WAKATE INITIATIVE SEMINAR

演題: A NEW METHOD OF ENGINEERING INTERFACES FOR BIO-MOLECULE SURFACE IMMOBILISATION.

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会場：医学系学系棟 272（Igakukei-gakukeitou room 272）

要旨：The ability to strongly attach biomolecules such as proteins including enzymes and antibodies to surfaces underpins a host of technologies which are rapidly growing in utility and importance. Such technologies include biosensors for medical and environmental applications and protein or antibody diagnostic arrays for early disease detection. Emerging new applications include continuous flow reactors for enzymatic chemical, textile or biofuels processing and "proactive" implantable biomaterials[1,2] which interact with their host via an interfacial layer of active biomolecules to direct a specific desired response to the implant. In many of these applications it is desirable to maintain physical properties (including mechanical and electrical) of an underlying material whilst engineering a surface suitable for attachment of proteins with high levels of bioactivity. Nanoscale integrated polymeric interlayers are therefore attractive for this purpose.

Over the last few years we have developed a new biomolecule binding interlayer with significant advantages over other currently available methods of achieving protein attachment to surfaces[3]. Our technology, based on the implantation of ions[4,5] from a plasma, achieves covalent attachment of biomolecules to surfaces. This attachment occurs spontaneously by immersion of the surface in protein containing solution, without the use of chemical linkers, and as such avoids the complex wet chemistry typically required to achieve covalent attachment and the requirements for the underlying surface to present particular termination groups. Our method can be used on any underlying material. The covalent attachment is achieved through the action of highly reactive free radicals in the interlayer which couple to proximate side chains of the protein. The fact that a high proportion of side chains groups participate in the formation of covalent bonds with the radicals means that the covalent binding capacity of the interlayer is effective with virtually all biomolecules. Because physical adsorption is not the mechanism of protein adhesion, the chemical and physical properties of the interlayer can be tuned so as to maximise the bioactivity of the bound proteins.

In this paper we present characterisation of the structure and properties of such protein binding interlayers and describe a detailed model for the covalent attachment of protein molecules from solution. The prospects for utilising these interlayers to functionalise the surfaces of conducting polymers and metals for applications as electrodes for cell stimulation will be discussed. The surface modification of self-assembled block copolymers using our techniques also opens up the possibility of creating controlled nanopatterns of functional protein molecules for basic research on isolated proteins or the inclusion of isolated biomolecules in mass produced nanoscale devices.

homepage**:** http://www.physics.usyd.edu.au/research/applied/research/platform.shtml

References:

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[2] Bax DV, McKenzie DR, Weiss AS, Bilek MMM, *Acta Biomaterialia*, 5(9) 3371-3381 (2009)

[3] Bilek M, McKenzie DR, "Plasma modified surfaces for covalent immobilization of functional biomolecules in the absence of chemical linkers: towards better biosenors and a new generation of medical implants", Biophysical Reviews, (in press DOI 10.1007/s12551-010-0028-1) (2010).

[4] **M. Bilek,** D.R. McKenzie, R.C. Powles**,** "Treatment of polymeric biomaterials by ion implantation" in *Biomaterials and Surface Modification* (ed. P.K. Chu and X. Liu)", Research Signpost 2007.

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