Washington University in St. Louis
Office of Technology Management

MR METHOD FOR QUANTIFICATION OF ANISOTROPIC DIFFUSION

Conradi, Mark, Sukstansky, Alexander, Yablonskiy, Dmitriy

Carter, Paul

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Magnetic Resonance (MR) is known to allow quantitative measurements of molecular diffusion in different materials. Such materials are frequently composed of structural units. Boundaries of these units serve as restrictive barriers for diffusing molecules. In case of structurally anisotropic units, molecular diffusion is also anisotropic and can be described by a tensor of diffusion coefficients. If structural units are of sufficient size to be resolved by direct imaging, the tensor of diffusion coefficients can be determined of each structural unity by means of MR imaging with multiply-oriented diffusion-sensitizing gradients.

There is a need for a method and system which allows extracting information on diffusion tensor components in cases where the anisotropic structural units are too small to be resolved by direct imaging and a multitude of differently oriented structural anisotropic units is present in a single imaging voxel. An example is a determination of anisotropic diffusion of hyperpolarized gas in small airways of lungs of humans and animals.

Washington University researchers have developed a novel method for measuring anisotropic molecular diffusion in biological systems and porous materials. This invention is a combination of MR pulse sequence to acquire MR data and a mathematical algorithm for data analysis. Maps of the components of the tensor of apparent diffusion coefficients, corresponding to anisotropic structural units, based on the processed MR data are also created.