Oral 14-2
A COCHLEAR AMPLIFIER IN THE HAIR BUNDLE?
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Hearing sensitivity relies on extremely fast electro-motility in hair-cells, which amplifies the auditory stimulus. Under certain conditions, including electrical stimulation of the cochlea, sound is actually emitted from the ear. Electrically evoked oto-acoustic emissions (EEOAEs) can be amplitude-modulated by pure tones, suggesting current influences a motility source via mechano-transduction channels in the stereocilia\(^1\). Two candidate mechanisms have been identified as possible sources of hair-cell motility; either somatic length changes or movements of the hair bundle at the apex of the cell. Both have been observed \textit{in vitro}, but experimental differentiation between the two \textit{in vivo}, through measurement of EEOAEs, is problematical in mammals. However in the bobtail lizard (\textit{tiliogua rugosa}), hair-cells are anatomically polarised such that two separate populations have hair bundles oriented in opposite directions\(^2\). A model of this system compared motility generated by the hair-bundles with somatic motility and predicted EEOAEs would be clearly different in the two cases.

Application of current (~5\(\mu\)A AC) to the cochleas of anaesthetised lizards (Nembutal; 25mg/kg i.p. initially then 6-12mg/kg/hr and ~150mg/kg for euthanasia) produced EEOAEs that exactly matched the hair-bundle simulation. They were of relatively low amplitude, consistent with mutual cancellation of two components that were opposite in phase. Furthermore they showed complex modulation patterns that were consistent only with mechanical energy being produced by the hair bundles.


Oral 14-3
RESPONSES OF BUSHY CELLS TO TONES: IMPLICATIONS FOR PLACE AND TEMPORAL SOUND CODING
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The coding of sound requires both temporal and spatial information. The relative importance of temporal and place coding in the ventral cochlear nucleus (VCN) has not been well established. In male rats anaesthetised with urethane (1.3g/kg i.p.), microelectrodes containing 1M KAc, were inserted into the VCN. Intracellular recordings were made in 26 neurons which had an intracellular response to pure tones typical of spherical bushy neurons. In response to tones at characteristic frequency (CF) these neurons responded in a primary-like (PL) fashion. The intracellular response was associated with sustained depolarisation to tones presented at CF. Action potentials were usually followed by hyperpolarisation, although hyperpolarisation was still present in their absence. The duration and amplitude of this hyperpolarising influence increased as tones off CF were presented. For CF tones below 1700 Hz, depolarising potentials were evident at successive cycles of the stimulus. Hyperpolarising potentials off CF affected this ability to respond to each stimulus period. The ability to process temporal information was further examined using extracellular recordings in 31 PL units. Upon unit isolation, 50 ms tones were presented from 100 to 2000 Hz at 100 Hz intervals with vector strength measured over at least 50 repetitions. Maximum vector strength values were seen at low frequency tones (400-800Hz). Vector strength decreased with increasing frequency of presentation. The maximum vector strength seen for a given tone occurred in neurons whose CF matched the frequency being presented. We concluded that the presence of strong inhibitory influences on spherical bushy cells aids to sharpen the frequency response and focus temporal information on a place basis. This may aid to fine tune place and temporal information sent to higher order processors.
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