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Preferential Transport Theory for Beta-Amyloid Clearance from the Brain MIKHAIL COLOMA, DAVID SCHAFFER , PAUL CHIAROT , PETER HUANG , State University of New York at Binghamton — The failure to clear beta-amyloid from the aging brain leads to its accumulation within the walls of arteries and to Alzheimer's disease. However, the transport mechanism for beta-amyloid clearance is not well understood. In this study, we propose a preferential transport theory for flow within the vascular walls in the cerebral arterial basement membrane. The flow conduit within the arterial basement membrane is modeled as an annulus between deformable concentric cylinders filled with an incompressible, single-phase Newtonian fluid. The transport is driven by arterial lumen deformation induced by heart pulsations superimposed with reflected boundary waves. Our theory predicts that while the overall arterial wave propagation is in the same direction as the blood flow toward the capillaries, a reverse flow in the basement membrane can be preferentially induced toward larger arteries. This has been suggested as a potential clearance pathway for beta-amyloid. We estimate the magnitude of the reverse transport through a control volume analysis which is corroborated by numerical solutions of the Navier-Stokes equations. Bench-top experiments to validate our computational models are presented.

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