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OBSERVATIONS ON TONOTOPIC ORGANIZATION WITHIN THE RAT SUPERIOR OLIVARY COMPLEX AND COMPARISONS TO HIGHER AUDITORY STRUCTURES USING 2-DEOXY-D[1-^{3}H] GLUCOSE.

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Tonotopic organization is believed to occur at numerous locations within the central auditory pathways. This may be construed as a multiple representation of the basilar membrane in which divergence or convergence of information can be emphasized in particular brain areas. In the present study, the labeled 2-deoxyglucose method was used to investigate selected auditory regions where binaural processing is believed to occur. Awake restrained male albino rats catheterized 24 hr previous were monaurally or binaurally presented with constant pure tone stimuli at 1, 2, or 8 kHz at various intensity levels. Animals were given intravenous injections of 2-deoxy-D[1-^{3}H] glucose, sacrificed 45 min later, and the brain removed in unperfused or perfused cases. Frontal or parasagittal sections 15-30 µm thickness were exposed to X-ray film and later stained with thionin. Differential optical densities observed could be validated and quantified using a computer image processing system.

Major subdivisions of the superior olive complex, inferior colliculus, medial geniculate body and auditory cortex showed preferential activity to pure tone stimulation. Little or no distinctive activity was observed in controls with ears plugged. A prominent focus of activity occurred in the caudal part of the lateral superior olive (LSO) adjacent to the facial nerve. At 1 kHz, this activity was concentrated in the ventrolateral tip of LSO; 8 kHz stimulation produced maximal activity at the dorsal hilus of LSO. There was a greater response to binaural than monaural stimulation at the same intensity levels. The medial nucleus of the trapezoid body showed a band of activity at the dorsal or dorsolateral margin to 1 kHz stimulation and deeper bands to more intermediate frequencies. Diagonal banding observed in the superior paraolivary nucleus appeared particularly prominent at 8 kHz. The darkest bands in the auditory system appeared in the inferior colliculus. Multiple bands were observed in the medial geniculate body including the ventral and dorsal nuclei. Active bands observed in cortex including the primary area varied in width and depth. Results indicate selective banding patterns to pure tones at major levels of the auditory system and suggest potential for parallel and convergent processing. (Supported by NIH AG-1571).