

**Label-free optical  
bio-sensors for  
proteomic analysis:  
current applications  
and future  
development in  
cancer research**

**Valentina Donzella**

Scuola Superiore Sant'Anna, Piazza Martiri  
della Libertà, Italy

Molecular tests based on specific protein quantification from body fluids or tissues have remarkably improved clinical practice. In oncology, they can be useful for early disease detection, treatment tailoring and prognosis prediction. Available technology does not always allow a comprehensive evaluation of proteomic alterations in patients.

To move towards analysis parallelization, a technological breakthrough is needed; it can be represented by Laboratories-on-a-Chip (LOCs). Those devices can integrate and automate all needed sample process functionalities into an inexpensive, portable and disposable, thumb-size object. Involved processes range from biological fluid handling and driving, heating, cooling, separating, molecule detection and signal processing. Which means integrating on the same chip optics, electronics, and micro-fluidics. The component dedicated to protein detection is the bio-sensor, where target bio-molecules are somehow 'trapped' producing a proper output signal. A bio-sensor is capable of providing specific quantitative or semi-quantitative analytical information using a biological recognition element (biochemical receptor), which is in direct spatial contact with a transduction element. The recognition elements can be composed of antibodies, enzymes, hormones, receptors, etc. Optical signal use for binding detection offers several advantages, e.g. it is immune from electromagnetic interference and is separated from electrical signals (needed for fluid stream control and for driving electronics). In addition, unlabelled detection requires no preventive sample preparation or alteration. Thus, label-free optical biosensors integrated in LOCs may pave the way to the discovery and detection of novel biomarkers, offering the advantages of low-cost, easy use and small volume requirements.

**Biography**

Valentina Donzella, B.Sc. (2003) and M.Sc. (2005) in Electronic Engineering, received her Ph.D cum laude in Engineering (Innovative technologies) in 2010, from Scuola Superiore Sant'Anna, Pisa (SSSUP, Italy). In 2009, she spent 8 months as visiting Ph.D. student of Engineering Physics at McMaster University, ON, CA. She is a postdoctoral fellow, IEEE member, working on integrated optical biosensors for biological markers as well as on silicon photonics. She is proposal reviewer for Technology Foundation (STW, NWO) in Utrecht, the Netherlands and Guest Editor for Micro and Nanosystems, Bentham Science Publisher. She is lecturer for the International Master on Communication Networks Engineering, at SSSUP.