# Usage of electrochemistry to study physiological parameters on a single cell level

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Understanding physiological events on a single cell level is required for deeper insights into the fundamentals of intra- and intercellular metabolism. Measuring metabolites on a single cell level with electrochemical techniques can be advantageous due to their high specificity, spatial and temporal resolution, as well as the circumstance that cells do not have to be invasively manipulated.

We report about electrochemical measurements using a bare Pt-UME to determine and quantify H2O2, extracellularly produced by primary human and mouse monocytes [1]. Since H2O2 has signaling functions at low (nM to low µM) and pathogenic functions at higher (high µM to mM) concentrations, sensitive and dynamic long-term measurements are crucial to understand redox-regulated cellular processes.
Furthermore, we show the electrochemical measurement of single-cell respiration. Changes in cellular respiration report about the metabolic state of a cell, its responses to specific treatments, to cellular stressors, and can indicate early apoptotic (cell death) processes. Here, we compare the O2 consumption by single human cells (cultured and primary) in the presence and absence of several quinones, which may interfere with the electron transport in the mitochondria of the cell [2].
Finally, we present simultaneous electrochemical and fluorescence measurements from single cells to monitor metabolites, such as H2O2, extra- and intracellularly.

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[2] Bogeski, I.; Gulaboski, R.; Kappl, R.; Mirceski, V.; Stefova, M.; Petreska, J.; Hoth, M. - Calcium Binding and Transport by Coenzyme Q. JACS 2011, Vol. 133, 24, 9293-9303. 10.1021/ja110190t.