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## Impedance Spectroscopy of Adherent Mammalian Cell Culture for Biochemical Applications : A Review (Article)

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### Abstract

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This review paper is focused on various applications of electric cell-substrate impedance sensing (ECIS) using adherent, two-dimensional (2D) mammalian cell culture. The ECIS technique is a non-destructive electrical approach to in vitro monitor in continuous fashion and real time the cell behavior related to attachment, growth, morphology, motility, proliferation and viability. The use of living cells as sensorial elements provides the opportunity for analysis of a large variety of pharmaceutical compounds and toxicants that affect cellular responses. In this review, we will cover some of the most important applications of the ECIS technique such as: impedance of cancer cell, toxicity studies, and investigation of stem cell using impedance spectroscopy sensing. Contractile activity of beating cardiomyocytes recorded with ECIS will also be presented. Combination of impedance sensing and resonant frequency measurements of cell monolayer will be discussed. An innovative stretchable device with integrated ECIS electrodes will be discussed. Recently, the ECIS technique was combined with machine learning algorithms to distinguish stem cell proliferation from the differentiation processes. This review demonstrates that ECIS is a powerful tool, effective to investigate mammalian cell properties and physiological functions and provides advantages over conventional assays, including simple, rapid and noninvasive cell screening. © 2001-2012 IEEE.

### SciVal Topic Prominence ⓘ

Topic: Electric Cells | Bioelectrical Impedance | Microelectrodes

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### Author keywords

ECIS cancer cell ECIS cardiac cell ECIS stem cell ECIS toxicity studies impedance spectroscopy

### Indexed keywords

Engineering controlled terms:

Cell proliferation Learning algorithms Machine learning Mammals  
Natural frequencies Spectroscopy Stem cells

Engineering uncontrolled terms

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