How to be innovative in a supersaturated world?

Connecting fundamental research with real-life applications is a quite challenging – and laborious – endeavor. To enter the market or to approach society with scientific-technological ideas requires innovation. The question arises, by which means can I be innovative? What is innovation? What do I have to consider in my research to be innovative?

The Nanoengineering Group at CIC nanoGUNE aligns its research according to industrial and clinical requirements and includes market-driven needs and real-life applications from the beginning into its research programs. The aim is bridging the gap between basic research and industrial as well as clinical applications by introducing nanotechnology, biochemistry and advanced data treatment into photonic approaches to finally gain added value for novel methods, devices and instrumentation.

The group follows several research lines that will be highlighted during the talk, including an overview about the research center CIC nanoGUNE and the scientific and technological ecosystem 'Basque Country'.

Specific insight will be given in plasmonic sensing, particularly plasmonic biosensing. There is still no answer where the limits of plasmonic sensing are, since surface plasmon resonance (SPR) systems as integrated instruments include many aspects more than merely the physical phenomenon of resonant coupling between light and electrical charges. Plasmonic sensing can be modified by introducing metallic nanostructures for generating localized surface plasmon resonances (LSPR). By using nanoparticles, similar and further localized phenomena can be observed. Apart from introducing nanostructures, we demonstrate that Gaussian beam shaping improves the sensing performance, and sensitivity can be increased even more just by data analysis, exploiting multiple features of the resonance curves via multivariate analysis methods.

Looking at the method in a systemic way, as a fully integrated vehicle, further technological factors become decisive in improving the performance. Suitable biofunctionalization of the metal layer or particles will help to enhance sensitivity as well as specificity. In combination with microsystems engineering, multiplexing becomes possible for analyzing complex analytes in a single run. Optimized microfluidic platforms will help to minimize analyte volumes and allow for the determination of dynamic changes, resulting in better quantification. The ultimate goal of the presented research is the establishment of a fast and reliable liquid biopsy for the detection of various biomarkers, as for example exosomes, and the creation of a sensing platform for food quality control.

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