Clustering of micro- and nanoscopic drug delivery agents in human blood flow

Initiative: Lichtenberg - Professuren

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Intensive worldwide research efforts are currently being dedicated to explore the potential of synthetic micro- and nanoscopic particles as drug delivery agents (DDAs) in the human vascular system. Most studies focus primarily on the biochemical interaction between a single DDA and a living cell. In contrast, the purpose of the professorship is to understand by means of computer simulations the physical multibody interactions between DDAs and the red blood cells which they encounter on their way from the injection needle through the cardiovascular system towards their target organ. The focus is on the possibility of an unintentional formation of clusters in which the DDA concentration and thus their biochemical activity is much higher than expected, and which may therefore have severe consequences for the patient. Which mechanisms can create such clusters? To answer this question, it is necessary to investigate simultaneously the microscopic trajectories of many DDAs, their hydrodynamic interactions and collisions with the highly deformable red blood cells, and the resulting macroscopic flow. Modern algorithms together with the power of present-day supercomputers are now able to provide such a complete picture which is very difficult to obtain from an experiment.

Projektbeteiligte

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