

Neural ensemble recordings in rat orbitofrontal cortex: coding of reward magnitude during olfactory discrimination learning

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Various network models of reinforcement learning emphasize the importance of neural coding of reward magnitude as a parameter that can be gauged and predicted during sensorimotor learning. According to one of these models, ensembles in orbitofrontal cortex (OBFc) and basolateral amygdala encode actual reward magnitude and have the capacity to construct a code for expected reward magnitude if reinforcement is preceded by a predictive stimulus. To test these predictions ensemble recordings were conducted in the OBFc of rats (N=7) engaged in associative learning during an odour discrimination 'go – no go' task. In this task animals learned to associate a particular odour stimulus with fluid reinforcement of varying magnitude or sign and to adjust their behaviour accordingly. Using an array of 12 tetrodes implanted in each rat up to 62 single units were recorded simultaneously and isolated by off-line cluster cutting procedures. In the analysis thus far, 54 of 312 neurones demonstrated statistically significant task-related responses (Wilcoxon signed rank, $p < 0.01$). These correlates were related to the various task phases, viz. (i) odour sampling (27%), (ii) waiting and anticipating reinforcement during an extended nose poke in a fluid well (40%), and (iii) reinforcement through consumption of either a quinine (150 μ l) or sucrose solution (0, 50, 150 or 300 μ l) (33%). These preliminary results show that both reward-related coding as well as odour-identity coding occur in the orbitofrontal cortex. The next step in the analysis will be to examine whether these neurones display differential activity in relation to the different magnitudes of reward.

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