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☰ ABSTRACT SUMMARY

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Title, content, keywords, and sessions

Title: Non-invasive real time analysis of electroporation phenomenon of individual cells

Body: Background: Electroporation (EP) is a promising approach for the targeted treatment of diseases such as cancer. This technique allows the transient pores formation in the cell membranes, facilitating the access of therapeutic agents such as bleomycin and cisplatin in the case of electrochemotherapy (ECT). However, while the efficacy and safety of EP have been demonstrated, questions remain and hinder its use. The differences in response between healthy and cancerous cells and the non-response of certain cancerous cells are still unknown. The current study aims at proposing an early detection of responses of healthy and cancerous cells, untreated or treated by ECT or by different types of EP (reversible, irreversible, calcium), using the microwave dielectric spectroscopy (MDS) technique for cellular and tissue analysis. Methods: To carry out this study, we perform both on-chip EP experiments and dielectric sensing in miniature devices. This method has the advantages of non-invasive testing, with fast test times and rapid diagnosis, while requiring small amounts of reagents and limited applied voltages to reach high electric fields. Among the different existing analysis methods, MDS proves to be an innovative approach to discriminate different cell types and states, while meeting the on chip requirements. Indeed, for the microwave range, the cell membrane becomes transparent, allowing the waves to reach the cell contents. The MDS method, adaptable from single cell to tissue scales, allows to obtain the dielectric properties of the sample in a non-invasive and non-destructive way, in real time and directly in the culture medium [1-2]. Results: Single cell analysis is of paramount importance for a better understanding of the effects of EP at larger scales. We measure the electrical signature of single cells isolated using a microfluidic device allowing to co-integrate EP and MDS. First, we calibrate the applied field for in-situ EP at the single cell level. We evaluate the different types of EP in a static manner. Second, in order to investigate the dynamics of EP within individual cells, we carry out real-time analyses. References: [1] A. Tamra, "Spectroscopie diélectrique HyperFréquence des cellules biologiques soumises à l'électroporation," Theses, Université Toulouse 3 Paul Sabatier, Mar. 2017. [Online]. Available: <https://hal.laas.fr/tel-01499406> [2] A. Tamra, "Spectroscopie diélectrique HyperFréquence des cellules biologiques soumises à l'électroporation," Theses, Université Toulouse 3 Paul Sabatier, Mar. 2017. [Online]. Available: <https://hal.laas.fr/tel-01499406>

Keywords: electroporation; microwave dielectric spectroscopy; single-cell analysis; in-vitro.

Session(s):

P18 Microfluidics: Electric fields and microfluidics [special]

Classification

Subject area	Topic	
Basic biology of electroporation	Cell responses (including intracellular trafficking and pathways)	✓
Medical applications	Drug delivery	✓
Pulsed-power devices, facilities and apparatus for Plasma and PEF treatment	Instrumentation diagnostics (pulsed power, optical, impedance, etc.)	✓
Technology	Micro and nano devices	✓
	Microfluidics	✓

Other Data

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- Either oral or poster presentation

If selected for Poster, willingness to participate in interactive poster session

- Yes
- No

Invitation letter for Visa required (presenting author)

- Yes
- No

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