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Surface periarterial spaces in the mouse brain are open, not porous. FATIMA MIN RIVAS, JIA LIU, University of Rochester, BENJAMIN C. MARTELL, MIT, TING DU, HUMBERTO MESTRE, MAIKEN NEDERGAARD, University of Rochester, JEFFREY TITHOF, University of Minnesota , JOHN H. THOMAS, DOUGLAS H. KELLEY, University of Rochester — Fluid-dynamic models of the flow of cerebrospinal fluid (CSF) in the brain have treated the perivascular spaces either as open (without internal solid obstacles) or as porous. We present experimental evidence that surface periarterial spaces in mice are essentially open: (1) Paths of particles in the PVS are smooth, as expected for viscous flow in an open vessel, not diffusive, as expected for flow in a porous medium. (2) Time-averaged velocity profiles in periarterial spaces agree closely with theoretical profiles for viscous flow in realistic models, but not with the nearly uniform profiles expected for porous medium. Because these spaces are open, they have much lower hydraulic resistance than if they were porous. To demonstrate, we compute hydraulic resistance for realistic periarterial spaces, both open and porous, and show that the resistance of the porous spaces is greater, typically by a factor of a hundred or more. The open nature of these periarterial spaces allows significantly greater flow rates and more efficient removal of metabolic waste products.

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