Although coherent rhythmic neuronal activity has been observed since the dawn of electrophysiology, its functional role remains unclear. One proposed functional role is binding, such as auditory stream segregation (Wang and Chang, 2008). The oscillation-for-binding hypothesis has been examined experimentally in a variety of settings, and although some observations have been suggestive they have not been definitive.

Oscillatory activity can be characterised as activity which is sparse in the frequency domain. Sparsity in the spatial domain has also been proposed as a principle of neuronal representations (Kanerva, 1988), a phenomenon for which there is growing evidence, both direct (DeWeese et al., 2003) and indirect (Shoham et al., 2006). Since action potentials are energetically expensive, sparsity can subserve metabolic efficiency. We argue (refs below) that sparsity, in a variety of domains, can also subserve efficient information processing in general, and inference in the auditory system, such as stream segregation, in particular.


