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The Fifth and Seventh Cranial Nerves in Plethodon glutinosus

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Thinking that possibly some of the conditions described by Dodds (1906) in the cranial nerves of Plethodon glutinosus might throw some light upon the homologies of the ramus maxillaris V in the urodele amphibians the writer was led to work out carefully the distribution of the fifth cranial nerve and its branches, together with those of the seventh nerve, in the same species.

The material, small adults 35mm. long, was fixed in Vom Rath’s picro-acetic-osmic-platinic mixture, infiltrated and sectioned in celloidin, and studied entirely from cross-sections. Although the differential staining was not as thorough as the writer has usually obtained by this method with amphibian material, yet except for very minute branches its precision is reliable.

According to Dodds there spring from the gasserian ganglion of Plethodon glutinosus three nerves: rr. mandibularis, maxillaris and ophthalmicus (profundus). The rr. mandibularis and maxillaris arise together and pass out by a common foramen. I find that three nerves arise from the dorso-lateral border of the ganglion, one of which is the r. mand. Dorsal to the latter there emerge two others that evidently represent collectively the r. max. of Dodds. According to the latter the r. max. branch “passes off laterally and curves forward in two parts. One branch (infraorbital) breaks up back of the eye-ball, and the other (maxillary) passes forward a little above the maxilla.” Of these two nerves that I find leaving the gasserian ganglion dorsal to the r. mand. the dorsal one is distributed to the skin dorsal and posterior to the eyeball. The more ventral passes anteriorly until it comes in contact with the posterior border of the eyeball, where it divides into about five branches, of which two are distributed to the skin dorsal and anterior to the eye, while the other branches pass ventrally and are distributed to the skin ventral and anterior to the eye and dorsal to the mouth. Dodds is doubtless correct in interpreting these two branches as the r. maxillaris V. That in many cases they arise from the ganglion as a single nerve, as described by him, is probable.

Dodds states that “the mandibular passes off laterally and soon curves ventrally to the maxilla, where it breaks up into three branches. Two of these remain in the upper jaw and pass forward well into the snout, one just external to, and the other just internal to the maxilla. * * * These two branches may possibly represent a part of the maxillary ramus. The third branch, about equal in size to the other two combined, passes ventrally into the lower jaw.” Such a distribution of the branches of the mandibular ramus as described by Dodds would be very unusual. I cannot agree with him as to the facts in the case. The r. mandibularis passes ventro-laterally from the gasserian ganglion and after giving off motor branches to the temporal, pterygoid and masseter muscles and a medium sized sensory branch to the skin, divides just
dorsal to the mandible into three branches. One of these passes straight vertically through the mandible between Meckel's cartilage and the dentary bone to be distributed to the intermandibular (m. mylohyoideus anterior) muscles anterior and posterior, and to the skin of the ventral surface of the head external to these muscles. The distribution of this branch is that which usually obtains in the Urodela. Miss Bowers (1900) designates it in Spelerpes as md. internus V. A second branch runs anteriorly at the lateral border of the mandible supplying the skin of the side of the lower jaw. This branch also has nothing unusual in its distribution. It has been described in Amblystoma (Coghill, 1902), Spelerpes (Bowers) and Amphiuma (Norris, 1908) and evidently is a constant feature in urodele anatomy. Miss Bowers terms it r. md. externus V. The third branch runs anteriorly along the dorsal border of Meckel's cartilage, then gradually shifts medially and ventrally between the cartilage and the angulo-splenial bone and fuses with a branch of the r. alveolaris VII. This combined nerve of general cutaneous and communis fibers runs anteriorly, presumably to supply the teeth and lateral floor of the mouth. This third branch has no peculiarities, and its anastomosis with the alveolaris has been described in Amblystoma and Amphiuma. Miss Bowers does not describe it in Spelerpes, but my own preparations of Spelerpes show it very distinctly, and that the anastomosis with the alveolaris undoubtedly occurs. None of these three branches of the r. mandibularis remain in the upper jaw, nor can I find any branches such as Dodds describes in the upper jaw.

Coghill describes in Amblystoma an anastomosis between the motor portion of the r. mand. supplying the intermandibular muscles and the motor part of the r. jugularis VII supplying the interhyoid muscle. A similar anastomosis occurs in Plethodon.

Of the ramus ophthalmicus profundus V Dodds says: "It soon divides into two branches. One of these extends dorso-lateral and breaks up in the muscles in front of the eye." Although this is not a positive statement that this dorsal branch is motor, yet such an inference may be drawn. There are no muscles in Plethodon anterior to the eyeball unless we except the superior and inferior oblique muscles of the eyeball itself. Furthermore, this dorsal branch is exclusively general cutaneous in composition and is distributed to the upper eyelid and the skin of the dorsal side of the head mesial and anterior to the eye. Examination of the published figures of the cranial nerves of Amblystoma, Spelerpes and Amphiuma shows that similar branches are found in these forms. Dodds correctly describes the three terminal divisions of the main portion of the r. oph. prof.: a mesial, a lateral and a ventral branch, the latter anastomosing with the r. palatinus VII. The condition seems to be similar to that in Amblystoma and Spelerpes. Of the exact nature of the anastomosis with the R. pal. VII the material studied does not give exact information. Apparently it differs from that described in Amblystoma and Amphiuma.

In the material studied the lateral line system had disappeared. Hence the VII-VIII complex is much simplified over that of the larval stage. The VII-VIII nerves arise from the brain by three groups of rootlets: a dorsal communis, a middle auditory and a ventral motor group. From the common ganglion of the VII-VIII nerves an anterior auditory vestibular branch passes to the utriculus and the anterior and horizontal semicircular canals of the ear. From the posterior part of the ganglion a number of auditory branches pass to the sacculus, lagena, etc. Dodds says that a single small twig supplies this portion of the ear. From
the antero-lateral portion of the ganglion the fibers of the facial nerve emerge in two parts: an anterior r. palatinus and a lateral r. hyomandibularis. The palatine branch passes anteriorly to its anastomosis with the r. ophthalmicus profundus already mentioned. A Jacobson's commissure between the IX nerve and the r. pal. VII evidently exists, but its entire course was not traced. The main portion of the facial nerve, truncus hyomandibularis, passes posteriorly, laterally and ventrally from the ganglion. It soon gives off a r. alveolaris (not noticed by Dodds) that passes antero-ventrally to supply the lateral floor of the mouth. Its anastomosis with the r. mandibularis V has been described. Near the place where the r. alveolaris leaves the hyomandibular trunk the latter receives the ramus communicans from the IX nerve. Most of the fibers of the r. communicans enter the r. alveolaris and are evidently communis.

Of the exact composition of the r. communicans no reliable information was gained, but apparently general cutaneous fibers are contained in it. The condition seems to be very much like that described by Coghill in Amblystoma. After giving off the r. alveolaris the hyomandibular trunk supplies the depressor mandibulae, sphincter colli and interhyoideus muscles and apparently sends general cutaneous fibers to the skin overlying these muscles.

A comparison of a plotting of the fifth and seventh cranial nerves of an adult Plethodon with that of a larval Spelerpes (as given by Miss Bowers), shows that after omitting the lateral line system of the latter the resemblances are very close, so close as to make evident an almost identical arrangement in the two.

It would appear that Dodds is completely in error in supposing that there are any anomalies in the composition and distribution of the fifth cranial nerve in Plethodon glutinosus.

LITERATURE CITED.

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