Electrical impedance spectroscopy at the service of complex tissue models

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The increasing demand for complexity in in vitro models of tissues to enhance their relevance in modelling human physiology, demands that monitoring techniques adapt at pace. Electrical impedance spectroscopy offers label-free, continuous, high content information on real time changes in cell morphology, behaviour and differentiation. In this talk I'll discuss a new generation of electrodes, based on conducting polymers. Unlike traditional electrodes, conducting polymer electrodes bring advantages in terms of improved interfacing with biology, mixed electronic and ionic conduction, increased versatility in terms of fabrication due to liquid formulation (e.g. conformability, transparency, 3-dimensionality etc) and enhanced signal to noise ratio. Bringing together principles of materials science, tissue engineering, 3D cell biology and bioelectronics, I will showcase how we are building advanced models of the gastrointestinal tract, with integrated 3D conducting polymer scaffolds to host and monitor the tissues, aiming to elucidate the role of microbiota in the gut-brain axis communication. Second, I'll discuss conformable electrodes we've developed for both monitoring of complex in vitro gut models, and validation with rodent tissues. These devices allow highly sensitive monitoring of impedance of the tissue (as an indicator of gut health).