Comments

Comment by Young:

A problem with models of the type considered in this paper, in which coincidence of inputs is required to produce output spikes, is that they result in spike trains in the post-synaptic neuron that are more regular than the observed spike trains of bushy-cell response types (primarylike and pri-notch neurons ; Rothman *et al*. 1993; Rothman and Young 1996). What was the regularity of the spike trains of the models you describe?

Rothman, J. S., Young, E. D. and Manis, P. B. (1993). Convergence of auditory nerve fibers onto bushy cells in the ventral cochlear nucleus: Implications of a computational model. J. Neurophysiol. 70, 2562-2583.

Rothman, J. S. and Young E. D. (1996). Enhancement of neural synchronization in computational models of ventral cochlear nucleus bushy cells. Aud. Neurosci. 2, 47-62.

Reply:

We adopted the shot-noise model to study mathematically the hypothesis that the variability of the output spikes reflects simply the statistical properties of the input spike patterns and the coincidence process. We focus on the relationship between the number of input terminals (n) on a single cell and the number of input events (k) required to produce an output spike. Simulations show poor regularity when $n \approx k$, and good regularity when $n >> k$, whether the inputs are suprathreshold or subthreshold. If n is very large, the model may produce spike trains that are more regular than observed in bushy cells. More complete models, such as conductance-based models, contain other stochastic components that would contribute to reduce regularity. We have intentionally disregarded such processes, and for this reason the model is likely to produce spike trains that are more regular than observed.

Comment by Carr:

The authors may find two recent papers of interest. First, Reyes (2003) shows the emergence of synchrony in iteratively constructed networks in vitro. He points out that synchrony can become inescapable under certain conditions. The second paper is by Cook *et al* (2003) and shows that synaptic depression can act as a gain control mechanism. Implementation of synaptic depression might allow Ito and Akagi to vary the number of synaptic inputs and still escape the synchrony that emerges from an increase in inputs.

Cook D. L., Schwindt P. C., Grande L. A., and Spain W. J. (2003) Synaptic depression in the localization of sound. Nature. 421: 29-30.

Reyes A. D. (2003) Synchrony-dependent propagation of firing rate in iteratively constructed networks in vitro. Nat Neurosci. 6: 543-544.

Reply:

The paper about synaptic depression by Cook *et al.* (2003) is particularly relevant. Physiological studies have indicated that the spontaneous activity of a spherical bushy cell (SBC) reflects that of input AN fibers. To simulate this property, a model must assume suprathreshold inputs. On the other hand, to achieve coincidence detection for enhancing synchronization as earlier studies suggested (Joris *et al*. 1994; Yin 2002), inputs should be subthreshold. Therefore the idea that synaptic strength may vary from suprathreshold to subthreshold during stimulation is attractive. We thank you for calling our attention to these papers.