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Transmission of temporal fine structure by a penetrating auditory nerve implant

John Middlebrooks[a] and Russell Snyder[b]
[a]University of Michican, KHRI, 1301 E. Ann St., Ann Arbor, MI 48109-5506, USA
[b]University of California, Epstein Laboratory, Room U-490, P.O. Box 0526, San Francisco, CA 94143 0526, USA

We are quantifying the transmission of temporal fine structure from a penetrating auditory nerve electrode array to the inferior colliculus (IC) in anesthetized cats. We stimulate with biphasic electrical pulse trains and determine the maximum pulse rate eliciting phase-locked activity. Many IC neurons showed significant phase locking to rates as high as 600 pulses per second (pps) when the nerve was stimulated with the penetrating array, whereas phase locking reached only 300 pps when stimulated with a conventional intra-scalar cochlear implant. Phase locking to rates >300 pps was found primarily among IC units with characteristic frequencies (CFs) <2 kHz. Such low frequency fibers are not stimulated selectively by conventional intra-scalar cochlear implant. We selectively stimulated apical fibers by placing ball electrodes on the apical spiral lamina. Activation of these balls selectively stimulated low-CF IC neurons. These neurons phase locked to 600 pps. Based on these results, we conclude that transmission of temporal information from a penetrating intraneural electrode array is superior to that obtained with a conventional cochlear implant but only insofar as the intraneural electrodes provide more selective access to low-CF pathways.
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