

# Heart-on-chip monitoring of cardiomyocyte electrical activity

**Commonly used acronym:** *Microelectrode arrays*

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## Contact person

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## Organisation

**Name of the organisation** Interuniversitair Micro-Electronica Centrum (IMEC)

**Department** Life Science Technologies

**Country** Belgium

**Geographical Area** Flemish Region

## SCOPE OF THE METHOD

<b>The Method relates to</b>	Animal health, Human health
<b>The Method is situated in</b>	Basic Research, Translational - Applied Research
<b>Type of method</b>	In vitro - Ex vivo
<b>Specify the type of cells/tissues/organs</b>	Human induced pluripotent stem cells derived cardiomyocytes

## DESCRIPTION

### Method keywords

action potentials

local field potentials

heart-on-chip

induced pluripotent stem cells

cardiac toxicity  
drug testing  
in vitro

### **Scientific area keywords**

cardiac toxicity  
organ-on-chip  
drug screening  
in vitro cell culture

### **Method description**

This method is used to monitor cardiac cell cultures *in vitro*. It can be used for monitoring both cell activity and drug-induced cardiac side-effects for primary cardiomyocytes or hiPSC-derived cardiomyocytes. Unlike conventional microelectrode array systems that only measure the local field potentials around cardiac cells, the imec-developed microelectrode array monitors the extracellular electrical activity, intracellular (open-cell) action potentials, and impedance of cells cultured directly on the chip. Furthermore, this method offers high throughput recordings of cells: the CMOS-based chip contains 16384 recording electrodes, wherein 1024 channels can simultaneously record multimodal cell electrophysiology on single-cell level. This multimodal MEA may open up new opportunities in high-throughput cell-based pharmacological screening as well as fundamental studies of cells.

### **Lab equipment**

Imec-developed microelectrode array chips and read-out setup.

### **Method status**

Published in peer reviewed journal

## **PROS, CONS & FUTURE POTENTIAL**

### **Advantages**

High quality electrical recordings (intracellular action potential recordings) High spatio-temporal resolution Single-cell recordings 16,384 recording electrodes Pacing

Multimodal Structured chip surfaces.

## Challenges

Custom-made tools ;  
Large volume of data ;  
Complex chip fabrication.

## Modifications

Software upgrades for user-friendliness ongoing ;  
Hardware improvements.

## Future & Other applications

Brain-on-chip ;  
Cancer-on-chip ;  
Gut-on-chip ...

## REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

### Links

[A 16384-electrode 1024-channel multimodal CMOS MEA for high-throughput intracel...](#)

[Single-cell recording and stimulation with a 16k micro-nail electrode array int...](#)

[Open-cell recording of action potentials using active electrode arrays](#)

[Action potential-based MEA platform for in vitro screening of drug-induced card...](#)

[Put your heart on this chip and your cancer treatment becomes 'healthier'](#)

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