Physikalisches Kolloquium

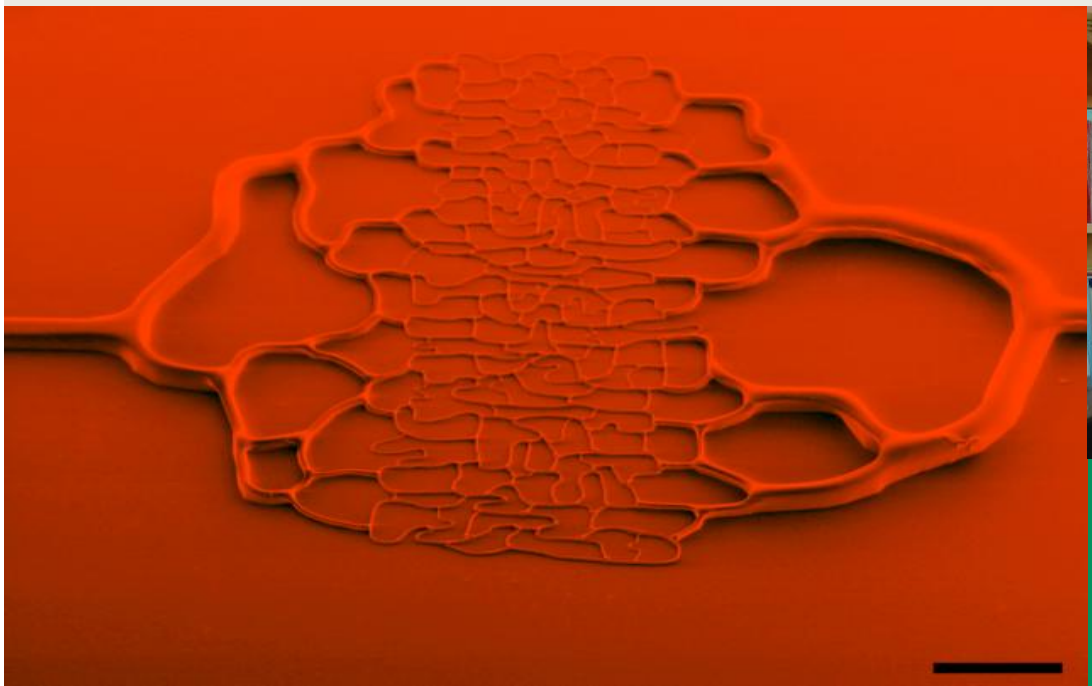
des Physikalischen Instituts

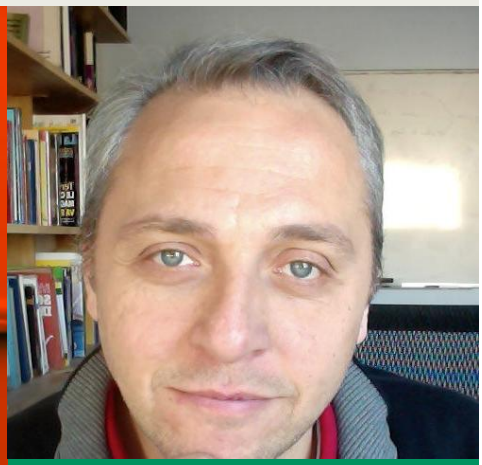
UNIVERSITÄT BAYREUTH

Transport, mixing and rheology of blood suspensions in the microcirculation

This presentation explores the physics of blood being a dense suspension of deformable red blood cells (RBCs) in three topics.
Firstly, RBCs navigate tiny vessel networks, deforming into various shapes to deliver respiratory gases effectively. Our experiments reveal that RBC flow through uniform networks shows non-linear transport characteristics with pressure, influenced by RBC volume fraction and network topology. This behavior is linked to the local membrane dynamics of RBCs.
Secondly, the importance of blood mixing at the arterio-venule scale is discussed. Effective mixing in microcirculation is crucial for nutrient and waste transport. We realise experiments with fluorescent macromolecules in RBC suspensions and we show that mixing improves with higher flow rates and specific volume fractions, suggesting RBCs aid in maintaining a well-mixed blood state.
Lastly, RBC dynamics under physiological conditions reveal complex morphological transitions under increasing shear stress, challenging the current understanding of shear thinning that RBCs align and elongate in flow. These transitions affect blood rheology and are influenced by pathological changes in plasma composition or RBC properties, impacting blood flow behavior.

Date: Tuesday, 22nd July 2025 | Time: 5 pm to 6pm| Room: H15 (NWII)





Dr. Manouk Abkarian
Physics & Mechanics of Biological Systems
Université de Montpellier