# In vivo Assessment of Tissue Microstructure and Microdynamics: Estimation of the Average Propagator from Magnetic Resonance Data

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## Technology description

## Summary

This invention relates to diffusion-weighted magnetic resonance imaging (DW-MRI) and describes a novel method for estimating the 3-D average propagator from DW-MRI data. The average propagator measures the probability that water molecules move from one place to another during a given diffusion time. This quantity provides local information about the tissue microstructure and the microenvironment in which water diffuses without making any a priori assumptions about the underlying diffusion process itself. Several methods, such as 3D q-space magnetic resonance imaging (MRI) and diffusion spectrum imaging have been developed to measure the average propagator, but these techniques currently require acquisition of large numbers of DW images, making them infeasible for routine animal and clinical imaging. The proposed methodology introduces a new data reconstruction concept, which involved using computer tomography (CT) algorithms to estimate the average propagator from the MR data. The proposed CT reconstruction requires many fewer DW-MRI data than conventional methods consistent with a clinically feasible period of MR image acquisition. The novel technique can be used to diagnose medical disorders that are associated with alterations in water diffusion, such as stroke and several neurodegenerative diseases and other disorders for which diffusion tensor MRI is currently used. Additional applications include drug development (screening drug candidates), material science (testing the quality of materials that have restricted and hindered compartments, e.g., porous media, gels and films) and food processing (testing structural changes in food).

## Application area

In vivo Functional MRI of humans and animals
Drug development
Material science
Food processing

Institution

NIH - National Institutes of Health

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