PH-biosensor based on hyper-polarized zymonic acid for non-invasive imaging and spectroscopy

Reference No: B73167

CHALLENGE

Natural pH regulatory mechanisms can be overruled during several pathologies such as cancer, inflammation and ischaemia, leading to local pH changes in the human body. Because of this potentially broad impact, non-invasive imaging of local pH changes has been a major goal in biomedical research, even though so far no technique to measure extracellular pH has been applicable in the clinic.

INNOVATION

This technology introduces hyperpolarized [1,5-$^{13}C_2$]zymonic acid (ZA) as a novel probe for MRI and MRS of pH. Using the ZA can non-invasively image extracellular pH both in vitro and in vivo, shows no toxicity and is independent of concentration, temperature, ionic strength and protein concentrations.

Importantly, ZA's pH sensitivity arises from protonation and deprotonation in proximity to its ^{13}C-labelled sites, which is fast on the NMR timescale (103–104 Hz under physiological conditions) and allows an assessment of pH whenever the agent reaches its target.

Furthermore the long lifetime of the hyperpolarization enhancement and the strong sensitivity to pH changes render this new technique valuable for further preclinical and clinical studies using extracellular pH as an imaging biomarker to characterize pathologies with aberrant acid-base balance.

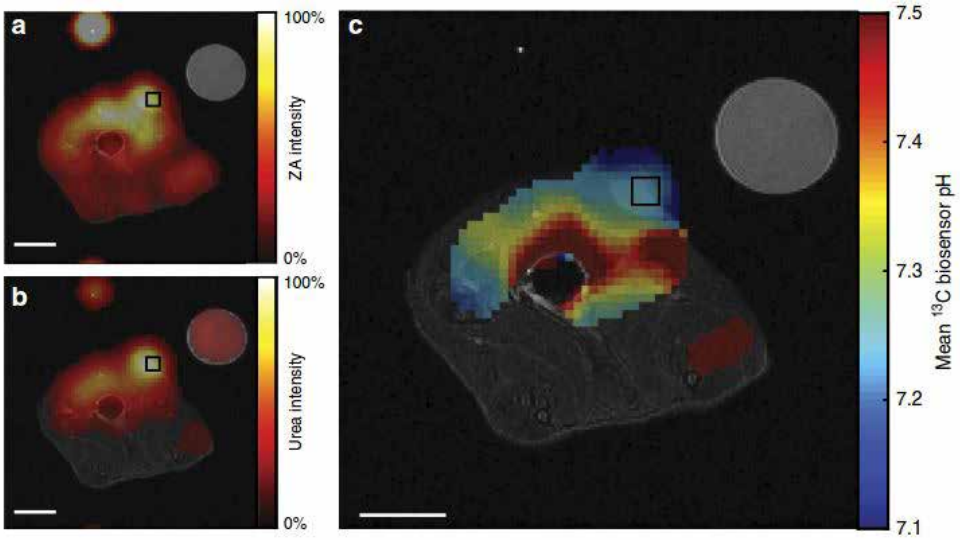

Figure 1: Hyperpolarized ZA *in vivo* pH measurements show an acidic tumour pH at 7 T. Representativetumour data from a hyperpolarized ^{13}C measurement (coloured) in an axial slice overlayed onanatomical proton images (greyscale). Both **(a)** ZA and **(b)** urea accumulate in the MAT B III tumour. **(c)** The mean pH map shows a lower pH value in the tumour compared to the surrounding tissue.

COMMERCIAL OPPORTUNITIES

- Reliable and **non-invasive extracellular imaging sensor** to localize and quantify pH
- Potential for **diagnosis and therapy** of diseases characterized by aberrant acid-base balances

DEVELOPMENT STATUS

Proof of concept *in vitro & in vivo*

REFERENCES:

Düwel S, Hundshammer C, Gersch M, et al. Imaging of pH in vivo using hyperpolarized 13C-labelled zymonic acid. Nature Communications. 2017;8:15126. doi:10.1038/ncomms15126.

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