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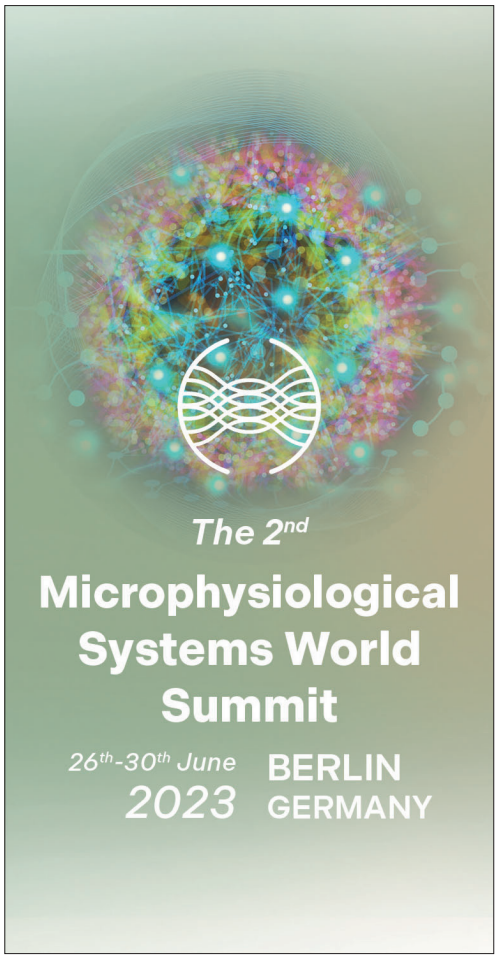
Welcome



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compounds, demonstrating its potential to predict safety-related issues before entering the animal testing phase.

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Presentation: Poster

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Quantitative fluid dynamic characterization of an organ-on-chip model using phase resolved Doppler OCT

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Organ-on-chip (OoC) systems are novel microfluidic microsystems that combine the advantages of well-characterised human cells with the benefits of engineered, physiological-like microenvironments manufactured in the system. The extracellular matrix (ECM) is the natural microenvironment of cells in the human body responsible for providing the appropriate stimuli to cells to control cell processes such as proliferation, migration, and apoptosis. OoCs can mimic the ECM, via channels and porous membranes, by providing the cells with physiological-like mechanical stimuli governed by the fluid dynamics in the system [1]. Understanding the fluid dynamics in OOC can aid in fine-tuning the stimuli sensed by the cultured cells, understanding cell behavior and cell fate. The current state of the art methods for characterizing fluid dynamics in the OoC systems are simulations, theoretical calculations, and empirical observations, therefore a quantitative characterization technique is lacking. Optical coherence tomography (OCT) has been used in previous studies to measure omnidirectional flow velocities in flow systems [2].

In this study, we measured the flow in a cuvette using a Thorlabs GANYMEDE II HR series (high axial resolution of 3 mm in air) spectral domain OCT system. We made quantitative 2D flow measurements using the phase-resolved Doppler method. This work was then extended to extract flow dynamics, in the Bi/ond inCHIPit using titania scattering nanoparticles, which would be a novel way of flow characterization in the field of OOC. The results are compared to the theoretical Hagen-Poiseuille equations and COMSOL simulations and found to be in good agreement. The results of the study were further extended to determine the shear stress experienced by the cells in the culture well of the OoC.

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Presentation: Poster

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Automated and high-volume wafer-scale microfabrication of organ-on-chip (OoC) polymer structures and components

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Organ-on-chip (OoC) technology is a promising improvement within *in vitro* cell culture, better mimicking functional units of human organs compared to conventional techniques. Current fabrication of three-Dimensional (3D) components in OoC, such as thin membranes and microfluidic structures, is often achieved via soft lithography, bonding, and punching of access holes of polymers, such as polymethylsiloxane (PDMS). However, these methods often suffer from the need of manual fabrication steps, drastically increasing production time and reducing yield due to handling errors and manual alignment of the layers. Consequently, the scalability is limited, which is a crucial aspect for a more widespread adaptation of OoC technology. In this work, we present a reproducible and scalable process for the direct patterning of various 3D polymer structures. The investigated process employs commercially available systems from IC packaging to mould pillars, membranes, and microfluidic channels with varying dimensions and thicknesses. Our process simultaneously improves the control over the thickness and dimensions of these structures in comparison to conventional fabrication techniques. Furthermore, proof of functionality is presented by adapting this technology to an existing OoC platform which incorporates integrated electrodes used for electrophysiological recording, stimulation, and TEER measurements. We demonstrate a complete process for wafer-scale microfabrication of OoCs, enabling low-cost, high-volume automated production. This is an important next step to large-scale manufacturing of