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Environmental adaptation of olfactory receptor distributions TIBERIU TESILEANU, CUNY-Graduate Ctr, SIMONA COCCO, REMI MONASSON, Ecole normale superieure, VIJAY BALASUBRAMANIAN, University of Pennsylvania — Olfactory sensory neurons (OSNs) in mammals are replaced every few weeks. Each neuron expresses one of hundreds of receptor genes, each with a different binding profile to a wide array of odorants. Experiments show that after replacement, the proportions of OSNs with different receptor types can change. We propose that these changes reflect adaptation of newly-born neurons to the olfactory experience of the animal in order to enhance detection of natural odors. We build a model for olfactory adaptation in which the distribution of receptor types is chosen so that receptor responses form a maximally-accurate representation of odorant concentrations given a fixed total number of OSNs. For small numbers of neurons, the optimal distribution involves a single receptor type. For large numbers of neurons, the distribution becomes almost uniform. In intermediate cases, our model predicts that a variation in olfactory environment should lead to a significant change in the abundances of various receptor types. Such an effect has recently been observed in mice. Our model can be used to predict the change in receptor distribution given a change in olfactory environment, or conversely, to gain insight about the olfactory environment given measured receptor affinities and abundances.

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