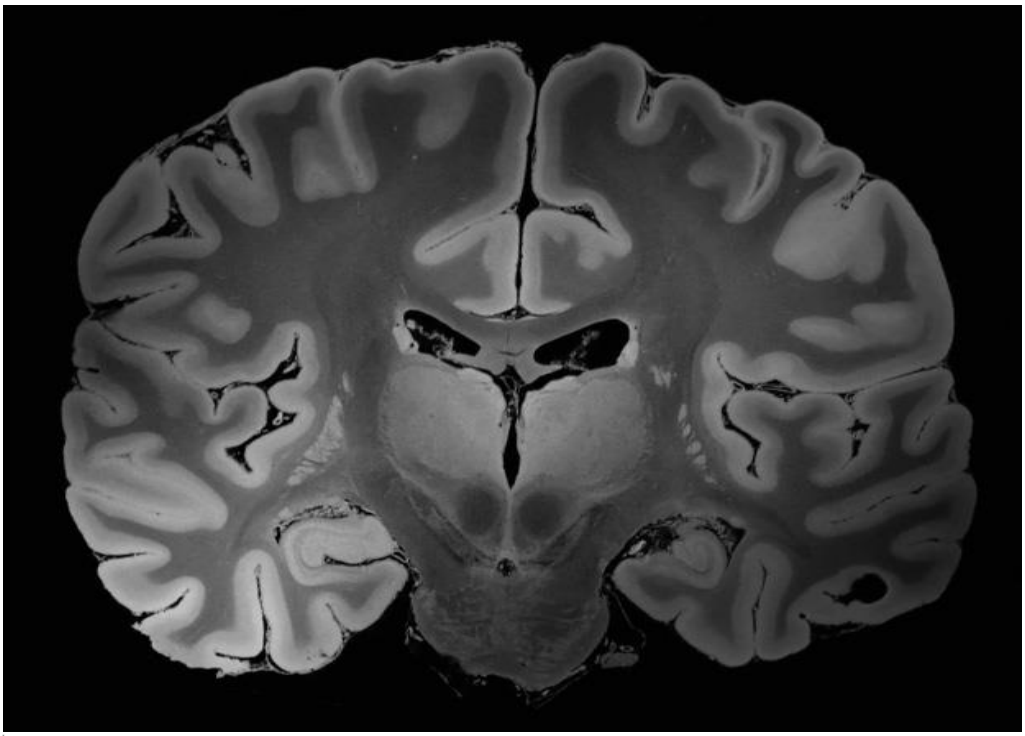


3T MR Research Program

Center for MR Research

University of Illinois at Chicago

TECH 2000 3T MRI RESEARCH FACILITY

SUMMER 2019 ISSUE

3T Research News

By Mike Flannery

Scheduling policy reminders

Due to recent inquiries, we would like to send another friendly reminder regarding the scheduling and cancelling of MR scan time.

Scheduling Policy

- The minimum booked time is 1 hour. If more than 1 hour of imaging is required for your project, you may add additional scan time in 30-minute increments.
- Time cannot be scheduled within 24 hours. Please contact the 3T CMRR staff to schedule time.
- Any available Saturday and Tuesday / Thursday scans **must be confirmed** prior to scheduling your subject.
- When scheduling your time, please remember to add the 'Prep Room" time needed for your study within the "Summary" section
- Investigators are responsible for all booked scan time.

Cancellation Policy

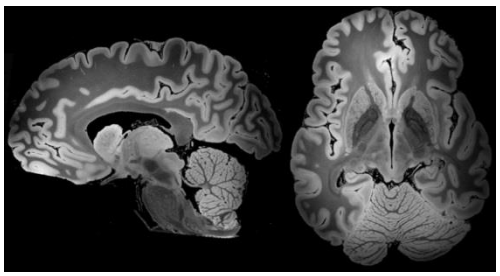
- Scan time cannot be changed or cancelled in the online scheduling system within **48 hours**.
- Please contact the 3T CMRR staff regarding any extenuating circumstances.
- If you need to cancel your time <24 hours, please email both Mike Flannery (mpflanne@uic.edu) and Hagai Ganin (ganin@uic.edu).

Technology advances in MRI

The idea and conceptualization of minimally invasive procedures in clinical practice has always been a goal for future medicine and patient care. One such recent advance, developed by INSIGHTEC, is MR-guided focused ultrasound (MRgFUS). The medical device, named "Exablate Neuro", uses focused ultrasound in conjunction with MR imaging to precisely target and treat areas deep within the brain without the need for surgical incision. This new technology is being used to treat Essential Tremor (ET), a neurological condition that causes shaking of the hands, head and voice, etc. as well as Tremor Dominant Parkinson's Disease (PD) and Neuropathic pain.

During planning and treatment, the patient lies on the treatment bed within an MRI scanner. MRI provides high resolution visualization, patient-specific treatment planning and continuous monitoring of the procedure. Real-time thermal feedback allows the physician to control and adjust the focused ultrasound treatment, ensuring that the targeted tissue is completely ablated. Immediately following treatment, patients demonstrate improvement in their tremor or chronic pain symptoms with minimal complications.

Around the web



7T ultra hi-resolution images of a postmortem brain. Image courtesy of Massachusetts General Hospital.

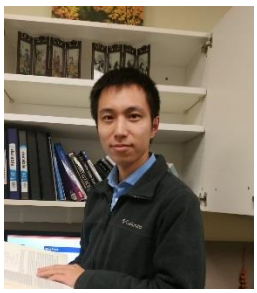
In case you haven't come across this headline, a group of researchers from Massachusetts General Hospital produced some of the most detailed images of the human brain to date. The group led by neuroimaging scientist Brian L. Edlow imaged an ex-vivo human brain specimen on a 7T MRI system for a total duration of 100 hours.

The images produced were acquired at a 100-micron isotropic resolution using a Single-echo multi-flip Fast Low-Angle Shot (FLASH) pulse sequence with a custom built 31-channel receive array coil. The research group has decided to make the dataset available to the academic community (https://datadryad.org/resource/doi:10.5061/dryad.119f80g) with the team saying they "envision that this dataset will be able to broaden the range of investigational, educational and clinical applications that will help advance the understanding of human brain anatomy in health and disease."

YouTube video links of the results:

https://www.youtube.com/playlist?list=PLIL7CEMX5bxzI1TqkJRK3pMV4Ax6By4bN

Research spotlight



Zheng Zhong, PhD Student

The 3T MR Research Program would like to congratulate Zheng Zhong for his accomplishments and winning the First Place Young Investigator Award for his innovative imaging work with Parkinson's disease subjects here at the Center for Magnetic Resonance Research. Zheng is a PhD student with the Bioengineering Department here at UIC and joined the 3T CMRR in 2015. Zheng Zhong and his colleagues discovered there were distinct changes seen in a specific area of the brain stem of the Parkinson's subjects when compared to the healthy control subjects. The following abstract was published earlier this year in *Radiology*.

High-Spatial-Resolution Diffusion MRI in Parkinson Disease: Lateral Asymmetry of the Substantia Nigra

Background: Motor symptoms in Parkinson disease (PD) have exhibited lateral asymmetry, suggesting asymmetric neuronal loss in the substantia nigra (SN). Diffusion MRI may be able to help confirm tissue microstructural alterations in the substantia nigra to probe for the presence of asymmetry.

Purpose: To investigate lateral asymmetry in the SN of patients with PD by using diffusion MRI with both Gaussian and non-Gaussian models.

Material and Methods: In this cross-sectional study conducted from March 2015 to March 2017, 27 participants with PD and 27 age-matched healthy control (HC) participants, all right handed, underwent MRI at 3.0 T. High-spatial-resolution diffusion images were acquired with a reduced field of view by using seven *b* values up to 3000 sec/mm^2. A continuous-time random-walk (CTRW) non-Gaussian diffusion model was used to produce anomalous diffusion coefficient (D_m) and temporal (α) and spatial (β) diffusion heterogeneity indexes followed by a Gaussian diffusion model to yield an apparent diffusion coefficient (ADC). Individual or linear combinations of diffusion parameters in the SN were unilaterally and bilaterally compared between the PD and HC groups.

Results: In the bilateral comparison between the PD and HC groups, differences were observed in β (0.67 ± 0.06 [standard deviation] vs 0.64 ± 0.04, respectively; P = .016), ADC (0.48 μm^2/msec ± 0.08 vs 0.53 μm^2/msec ± 0.06, respectively; P = .03), and the combination of CTRW parameters (P = .02). In the unilateral comparison, differences were observed in all diffusion parameters on the left SN (P < .03), but not on the right (P > .20). In a receiver operating characteristic (ROC) analysis to delineate left SN abnormality in PD, the combination of D_m, α, and β produced the best sensitivity (sensitivity, 0.78); the combination of D_m and β produced the best specificity (specificity, 0.85); and the combination of α and β produced the largest area under the ROC curve (area under the ROC curve, 0.73).

Conclusion: These results suggest that quantitative diffusion MRI is sensitive to brain tissue changes in participants with Parkinson disease and provide evidence of substantia nigra lateral asymmetry in this disease.

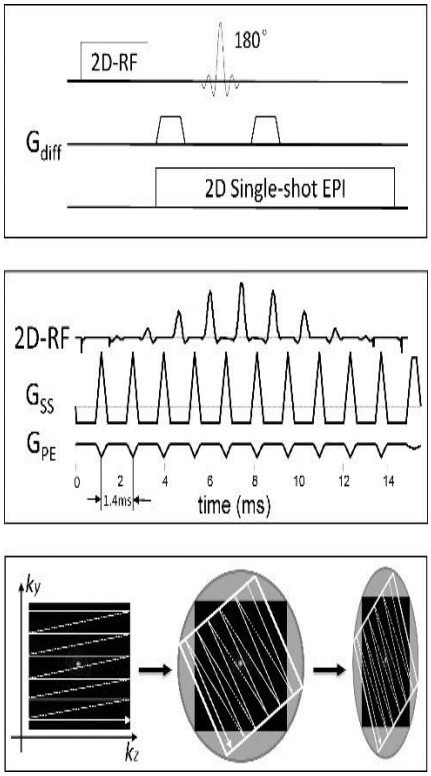


Figure 1: Diagram shows reduced field-of-view pulse sequence (top) used in this study and its two-dimensional (2D) radiofrequency (RF) pulse (middle).

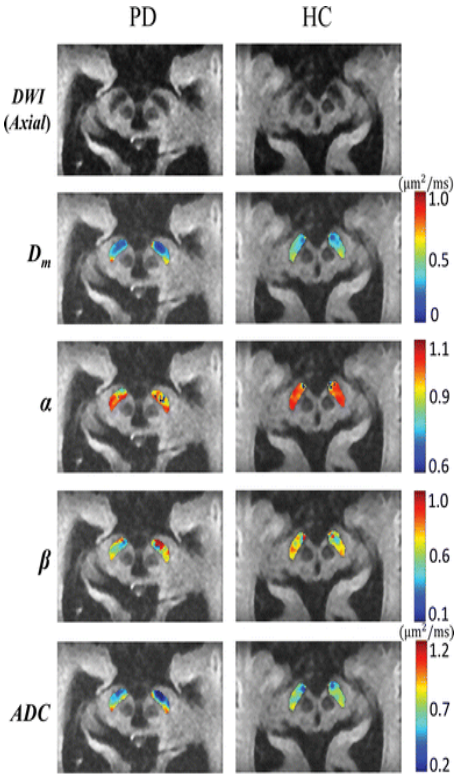


Figure 2: A set of representative axial diffusion-weighted (DW) images and different diffusion parameter maps from a patient with Parkinson disease (PD; 71-year-old man with PD duration of 10 years) and a healthy control (HC) participant (71-year-old man). The DW MR images (DW imaging; *b* = 1000 sec/mm^2; top row) illustrate high spatial resolution and absence of image distortion achieved by the reduced field-of-view pulse sequence. α = temporal diffusion heterogeneity index, β = spatial diffusion heterogeneity index, ADC = apparent diffusion coefficient, D_m = anomalous diffusion coefficient.