

Extension of possibilities for non-invasive analysis by microwave spectroscopy of 3D biological models

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Abstract

Microwave and millimeter wave dielectric spectroscopy is a powerful technique for non-ionizing and non-destructive material characterization whether solid, liquid or gaseous [1]. The applicative areas of this technology are consequently diverse, as with biology and medicine with the non-invasive detection of diseases, such as cancer notably, to agriculture with the analysis of the moisture content of granular compounds [2] or meat quality evaluation [3] for instances. Therefore, its development for the analysis of the living at the molecular, cellular levels and up to tissues is very attractive for biological researches and biomedical applications, where non-invasivity, label-free and contact-less abilities as well as in-liquid measurements constitute important leitmotifs.

To enable the analysis of the traditional biological models, specific sensors enabling the microwave characterization of molecules, cells in the individual state and in suspension as well as tissues have been developed. However, one biological model was up to now not covered by this sensors' library due to its late development by biologists. It corresponds to spheroids, also called microtissues. They are constituted of an aggregate of cells, which exhibits a round shape and forms a tri-dimensional biological model. They not only include cells with different states and interactions, but also an extracellular matrix and gradients. Such 3D biological models are therefore of great interest, as they approach the complexity of living beings while avoiding *in vivo* animal experiments.

The presentation will consequently provide a status of existing miniature microwave-based biosensors, which have been developed to characterize different biological materials, and open to the possible dielectric characterization of microtissues with dedicated sensors.

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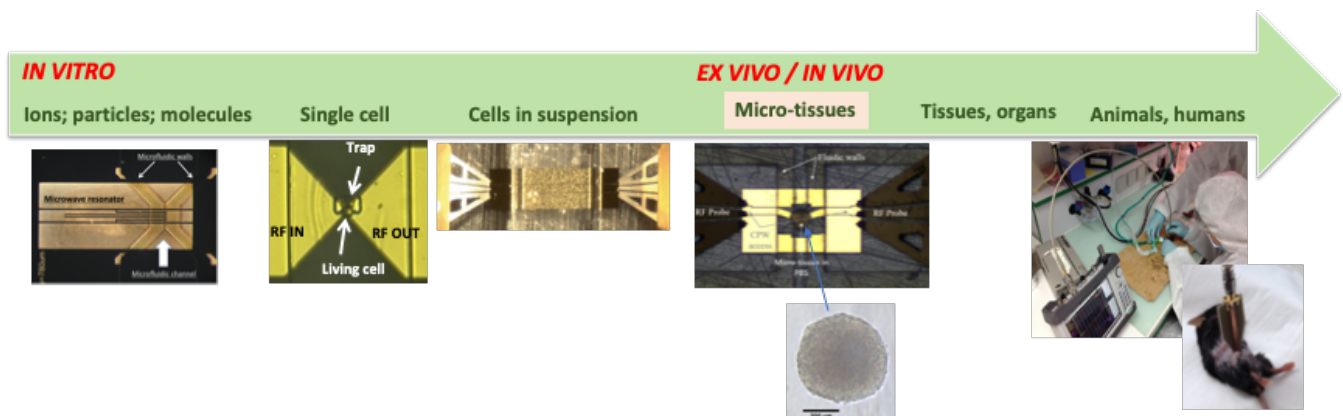


Figure 1. Microwave sensors developed for analyzing various biological models, from molecules to tissues.