MRI measurements of reporter-mediated increases in transmembrane water exchange enable detection of a gene reporter.

Non-invasive imaging of gene expression can be used to track implanted cells in vivo but often requires the addition of an exogenous contrast agent that may have limited tissue access. We show that the urea transporter (UT-B) can be used as a gene reporter, where reporter expression is detected using (1)H MRI measurements of UT-B-mediated increases in plasma membrane water exchange. HEK cells transfected with the reporter showed an increased apparent water exchange rate (AXR), which increased in line with UT-B expression. AXR values measured in vivo, in UT-B-expressing HEK cell xenografts, were significantly higher (about twofold, P< 0.0001), compared with non-expressing controls. Fluorescence imaging of a red fluorescent protein (mStrawberry), co-expressed with UT-B showed that UT-B expression correlated in a linear fashion with AXR. Transduction of rat brain cells in situ with a lentiviral vector expressing UT-B resulted in about a twofold increase in AXR at the site of virus injection.