Title: In-vivo and in-vitro metabolomics with porphyrins based sensor arrays

Abstract. Porphyrins have been used in the last two decades to prepare sensor arrays for a diversity of applications. The wide chemical interactivity of porphyrins sustains these applications making possible the measurement of complex patterns of volatile compounds.
The interplay between the metal ion, the aromatic ring and the peripheral compounds establishes unique selectivity patterns which are fundamental elements for sensor array design and development [1].
Porphyrin films can be adequately applied to inorganic surfaces making possible the preparation of different kinds of chemical sensors. Among them mass transducers, such as Quartz Microbalances (QMBs), have been found particularly suitable for several applications. The moderate sensitivity of the transducer avoids unpleasant effects of signal saturation. Furthermore, QMBs do not operate any selection among the interaction mechanisms giving the unique chance to appreciate and to use the whole bouquet of interactions occurring among the volatile compounds and the sensitive layers.
The combination of the intrinsic porphyrins sensitivity and the transduction operated by QMB makes porphyrins sensor array able to discriminate among subtle changes in patterns of volatile compounds produced by living organisms. In-vivo, these sensors have been applied to the measure of volatile compounds released by various body compartments such as skin, breath, and urines.
In breath, the identification of lung cancer has been carried out since 2003 and more recently the relationship between sensor signals and tuberculosis has been studied. [2, 3]
In-vitro applications were concerned with the identification of cancer cells and, more recently, with the identification of the steps of stem cells differentiation has been shown. [4] Finally, it has to be mentioned the use of sensors to study the evolution of xenografted tumors and malaria infection in animal models. [5]
All these results evidence the capability of porphyrin sensor array to capture the differences in volatile compounds patterns elicited by living organisms.
Similar results can be obtained by other sensors technologies; however, porphyrin sensors show a unique character of universal approach to the identification of metabolic volatiles.
A suggestive explanation of this behavior considers the role of oxidative stress to the production of cancer related volatile metabolites and in particular on the role played by natural porphyrins in the oxidative stress promoted by the Cytochrome p450. In practice, a porphyrin may be active in the synthesis of the relevant compounds and other porphyrins are used to detect them.

References.
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