Flow distributions and spatial correlations
in mice brain microvascular networks

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Introduction

The vascular system of the mouse brain cortex is composed of a space filling mesh-like capillary network connected upstream and downstream to branched quasi-fractal arterioles and venules [1]. The distribution of blood flow rates in these networks may affect the efficiency of oxygen transfer processes. Here, we investigate the distribution and correlation properties of blood flow velocities from numerical simulations in large 3D mice intra-cortical vascular network (~10000 segments) (data kindly provided by P. blind and P. Tsai).

Methods

In each segment, the flow is solved from a 1D non-linear model taking account of the complex rheological properties of blood flow in microcirculation to deduce the blood pressure, blood flow and red blood cell volume fraction distributions throughout the network [2,3].

Results

The network structural complexity is found to impart broad and spatially correlated Lagrangian velocity distributions, leading to power law transit time distributions. The origins of this behavior (existence of velocity correlations in capillary networks, influence of the coupling with the feeding arterioles and draining veins, topological disorder, complex blood rheology) are studied by comparison with results obtained in various model capillary networks of controlled disorder.

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References