

Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Flow distributions and spatial correlations in human brain capillary networks¹ SYLVIE LORTHOIS, MYRIAM PEYROUNETTE, ANNE LARUE, Institut de Mécanique des Fluides de Toulouse, UMR CNRS INPT UPS 5502, TANGUY LE BORGNE, Université de Rennes 1 — The vascular system of the human brain cortex is composed of a space filling mesh-like capillary network connected upstream and downstream to branched quasi-fractal arterioles and venules. 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 human intra-cortical vascular network (10000 segments) obtained from an anatomical database. In each segment, flow is solved from a 1D non-linear model taking account of the complex rheological properties of blood flow in microcirculation to deduce blood pressure, blood flow and red blood cell volume fraction distributions throughout the network. 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.

¹ERC BrainMicroFlow GA615102, ERC ReactiveFronts GA648377

Sylvie Lorthois
Centre National de la Recherche Scientifique

Date submitted: 01 Aug 2015

Electronic form version 1.4