Evidence for the role of intracellular water lifetime as a tumour biomarker by *in vivo* Field-Cycling relaxometry

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Magnetic resonance imaging (MRI) has had a key role in the field of oncology over the last few decades. The prominent role of MRI relies on its superb spatial and temporal resolution and its diagnostic power arises basically from the differences in the longitudinal (T_1) and transverse (T_2) proton relaxation times between healthy and pathological tissues. However, at the magnetic field strength of the currently available MRI scanners, changes in T_1 do not appear sensitive enough to report on the particular aspects of the tumour stage[1]. However, there is widespread opinion that, at low magnetic field strength, the marked increase of R_1 (=$1/T_1$) observed in biological tissues might be beneficial towards improving the diagnostic potential of MRI in tumour phenotyping[2-4].

Herein it is shown that the *in vivo* acquisition of $1/T_1$ Nuclear Magnetic Resonance Dispersion (NMRD) profiles (from 0.2 to 200mT) fully supports this expectation as the observed R_1s at low magnetic fields (< 0.2 T) allow a clear discrimination between tumours characterised by different metastatic potential.

The T_1-lengthening is associated with an enhanced water exchange rate across the transcytolemmal membrane through an overexpression/upregulation of GLUT1 and Na^+/K^+/ATP-ase transporters. It follows that the intracellular water lifetime represents a hallmark of tumour cells that can be easily monitored by measuring T_1 at different magnetic field strengths ranging from 0.2 to 200mT.

References.

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