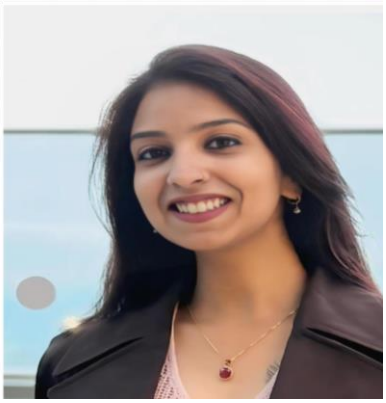
Title:Immunohistochemical Characterisation of Dopaminergic and Cholinergic Alterations in the Prefrontal Cortex and Hippocampus of MPTP-Treated Marmosets



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Abstract:

Motor symptoms traditionally characterise Parkinson's disease (PD), yet cognitive dysfunctions have emerged as critical non-motor features that significantly affect patients' independence and quality of life. While dopamine depletion in the substantia nigra underlies motor deficits, growing evidence implicates widespread neurochemical disruptions beyond the nigrostriatal system in driving cognitive decline. This preclinical study investigated dopaminergic and cholinergic changes within the hippocampus and prefrontal cortex (PFC)—two regions essential for learning, memory, and executive function.

Ten adult marmosets were used; five received 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP) to induce Parkinsonian pathology, while five served as healthy controls. Brain sections were processed using immunohistochemistry to visualise tyrosine hydroxylase (TH) and choline acetyltransferase (ChAT). Quantitative analysis with ImageJ assessed neuron counts, fibre length, and optical density. Results revealed substantial reductions in TH-positive neurons (66.2% in hippocampus, 48.7% in PFC) and ChAT-positive neurons (47.6% in hippocampus, 39.5% in PFC). Correspondingly, fibre length and optical density declined by over 55% in both regions.

These consistent neurochemical alterations highlight a multifactorial basis for PD-associated cognitive deficits, suggesting that concurrent dopaminergic and cholinergic dysfunction plays a central role. Although behavioural assessments were not included in this study, the histopathological changes observed are in strong agreement with previously reported mechanisms underlying cognitive impairment in PD, as documented in both clinical and experimental research.

The findings underscore the importance of considering multiple neurotransmitter systems when developing therapeutic strategies for PD. By identifying region-specific and cell-type-specific vulnerabilities, this work provides a detailed neuropathological framework that could inform the design of interventions aimed at preserving cognitive function in affected individuals.

Biography:

Sanaa Khosla holds an MSc in Neuroscience from King's College London and a BA+MA in Clinical Psychology. Her research focuses on neurodegenerative diseases, particularly Parkinson's disease. She has hands-on experience in immunohistochemistry and animal model research, with a keen interest in understanding cognitive impairments in PD. Her work integrates clinical insight with neuropathological analysis to explore therapeutic avenues that address the complex neurochemical basis of cognitive decline

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- Session/Track Name: SESSION 22-Parkinsons’s Disease and Epilepsy
- Category (Poster)

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