

Organs-on-Chip high throughput platform for pharmaceutical screening

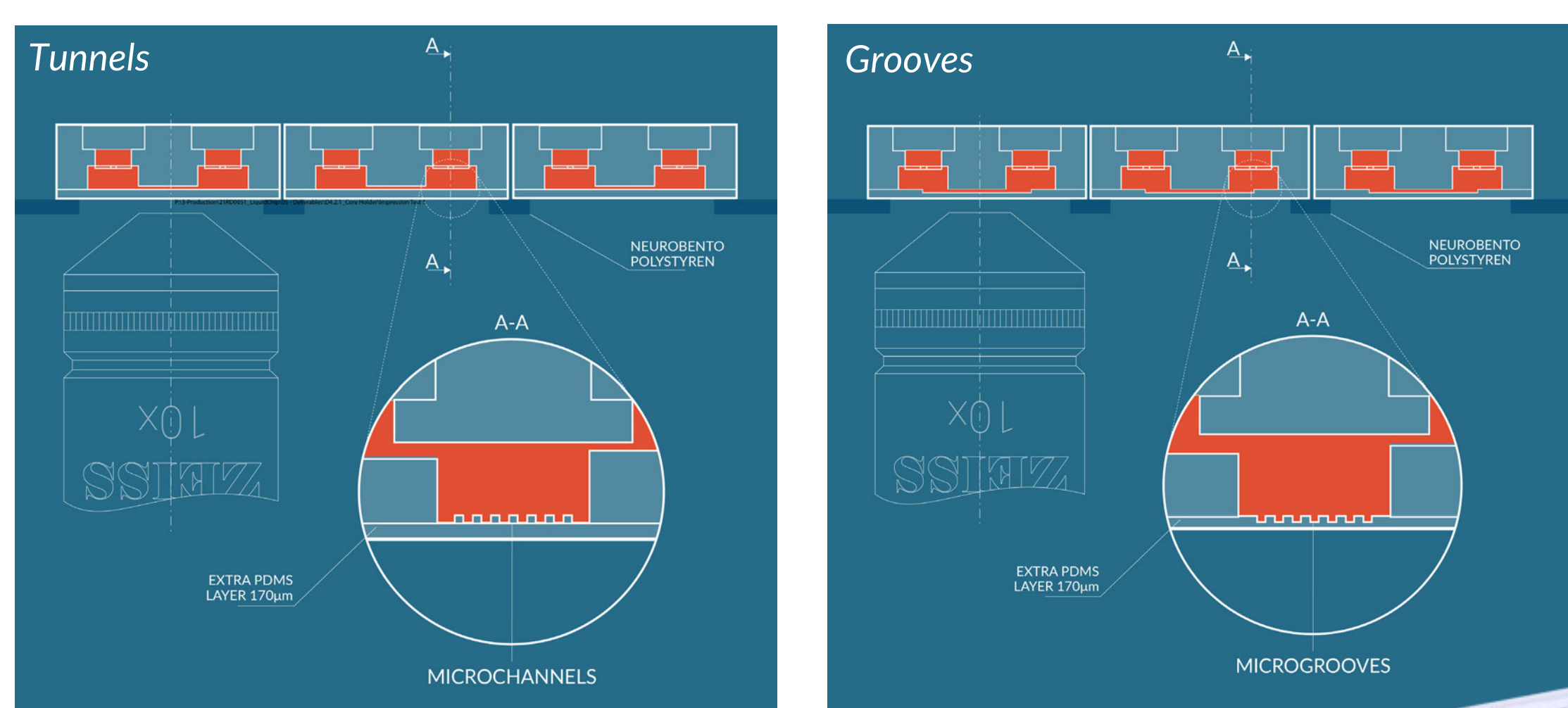
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Background

The promises of predictive in vitro models rely on the creation of robust and repeatable tool. In this study, we introduce a new microfluidic platform compatible with high throughput screening equipment for biological and pharmaceutical applications based on the organs-on-chip technology.

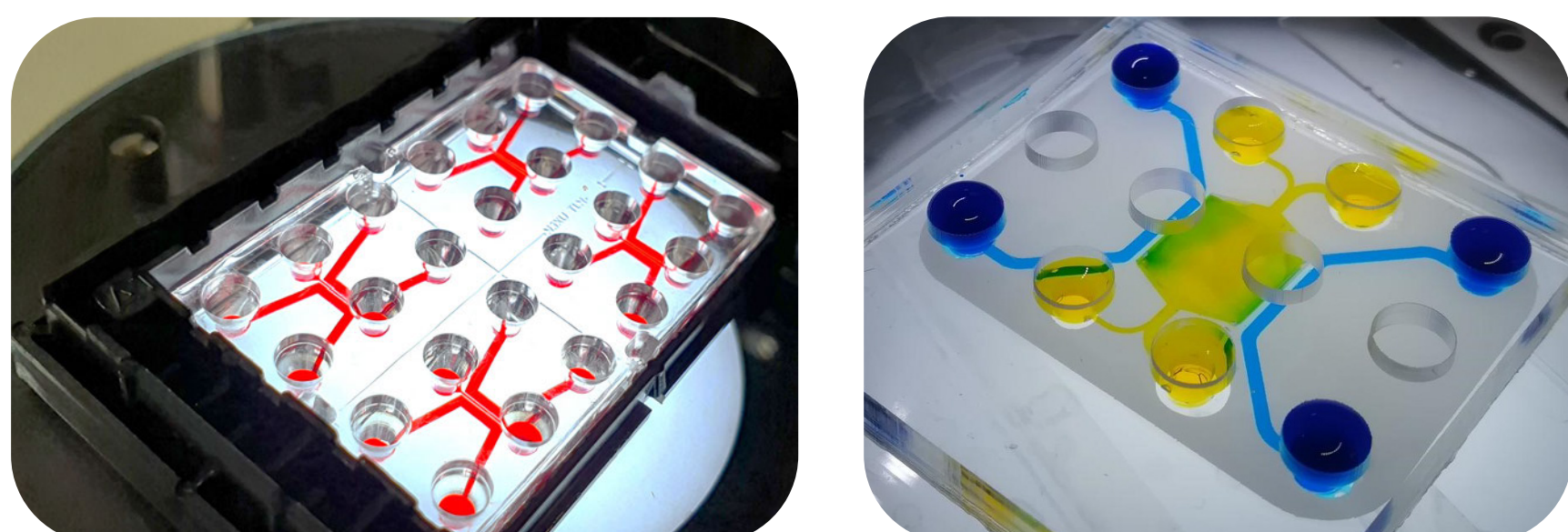
Results

PHYSIOLOGICAL DEVICES



MICROFLUIDIC TECHNOLOGIES

- Microchannels *Tunnels*/ Microchannels *Grooves*
- 3D-Deposition Chambers
- 2D/3D architectures
- Compartmentalization
- Porous membrane interface



Pictures of (Left) industrial multi microfluidic chip format inside platform (QuarterBento™) and (Right) customized chip combining 3D-Deposition Chambers, Microchannels Tunnels and Porous Membrane.

HUMIDIFICATION SYSTEM

LABYRINTH TECHNOLOGY

- Limit the liquid movement
- Avoid water spilling during transport
- Maintains, for several days, a humid environment for cell cultures

PLUGS

- Replace an absent multi microfluidic chip
- Have their own labyrinths to bring humidity

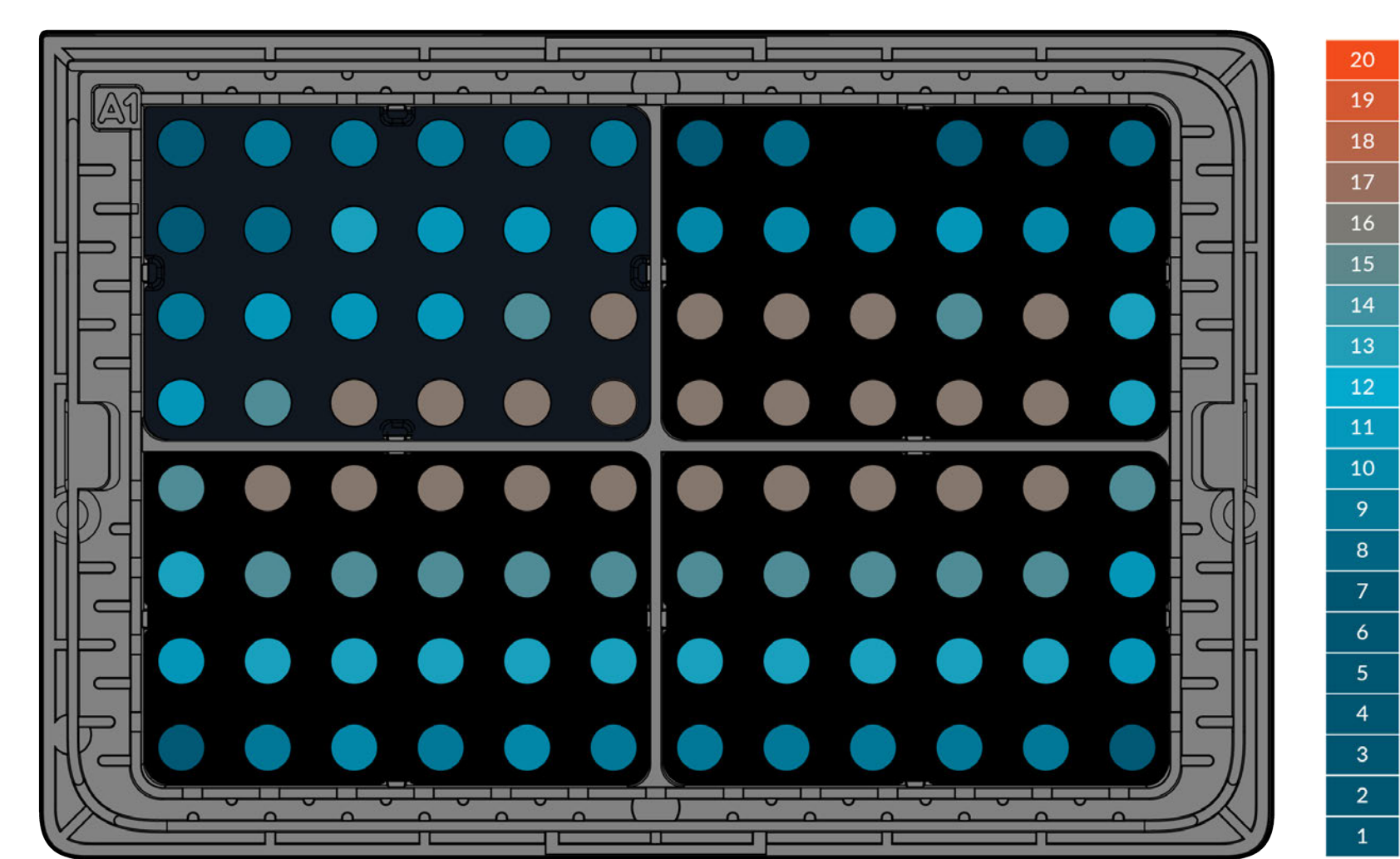
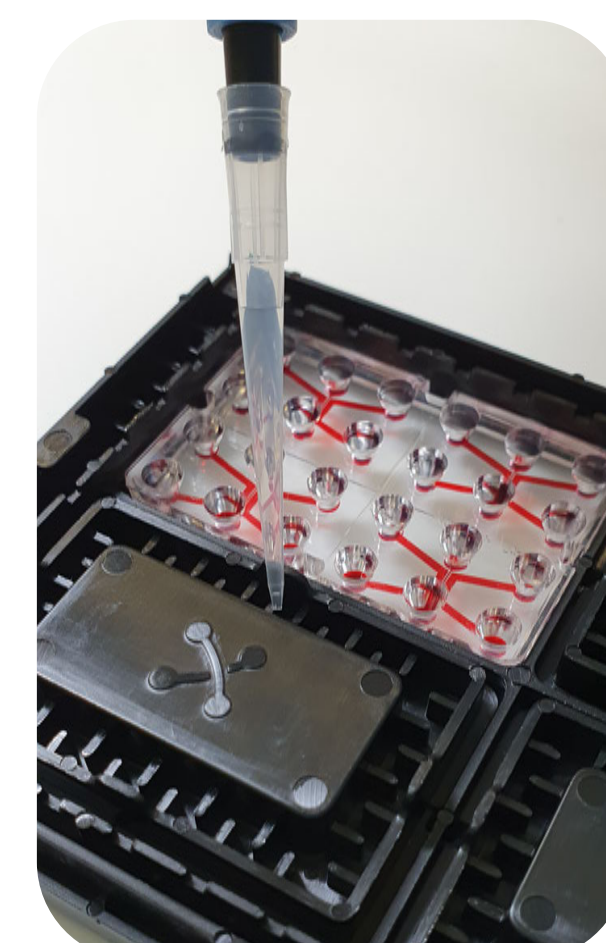


Illustration of the humidification test where reservoirs of the microfluidic platform chips were filled with DI water and controlling - per chip position - the relative evaporation after 4 days in the incubator. Evaporation percentage is represented by color gradient from dark blue (less than 1%) to orange (more than 20%)

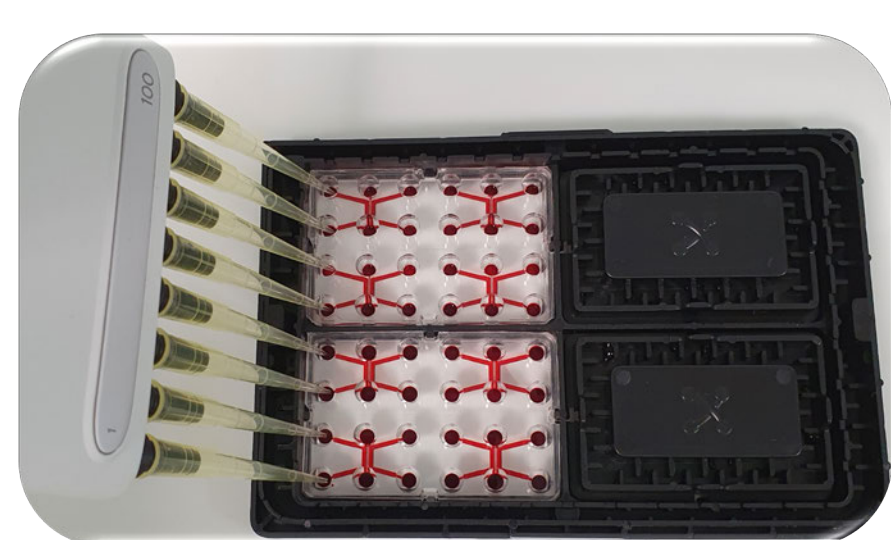
MEA Recording



- Adapted frame and microfluidic devices compatible with live-cell assay platforms
- Bar code compatible with AXION recording system to access of full functionalities

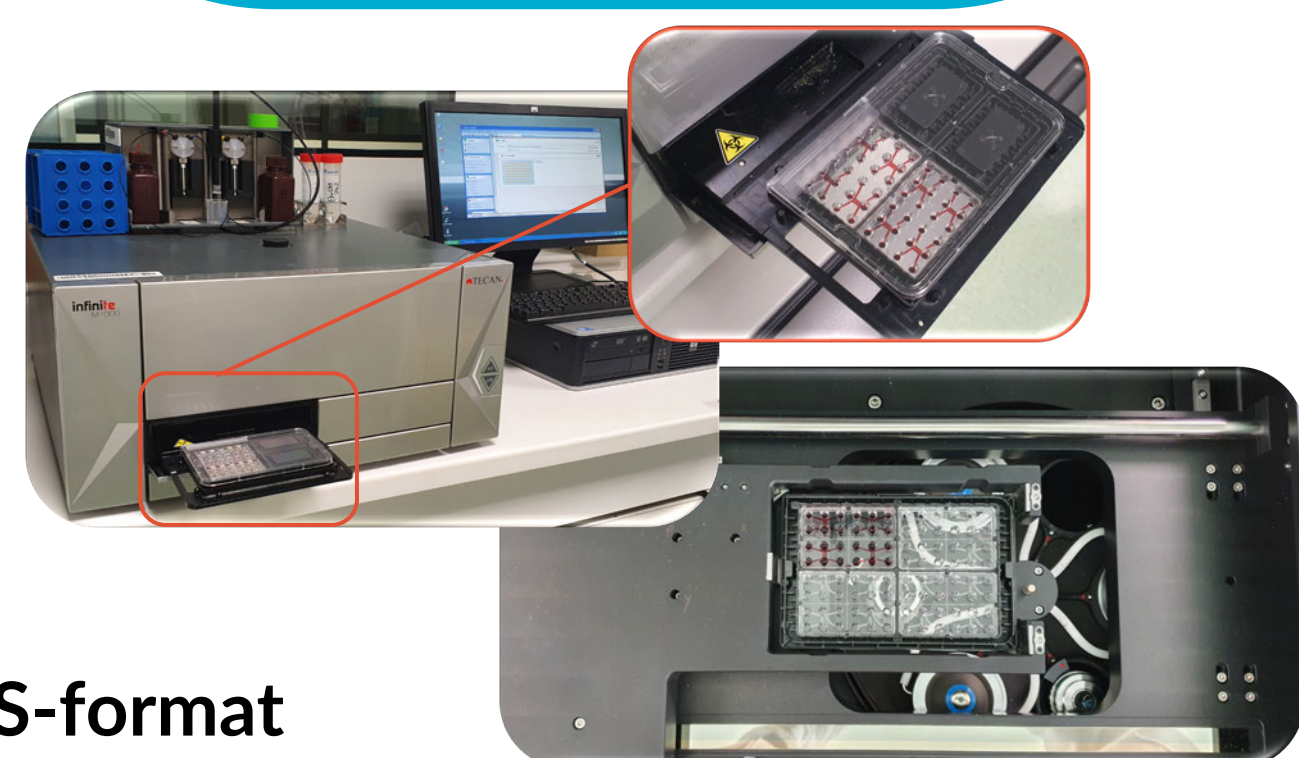


Liquid Handling Robots

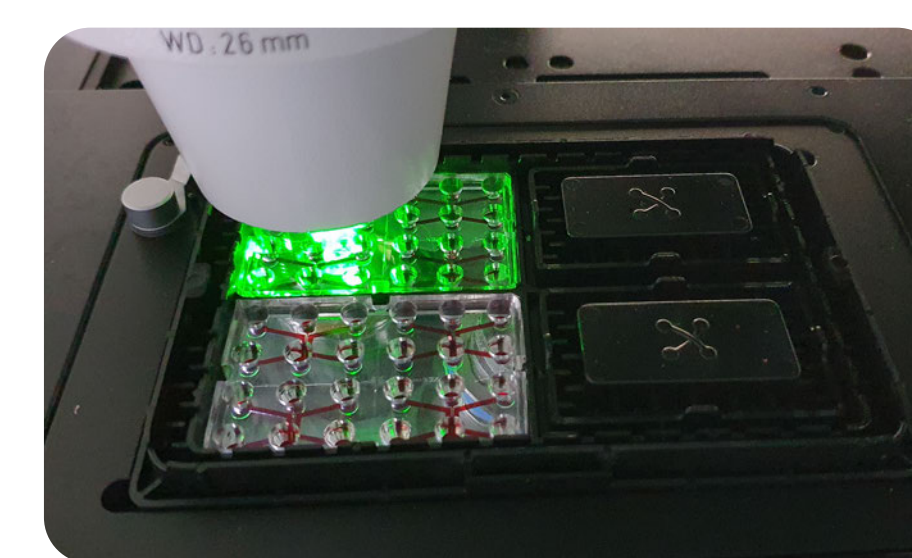
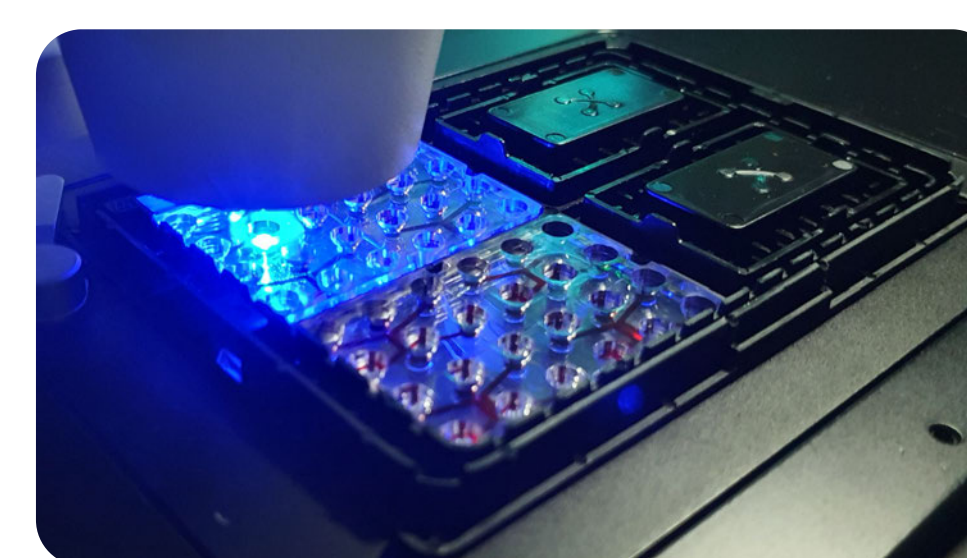


- Frame dimensions respect SBS-format
- Correct positioning of inlet and outlet of the chip with regards to the 96-well plate positioning

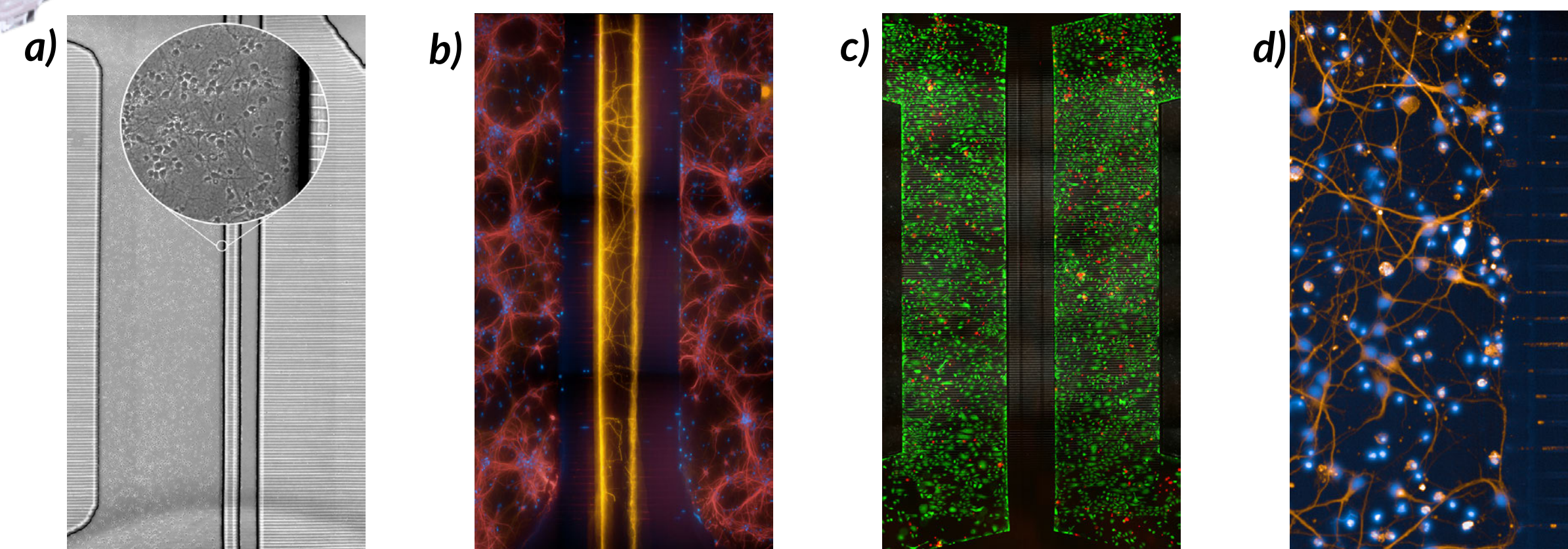
HTS Imaging Systems



HIGH THROUGHPUT SCREENING (HTS) EQUIPEMENT COMPATIBILITY



- Transparency of the silicone allows brightfield imaging
- Microfluidic devices are bonded on 170-µm-thick PDMS layer compatible with confocal microscopy
- Fluorescence pictures with multi staining could be performed inside microfluidic devices



a) Brightfield illumination pictures of Human Motor Neurons-derived from human induced Pluripotent Stem Cells (hiPSCs at Day 7) b) Culturing primary neurons from embryonic rat hippocampus at Day 17 staining with MAP2 and BetallITubulin (Red) acquired with high resolution microscopy (Operetta Perkin Elmer) c) Primary human keratinocytes at DIV 4 - Live-Dead assay (green=live cells; red=dead cells) d) human glutamatergic neurones iPSC-derived

MICROSCOPY COMPATIBILITY

Conclusions and Perspectives

In this study, we introduced

- ✓ Microfluidic devices combining several technologies allowing to mimic organ functionalities
- ✓ Frame, containing microfluidic chips, compatible with live-cell assay and HTS equipment
- ✓ Humidification system to maintain long-term cell culture up to 4 days without media changes
- ✓ Platform compatible with standard and confocal microscopies for cell culture imaging

Now, this platform can be used for biological and pharmaceutical applications based on the organs-on-chip technology.

