The Neuromodulatory role of Orbitofrontal Noradrenaline in the control of action-outcome updating

Hadrien Plat*[1]

[1]Institut de Neurosciences cognitives et intégratives d'Aquitaine – University of Bordeaux, CNRS UMR 5287, 33076 Bordeaux, France, CNRS UMR 5287, Université de Bordeaux, Bordeaux CEDEX, France, Univ. Bordeaux, CNRS, INCIA, UMR 5287, F-33000 Bordeaux, France – France

Résumé

Behavioral flexibility is a fundamental neurocognitive process referring to an organism's ability to adapt to environmental changes. Past research across different species has demonstrated that the Orbitofrontal Cortex (OFC) plays a key role in behavioral flexibility given that its alteration results in a wide range of behavioral impairments, from value updating to economic decision-making and reversal learning (RL) (1).
Recent research from our team has highlighted the importance of noradrenergic (NE) input from the Locus Coeruleus (LC) to the OFC in controlling reversal learning when the subjects must encode a new relationship between an action and a specific outcome (2). In the current study, we further investigated the role of LC (NE)-OFC system in behavioral flexibility using a probabilistic RL task allowing us to study the online updating of action value.

In this task, rats must identify the most valuable option among 2 possible choices, with one lever being associated with an 80% chance of reward delivery while the other option delivers the reward only on 20% of the presses. Within a session, the contingencies are shuffled multiple times based on the rats' performances to prompt the animals to switch from one lever to the other, therefore online updating the contingencies continually.

Using this task, we found that chemogenetic silencing of the OFC CaMKII neurons ii) of LC-OFC NE inputs impaired the rats' ability to adjust their behavior at reversal following reward omission trials. Interestingly, fiber photometry recordings suggest that reward omissions violating prior expectations might enhance NE release within the OFC, an indication that this specific pathway might be central in regulating behavioral flexibility.
Taken together, our finding demonstrate a specific role of NE terminal in the OFC for controlling the online updating of the relationship between an action and its outcome.

*Intervenant