

Cellular monitoring: A technological and creative challenge

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In technological and preclinical laboratories more and more methods become available to measure biochemical and biophysical parameters in living cells and tissues. Especially advances in biomedical optics have led to a large number of techniques that would in principle allow for the development of methods for patient monitoring at the cellular and subcellular level. For example, an advanced optical technique like optical coherence tomography (OCT) allows structural imaging of tissues on the micron level. Another optical technique, Raman spectroscopy, is able to get an optical fingerprint of the constituents of a sample volume and can nowadays be applied on the level of a single cell.

Unfortunately a large discrepancy exists between the technical possibilities in a laboratory setting and the clinical availability and usability. On the one hand this might be due to the enormous technical challenges one faces in the transition to an uncontrolled in vivo setting. On the other hand the engineers might miss the insight in the potential use and clinical impact of a newly developed technique.

In my presentation I will discuss some of these technological and creative challenges by a number of examples. Furthermore, I will share some thoughts on the potential use of cellular monitoring in critical care medicine. This is meant as an introduction to the rest of the session in which techniques for monitoring of mitochondrial and metabolic function will be presented. One of these techniques, NADH fluorimetry, uses the fluorescent properties of reduced nicotinamide adenine dinucleotide (NADH) to monitor mitochondrial redox state. Another technique that will be presented is a method to directly measure mitochondrial respiration by means of delayed fluorescence of aminolevulinic acid- induced protoporphyrin IX.

Conflict of interest statement – I am founder and shareholder of Photonics Healthcare B.V., a company aimed at making protoporphyrin IX delayed fluorescence lifetime technology commercially available. Photonics Healthcare B.V. holds the exclusive licenses to several patents regarding this technology, filed and owned by the Academic Medical Center in Amsterdam and the Erasmus Medical Center in Rotterdam, The Netherlands.