

# TEERO\_C\_UNLOOC (Unlocking the data content of Organ-on-Chips)

## Real-time monitoring of the electrical bio-impedance

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### Brief description

The European UNLOOC project addresses the challenges of animal testing in drug development by demonstrating how Organ-on-Chip (OOC) technology can create more effective treatments without animal subjects.

HEPIA will develop a Lung-on-Chip (LOC) monitoring platform with a bio-impedance device using two electronic boards to measure trans-epithelial/endothelial electrical resistance (TEER) of the cell layer at the air-liquid interface with microfabricated porous, flexible electrodes.



TEERO\_C: a bio-impedance measuring electronic board

Epithelial airway lung cells are cultured at the interface between air and liquid in the lungs. These cells, through tight junctions, regulate the transport of molecules in and out of the lungs. In a specifically designed OOC, the effectiveness of these tight junctions can be monitored using TEER, measured by a bio-impedance meter. This device measures the electrical impedance of the cell layer between two electrodes by performing a frequency sweep or using selected frequencies. The TEER value reflects the integrity of the cell barrier: a high TEER value indicates a tight and healthy barrier, while a low TEER value points to a disrupted or weakened one.

This device is designed for real-time, long-term monitoring of TEER, enabling continuous observation during cell seeding, proliferation, and tight junction formation. Moreover, it serves as a tool for drug testing by assessing a compound's ability to compromise the epithelial barrier and monitoring its recovery post-exposure. This approach offers a dynamic, non-invasive method to study lung epithelial behaviour under physiological and pathological conditions, improving the predictive power of in vitro models and supporting drug development and safety screening.

### Key points

This European project allows HEPIA to collaborate with experienced companies in OOC development, such as Alveolix AG and Microfluidic ChipShop GmbH, to create a LOC platform. HEPIA's Bioengineering and Electronics laboratories have developed a bio-impedance measurement device and microfabricated electrodes to measure cells' TEER at the air-liquid interface. HEPIA also collaborates with CSEM to integrate an AI-based data analyser for TEER measurements.



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## Output

This project has been presented at the CSEM 4th Next-gen organ-on-chips & organoids workshop in Switzerland and at the JRC Summer School on non-animal approaches in science in Italy in 2025. A poster has been presented at the MPS World Summit 2025 in Belgium.

## Special equipment

During this project, a bio-impedance measuring device has been developed in two parts: a measuring head and an acquisition LID (Liquid Ion Distribution). To measure the TEER, specific microfabricated electrodes have been developed.

### Legends

1 - TEEROC: a bio-impedance measuring user interface