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INTRINSIC CONNECTIONS OF THE RAT COCHLEAR NUCLEUS

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In mammals three subdivisions of the cochlear nucleus can be distinguished: the dorsal (DCN), the posterior (PVCN) and the anteroventral (AVCN) cochlear nucleus (CN)[1]. The intrinsic connections between and within these areas have not been well defined. Wickesberg et al.[2] revealed that projections from DCN to AVCN in the mouse are frequency specific and tonotopic. In contrast Synder and Leake[3] in the cat revealed projections from AVCN to PVCN and DCN but only modest projections from PVCN and DCN to AVCN with no frequency specificity observed. These previous studies utilized the retrograde tracer horseradish peroxidase. We investigated this apparent contradiction further, using neurobiotin, a retrograde and anterograde tracer, to examine connections within the cochlear nucleus of the rat, with emphasis on the AVCN subdivision. Male rats were anaesthetized with urethane (1.3g/kg i.p), placed in a stereotaxic frame, the crania and dura removed and the cochlear nucleus exposed. The cochlear nucleus of six rats was injected with neurobiotin (0.3µl). Four injection sites were localized within AVCN subdivision, one in PVCN and one in DCN. We found reciprocal connections to exist between AVCN and DCN with tonotopicity restricted to those projections from the anterior AVCN to DCN. Reciprocal projections were also observed between PVCN and DCN, however these were not tonotopically organised. Restricted projections from anterior AVCN to PVCN were observed, but no connection from PVCN to AVCN was present. Within the AVCN subdivision projections were seen between posterior and anterior AVCN, with the latter also shown to have intrinsic connections. The majority of interneurones involved in the CN intrinsic circuitry were identified as stellate cells. Auditory nerve fibers were also retrogradely labelled with neurobiotin. Auditory nerve terminals were shown to be present in all subdivisions following localised injections. The organization of connections between and within CN subdivisions suggests that the AVCN may not only maintain frequency specificity of auditory information to DCN and to a lesser extent PVCN, but may also modify incoming auditory information through its intrinsic circuitry. In addition, auditory information processing in AVCN may be further influenced by feedback from the DCN.

1. Brawer J.R, Morest D.K, Kane E.C. (1974) J.Comp Neurol. 160, 491-506.
2. Wickesberg R and Oertel D. (1988) J.Comp Neurol. 268, 389-399.
3. Synder RL and Leake PA (1988) J.Comp Neurol. 278, 209-225.