Paper-based Printed Electrochemical (bio)sensors as Smart and Sustainable Point-of-Care Devices

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As reported in my recent review entitled "*Electrochemical paper-based devices: When the simple replacement of the support to print ecodesigned electrodes radically improves the features of the electrochemical devices*" published in Current Opinion in Electrochemistry SI: Emerging Opinions (2022) [1]: "*Paper-based electrochemical (bio)sensors have emerged as highly attractive analytical devices for their superior sustainable features, such as avoiding the use of polyester as support and the reduction of waste, being incinerated after use. However, paper-based electrochemical (bio)sensors have recently demonstrated further advantages, including the simple combination with vertical microfluidics and their use as a reservoir to deliver smart electrochemical (bio)sensors able to (i) contain the reagents; (ii) preconcentrate the target analyte, and iii) synthesize the nanomaterials inside the paper network. Furthermore, these devices have demonstrated their ability to overcome the limitations of the other printed electrochemical sensors in the measurement of entirely liquid samples by detecting the target analyte in the aerosol phase or solid sample, without the additional sampling system. These achievements highlight their valuable and varied advantages in the sensing sector*". In this plenary lecture, I will report on the roadmap research activity carried out in the last 8 years related to the development of paper-based electrochemical devices for delivering lab-on-a-chip on paper as well as sustainable tools for overcoming the limitation of polyester-ceramic based printed sensors [2–9]. Furthermore, following the approach recently selected for printed electronics in which the hybrid systems have been the most useful for market entry, we recently demonstrated this approach for a market entry device for virus detection in saliva (patent filled), a wearable paper-based immunosensor washing-free for cortisol detection in sweat [10], and a paper-based device combined with polyvinyl chloride electrochemical system in which a paper layer loaded with reagents is inserted into this device, working as a new concept of paper card-like for a reagent-free and easy measurement of target analyte (*i.e.*, glucose) in solution (*i.e.*, tears) [11].

Acknowledgements
Horizon Europe Pathfinder PHOENIX-OoC Project 101130395 and PRIN 2022 SMARTMASK4CF 2022XTCTWH.

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