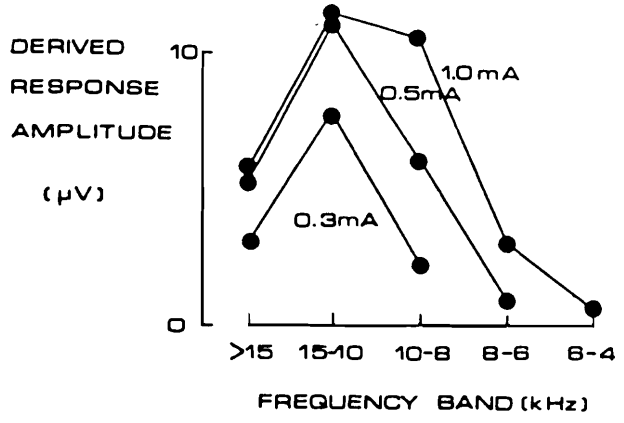
DISTRIBUTION OF ELECTRICALLY STIMULATED NERVE FIBRES IN THE CAT COCHLEA

R.C. Black, G.M. Clark and C.W. Walters, Department of Otolaryngology, University of Melbourne, Parkville, Victoria, 3052, Australia.

An implant electrode array for a cochlear hearing prosthesis has been developed with mechanical properties which allow atraumatic implantation into the human scala tympani. It consists of small platinum electrode bands welded around a flexible silicon rubber tube (Clark *et al.*, 1979). The present study examines the properties of this electrode in electrically stimulating the auditory nerve.

The electrode was inserted through the round window for a distance of 5-6 mm into the scala tympani of the cat. Brainstem evoked responses and those from the round window were recorded when stimulating with square biphasic current pulses (0.1 msec/phase). Since there was usually less than 10-20 dB hearing loss in the implanted ear, it was possible to selectively mask components of these responses with high-pass filtered noise. The noise masked the response component arising from fibres in the cochlear region corresponding to the noise band. Responses were recorded in the presence of noise with different cut-off frequencies. Subtraction of electrically evoked responses recorded at two adjacent cut-off frequencies F1, F2 therefore yielded a response band-limited to the region F1-F2. In this way it was possible to measure the amount of electrically stimulated activity in a number of different frequency bands. This technique is identical to that of derived response audiometry using acoustic stimulation. The input-output characteristics of the cochlea to a variety of acoustic transients were measured to exclude the possibility of either electrophonic hearing or altered basilar membrane characteristics contaminating the results.

The figure shows the distributions of excited fibres using an electrode with an extended ground system running longitudinally in the cochlea. They were measured as the amplitude of the band-limited responses. Results were similar for bipolar electrodes and these electrodes are thus equally suitable for our present cochlear implant prosthesis.



Further studies have been undertaken to examine the effect of stimulating animals with nerve dendrites degenerated by the passage of direct currents. In this case, substantial elevation of electric thresholds with an increased rate of growth of the brainstem response above threshold were observed. Further experiments where animals received a 110 dB broadband noise stimulus for 15 minutes also showed a greatly elevated electrical threshold indicating neural damage from this sound stimulus.

Clark, G.M., Patrick, J.F. & Bailey, Q.R. (1979) *Journal of Laryngology and Otology*, 93, 107-109.

Author/s:
Black, R. C.; Clark, Graeme M.; Walters, C. W.

Title:
Distribution of electrically stimulated nerve fibres in the cat cochlea

Date:
1982

Citation:
Black, R. C., Clark, G. M., & Walters, C. W. (1982). Distribution of electrically stimulated nerve fibres in the cat cochlea. In Proceedings of the Australian Physiological and Pharmacological Society.

Persistent Link:
http://hdl.handle.net/11343/26807