

Micro-Perf

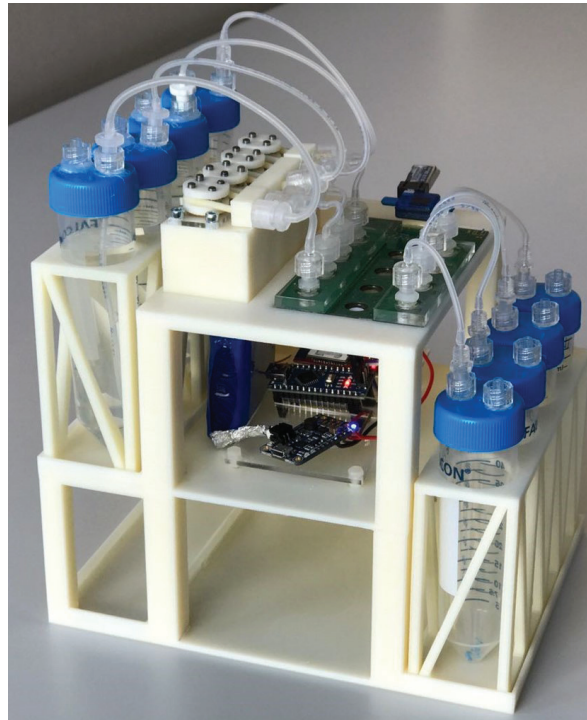
Development of a miniaturized perfusion system for electrophysiological recording

Luc Stoppini (HEPIA), Marco Mazza (HEIA-FR),
Alexandra Homsy (HE-ARC)

Brief description

Our lab is currently developing an *in vitro* perfusion used to change the medium of *in vitro* neuronal culture and to inject drug. This perfusion system will be compatible with the electrophysiological recording of neurons. It is composed of five parts:

- Micro-electrode Array device (to measure neuronal activity).
- 4 independent peristaltic pumps.
- Electronic board to control the pumps by Bluetooth.
- Silicone tubing and tanks of liquid for culture medium, tested drugs or waste.
- User friendly software.



Representation of the perfusion system for a Micro-Electrode Array (MEA) device

There is a growing need for volume control and liquid distribution by means of micro-pumps and/or micro-valves in the medical market and in particular in the fields of continuous drug dispensing and blood volume control during a diagnosis.

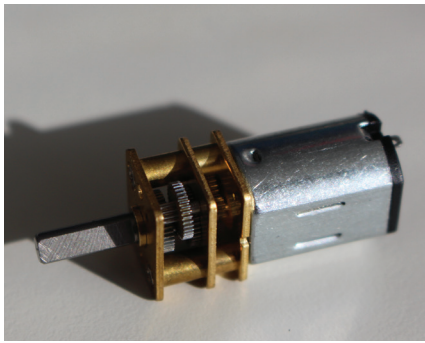
Moreover, there has still been little advancement as regards one aspect of microfluidics: the creation of dynamic or stable controllable flows. These flows are however necessary for all processes involving the infusion or injection of a liquid into a system or an organism.

The Micro-Perf project aims to find innovative solutions in the field of flow control, especially for applications involving microfluidics. This is particularly relevant for *in vitro* cells cultures which are traditionally statically realized in multi-well plates. Continuous infusion of tissue will place cultures in more physiological conditions. An integrated perfusion system will allow biologists to better control not only the quantity but also the characteristics of the culture medium that will perfuse the cells/tissues. This will allow a finer control of the cellular microenvironment.

Key points

Our technology will :

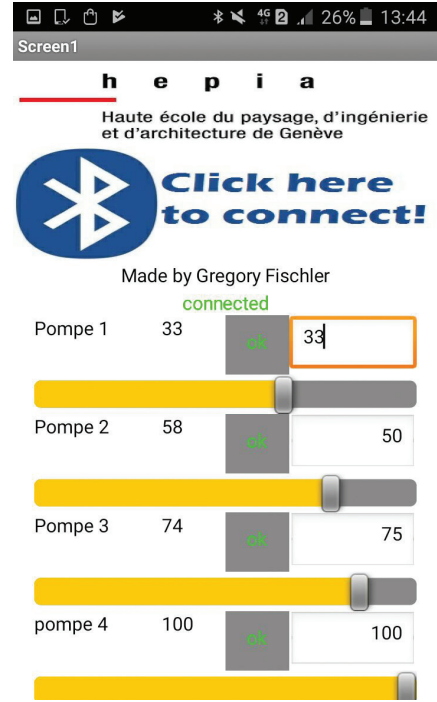
- Perfuse automatically the culture with fresh medium for 5 days on battery or even longer on electric current
- Be controlled by a wireless technology (Bluetooth) to change the parameters.
- Reduce the manipulation by biologists and therefore limit the tissue stress due to temperature change and contamination risk.
- Work in a hostile environment for motor and electronic devices (37°C, 100% humidity and 5% CO₂).
- Be compatible with other evolutions and options (drug injection, medium sampling).



1



2



3

Output

Various applications are expected to benefit from the Micro-Perf project: not only the substances perfusion into a cell culture system, as described above, but also *in vivo* perfusion.

In addition, sampling of biological fluids for chronic or periodic analyzes is also one of the many applications benefiting from these developments.

On the other hand, this project could be useful for the screening of toxic molecules, new drugs and/or nanoparticles on different types of cells.

Special equipment

- Board MEA

Legend

- 1 - Air Pump Motor
- 2 - Board MEA
- 3 - Application control pump