A Global Analysis of Endothelial Cell Electrical Barrier Function Parameter Errors

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Microimpedance measurements have become increasingly used to study cellular barrier function. Using frequency dependent impedance measurements and models of cellular barrier function that account for subcellular and intercellular conductance paths it is, in principle, possible to resolve cell-cell and cell-matrix adhesive components. Despite the number of studies based on this approach, however, few have considered the error propagation and parameter stability based on these measurements. This study, therefore, carefully examines the propagation of random and systematic errors in endothelial cell monolayer barrier function parameters obtained from microimpedance measurements. Using an industry standard model, the results of this work show that model parameter errors are state dependent and, therefore, demand a global analysis of their stability, identifiability and correlation. As a result, the ability to independently resolve subcellular, cell-cell, membrane capacitive, and membrane resistive parameters and set their error bounds is a function of the cellular attachment state. The results of this study, therefore, have important implications for time dependent parameter error estimation used to quantify dynamic cellular attachment processes.

Keywords - **Endothelial cell impedance, cellular barrier function, parameter estimation, endothelial cell adhesion, cell-cell adhesion, cell-matrix adhesion, global error analysis**