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Presentation Abstract

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| Program#/Poster#: | 844.07/TT17 |
| Presentation Title: | Neurophysiological mechanisms supporting flexible, context-specific, operant and pavlovian behavior |
| Location: | Halls A-C |
| Presentation time: | Wednesday, Nov 19, 2014, 3:00 PM - 4:00 PM |
| Topic: | ++F.02.e. Executive function: Network activity |
| Authors: | ***J. MUNUERA**[1], M. RIGOTTI[1,3], S. FUSI[1], D. C. SALZMAN[1,2,4]; [1]Neurosci., [2]Psychiatry, Columbia Univ., New York, NY; [3]Physical Sci., IBM T. J. Watson Res. Ctr., Yorktown Heights, NY; [4]Psychiatry, NYPSI, New York, NY |
| Abstract: | In everyday life, the relationship between actions and outcomes can vary depending upon context. The presentation of a stimulus thereby can lead to the performance of distinct actions in different situations. This flexible behavior relies on an ability to represent information about stimuli, contexts, and potential actions and outcomes. Further, agents must integrate this information appropriately to support flexible behavior. A neurophysiological signature of the integration of information about multiple parameters can be found in single neurons when cells respond selectively to combinations of parameters, exhibiting non-linear "mixed selectivity" [Rigotti et al., Nature 2013]. We sought to understand how the encoding and integration of information about multiple parameters relates to performance of a task that demands flexible actions to acquire rewards. We targeted the amygdala and 2 parts of the prefrontal cortex interconnected with the amygdala, the anterior cingulate and orbitofrontal cortices (ACC and OFC). Rhesus monkeys learned to associate each of 4 images (conditioned stimuli, CSs) to an operant action (hold or release a button) in two different contexts. Each context was defined by the set of operant and reinforcement contingencies for the CSs. For each CS, either, both, one, or |

neither of the operant and reward contingencies differed in the two contexts. In both contexts, correct action execution resulted in reward delivery (unconditioned stimulus, US) for 2 of the CSs, and in successful trial completion without a reward for the other 2 CSs. Failure to complete trials correctly led to a time out and repetition of the trial type. Both pavlovian (anticipatory licking) and operant behaviors indicated that the monkeys understood the rules that linked stimuli and contexts to actions and rewards. All task-relevant variables, including stimulus identity, context, operant action, and expected reinforcement were encoded in in each area, with many single neurons exhibiting mixed selectivity. The encoding of operant actions in amygdala and OFC was particularly surprising given prior studies. These data suggest that the complexity of the task resulted in the sculpting of neural responses properties such that populations of neurons simultaneously integrated information about the many variables needed to support good performance. Further analyses aim to establish whether and how the encoding and formatting of the different types of information account for flexible behavior.

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PREFRONTAL CORTEX

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