion, then turning ventrally and anteriorly divides into two branches, one of which unites with a branch of the vagus as above described, the other passes anteriorly into the connective tissue ventral to the thymus gland. The first spinal nerve does not share in the brachial plexus. The brachial plexus is formed from the main trunks of the second and third spinal nerves. I did not trace the branches of the brachial plexus to their final distribution.

EXPLANATION OF PLATE.

Projection of the VIIth., IXth. and Xth. cranial, the hypoglossal and the anterior spinal nerves of *Amphiuma* seen from the right side.

REFERENCE FIGURES AND LETTERS.

1. Origin of Jacobson's commissure from vagus ganglion.
 2. Supratemporalis (?) nerve.
 3. Glossopharyngeal—branchial trunk.
 4. Second branchial nerve.
 5. Third branchial nerve.
 6. Ramus lateralis superior of vagus.
 7. Ramus lateralis medius of vagus.
 8. Ramus inferior of vagus.
- aa, branches of auditory nerve.
AfBr, nerve to inner border of afferent branchial vessel.
afbr, nerve to outer border of afferent branchial vessel.
AG, Auditory—facial ganglion.
Alv, alveolaris branch of facial nerve.
Br, brachial nerve.
Brpl, brachial plexus.
Dtr, branch of vagus to dorsotrachealis muscle.
Gl, glossopharyngeal nerve trunk.
Hm, hyomandibular branch of facial nerve.
Hma, hyomandibularis accessorius branch of facial nerve.
Hy, hypoglossal nerve.
Jc, Jacobson's commissure.
Mte, maxillaris facialis externus branch of facial nerve.
Pal, palatine branch of facial nerve.
RiX, ramus intestinalis of vagus nerve.
RiVII, ramus lateralis posterior of facial nerve.
RliX, ramus lateralis inferior of vagus nerve.
RlmX, ramus lateralis medius of vagus nerve.
RlsX, ramus lateralis superior of vagus nerve.

RtV, root of trigeminal nerve.

RtVII-VIII, auditory-facial nerve root.

RtIX-X, roots of glossopharyngeal—vagus nerves.

RtVII, lateralis root of facial nerve.

1, 2, 3 *Sp*, first, second and third spinal nerves and ganglia.

VG, vagus ganglion.

