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30 Years of Surface Plasmon Resonance (SPR) for Biosensing

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The year 2013 marked the 30th anniversary of the publication of a paper that changed the world of chemical and biomedical diagnostics: The manuscript of Bo Liedberg, Claes Nylander, and Ingemar Lundström entitled "Surface plasmon resonance for gas detection and biosensing" (*Sensors and Actuators* 4: 299) introduced the application of a physical concept, i.e., the optical excitation of plasmon surface polaritons (or surface plasmons for short) at a metal/dielectric interface for the quantitative analysis of affinity reactions happening at this interface between a surface-immobilized binding group and an analyte approaching from the adjacent solution. Based on a rather old optical phenomenon, first described as Wood's anomaly in the spectral reflectivity of a metal grating, this report on how to use this surface light for biosensing triggered a paradigm change in the way we can quantify interfacial binding reactions in situ and in real time. By monitoring the time dependence of the association (binding) and dissociation reactions between the binding partners, we can quantify the associated kinetic rate constants and by analyzing the corresponding binding strength, i.e., the affinity constants K_A or the inverse of that, i.e., the half saturation concentration, $c_{1/2}$, it is possible to gain a very detailed picture of the molecular details of the binding reactions between antibodies and antigens, oligonucleotide capture probes and target DNA strands, ligands and their receptors, and oligosaccharides and lectins to mention a few examples.

This first report not only initiated a worldwide wave of research activities in the field of bio-affinity reactions but it was also the trigger for the development and commercial implementation of instruments that are based on the principles of surface plasmon excitation.

Both aspects, the fundamentals of surface plasmon optics in biosensing and the application to various problems in biology, medical diagnostics, chemical sensing, environmental monitoring, etc. were discussed during a symposium that was held on November 5–7 at the Nanyang Technological University in Singapore. Speakers reflecting on the early years of SPR biosensing joined with others that reported on recent developments in the field, including the use of surface plasmon waves for imaging purposes in applications that combine the field enhancement mechanisms operating at resonant surface plasmon excitation with fluorescence detection concepts and extending the principle of propagating modes to the world of localized plasmon excitation in metallic nanostructures.

Most of the contributions presented at the symposium are summarized in this Special Issue of Plasmonics. Enjoy the state-of-the-art-description of how far the field has gone during the past 30 years.

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