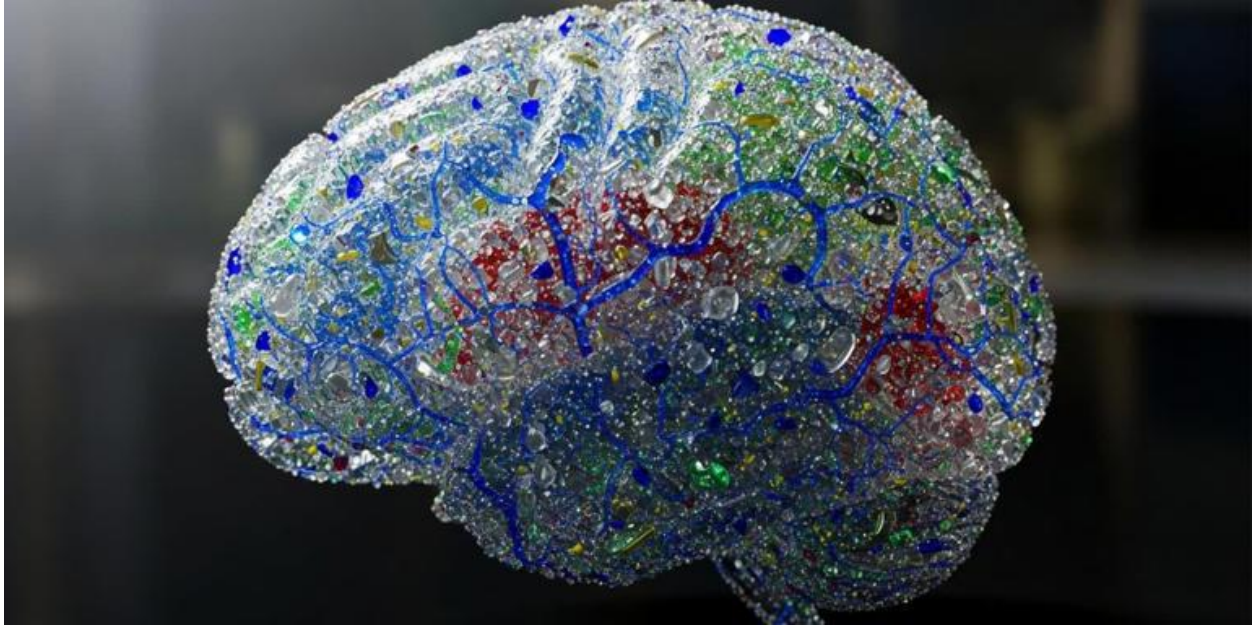


Microplastics found to obstruct brain blood vessels in troubling neuroscience study



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A new study published in [Science Advances](#) has uncovered a previously unknown mechanism by which microplastics can disrupt brain function. Using high-resolution in vivo imaging, researchers observed that microplastics in the bloodstream are engulfed by immune cells, which then become trapped in the brain's capillaries. These obstructions reduce blood flow in the brain and lead to neurological impairments in mice. The findings provide an important new perspective on how plastic pollution may threaten human health, particularly through impacts on the vascular system and brain.

Microplastics are tiny particles of plastic less than 5 millimeters in size. They can originate from degraded larger plastic items, synthetic textiles, packaging materials, and consumer products. Microplastics are now found everywhere—from oceans to mountaintops—and have made their way into human bodies through food, drinking water, air, and even medical devices.

Studies have already detected microplastic particles in human blood, lungs, placenta, and feces. More recently, scientists found nanoplastics, which are even

smaller than microplastics, capable of crossing the blood-brain barrier. But how microplastics might impair brain function without passing into brain tissue has remained unclear.

To investigate this question, the research team—led by Haipeng Huang, Jiaqi Hou, and Beidou Xi of the Chinese Research Academy of Environmental Sciences—employed advanced two-photon imaging techniques to examine how microplastics behave inside the brains of living mice. Collaborators from Peking University, Duke University, and the National University of Singapore contributed to the study.

The researchers introduced fluorescently labeled polystyrene microplastic particles into mice by either oral administration or direct injection into the bloodstream. The particles were about 5 micrometers in diameter, which is similar in size to those found in real-world human exposure. The team then used *in vivo* imaging to track how the particles moved through cerebral blood vessels.

They discovered that after entering the bloodstream, the microplastic particles were engulfed by immune cells, particularly neutrophils and macrophages. These immune cells, now carrying the plastic particles, circulated through the blood and occasionally became lodged in tiny brain capillaries. The researchers referred to these plastic-bearing immune cells as MPL-cells. In many cases, MPL-cells became permanently stuck in the vessels, with some remaining for up to a week.

The blockages were visualized using real-time imaging and confirmed through three-dimensional reconstructions of the blood vessels. MPL-cells often became stuck at vascular branch points or in curved regions of vessels, where blood flow is slower and narrower. This mechanical obstruction reduced local blood perfusion in the brain, particularly in smaller vessels with lower flow rates.

To understand the physiological consequences of these blockages, the researchers performed a series of behavioral tests on the mice. Mice exposed to microplastics showed reduced movement in an open field, poorer performance in memory tasks, and impaired balance and coordination on motor tests. These symptoms resembled those observed in animals with reduced brain blood flow, supporting the idea that MPL-cell obstructions were interfering with normal brain function.

The team also studied the dynamics of the MPL-cells and found that the particle size significantly influenced whether blockages occurred. Cells that had engulfed smaller plastic particles—2 micrometers or less—were less likely to become trapped and were more easily cleared from the bloodstream. When the researchers used particles just 80 nanometers wide, they observed very few obstructions. This suggests that larger microplastic particles pose a greater risk for vascular blockage, while smaller particles are more easily tolerated.

Interestingly, even at exposure levels as low as 5 micrograms per milliliter—comparable to levels detected in human blood—MPL-cell obstructions were still observed. The study also showed that the longer the immune cells remained stuck, the more severe the behavioral symptoms became. However, by 28 days after exposure, the mice's behavior had mostly returned to normal, and the density of blocked cells in the brain had dropped significantly, suggesting the effects may be reversible if exposure ceases.

One of the most significant implications of the study is that microplastics can impair brain function without entering brain tissue directly. Instead, they do so indirectly by compromising blood flow. This represents a third possible mechanism of toxicity, alongside the known pathways of endocrine disruption and direct neural invasion by nanoplastics. The obstruction of brain capillaries by MPL-cells mirrors what occurs during certain forms of stroke or vascular dementia, although on a much smaller scale.

The researchers also noted that the phagocytosis of microplastics altered the physical properties of the immune cells. Compared to normal neutrophils, those containing microplastics were larger and more rigid, making them more likely to clog small vessels. These changes were detected using flow cytometry, a technique that measures the size and internal complexity of cells. The cells also showed altered adhesion behaviors, which may contribute to their tendency to stick to vessel walls.

Although the study was conducted in mice, the authors caution that the findings may be relevant to human health. While human blood vessels are generally larger than those in mice, capillaries in both species are roughly the same size—about 8 to 10 micrometers in diameter. This means that obstructed immune cells swollen with plastic particles could plausibly become stuck in human capillaries as well, especially in individuals with preexisting vascular damage or inflammation.

Still, the researchers urge caution in drawing direct parallels between mice and humans. Differences in blood volume, immune system function, and vascular architecture may affect how microplastics behave in the human body. The study also only examined the effects of a single type and size of plastic particle over a 28-day period. Humans are exposed to a wide variety of microplastic materials, shapes, and sizes over a much longer time frame.

The study points to a need for further research using larger animal models and more realistic exposure conditions. It also underscores the importance of monitoring microplastic contamination in medical devices and fluids. If microplastics are introduced directly into the bloodstream through intravenous solutions, catheters, or other medical supplies, the risk of vascular obstruction may be higher than from dietary or airborne exposure alone.

The authors suggest that long-term accumulation of MPL-cell obstructions could contribute to chronic conditions like neurodegeneration or cardiovascular disease. People with narrow or damaged blood vessels may be especially vulnerable. The findings highlight the urgency of understanding the full scope of health risks associated with microplastic exposure and call for stronger regulations to limit plastic pollution in medical, food, and consumer products.

The study, "[Microplastics in the bloodstream can induce cerebral thrombosis by causing cell obstruction and lead to neurobehavioral abnormalities](#)," was authored by Haipeng Huang, Jiaqi Hou, Mingxiao Li, Fangchao Wei, Yilie Liao, and Beidou Xi.