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Abstract title

"Modular Organization of the Parasubiculum: Implications for Memory and Spatial Navigation." <u>Kalala Kavyapriya and Chris J Tinsley</u>

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Abstract

The parasubiculum (PaS), a key structure within the parahippocampal cortex, plays an essential role in memory processing and spatial navigation. However, the modular organization of this region remains poorly understood. This study aimed to identify and characterize the distinct modules within the PaS, assess their distribution patterns, and examine the specific cell types in relation to module size, geometry, and density. CD1 mouse brain tissue was processed using cryostat sectioning and visualized via thionine staining, visualised using bright field microscopy. Images were analysed using ImageJ and MATLAB to automate the quantification of module size, density, and cellular composition across biological replicates. The findings revealed that PaS modules ranged in size from 50 to 120 µm, with an average density of 15 modules per mm². We observed distinct clusters based on the geometric features of the modules, including area, circularity, aspect ratio (AR), and solidity. Principal component analysis (PCA) indicated a strong correlation between circularity and solidity, while the area exhibited weak correlations with other features, suggesting a different role in module organization. Cell type analysis revealed a higher concentration of pyramidal neurons in the central regions of PaS modules, with inhibitory interneurons distributed more uniformly across modules. This study contributes to the understanding of the structural complexity of the PaS, revealing insights into its role in cognitive functions such as spatial memory and navigation. These findings may inform future research into neurological disorders, including Alzheimer's disease and epilepsy.

Keywords: parasubiculum; modular organization; spatial memory; PCA; k-means clustering; pyramidal neurons; inhibitory interneurons; brain structure; cognitive functions; neuroanatomy

Biography

Kalala Kavya Priya is an M.Sc. Neuropharmacology graduate from Nottingham Trent University. My research focuses on the structural organisation and functional implications of brain regions involved in cognition and memory. Under the mentorship of Dr. Christopher Tinsley, I conducted this project on the modular organization of the parasubiculum, contributing to the field of neuroanatomy and advancing the understanding of brain architecture. Dr. Christopher Tinsley is a senior lecturer at Nottingham Trent University, specializing in neuroscience with expertise in brain circuits, memory processing, and neuropharmacology.