



*Department of Neurology, University Medical Centre
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Altered white matter microstructure in Parkinson's disease

Indre Pileckyte



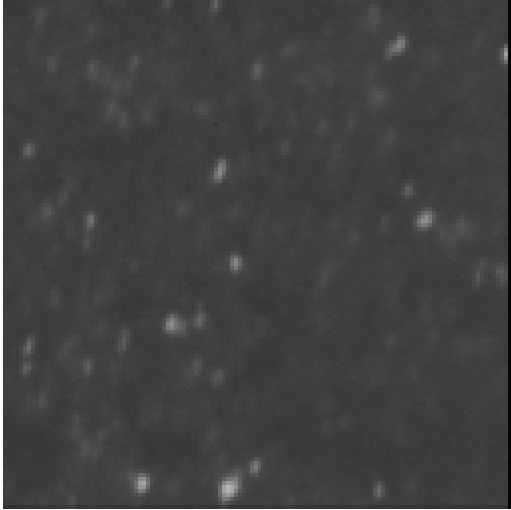
Why the White Matter?

Imaging studies in PD:

- Functional disruption
- Wide spread metabolic changes
- Subtle Gray Matter atrophy

The findings point to the possible changes in structural connectivity

Diffusion Tensor MRI is a non-invasive imaging technique that allows in vivo quantification of water diffusion magnitude and directionality in tissue



(Wikimedia Commons)



(Wikimedia Commons)



Isotropic diffusion



Anisotropic diffusion



(Mori, Introduction to DTI, 2007)



WM changes in Parkinson's disease

- **Global WM microstructural deterioration is evident in individuals with PDD**
(Perea et al., 2013)
- **WM microstructural damage occurs with increasing PD severity**
(Agosta et al., 2013; Gattellaro et al., 2009)
- **WM correlates with cognitive deficits**
(Agosta et al., 2013; Hattori et al., 2012; Deng et al., 2013; Theilmann et al., 2013)

Protocol and data analysis

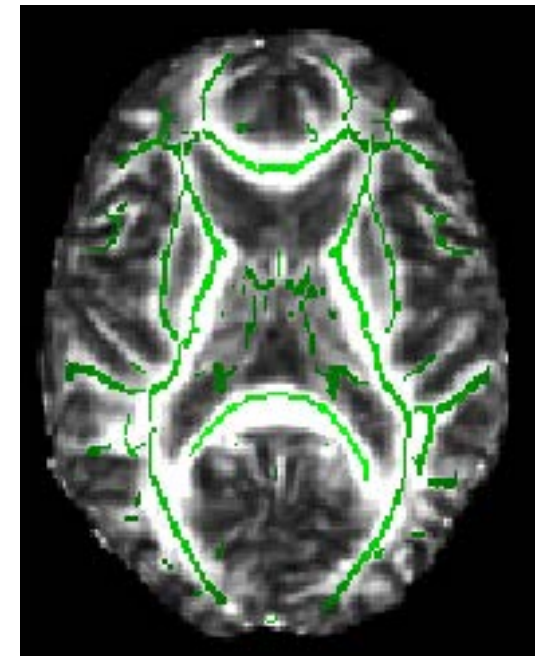
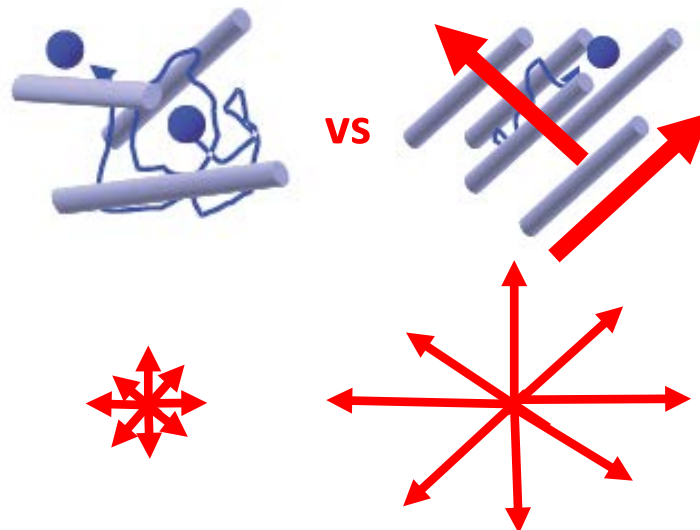
- Protocol: 3T, b=1000, 1 b0, 32 directions.
- Participants: 14 PD-MCI, 13 PD-non-MCI, 18 CON
- Analysis: Tract-Based Spatial Statistics (Smith et al., 2006)
- Parameters:

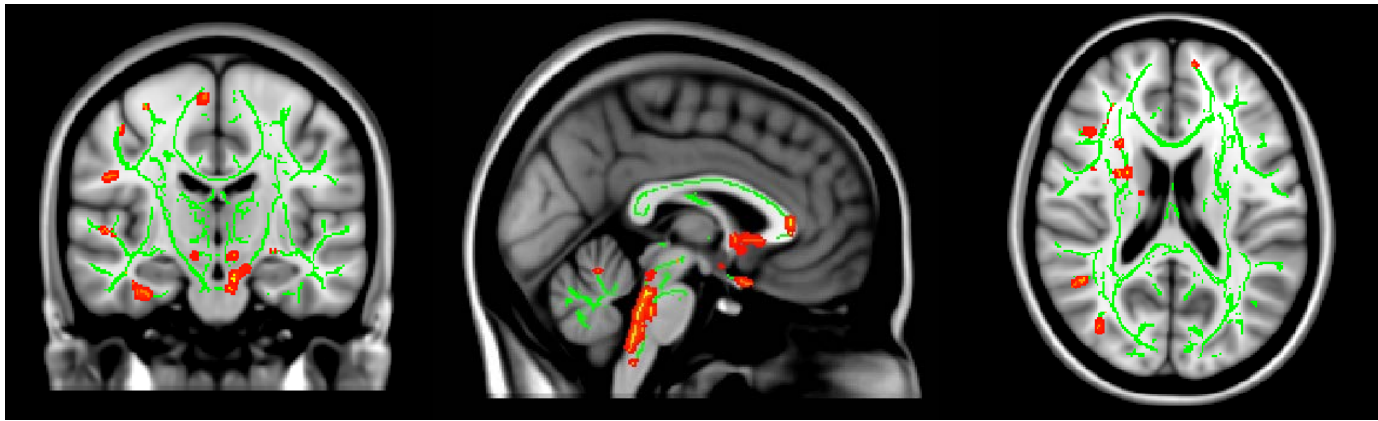
FA (“directionality”)

MD (“magnitude”)

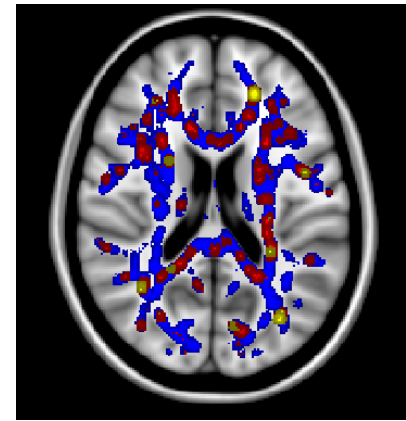
RD (“myelination”)

AD (“axonopathy”)





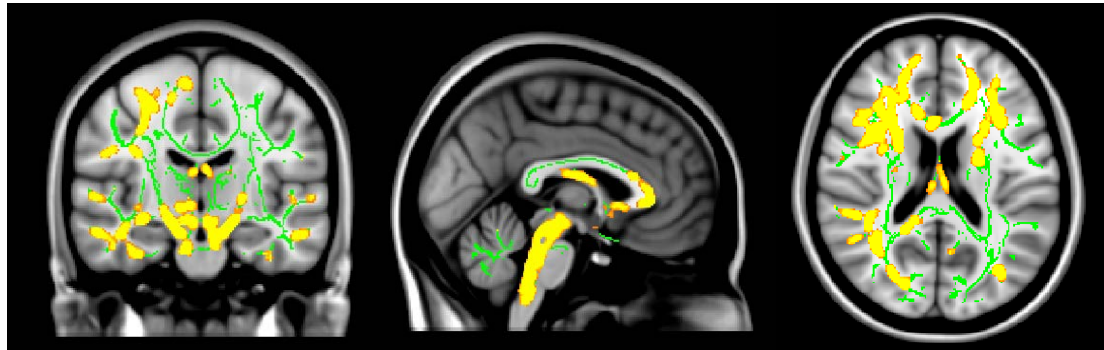
FA
all PD < CON
 $p < 0.05$, uncorr



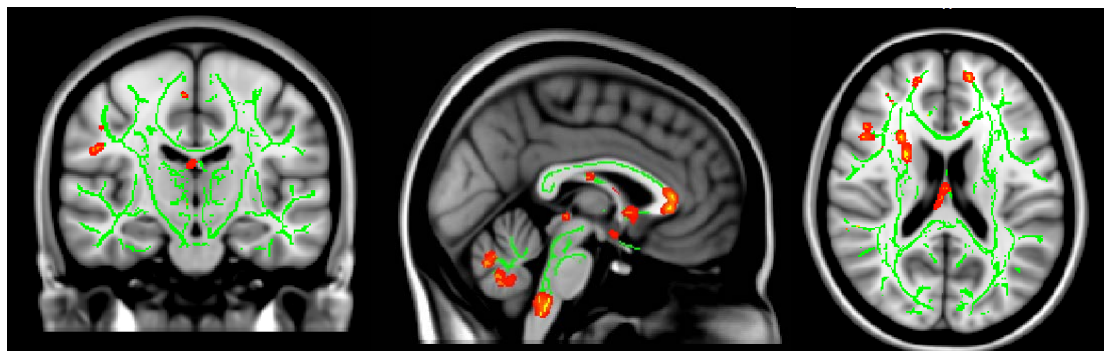
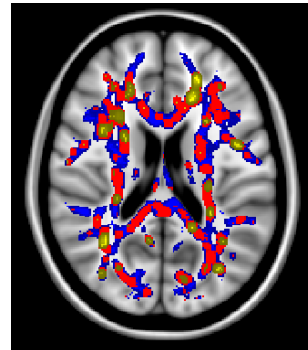
0.2 < d < 0.5
0.5 < d < 0.8
d > 0.8

- FA differences mostly in the right side, multiple areas
- No differences in MD, RD, and AD

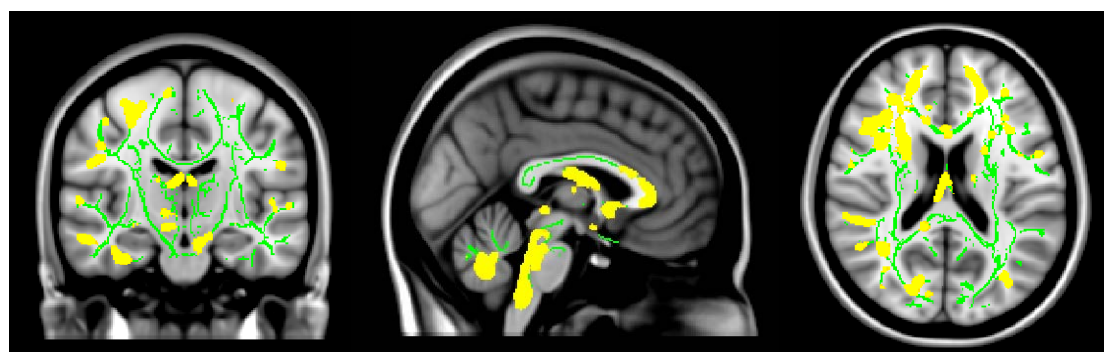
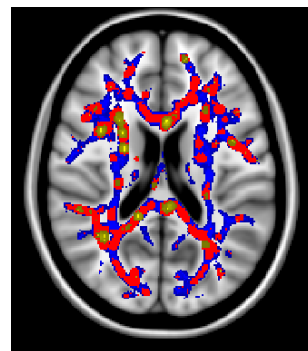
No differences comparing CON and PD-non-MCI



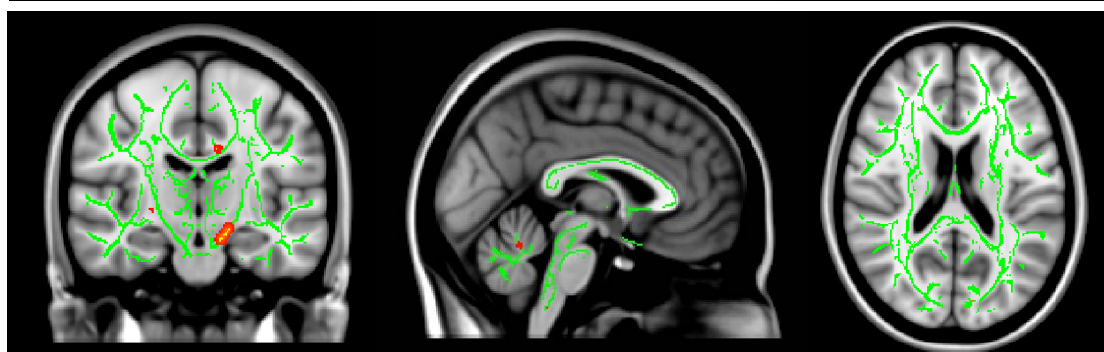
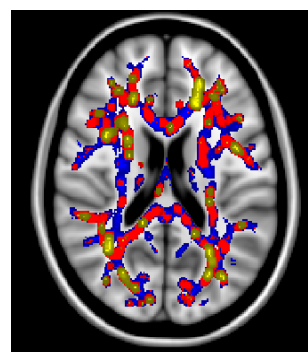
FA
 PD-MCI < CON
 $p < 0.05$, uncorr



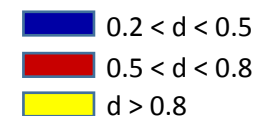
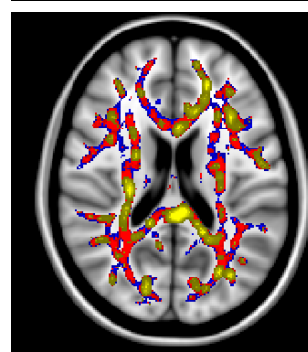
MD
 PD-MCI > CON
 $p < 0.05$, uncorr

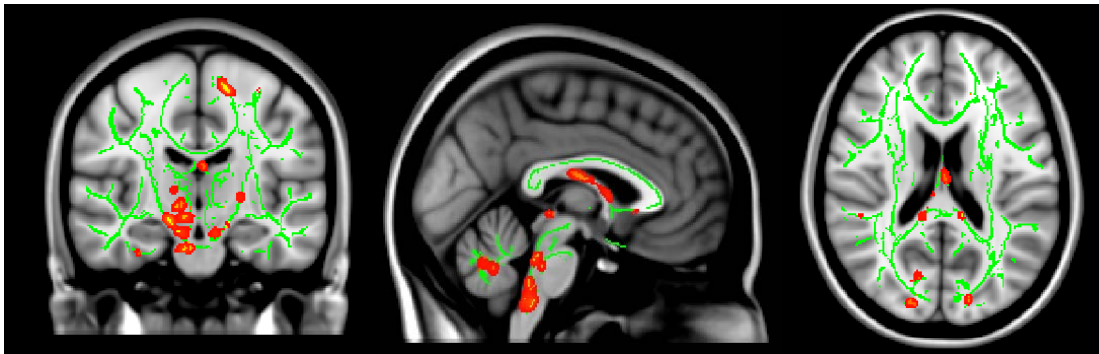


RD
 PD-MCI > CON
 $p < 0.05$, uncorr

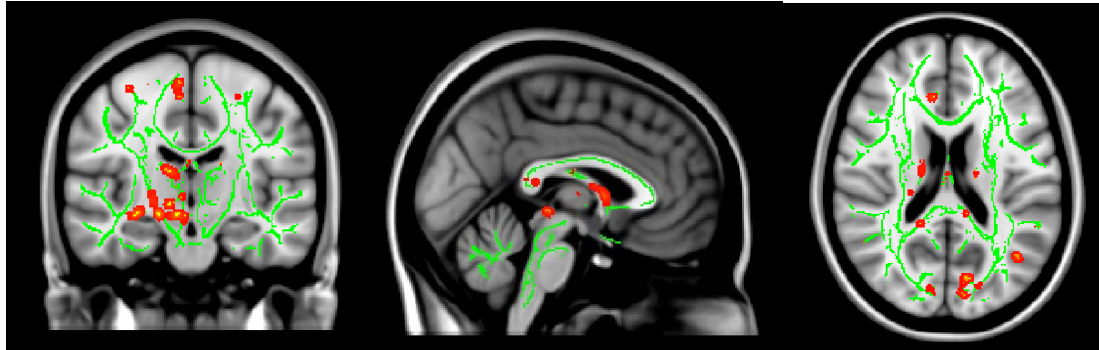
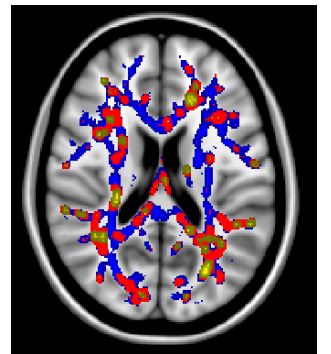


AD
 PD-MCI > CON
 $p < 0.05$, uncorr

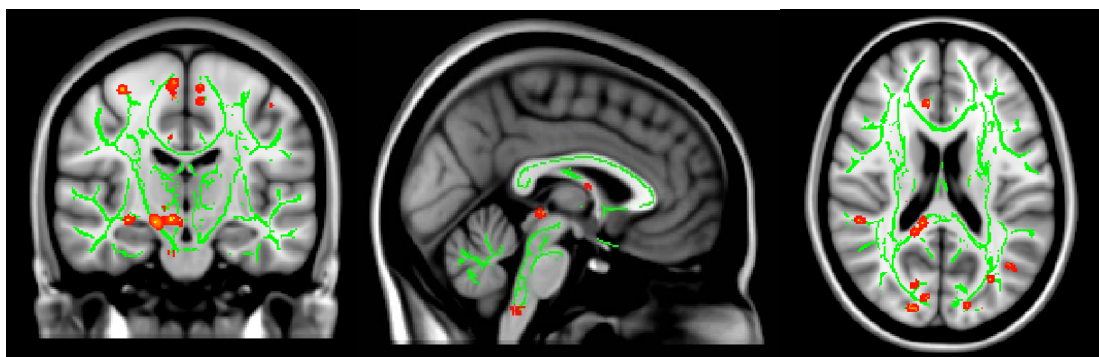
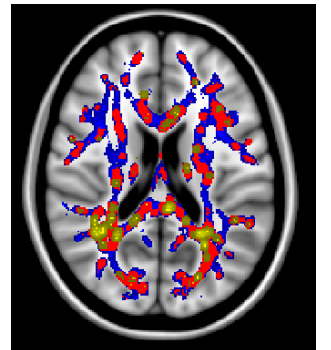




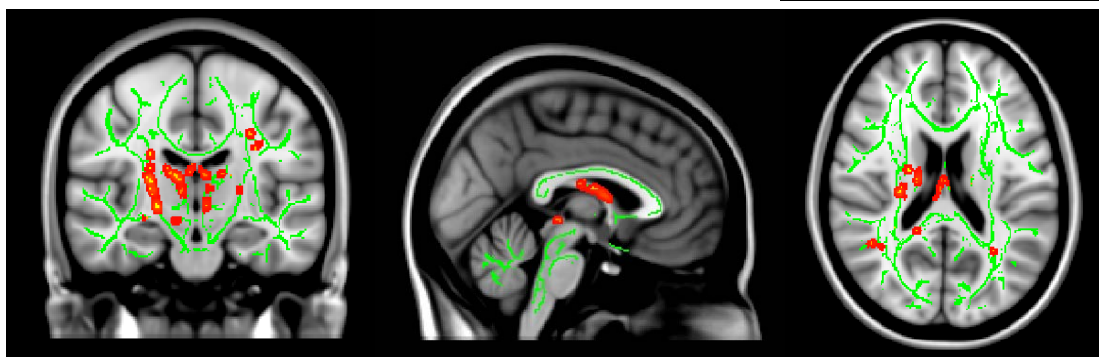
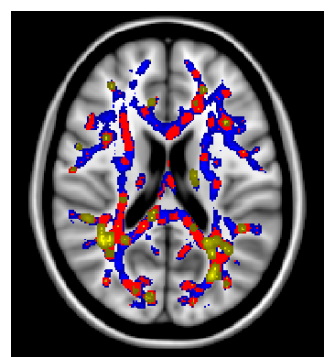
FA
 PDMCI < PD
 $p < 0.05$, uncorr



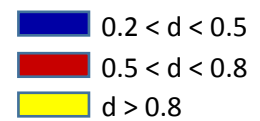
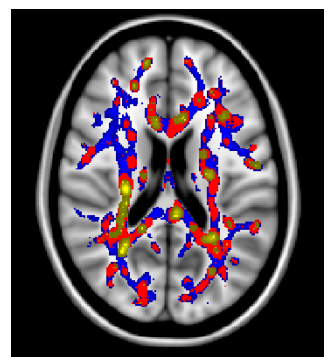
MD
 PDMCI > PD
 $p < 0.05$, uncorr



RD
 PDMCI > PD
 $p < 0.05$, uncorr



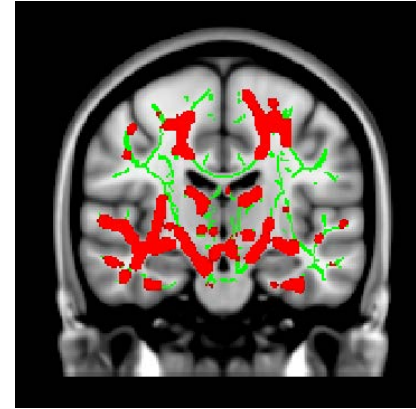
AD
 PDMCI > PD
 $p < 0.05$, uncorr



Correlation between FA
in CON and all PD with:

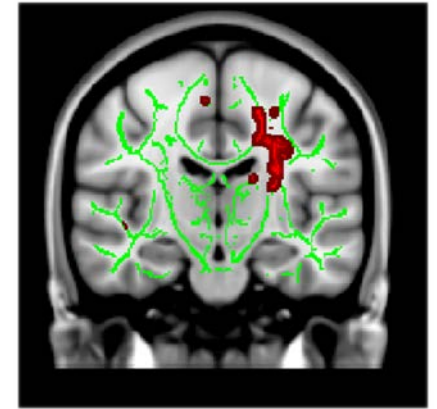
- Digital-Span
(backwards)
- Color-Word score
- Short Delay Free
Recall
- Tower

Short Delay Free Recall

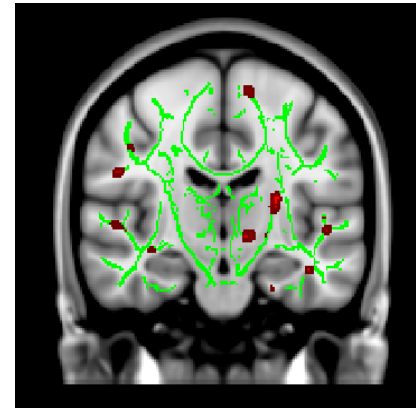


patients
 $p < 0.01$, uncorr

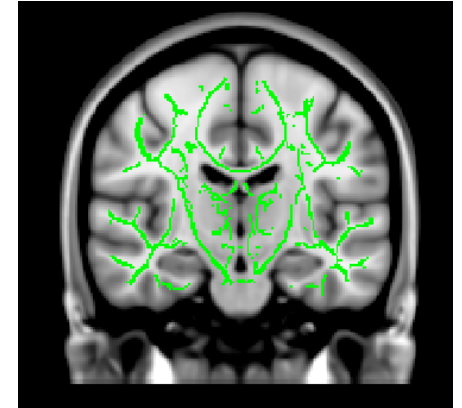
Digit-Span (backwards)



patients
 $p < 0.01$, uncorr



controls
 $p < 0.01$, uncorr



controls
 $p < 0.01$, uncorr

Discussion

- Widespread WM alterations in different brain areas
- PD-non-MCI and CON show no differences
- WM alterations are more prominent in PD-MCI

Limitations

- Unclear underlying mechanisms of the observed microstructural changes

Acknowledgements

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