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Dear JoVE editor,

I would like to submit our manuscript, “Electronic measurements of cellular adhesion using Field-Effect Transistor Cell-substrate Impedance Sensing (FETCIS)” on behalf of all the authors, as discussed with Dr. Eric Veien. In this letter, the sensor technology, the measurement principle, and its biological and pharmacological applications are briefly stated below.

Electric Cell-substrate Impedance Sensing (ECIS) is one example for electronic biosensors able to detect the adhesion of a colony of – most of the time confluent – cells on technical substrates, via impedance changes on large metal microelectrodes (250 µm diameter). Here we introduce an alternative, label-free electronic platform named FETCIS to supplement ECIS with the possibility to reach down to a single cell resolution.

The used quasi-planar FET devices were fabricated in our group and optimized to measure the attachment and detachment process of a single cell. Confluent and low density cell cultures were used to prove that the sensitivity of the devices and the amplifier system can reach down to single cell resolution. Using impedance spectrometry, significant differences in impedance spectra were observed between the cell-free and cell-covered transistors in both confluent and single cell cultures. The results show that our FET devices and amplifier system are suitable for detecting cell adhesion down to single cells. In order to use the present system as a pharmacological platform for studying cytotoxicity drug effects on cancer cells, the standard anti-cancer drug topotecan hydrochloride and silica nanoparticles were applied to human lung cancer cells cultured on the FET devices. Real-time cell detachment processes due to cytotoxicity were monitored by FETCIS.

Our novel measurement technique clearly demonstrates a single cell resolution, which was the aim in the ECIS community for many years. By far, there is no label-free method, which can be used to measure the direct adhesion strength between cell and substrate in a swift and straightforward approach. We hope that by this publication, we reach a lot of researchers in the field and open a whole-new direction within the biosensor community.

Sincerely

Prof. Dr. Sven Ingebrandt

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List of authors and their contribution to this work is stated below:

Dr. Jessica Ka Yan Law: Organization and writing of manuscript

Anna Susloparova*: Established the data fitting model and performed simulations

Dieter Koppenhöfer*: Performed cell experiments and data analysis

Dr. Xuan Thang Vu: Chip fabrication

Felix Hempel: Manuscript planning

Prof. Dr. Sven Ingebrandt: Corresponding author

*: Equal contribution