The researchers mapped the cortical projections from various sensory, motor, and executive cortices to the claustrum of the mouse.

This article of the month (PDF) is the work of Gal Atlan, Anna Terem and Noa Peretz-Rivlin from Ami Citri’s research group, together with Maya Groysman, the director of ELSC’s virus core facility, published in the Journal of Comparative Neurology.

In this paper (‘Mapping Synaptic Cortico-Claustral Connectivity in the Mouse’), the researchers mapped the cortical projections from various sensory, motor, and executive cortices to the claustrum of the mouse, finding a topographical organization of projection-based sensory zones within the claustrum, as well as a core-shell organization which suggests a hierarchy within cortical projections. The claustrum, the most interconnected brain structure per regional volume, is thought to process and modulate the cortical activity, potentially affecting sensory perception, attention, and awareness. The results shed new light on the organization of this structure, and may serve to direct future attempts to uncover the function of this mysterious, yet central region.

Abstract:
The claustrum is an intriguing brain structure, featuring the highest connectivity per regional volume in the brain. It is a thin and elongated structure enclosed between the striatum and the insular cortex, with widespread reciprocal connections with the sensory modalities and prefrontal cortices. Retinotopic and somatotopic organizations have been described in the claustrum, and anatomical studies in cats, monkeys, and rats have demonstrated topographic organization of cortico-claustral connections. In this study, we mapped the projections from cortical modalities (visual, auditory, somatosensory, motor and olfactory), and prefrontal regions (anterior cingulate cortex and orbitofrontal cortex) to the claustrum in mice. Utilizing expression of a virally-encoded synaptic anterograde tracer, AAV-SynaptoTag, followed by 3-dimensional reconstruction of the cortical projections, we performed a comprehensive study of the organization of these projections within the mouse claustrum. Our results clearly demonstrate a dorsoventral laminar organization of projections from the sensory cortices to the claustrum, whereas frontal inputs are more extensive and overlap with the inputs from the sensory cortices. In addition, we find evidence in support of a core/shell organization of the claustrum. We propose that the overlap between the frontal inputs and the inputs from the sensory modalities may underlie executive regulation of the communication between the claustrum and the cortical modalities.
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