

Pervasive environmental chemicals impair oligodendrocyte development.

Cohn, Erin F et al. Nature neuroscience vol. 27,5 (2024): 836-845.

Presenter: Yan-Min Chen Date/Time: 2025/06/19, 16:10-17:00

Commentator: Dr. Chun-Hsien Chu Location: Room 601, Med College Building

Background:

Oligodendrocyte development is crucial for the proper myelination and function of the central nervous system (CNS). Environmental chemical exposure, particularly during critical neurodevelopmental windows, is a growing concern in the pathogenesis of white matter disorders. However, the extent to which pervasive chemicals disrupt oligodendrocyte lineage progression remains poorly understood.

Objective: To systematically evaluate the impact of thousands of environmental toxicants on oligodendrocyte differentiation and identify chemical classes that impair myelin lineage development.

Results:

Using high-content screening of over 1,800 environmental chemicals on primary oligodendrocyte cultures, the study identified dozens of compounds that significantly reduced the proportion of O1⁺ oligodendrocytes without causing overt cytotoxicity. These chemicals included pesticides, flame retardants, and industrial compounds. Follow-up transcriptomic and functional analyses revealed that many of these agents disrupted thyroid hormone signaling and lipid metabolism, two pathways crucial for the maturation of oligodendrocytes. Notably, in vivo exposure to prioritized hits during perinatal development impaired white matter integrity and reduced myelin protein expression in the mouse brain.

Conclusion:

This study provides compelling evidence that widely prevalent environmental chemicals can selectively hinder oligodendrocyte development and CNS myelination. The findings underscore the need for stricter neurodevelopmental toxicity screening of ecological agents and suggest that environmental exposure may be an underappreciated risk factor for myelin-related neurodevelopmental disorders.