The Australian Society Of Rheology, Inc.

2020-21 Rheology Lecture Series

CAV Reg. No. A0055806E

Calendar details

Date:	**Tuesday, 16 March 2021**
Time:	**18:00 - 19:30 pm (Melbourne, Australia)**
Event Registration Link:	https://www.eventbrite.com.au/e/australian-society-of-rheology-seminar-16-march-2021-registration-142817891157

Invited lecture

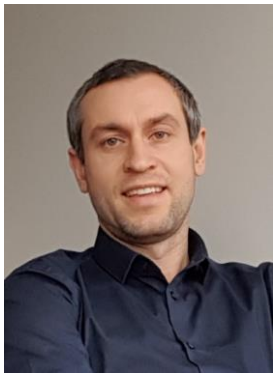
Dr Dmitry Fedosov

(Institute of Complex Systems, Forschungszentrum Juelich)

Blood Rheology and its Effect on the Migration of Micro- and Nano-particles in Blood Flow

Blood rheological properties have a pronounced effect on efficient perfusion of the vascular tree. In particular, the shear-thinning property of blood is intimately related to the dynamics and mutual interactions of its major constituents, the red blood cells (RBCs). We will show that shear-thinning is the result of a rich dynamic behavior of RBCs convoluted with a large distribution of shapes for any given flow condition. For increasing shear stresses, RBCs will successively tumble, roll, deform into rolling stomatocytes and finally adopt highly deformed and polylobed shapes. These morphological changes are mainly controlled by the viscosity difference between RBC cytosol and blood plasma, determining the global rheological behaviour of blood. Furthermore, blood rheological characteristics affect the adhesion of micro- and nano-carriers in blood flow, which can be used for drug delivery. Using mesoscopic hydrodynamic simulations of blood flow, we predict the margination of carriers or their migration properties toward vessel walls. Our results show that margination strongly depends on the thickness of the available free space close to the wall, the so-called red blood cell-free layer (RBC-FL), in comparison to the carrier size. The carriers with a few micrometers in size are comparable with the RBC-FL thickness and marginate better than their sub-micrometer counterparts. Deformable carriers, in general, show worse margination properties than rigid particles. As a conclusion, micron-size particles appear to be more favourable for vascular drug delivery in comparison to sub-micron carriers.

Speaker's biography



Dmitry Fedosov received his bachelor's degree in mathematics from Novosibirsk State University, Novosibirsk, Russia in 2002. After earning a MS degree in aerospace engineering from the Pennsylvania State University in 2004, he moved to Brown University, where he pursued a PhD degree in applied mathematics. Dmitry received a MS degree in applied mathematics in 2007 and his PhD in 2010. His thesis work was on multiscale modelling of blood flow and soft matter with the focus on modelling polymers and blood cells. His thesis work was recognized with the David Gottlieb Memorial Award for excellence in graduate study by the Brown University's Division of Applied Mathematics and with the 2011 Nicholas Metropolis Award for outstanding doctoral thesis work in computational physics from the American Physical Society. After completing his PhD, Dmitry moved to Forschungszentrum Juelich, Germany for a postdoctoral position in the theoretical soft matter and biophysics group led by Gerhard Gompper. In 2012, Dmitry was awarded

the Sofja Kovalevskaja Award from the Humboldt foundation to build up an independent research group at the Institute of Complex Systems, Forschungszentrum Juelich, Germany. In 2016, he obtained a Habilitation in Theoretical Physics from the Faculty of Mathematics and Natural Sciences, University of Cologne, Germany. Dmitry continues to work as a research group leader at the Institute of Biological Information Processing and Institute for Advanced Simulation, Forschungszentrum Juelich with a research focus on non-equilibrium physics, including various complex systems in biophysics, and soft and active matter.

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