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Advances in MRI using hyperpolarized and inert gases and molecular MR imaging

Hyperpolarized (HP) agents have the potential to vastly improve MRI sensitivity for the diagnosis and management of various diseases. The polarization of ^{3}He and ^{129}Xe can be enhanced by a factor of up to 100,000, which enables direct detection of the HP agent with no background signal. Conventional 1H MR imaging of the lungs is very challenging, particularly due to the low proton density in lung tissue. HP gas MRI, using ^{3}He or ^{129}Xe, can be used to obtain high-quality images of the lung structure and function. Inert fluorinated gas ^{19}F MRI is a new pulmonary imaging modality that may be able to provide images and functional information similar to HP gas MRI. Inert fluorinated gases are nontoxic, abundant, inexpensive, and do not need to be hyperpolarized prior to their use in MRI, and their short T1 allows for signal averaging within a breath-hold. HP ^{129}Xe is a potentially valuable MR tracer for functional brain imaging due to its high solubility in the blood and brain, and its large chemical shift range. We published the first results using HP ^{129}Xe brain imaging techniques for the measurement of cerebral ischemia and cortical brain function in rats. HP ^{129}Xe can also be used in biosensors for molecular MR imaging, and delivered to a target by means of dedicated molecular cage systems that can encapsulate xenon and bind to biological sites of interest using a targeting moiety, such as an antibody or a ligand, which enables detection of a specific biomarker.

Biography

Mitchell S Albert is a Research Chair at the Thunder Bay Regional Research Institute and Lakehead University. He is the Director of MRI research, Director of the Hyperpolarized Gas MRI Laboratory, a Scientist at TBRRI, and Professor of Chemistry at Lakehead University. Prior to this, he was Associate Professor of Radiology at the Harvard Medical School. He is one of the inventors and pioneers of hyperpolarized gas MRI, and holds 9 patents on its development. He received the United States Presidential Award from President Clinton for this invention and received a CAREER award from the National Science Foundation (NSF).

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