Abstract Submitted
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A model of olfactory associative learning[1] GAIA TAVONI, VIJAY BALASUBRAMANIAN, University of Pennsylvania, Department of Physics and Astronomy — We propose a mechanism, rooted in the known anatomy and physiology of the vertebrate olfactory system, by which presentations of rewarded and unrewarded odors lead to formation of odor-valence associations between piriform cortex (PC) and anterior olfactory nucleus (AON) which, in concert with neuromodulators release in the bulb, entrains a direct feedback from the AON representation of valence to a group of mitral cells (MCs). The model makes several predictions concerning MC activity during and after associative learning: (a) AON feedback produces synchronous divergent responses in a localized subset of MCs; (b) such divergence propagates to other MCs by lateral inhibition; (c) after learning, MC responses reconverge; (d) recall of the newly formed associations in the PC increases feedback inhibition in the MCs. These predictions have been confirmed in disparate experiments which we now explain in a unified framework. For cortex, our model further predicts that the response divergence developed during learning reshapes odor representations in the PC, with the effects of (a) decorrelating PC representations of odors with different valences, (b) increasing the size and reliability of those representations, and enabling recall correction and redundancy reduction after learning.

[1]Simons Foundation for Mathematical Modeling of Living Systems

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