

Novel approaches for label-free biological measurement using functionalised surface chemistries

Biological detection and measurement systems, such as label-based arrays and label-free surface plasmon resonance (SPR) are critical components of the drug discovery and development toolbox. Universities, biotech and pharma companies, and contract research organisations are using such tools for rapid screening, evaluating drug/pathogen binding kinetics, hit confirmation and receptor detection and more. Typically, these techniques either require analytes and/or ligands to be chemically labelled prior to analysis, which is known to impact on binding properties; or require modification with chemical linkers, which are limited to specific chemistries, to adhere to surface substrates.

Additionally, label-free detection (LFD) platforms are yet to provide high-throughput multiplexing capabilities. Cutting-edge research in the field has suggested that combining micro-electro-mechanical systems (MEMS) and micro-plasmonics with novel materials will provide the substrates required to achieve multiplexed LFD capability for detection and quantitation of biological and chemical analytes. However, the properties of the organic monolayer are key to the success of this technology. The surface and interfacial energetics, as well as the electronic and plasmonic properties, of the substrate must be optimised and conserved pre- and post-immobilisation of functional biomolecules.

Functionalised substrates that enable the detection of biomolecular interactions without spatial interference, auto fluorescence or quenching effects of labels are highly-sought tools.

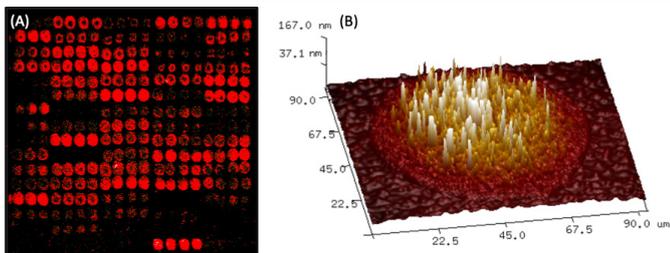
The Technology

Researchers at the Institute for Glycomics have developed an affordable, one step functionalisation method suitable for a wide range of semiconducting and plasmonic materials including silicon carbide (SiC), indium tin oxide and glass. Our proprietary technology enables the generation of smooth and robust functionalised surfaces, in a variety of shapes. Surfaces can be conjugated with proteins, antibodies, DNA or glycans and used for hit confirmation and direct measurement of binding affinities. This versatility provides significant advantage over existing LFD technologies.

Market

The global label-free detection market is expected to grow from USD 872.2 Million in 2017 to USD 1,311.2 million in 2022, based on a CAGR of 8.5%. Growth of this market will be driven by advances in LFD technology and an increased awareness of the insights it provides into interaction studies, as well as increased spending on “-omics”-based research and drug development. This will be observed across pharmaceutical biotechnology companies, academic research organisations and CROs. In 2017, SPR accounts for the largest share of the label-free detection market, by technology and, understanding binding kinetics was the key application of the technology. The increasing need to understand real-time bio-molecular interactions in drug discovery is expected to drive the continued growth of this segment.

Fighting diseases of global impact



(A) The Hybridisation of a Texas Red conjugated carbohydrate binding protein to a Glycan Array printed on a functionalised surface. (B) 93 μm x 93 μm 3D atomic force microscopy image of printed glycan onto the functionalised surface, showing a smooth and robust surface.

Development of highly customisable substrates that can facilitate measurement of a wide variety of analytes, in a rapid and cost-effective manner will support end-users to justify significant capital costs for the associated instrumentation.

Development Status

Proof-of-principle using microarray chips functionalised with our technology and compared to commercially available microarray surfaces showed similar signal intensities, with decreased noise, indicating minimal non-specific interactions to the surface. Decreases in background noise improve the sensitivity of analyte detection, which is especially important for measuring weak interactions. This illustrates that our improved functionalisation method is ideal for augmenting the efficiency and bio-compatibility of current biosensor platforms, in various shapes and presentations. We have also demonstrated that our method does not affect the electrical or interfacial surface properties of semiconducting materials, and as such, offers a promising approach towards LFD. Next, our research team will focus on transferring this approach to numerous other biosensor platforms and validating its efficacy against commercial platforms that are currently available.

Opportunity for Partnership

The Institute for Glycomics has a strong track record in the development and commercialisation of various types of functional microarrays, used to elucidate biological functions. Specifically, we have developed world-leading technology for the assessment of whole-cell binding interactions, as well as high-throughput SPR screening techniques. We are now seeking a partner with expertise in instrument and device (eg, microarray, SPR, MEMS and/or micro-plasmonics) fabrication, with a focus on LFD technologies, to licence and co-develop this technology. Co-development of our functionalisation method, with an appropriate industry partner, to realise multiplexed LFD technology could enable a paradigm shift in the ability to measure and detect biomolecules faster and with greater accuracy than ever before.

RESEARCH LEADER

Associate Professor Joe Tiralongo is an expert in the field of glycobiology, and is internationally known for his expertise in sialic acid biology and glycomics microarrays. He is currently investigating the glycobiology of cancer, adult stem cells and cancer stem cells using a range of array technologies, while also developing novel glyco-nanotechnology platforms and materials specifically aimed at studying diverse glyco-interactions. The Tiralongo Group has a strong focus on applied and commercial research as well as discovery, and as such he has been particularly successful in securing not only national and international competitive grant funding from a diverse range of granting bodies, including the Australian Research Council (ARC), Cancer Council, and the Association for International Cancer Research, but also more recently through engagement and commercial partnership with industry.



Associate Professor Joe Tiralongo was awarded an ARC Fellowship in 2005, followed by Griffith University Research Fellowship in 2008 and has been an independent researcher leader since 2005.

ABOUT US

The Institute for Glycomics is a flagship biomedical research institute at Griffith University's Gold Coast Campus in Queensland, Australia. The Institute is one of only six of its kind worldwide and has a strategic focus on translating basic drug and vaccine research into clinical outcomes. We have a strong track record in commercialisation and industry engagement, and our research leaders have extensive experience in developing technologies for the commercial market. With over 200 multidisciplinary researchers and staff, the Institute for Glycomics is well positioned to deliver tangible clinical solutions for infectious diseases and cancer.

CONTACT

Eloise Keeffe - Business Manager

e.keeffe@griffith.edu.au

Institute for Glycomics

Griffith University Gold Coast campus,
Parklands Drive, Southport
Queensland, 4215

P +61 7 5552 9283