

Poster

INFLAMED AND REMODELED: THE NEUROMORPHOLOGICAL TOLL OF NANOPLASTICS IN ALZHEIMER'S DISEASE

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Background and Objectives. Nanoplastics (NPs) are pervasive environmental pollutants, yet their long-term impact on structural neuroplasticity and Alzheimer's Disease (AD) progression remains poorly understood. This study investigates the neuromorphological and inflammatory consequences of chronic NP exposure, assessing its role as an environmental disease modifier in both healthy and AD-predisposed brains.
Methods. Wild-Type (WT) and Tg2576 (AD model) mice were orally administered with fluorescent polystyrene NPs (100 nm, 0.1 mg/day) via drinking water for a prolonged period of 11 months (from 1 to 12 months of age). Control groups received NP-free water. Neuronal, inflammatory and pathological alterations were subsequently evaluated.
Results. Chronic NP exposure elicited a distinct, genotype-specific neurotoxic response. In WT mice, NPs induced a highly selective degeneration of the dopaminergic (DA) system, evidenced by significant DA neuron loss specifically in the Ventral Tegmental Area (VTA) and a consequent reduction in hippocampal DA fiber density. This vulnerability was strictly localized, entirely sparing TH-negative neurons, the Substantia nigra *pars compacta*, and the Locus coeruleus. Strikingly, this NP-induced structural damage in WT mice mirrored the baseline dopaminergic degeneration observed in unexposed AD controls. Furthermore, prolonged NP exposure and the subsequent DA loss triggered overt hippocampal microglia-mediated neuroinflammation in WT mice. Conversely, in the Tg2576 AD model, where baseline VTA DA loss was already established, NP exposure did not further affect these neurons; however, it actively exacerbated canonical AD pathology, driving profound hippocampal neuroinflammation and a significant increase in β-amyloid plaque deposition.
Conclusions. Chronic ingestion of NPs exerts profound, divergent neuromorphological effects depending on the underlying genetic landscape. In a healthy brain, NPs act as selective neurotoxins that dismantle the VTA-hippocampal DA network, effectively inducing an AD-like dopaminergic phenotype. In an AD-predisposed environment, while further DA neuronal loss is halted, NPs function as a potent environmental catalyst that actively accelerates both neuroinflammatory responses and amyloid pathology.