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A spatiotemporal coding mechanism for background independent recognition of odors

Baranidharan Raman

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Sensory stimuli often evoke temporal patterns of spiking activity across a population of neurons in the early processing stages. These neural responses are considered a 'temporal code' if they change on a timescale that is different than the stimulus variations that caused them and when they convey useful information about the stimulus. A fundamental problem in sensory neuroscience is determining what stimulus-specific information is encoded by dynamic patterns of ensemble neural activity and whether this information is behaviorally relevant. Furthermore, since the same stimulus can be encountered in a variety of ways in natural environments, what attributes of the spatiotemporal population responses are invariant to any or all such variations in stimulus features?

In this talk, I will describe how dynamic processing of odor signals allows an invertebrate olfactory system to recognize odorants in a background-independent manner. I will first discuss how freshly introduced odors are received by olfactory receptor neurons in the locust antenna (Schistocerca americana), and then show how the generated sensory input is transformed, step-by-step, into background-invariant neural representations. I will conclude with a brief discussion of correlations between temporally patterned neural activity and behavioral performance of locusts in an odor recognition task.

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Department of Biomedical Engineering, Washington University, St. Louis MO, USA