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Toward calibration free ion sensing: a focus on fiber optic fluorescence pH sensor

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Abstract:

This work is part of the development of a fiber optic fluorescence pH sensor for *in vivo* measurement. The sensor uses pH dependent molecules grafted at the cleaved-end of an optical fiber. Molecules like SNARF®, allow measuring pH by calculating the ratio of the emitted fluorescence at two distinct wavelengths. This ratiometric technique is not calibration free and molecule manufacturers advise users to perform a pre-calibration using the acidic and basic endpoints of titration respectively. This calibration procedure requires controlling very accurately the experimental conditions and is time consuming for clinical applications.

In this conference, we present methods to simplify and even avoid calibration procedures. We first show that calibration can be performed without controlling the experimental conditions. Then, we present a complete mathematical description of the pH-dependent fluorescence properties of SNARF®. Once modelled, the whole shape of the fluorescence spectrum can be described using only one parameter, thus allowing a calibration free pH measurement using simple and rapid numerical fitting.

However, SNARF® exhibit some drawbacks (extremely fragile and low quantum efficiency). Conversely, fluorescein is a robust and high quantum efficiency pH dependent fluorescent molecule. Up to now, fluorescein had never been considered for a potential calibration free pH measurement because of its single emission peaks. It was considered that pH can only be measured by normalizing the fluorescence intensity measured at unknown pH with the intensity measured at high pH value. In this conference, we show that numerical treatments of the emitted fluorescein spectra allow measuring the pH without calibration.

Key words: Fluorescence, pH sensing, digital signal processing, calibration free measurement.

Biography:
Bruno Wacogne is a CNRS Research Director at the FEMTO-ST Institute (UMR CNRS 6174) where he is leading the transversal axis Biom'@x concerning Sciences and Technologies for a Translational Medicine. He is also the technological coordinator of the Clinical Investigation Center of Besançon University hospital (INSERM CIC1431) where he is leading the Microsystems and Biological Qualification team. His research interests are micro technologies, optics, translational research, biological qualification and immune-combined medical devices. He is the author or co-author of nearly 200 communications and 10 patents.

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