



MANCHESTER NEUROSCIENCE SEMINAR SERIES

FROM UNIVERSITY COLLEGE LONDON

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Hosted by Prof Rasmus Petersen

From goals to actions: a cortico-collicular circuit for navigating during escape

When faced with predatory threats, escape towards shelter is an adaptive action that offers long-term protection against the attacker. Animals rely on knowledge of safe locations in the environment to instinctively execute rapid shelter-directed escape actions. Although previous work has identified neural mechanisms of escape initiation, it is not known how the escape circuit incorporates spatial information to execute rapid flights along the most efficient route to shelter. Here we show that the mouse retrosplenial cortex (RSP) and superior colliculus (SC) form a circuit that encodes the shelter-direction vector and is specifically required for accurately orienting to shelter during escape. Shelter direction is encoded in RSP and SC neurons in egocentric coordinates and SC shelter-direction tuning depends on RSP activity. Inactivation of the RSP-SC pathway disrupts the orientation to shelter and causes escapes away from the optimal shelter-directed route, but does not lead to generic deficits in orientation or spatial navigation. We find that the RSP and SC are monosynaptically connected and form a feedforward lateral inhibition microcircuit that strongly drives the inhibitory collicular network because of higher RSP input convergence and synaptic integration efficiency in inhibitory SC neurons. This results in broad shelter-direction tuning in inhibitory SC neurons and sharply tuned excitatory SC neurons. These findings are recapitulated by a biologically constrained spiking network model in which RSP input to the local SC recurrent ring architecture generates a circular shelter-direction map. We propose that this RSP-SC circuit might be specialized for generating collicular representations of memorized spatial goals that are readily accessible to the motor system during escape, or more broadly, during navigation when the goal must be reached as fast as possible.

APRIL • 26TH • 2023

2.00pm- 3.00pm

HYBRID DELIVERY

Michael Smith Lecture Theatre and online

<https://zoom.us/j/95228421526>

Meeting ID: 952 2842 1526

EVERYONE WELCOME