

Nanophotonic biosensors as diagnostics tools for deciphering cellular pathways

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We have recently proposed to employ nanophotonic biosensors as an unconventional strategy for studying gene expressions. Biosensing could help in gaining knowledge on the expression pathways in eukaryotic cells as understanding of complex molecular outcomes will require investigation of how cellular interactions, including the influence of epigenetic modifications and other gene regulation mechanisms, create higher-order functions. Monitoring of these events of genes expression at different biological levels is relevant to the diagnosis and therapeutic outcome of several diseases, as cancer. Albeit these biological events could all be analysed separately using state-of-the-art technology, this would require unification of a diverse array of complex, label, time-consuming (i.e. long turnover times) and costly techniques, and consequently, would not be amenable to systematic analysis of individual cancer patients. Using biosensors, the analysis can be simplified as these devices allow a real-time, label-free and high-sensitivity detection of biomolecular interactions.

To achieve this ambitious objective, we are applying nanophotonic sensing to the analysis of the following gene expression levels: (i) alternative RNA splicing variants; (ii) epigenetics modifications as DNA methylation; (iii) interaction with non-coding RNA regulators such as microRNAs; and (iv) interactions between native surface cell receptors with key molecules, as regulating factors or therapeutic drugs.

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Prof. Lechuga is the Head of the Nanobiosensors and Bioanalytical Applications Group in the Catalan Institute for Nanoscience and Nanotechnology (ICN2) in Barcelona (Spain). The principal focus of her research program is the technological development of photonic (plasmonics and silicon-based) and nanomechanical biosensors, their integration in portable lab-on-a-chip platforms and their application in clinical and environmental diagnostics. She has published over 150 articles, book chapters and conference proceedings, has 8 families of awarded patents at European, US or international level, and has presented more than 100 invited research papers at international level. She has been the driving force for the establishment of one spin-off company in 2004 (SENSIA, SL, which was sold to a large industrial Group in 2012) and co-founder of a new spin-off in 2010 (BIOD, SL).

Prof. Lechuga is associate editor of the IEEE Photonics Journal, associate editor of the J. Optics and Laser Technology (Elsevier) and is at the Editorial Board of the Journal of Nanobiosensors in Disease Diagnosis (Dovepress). She is a member of the Optical Society of America (OSA), member of the International Society for Optical Engineering (SPIE), and member of the European Optical Society (EOS). She is a member of Permanent Steering Committees of Advanced Study Course on Optical Chemical Sensors (ASCOS) and Europt(r)ode Conference Series.