EVALUATING THE IMPACT OF PERFUSION ON NANOMATERIAL UPTAKE RATES AND CYTOTOXICITY USING MICROFLUIDIC *IN VITRO* & *IN SILICO* CELL CULTURES SYSTEMS

Peter Ertl, Faculty of Technical Chemistry, Vienna University of Technology (TUW), Austria
peter.ertl@tuwien.ac.at
Mario Rothbauer, Faculty of Technical Chemistry, Vienna University of Technology (TUW) Austria

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In the last decade, the application of nanomaterials (NMs) in technical products and biomedicine has become a rapidly increasing market trend. As the safety and efficacy of NMs are of utmost importance, new methods are needed to study the dynamic interactions of NMs at the nano-biointerface. However, evaluation of NMs based on standard and static cell culture end-point detection methods does not provide information on the dynamics of living biological systems, which is crucial for the understanding of physiological responses. To gain a deeper understanding of nanomaterial – cell interactions under perfused conditions, we here present a combinatorial *in vitro* & *in silico* approach to describe shear-force dependent uptake of nanoparticles on vascular endothelial cells. Additionally, we present a microsensor-integrated microfluidic system capable of monitoring the enhanced cytotoxic effects of nanodrugs on lung cells following chronic and acute exposure scenarios. Result of our study demonstrate that both active uptake rates and cytotoxicity of nanomaterials are strongly modulated by flow velocity and local shear-force conditions.

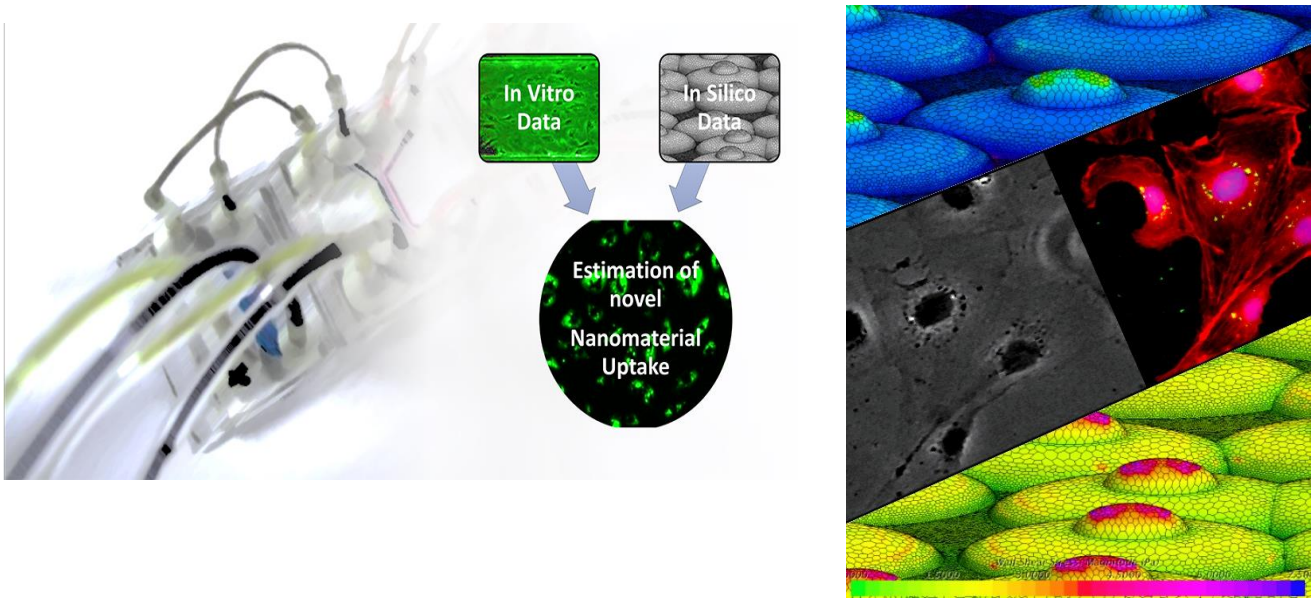

Figure 1 – Concept of in vitro & in silico approach to study nanomaterial uptake rates