MEMS and Lab On Chip for Life Sciences

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I. Abstract Body

The large development of Lab-on-Chip (LOC) technologies and improvement of micro total analysis systems, led to the development of highly flexible instruments with a large portfolio of analytes related to diagnosis and control of diseases, monitoring of environmental threats, toxins and allergens from food and agriculture products. To this aim, we improved a plethora of biosensing tools based on innovative transduction systems in order to develop robust, miniaturized and reliable biosensing devices. In particular we realized Electrochemical Impedance Spectroscopy (EIS) based biosensors for the ultrasensitive, point-of-care detection of tumor biomarkers (for prostate and pancreatic diseases) [1-3] (Figure 1A), toxins from environmental [4] and food samples [5, 6]. Our EIS platform has also been used for the near-the-bed evaluation of multiple lower genital tract pathogens providing clinicians a cost and time-saving alternative tool for routinely analysis [7]. We explored the high potential of RF methods also to develop sensors and actuators based on Surface Acoustic Waves (SAW) [9] (Figure 1B) and Splitt Ring Resonators devices (SRR) in order to obtain robust biosensing methods for the detection of small molecules or rare cells [10]. We also developed innovative platform based on electrosynthesized Molecularly Imprinted Polymers (MIP), in order to provide an enhanced sensitivity of small molecules with respect to standard methods[8] (Figure 1C). From the combination of SAW transduction method, electrosynthesis of MIP and microfluidic integration, our group gained a H2020 Attract project called SMILE, with the aim to detect biomarker from saliva specimen and realize an ease of use tool for the prevention of oral cancer. One of the last research area of our group (embedded in MADIA European Project) deals with the realization of a magnetoresistive and microfluidic platform for the femtomolar detection of circulating proteins as serum biomarkers of neurodegenerative diseases, with the ambition to provide a precious tool in the early diagnosis of neurodegeneration.

II. Image:

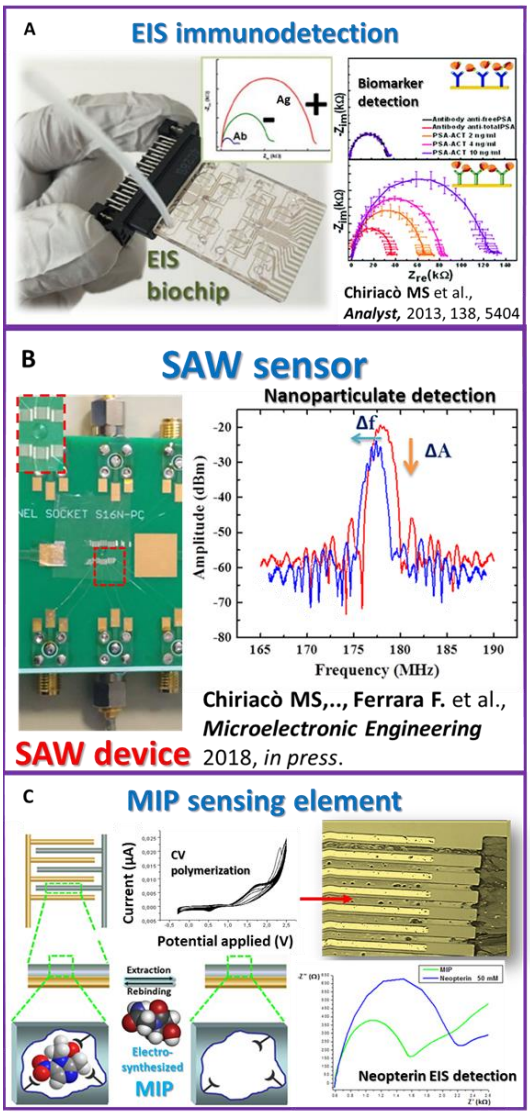


Figure 1

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III. Reference:

1. Chiriacò, M.S., et al., On-chip screening for prostate cancer: An EIS microfluidic platform for contemporary detection of free and total PSA. Analyst, 2013. 138(18): p. 5404-5410.
2. Chiriacò, M.S., et al., Towards pancreatic cancer diagnosis using EIS biochips. Lab on a Chip - Miniaturisation for Chemistry and Biology, 2013. 13(4): p. 730-734.
3. Paul, A., et al., Picomolar detection of retinol binding protein 4 for early management of type II diabetes. Biosensors and Bioelectronics, 2019. 128: p. 122-128.
4. Chiriaco, M.S., et al., EIS microfluidic chips for flow immunoassay and ultrasensitive cholera toxin detection. Lab on a Chip, 2011. 11(4): p. 658-663.
5. Chiriacò, M.S., et al., Portable gliadin-immunochip for contamination control on the food production chain. Talanta, 2015. 142: p. 57-63.
6. Primiceri, E., et al., A multipurpose biochip for food pathogen detection. Analytical Methods, 2016. 8(15): p. 3055-3060.
7. Chiriaco, M.S., et al., Simultaneous detection of multiple lower genital tract pathogens by an impedimetric immunochip. Biosensors & Bioelectronics, 2016. 79: p. 9-14.
8. Chiriacò, M.S., et al., Optimization of SAW and EIS sensors suitable for environmental particulate monitoring. Microelectronic Engineering, 2018.
9. Primiceri, E., Turco A., Chiriacò MS et al. MIP based EIS biosensors for medical diagnostics, 2019 (under submission)
10. Primiceri E., Monteduro A.G., et al., 2019 (under submission)

IV. Biography:

Maria Serena Chiriacò (1984) achieved her master degree cum laude in Human Biology and in 2012 she gained her PhD in “Smart Systems and Technologies”. Since 2019, she is a permanent researcher at CNR Nanotec Institute in Lecce where she is coordinator of the European project “SMILE” (a SAW-MIP Integrated device for oraL cancer Early detection) and the coordinator for Nanotec unit of National PRIN project “Prostate cancer: disentangling the relationships with tumor microenvironment to better model and target tumor progression”. She gained high-level expertise in the field of Lab-On-Chip. Her skills include the design, fabrication and applications of electrochemical biosensors and microfluidics.

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