Single Entity Biosensors: From Detecting Many to Detecting One to Detecting Many

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Abstract

There has been a trend in measurement science to smaller and smaller sample sizes, and with this an associated decrease in the number of molecules or cells that are analysed. This trend has reached its logical conclusion of a range of techniques developed that can detect single molecules or single cells. The power of being able to detect single entities is you can learn about mechanisms and behaviour at that level. Many single entity measurements would then allow the determination of heterogeneity in behaviour. We are just on the cusp of technologies that can detect many single entities. The ability to detect many single entities is important for sensors in particular as you can not only develop sensors that can have the ultimate detection limit, just one species, but also better performing sensors that do not require calibration, which can differentiate specific from nonspecific effects and potentially could allow a single sensing surface to measure many different types of interactions. We have a research program which looks at strategies for detecting rare single molecules, detecting many single molecules, detecting rare single cells and detecting many single cells. This seminar will cover some of the technologies we are developing sensors for detecting single molecules and single cells. It will outline what the challenges are for detecting single molecules and cells and the opportunities that detecting single molecules and cells provides.

Biography

Scientia Professor Justin Gooding is currently an Australian Research Council Australian Laureate Fellow, the co-director of the Australian Centre for NanoMedicine and co-Director of the New South Wales Smart Sensing Network. He is editor-in-chief of the journal ACS Sensors, a Fellow of the Australian Academy of Sciences and Australian Academy of Technolgy and Engineering. He graduated with a B.Sc. (Hons) from Melbourne University before spending two years working for ICI Research on explosives. He then returned to University obtaining a D.Phil. from the University of Oxford and received post-doctoral training at the Institute of Biotechnology in Cambridge University. He returned to Australia in 1997 as a Vice-Chancellor’s Post-Doctoral Research Fellow at the University of New South Wales (UNSW). He was promoted to full professor in 2006. He was one of the recipients of a 2004 NSW Young Tall Poppy award, a 2005 Alexander von Humboldt Fellowship, the 2007 RACI Lloyd Smythe Medal for Analytical Chemistry, the 2009 Eureka Prize for Scientific Research, the RACI 2011 H.G. Smith Medal for contributions to chemistry, the 2012 RACI R.H. Stokes Medal for electrochemical research, the 2012 Royal Society of Chemistry Australasian Lecturer, the 2013 NSWS Science and Engineering Award for Emerging Research and the 2016 Faraday Medal of the Royal Society of Chemistry Electrochemistry Division, the 2016 Biosensors and Bioelectronics award, the 2017 Eureka Prize for Outstanding Mentor to Young Researchers and the 2017 International Society of Electrochemistry Katsumi Niki Prize in Bioelectrochemistry. He leads a research team of 45 people interested in surface modification and nanotechnology for biosensors, biomaterials, electron transfer and medical applications.