Abstract for oral presentation (invited talk)

Session Title: Organ-on-chip (chair Tommaso Serchi)

Cell cultures in flow: approaches for *in vivo*-like safety screening

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Microfluidic technology is a valuable tool to create more *in vivo*-like cell models for rapid and animal-free risk assessment of new chemicals and drugs. Microfluidic cell-based devices allow high-throughput screening and flexible automation while lowering costs and reagent consumption due to their miniaturization. For drug development and safety assessment of chemicals (REACH) there is a growing need for faster and animal-free approaches. By simulating physiological conditions and avoiding most of the disadvantages of conventional cell cultures, organ-on-chip models are an attractive alternative to conventional static cell models.

The development of advanced miniaturized *in vivo*-like non-animal approaches for toxicity profiling and non-invasive cell characterization will be presented. Different approaches and technological setups for *in vivo*-like screening, including chip-based microfluidic modules, will be discussed.

Fluidic systems guarantee the cultivation of 2D or 3D cell models as well as primary or stem cell derived models. Different integrated sensors allow online characterization of the cell systems. Aerosol exposure as well as chronic exposure via fluidics is possible in these flow systems. Furthermore, by interconnecting several *in vitro* models on chip, the detection of secondary toxicity, triggered by toxic metabolites from cells of one of the upstream models, could be realized. This allows real-time recording of dynamic interactions between several tissues and mapping of altered effect of drugs or chemicals.

So, *in vitro* cultures in flow can contribute to the replacement of animal testing in risk assessment studies in compliance with the 3R's to reduce, replace and refine animal experiments.