MBG FOCUS TALK

hosted by Erik Østergaard Jensen

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Dept. of Mathematics Aud D1 (1531-113)

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Cell-type specific signals in the basal forebrain

The nucleus basalis (NB) gives rise to the central cholinergic neuromodulatory system that innervates the entire neocortex and is thought to regulate sensory processing, attention and learning. Parallel to this cholinergic projection, the NB sends GABAergic fibers to the cortex that innervate cortical interneurons, likely express parvalbumin (PV) and may also participate in cognitive control. How these cell types are differentially activated during behavior is not known. We used optogenetic identification to record cholinergic and PV-expressing GABAergic neurons of the NB in behaving mice performing a sensory detection task that requires sustained attention and involves reinforcement learning. We found that cholinergic neurons responded phasically to primary reward and punishment with remarkable speed and precision (18±2 ms), unexpected for a neuromodulatory system. Responses to reward were scaled by reinforcement surprise, raising the possibility that the cholinergic system also conveys cognitive information. In contrast, PV-expressing GABAergic neurons showed tonic, sustained responses starting already after the predictive cues and outlasting cholinergic activation. These results suggest that cholinergic neurons form a rapid, reliable and temporally precise signaling route for reinforcement feedback, which may be specifically enhanced or enabled by disinhibition mediated by NB GABAergic projections.