

Heart-on-chip monitoring of cardiomyocyte electrical activity

Commonly used acronym: Microelectrode arrays

Created on: 26-08-2019 - Last modified on: 08-11-2019

Contact person

Thomas Pauwelyn

Organisation

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

Department Life Science Technologies

Country Belgium

Geographical Area Flemish Region

SCOPE OF THE METHOD

| | |
|---|---|
| The Method relates to | Animal health, Human health |
| The Method is situated in | Basic Research, Translational - Applied Research |
| Type of method | In vitro - Ex vivo |
| Specify the type of cells/tissues/organs | 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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