

Real-time monitoring of ischemia with implantable potentiometric ion selective sensors in an array format

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Miniaturized, implantable chemical sensors, which can be employed for real-time monitoring of clinically important species, such as pH, O₂, and CO₂, Na⁺, K⁺ and Ca²⁺; glucose; lactate... remain one of the great challenges in analytical and biomedical science. Ischemia is a shortage of the blood supply to an organ that causes severe tissue damage in a situation of lack of oxygen. Tissue damage from ischemia is critical for the development of further complications, multiple organ failure and death. Therefore, ischemia monitoring is very valuable during surgical procedures. When the tissue is under ischemia conditions, there is a decrease in the oxygen and glucose available to the tissue as well as a decrease in the removal of CO₂ from the tissue due to inadequate blood flow. In these conditions, the ions are not pumped properly and so intracellular and extracellular concentrations of important small molecules such as sodium, potassium and chloride shift, leading to abnormal ion concentration within the cells [1]. The device that our group is developing will be non-invasive, harmless, inexpensive, portable and fast in the response. This device will contain different sensors for ischemia detection such as pH and potassium sensors. This array will be integrated in an endoscope that will perform scarless surgery directly inside the stomach and the array will monitor in situ the evolution of the patient. The stomach in situ detection of ischemia allows the detection of the disruption of the gastrointestinal mucosa that plays a key role in the evolution of shock and it is the motor of multiple organ failure.

[1] D. Ammann, P. Anker, E. Metzger, U. Oesch, W. Simon, in: Ion Measurements in Physiology and Medicine, Eds. M. Kessler, D.K. Harrison, J. Höper, Springer-Verlag, Berlin, Heidelberg 102