

Poster 215

ELECTROPHONICALLY DRIVEN SINGLE UNIT RESPONSES OF THE ANTEROVENTRAL COCHLEAR NUCLEUS IN CAT

N. A. Morrison, M. Brown and G. M. Clark

Australian Bionic Ear and Hearing Research Institute, East Melbourne 3002, Victoria, Australia

Electrical stimulation of the cochlea results in both direct and electrophonic excitation of auditory nerve fibres. It has been proposed that electrophonic stimulation results from the creation of a mechanical disturbance on the basilar membrane which has properties similar those resulting from acoustic stimuli. Auditory nerve compound action potential (CAP) forward masking studies¹ show the level of frequency specific electrophonic stimulation is highly correlated with the spectral energy of the electrical stimulus waveform. The level of spectral energy in pulsatile biphasic electrical stimuli decreases toward low frequencies suggesting the level of electrophonic stimulation will be diminished in the low frequency region of the cochlea. This proposed diminished input has important implications for the application of electrophonic stimulation in cochlear implant patients who have some low frequency residual hearing. Due to low frequency limitations of CAP forward masking studies, single unit responses in the anteroventral cochlear nucleus (AVCN) to pulsatile biphasic electrical stimuli were investigated to directly assess the level of electrophonic stimulation in the low frequency region of the cochlea. Five adult cats were anaesthetised with pentobarbital sodium (Nembutal; 45 mg/kg) I.P. and maintained with supplemental doses I.V. Following a dorsal exposure of the AVCN, animals were unilaterally implanted with a feline version of the Melbourne/Cochlear scala tympani electrode array. Single unit responses were recorded through KCl filled micropipettes advanced dorsoventrally through the anterior part of the AVCN. Following acoustic characterisation of isolated unit responses, intracochlear bipolar electrical stimuli between 25 and 500 μ s per phase were presented over an intensity range of 0 to 34 dB (re 1 μ A). The electrophonic component of unit responses was separated from that of the direct electrical response based on response latency. The electrophonic response shows clear phased-locked activity in all low characteristic frequency (< 2.5 kHz) units (N = 9). Fast Fourier transforms of the response histograms revealed the frequency components of the electrophonic stimulus to which the units are responding. These frequencies corresponded to the maximum spectral input of the electrical stimulus with respect to the units frequency threshold tuning curve. Furthermore, the input-output functions of the electrophonic response showed similar properties to those of acoustic stimuli. An important finding of this study showed that the absolute level of the low frequency electrophonic response was far greater than that predicted from the forward masking studies. These results suggest a possible non-linear transduction process for the low frequency component of the electrophonic input.

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Author/s:

Morrison, N. A.; Brown, M.; Clark, Graeme M.

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