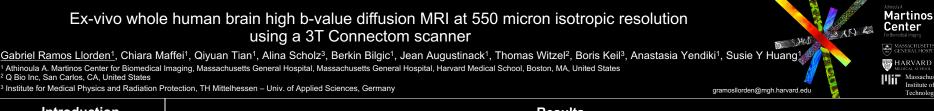
Ex-vivo whole human brain high b-value diffusion MRI at 550 micron isotropic resolution using a 3T Connectom scanner

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Introduction

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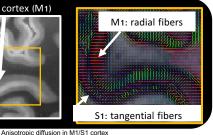


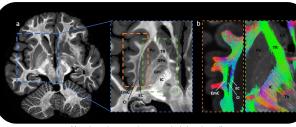
Technology

Results

Diffusion MRI (dMRI) holds the DWI images at b = 10 000 s/mm² most promise among noninvasive imaging methods for probing cellular structure in the human brain

Primary Motor cortex (M1)





Mean kurtosis map and tractography in basal ganglia

Multi-scale validation is key Using in vivo and ex vivo diffusion MRI of human brain tissue and comparing against measurements at finer scales with micro CT and serial EM.

Methods

8-channel ex vivo brain-co

Mean DWI

Axial, coronal, and sagittal slices of 550-micron DWI volume at b = 10 000 s/mm²

Detailed anatomical structures

Internal capsule

EC: external capsule.

Cl: claustrum.

a) Mean Kurtosis map

Emc: extreme capsule. IC: internal capsule. GPi/GPe: internal/external globus pallidus.

b) Probabilistic tractography EC and EmC (left)

thalamic connectivity (right). Ca: caudate.

Th: thalamus. Pu: putamen. TR: thalamic radiation.

Tractography revealing hippocampal connectivity

a-b) CSD-based directionally-encoded color maps showing coronal and sagittal views of the hippocampus. a-b1,2,3: higher magnifications of the boxes shown in a-b. 1) CSD-based maps (0-th order SH) showing main hippocampal formation structures. 2) probabilistic tractography showing internal hippocampal connectivity. 3) lower spatial resolution data (downsampling factor = 3, 1.65 mm).

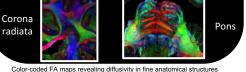
AB: angular bundle. Alv.: Alvear path. Fi: fimbria. IC: internal capsule. PP: perforant pathway.

3T Connectom scanner Ultra-high gradient strength

geometric distortions

3T Siemens Connectom

3D segmented EPI DW-spin echo sequence: High SNR, reduced



Conclusions

Future analysis with ex-vivo diffusion imaging will help bridge the gap between macroscale connectivity and human brain microstructure through comparison with micro-CT or electron microscopy.

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