

# Lab-on-a-chip Platforms for Single Zoospore, Fungal and Oomycete Studies

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Although only a small minority of fungi and oomycetes are pathogenic, those that are have a rich diversity and increasingly serious impact on human health, food security and ecosystem resilience.<sup>1</sup> The capability of hyphal tip growth to penetrate throughout host tissue is essential for pathogenicity,<sup>2</sup> and the epidemic spread is primarily based on the dispersal of free-swimming zoospores from host to host.<sup>3</sup> Our work is developing a collection of compartmentalization and force sensing lab-on-a-chip (LOC) devices as platform technology for the study of fungal and oomycete hyphae and spores. These can be used to test anti-fungal/oomycete compounds on individual cells, and help investigating the mechanisms of invasive growth.

This paper will summarize the LOCs developed thus far and introduce others currently under development. Included are the monolithic platform shown in Fig. 1, which consists of a gas layer and a fluidic layer, separated by a thin PDMS membrane. Combined, both layers use pneumatic valving to compartmentalize zoospores for parallelized trapping and force measurements using freely-bending micropillars as force sensor.<sup>4</sup> As shown in Fig. 1(c) & (d), zoospores of *A. bisexualis* could be captured.<sup>5,6</sup> During subsequent culture on the platform, zoospores germinated and resulting germ tubes grew along channels, impacting on force sensing pillars. Protrusive force (Y-direction in example) of germ tubes was recorded up to 0.56  $\mu\text{N}$  while directly impacting on sensor pillars.

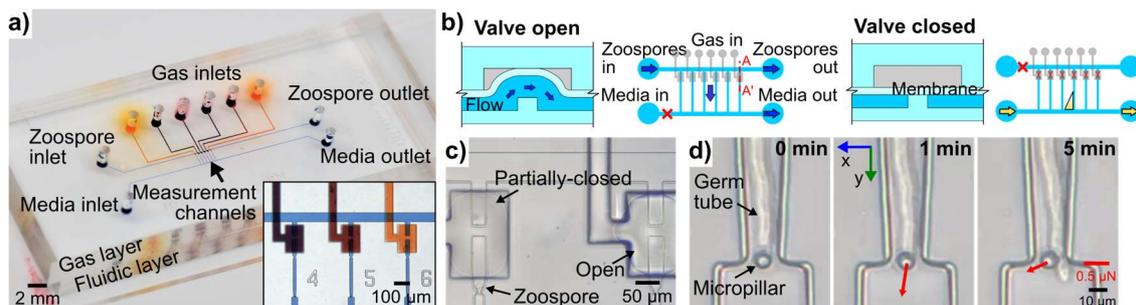


Figure 1: Monolithic PDMS platform. (a) Photograph of assembled platform with separate gas inlets for each valve. (b) Schematic diagram of platform operation while introducing (valve open) and culturing zoospores (valve closed). (c&d) Experimental results of *Achlya bisexualis* zoospores on the platform.

## References:

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