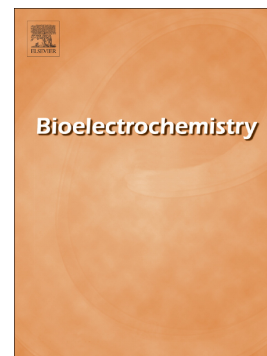


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# Dielectric properties of isolated adrenal chromaffin cells determined by microfluidic impedance spectroscopy

## Authors

A C Sabuncu<sup>1,\*</sup>, M Stacey<sup>2</sup>, G L Craviso<sup>3</sup>, N Semenova<sup>2</sup>, P T Vernier<sup>2</sup>, N Leblanc<sup>3</sup>, I Chatterjee<sup>4</sup> and J Zaklit<sup>4</sup>

<sup>1</sup> Department of Mechanical Engineering, Southern Methodist University, Dallas, TX 75205, USA

<sup>2</sup> Frank Reidy Research Center for Bioelectrics, Old Dominion University, Norfolk, VA 23508, USA

<sup>3</sup> Department of Pharmacology, University of Nevada, Reno School of Medicine, Reno, NV 89557, USA

<sup>4</sup> Department of Electrical and Biomedical Engineering, College of Engineering, University of Nevada, Reno, Reno, NV 89557, USA

\*Contact author. E-mail: [asabuncu@smu.edu](mailto:asabuncu@smu.edu)

**Corresponding author:** Ahmet Can Sabuncu

**Email:** [asabuncu@smu.edu](mailto:asabuncu@smu.edu)

**Phone:** 214 768 3200

**Fax:** 214-768-1473

## Abstract

Knowledge of the dielectric properties of biological cells plays an important role in numerical models aimed at understanding how high intensity ultrashort nanosecond electric pulses affect the plasma membrane and the membranes of intracellular organelles. To this end, using electrical impedance spectroscopy, the dielectric properties of isolated, neuroendocrine adrenal chromaffin cells were obtained. Measured impedance data of the cell suspension, acquired between 1 kHz and 20 MHz, were fit into a combination of constant phase element and Cole-Cole models from which the effect of electrode polarization was extracted. The dielectric spectrum of each cell suspension was fit into a Maxwell-Wagner mixture model and the Clausius-Mossotti factor was obtained. Lastly, to extract the cellular dielectric parameters, the cell dielectric data were fit into a granular cell model representative of a chromaffin cell, which was based on the inclusion of secretory granules in the cytoplasm. Chromaffin cell parameters determined from this study were the cell and secretory granule membrane specific capacitance (1.22 and 7.10  $\mu\text{F}/\text{cm}^2$ , respectively), the cytoplasmic conductivity, which excludes and includes the effect of

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