

DYNAMICS OF PROTEIN MOVEMENTS ON THE CELL SURFACE; ROLE IN ATTACHMENT AND EFFECTS OF SURFACE DIPOLES & ELECTROSTATIC POTENTIALS

¹Paul O'Shea & Josep Cladera

¹[Cell Biophysics Group](#), School of Biomedical Sciences, University of Nottingham England UK

INTRODUCTION: The behaviour of proteins located upon and within the plasma membranes of living cells has long been recognised to underlie the many types of interaction of such cells. In terms of communication with various substrata, this involves responses from signalling systems as well as those simply involved in physical adherence. The movements of plasma membrane proteins also seem likely to be involved in such interactions. In our laboratory we have made efforts to study the physical nature of the membrane surface with a view to determining how this affects and is affected by membrane components. In particular, we have developed techniques to measure the surface electrostatic properties of the cell surface as well as the influence molecular dipoles have on many types of inter-molecular interactions with membranes (¹⁻⁵). These factors also have a significant bearing on how cells interact with artificial surfaces and may be used for the rational design of 'bioactive' surfaces.

The current presentation will outline this technology and indicate how it may be applied to studies of relevant cell properties involved in communication with biocompatible surfaces. This will be illustrated with examples of intermolecular interactions with membranes, protein movements and controlled cellular adhesion. Studies are routinely undertaken with populations of cells for kinetic measurements of molecular interactions and for single cell imaging for studies of localised interactions on the cell surface.

METHODS: The sensing technologies involve labelling the plasma membranes of living cells with fluorescent indicators sensitive to the surface electrostatic potential and the membrane dipole potential (see ¹⁻⁵). For populations of cells, studies are undertaken with any standard benchtop fluorimeter. For studies of more localised interactions on the cell surface, ultra-high resolution imaging facilities have been developed utilising the same sensor technologies.

RESULTS AND DISCUSSION: A body of knowledge has been built up of the role that the surface electrostatic potential and membrane dipole potential plays in the molecular interactions

of membranes. Fig 1 illustrates some of these techniques showing that the interactions of a surface-active peptide (involved in HIV infection) is highly localised about the cell surface. Similar such studies have been performed with other kinds of protein such as fibronectin (paper in preparation). An outline of the factors that control these membrane properties will be given.

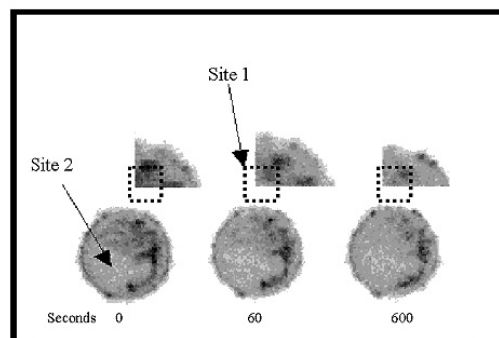
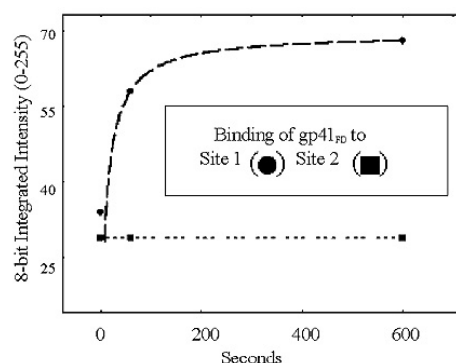


Fig 1 – localised binding of HIV peptide with T cells. See ref. ⁴

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