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Microstrokes and capillary dilations – investigating the effect of single capillary alterations. FRANCA SCHMID, GIULIA CONTI, ETH Zurich, BRUNO WEBER, University of Zurich, PATRICK JENNY, ETH Zurich — Capillaries are the most frequent vessel type in the brain microvasculature. The dense and interconnected capillary bed has to ensure a robust blood supply across the cortex. Besides its relevance our knowledge of structural and functional properties of the capillary bed remains limited. We perform numerical blood flow simulations in realistic microvascular networks and alter individual capillaries in order to improve our understanding of topology and perfusion of the capillary bed. Capillary dilation has been suggested as a mechanism to up-regulate blood flow and microstrokes have been linked to diseases like dementia and Alzheimer. For both scenarios we analyze changes in blood flow rate and red blood cell (RBC) distribution with a specific focus on the impact of RBCs. This is possible thanks to our numerical model that tracks the motion of 100 thousands of RBCs through the microvasculature. Our results reveal that in response to capillary dilation the changes are strongly affected by the baseline velocity ratio at the upstream bifurcation. Moreover, we show that the severity of a microstroke is governed by the local vascular topology. Taken together, we highlight the relevance of the bi-phasic nature of blood and uncover novel topological characteristics of the capillary bed.

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