Abstract View

TIMED INHIBITION AFFECTS COINCIDENCE DETECTION IN AN MSO NEURON MODEL.

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Recent experiments (in gerbil, by Brand et al, 2002) call into question the classical Jeffress, place-code, model for low frequency sound localization that assumes paired (ipsi and contra) excitatory inputs. However, the interaural time delay (ITD) response curve is strongly influenced by inhibition, shifting its peak into the contra-leading region and out of the physiological range. Meanwhile, the curve's steeply rising ipsi-leading side is positioned near ITD=0; a slope-code is suggested. A computational model (adapted from Rothman et al, 1992) was shown to agree with the experimental results, when the brief inhibition is delivered just in advance of (A=0.1 ms) the contra-excitation.

Using this same HH-type model we explore the effect of the timing and strength of brief inhibitory inputs on ITD responses. Some effects can be demonstrated by considering combinations of individual (subthreshold) inputs: EPSG+IPSG or 2 EPSGs+IPSG. For example, as in Brand et al, the ITD tuning shifts towards the contra-leading side if the IPSG is timed to just precede the contra-EPSG. Surprisingly, a single subthreshold EPSG may also elicit a spike if the timing of a brief IPSG falls within a critical but more advanced (say A=1 ms) brief time window. This enhancement of the EPSP, a transient form of postinhibitory rebound or exaltation (PIE), depends on the model's low-threshold K+ current. Thus, PIE provides yet another mechanism for responsiveness to precisely timed inputs in the auditory pathway. Correspondingly, PIE also influences the ITD tuning curve for bilateral "tone" inputs (when conductances are modeled by periodically modulated Poisson spike trains); the suppressive effect of inhibition on the rising side (ipsi-leading) is diminished as A increases while the responses are enhanced on the falling side (contra leading) due to PIE.
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