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The Microbiota–Gut–Brain Axis: Key Mechanisms Driving Glymphopathy and Cerebral Small Vessel Disease
(2025) *Life*, 15 (1), art. no. 3, .

DOI: 10.3390/life15010003

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Abstract
The human microbiota constitute a very complex ecosystem of microorganisms inhabiting both the inside and outside of our bodies, in which health maintenance and disease modification are the main regulatory features. The recent explosion of microbiome research has begun to detail its important role in neurological health, particularly concerning cerebral small vessel disease (CSVD), a disorder associated with cognitive decline and vascular dementia. This narrative review represents state-of-the-art knowledge of the intimate, complex interplay between microbiota and brain health through the gut–brain axis (GBA) and the emerging role of glymphatic system dysfunction (glymphopathy) and circulating cell-derived microparticles (MPs) as mediators of these interactions. We discuss how microbial dysbiosis promotes neuroinflammation, vascular dysfunction, and impaired waste clearance in the brain, which are critical factors in the pathogenesis of CSVD. Further, we discuss lifestyle factors that shape the composition and functionality of the microbiota, focusing on sleep as a modifiable risk factor in neurological disorders. This narrative review presents recent microbiome research from a neuroscientific and vascular perspective to establish future therapeutic avenues in targeting the microbiota to improve brain health and reduce the burden of CSVD. © 2024 by the authors.

Author Keywords
cerebral small vessel disease; glymphatic system; gut–brain axis; microbiota; microparticles; sleep

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Publisher: Multidisciplinary Digital Publishing Institute (MDPI)

ISSN: 20751729
Language of Original Document: English
Abbreviated Source Title: Life
2-s2.0-85215779561
Document Type: Review
Publication Stage: Final
Source: Scopus