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Fluid Mechanics of the Vascular Basement Membrane in the Brain MIKHAIL COLOMA, JONATHAN HUI, PAUL CHIAROT, PETER HUANG, State University of New York at Binghamton, ROXANA CARARE, University of Southampton, KENNETH MCLEOD, DAVID SCHAFFER, State University of New York at Binghamton — Beta-amyloid is a normal product of brain metabolic function and is found within the interstitial fluid of the brain. Failure of the clearance of beta-amyloid from the aging brain leads to its accumulation within the walls of arteries and to Alzheimer's disease. The vascular basement membrane (VBM) within the walls of cerebral arteries surrounds the spirally arranged smooth muscle cells and represents an essential pathway for removal of beta-amyloid from the brain. This process fails with the stiffening of arterial walls associated with aging. In this study we hypothesize that the deformation of the VBM associated with arterial pulsations drives the interstitial fluid to drain in the direction opposite of the arterial blood flow. This hypothesis is theoretically investigated by modeling the VBM as a thin, coaxial, fluid-filled porous medium surrounding a periodically deforming cylindrical tube. Flow and boundary conditions required to achieve such a backward clearance are derived through a control volume analysis of mass, momentum, and energy.

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