

The Silent Journey of Microplastics in the Human Body: From Organs to the Brain and their Hidden Threat to the Nervous System

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ABSTRACT

Introduction: Microplastics (MPs), defined as plastic fragments smaller than 5 mm, have emerged as a critical environmental and health concern. Initially studied in aquatic and terrestrial ecosystems, MPs have now been detected in human tissues and biological fluids, including blood, urine, placenta, and breast milk. Recent findings even demonstrate the presence of MPs in the olfactory bulb of the human brain, raising serious questions about their neurotoxic potential.

Objectives: This keynote aims to [1] highlight the pathways through which MPs enter the human body, [2] discuss their distribution across major organ systems, [3] evaluate their potential biochemical and toxicological effects, particularly on the nervous system, and [4] propose strategies for prevention, early detection, and therapeutic interventions.

Methodology: The talk synthesizes evidence from peer-reviewed studies using advanced analytical techniques, including spectroscopy, microscopy, and tissue analysis, to detect and characterize MPs. Literature addressing toxicological, pharmacological, and biochemical impacts was reviewed to provide an integrative perspective on human health risks.

Key Findings: MPs have been detected in cardiovascular, digestive, respiratory, reproductive, endocrine, lymphatic, and urinary systems, as well as in the placenta and breast milk. The olfactory pathway offers a direct route for MPs to bypass the blood–brain barrier, potentially triggering neuroinflammation and neurodegeneration. MPs can act as vectors for toxic chemicals and pathogens, intensifying their harmful effects. Mechanisms of toxicity include oxidative stress, chronic inflammation, immune dysregulation, and neuronal degeneration. These processes may accelerate neurodegenerative diseases such as Alzheimer's, Parkinson's, and multiple sclerosis.

Conclusion: Microplastics represent an invisible yet growing threat to human health. Their ability to infiltrate multiple organs, reach the brain, and induce cellular damage underscores the urgent need for stricter environmental policies, enhanced detection methods, and preventive strategies. This keynote emphasizes that addressing microplastic pollution is not only an ecological necessity but also a pressing public health priority.

Keywords: Microplastics, Neurotoxicity, Human Health, Environmental Toxicology, Public Health.

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