The Cell Membrane Conductivity Disparity

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***Abstract*—The cell membrane is known to contain many molecules that are vital to the function of the cell: pores, pumps, switchable channels and signal-transmission assemblies. It has been the hope of many electrophysiologists that electrical measurements will give information on these via the conductance across the membrane, and perhaps even from its frequency-dependence.**

Whilst this has been found to be the case with direct electrical measurements using microelectrodes, e.g. patch-clamp, these are difficult and invasive measurements not suited to mass screening, and still less to the sorting, of cells. The frequencies used are DC to a few kHz maximum.

On the other hand, non-invasive measurements of field-induced properties such as impedance spectroscopy, dielectrophoresis and electrorotation suffer from poor or marginal resolution of the membrane conductance. The frequencies used are invariably above 1kHz, and usually above 10kHz.

Where data from the two approaches can be compared, it has been found that the field-induced measurements give conductivities that are larger, sometimes by orders of magnitude, than those from the direct-contact microelectrodes.

Possible causes for this disparity are discussed: a frequency-dependence of the properties of the membrane material is only one such possible cause.