

Detecting biomarkers for challenging clinical applications: opportunities offered by plasmonics and droplet microfluidics

Giuseppe Spoto

*Dipartimento di Scienze Chimiche, Università di Catania,
I.N.B.B. Consortium
Viale A. Doria 6, Catania, Italy
gspoto@unict.it*

The detection of clinically relevant biomarkers often requires analytical methods able to operate with high selectivity, multiplexed capability and ultrasensitivity. Cancer diagnostics based on liquid biopsy is one of those highly challenging applications requiring advanced performances in terms of limit of detection and selectivity. Opportunities offered in this context by plasmonics and droplet microfluidics will be presented. In particular, the detection of non-amplified human genomic DNA by nanoparticle-enhanced surface plasmon resonance imaging (SPRI) will be discussed in the context of applications to cancer early diagnosis, oncology follow-up and prenatal non-invasive diagnosis. The characteristics of functionalized nanoparticles for the effective nanoparticle-enhanced SPRI detection of genomic DNA will be discussed with specific attention to streptavidin-coated gold nanoparticles, and emphasis will be given to the role played by biotinylated oligonucleotides in the stabilization/destabilization of the streptavidin-capped nanoparticle dispersions. The combined use of droplet microfluidics and molecular beacon-assisted isothermal circular strand-displacement polymerization of nucleic acids will be also discussed by showing possibilities for the optical detection of DNA and microRNA samples compartmentalized in nanoliter droplets.