LSPR based Detection of Biomolecules and Pathogens in Single Assay and Microarray Format

Stephan Kastner, Lisa Seiler, Ondrej Stranik, Andrea Csáki, Wolfgang Fritzsche

Leibniz Institute of Photonic Technology, Albert-Einstein-Str. 9, 07745 Jena, Germany

The rapid, accurate and cost-efficient detection of biomolecules and pathogens is of great importance in the environment, industry and medical diagnostics as well as in the development of new drugs or biosimilars. It is advantageous to be able to work lable-free and to obtain as much information as possible from the individual experiments. We use localized surface plasmon resonance spectroscopy (LSPR) in a microfluidic system to detect biomolecules and to study kinetics with possible binding partners.

Single assays [1] as well as multiplex assays [2] are used to investigate pathogens and cancer or rheumatoid arthritis (RA) biomarkers for example in microarrays for diagnostic purposes. Field trials with transportable devices are also conceivable, as the measuring instruments can be very small and yet inexpensive to build [3]. The challenge is to develop robust and at the same time highly sensitive DNA or protein-based sensors to enable even "online measurements" especially in industrial plants [4]. LSPR sensors can combine the advantages of well-established methods such as ELISA and SPR: The measuring principle is simple, robust and multiplexable like enzyme-linked immunosorbent assays (ELISA), and at the same time it provides the high information content of a direct, fast and label-free surface plasmon resonance (SPR) measurement. Our goal is the development of low-cost multiplex LSPR sensors for fast and easy detection of biomarkers, pathogens and (other) antibiotics resistant microorganisms.

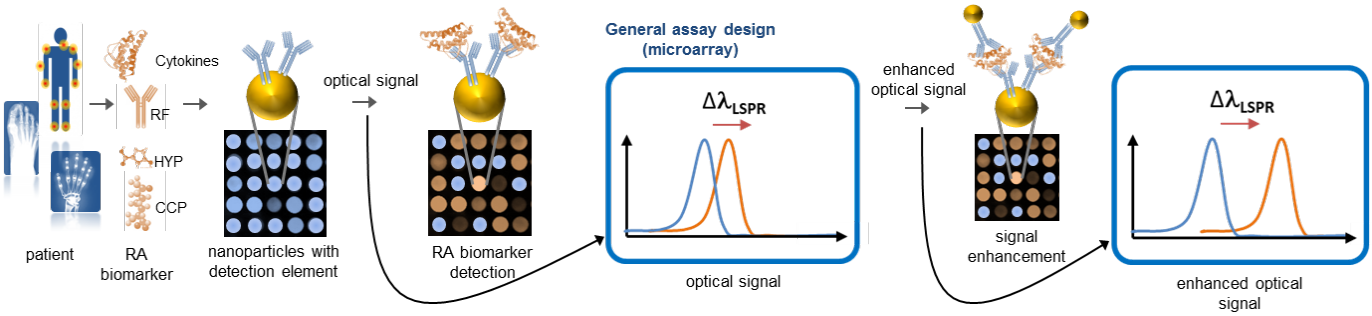

Fig.1: Schematic overview of the general Assay design for microarrays. CCP = cyclic citrullinated peptide; HYP = hydroxyproline; RF = rheumatoid factor

[1] Csáki et al, Expert Review of Mol. Diag. 18 (3), 279-296 (2018).
[2] Zopf et al, Biosensors & bioelectronics 81, 287–293 (2016)
[3] Yang et al, Nanoscale research letters 13 (1), S. 397 (2018).
[4] Dahlin et al, Analytical chemistry 78 (13), 4416-4423 (2006).