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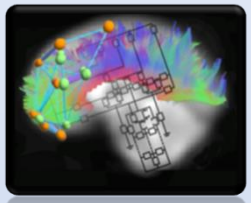

MRI Laboratory

CONCURRENT ASSESSMENT OF PERFUSION AND FUNCTIONAL CONNECTIVITY IN PARKINSON'S DISEASE

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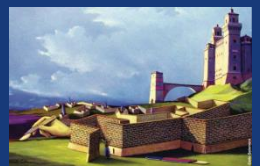

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Background

Parkinson's disease: neurodegenerative disorder impairing motor function and cognition

Resting state fMRI

Functional connectivity alterations since the first phases of the disease:

- ↓ in the left occipital cortex[2,4] and left lingual gyrus[4] → Visuo-spatial functions
- ↓ or ↑in motor areas[2,3]

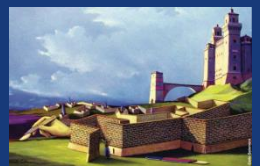
[1]Kwak et al., Front in syst neurosc 2012; [2]Luo et al, Human brain mapping 2015
[3]Wu et al., Human brain mapping 2011.

Brain perfusion - Arterial Spin Labeling

Brain perfusion alterations in people with Parkinson's Disease:

- ↓ posterior parieto-occipital cortex, precuneus and cuneus, and middle frontal gyri[4]
- ↓ left supramarginal gyrus/superior temporal gyrus and left posterior cingulate/precuneus[5]
- ↓ posterior cortex[6]

[4]Melzer et al. Brain 2011; [5]Syrimi et al. J Neural Transm 2017; [6]Kamagata et al. JMRI2011



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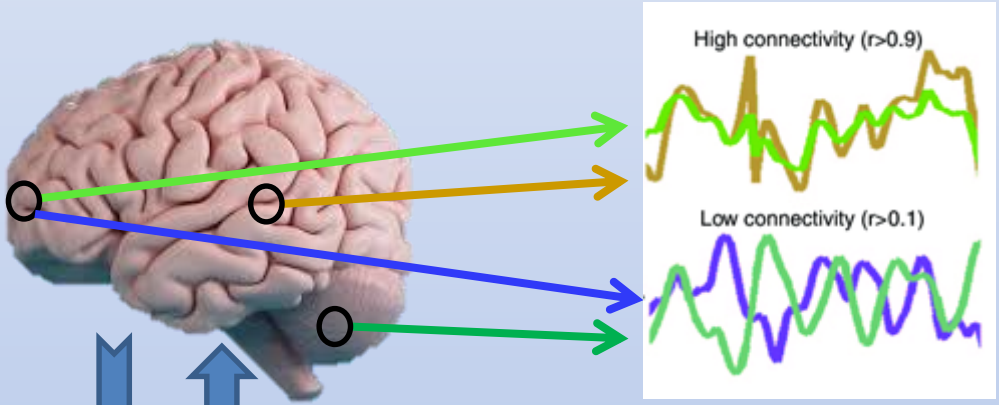
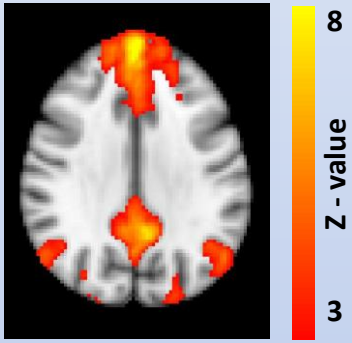
Background

Resting state fMRI

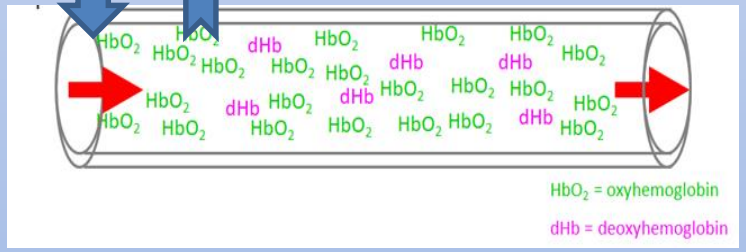
rsfMRI estimates the funtional connectivity of various gray matter regions at rest, indirectly measuring regional spontaneous neuronal activity



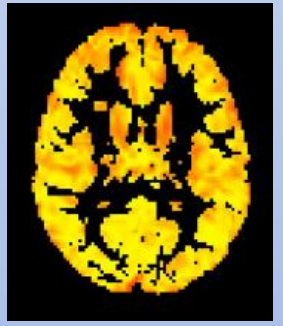


Correlation map (Z-stat map)

Brain perfusion - Arterial Spin Labeling

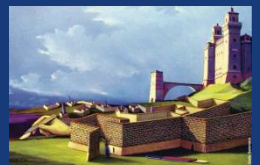


Capillary:
↑ ↓ blood flow
↑ ↓ oxy/deoxy-hemoglobin



Cerebral Blood Flow (CBF)

ASL quantitatively estimates amount of blood flow to brain tissue in ml/min/100g, without the need of exogenous contrast agent



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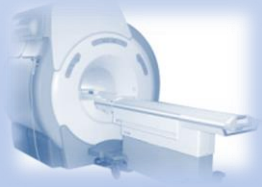
Materials and Methods

Demographics
People with Parkinson's Disease (PD) and Healthy controls (HC)

	PD	HC	p-value
N	26	18	
#Males/Females	22/4	11/7	0.093
age	60.0[50.3-79.8]	65.1[51.5-79.7]	0.618
Disease duration	3[1-12]		
H&Y	1.5[1-3]		
Mini-Mental PD (corr)	29.8[17.7-32]		
MoCA_(corr)	23.6[10-27.4]		

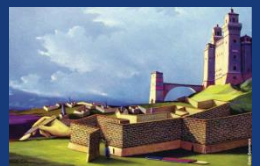
MRI acquisition protocol (1.5T Siemens scanner):



- **High resolution 3D T1-weighted image**
(MPRAGE, TR=1900 ms, TE=3.37 ms, resolution=1×1×1 mm^3, 176 axial slices)

- **Multi-echo (ME) T2* EPI sequence for resting state fMRI (rsfMRI)**
(TR=2570 ms; TE=15, 34, 54 ms; resolution=3.7×3.75×4.49 mm^3; 31 axial slices)

- **Multi-delay pseudo-continuous ASL** with background suppressed GRASE sequence
(TR/TE=3500/22.58 ms, labeling duration=1500 ms, 5 post-labelling delays=[700, 1200, 1700, 2200, 2700] ms, 12 pairs of tag/control images for each delay, resolution=3.5x3.5x5 mm^3, 32 slices)



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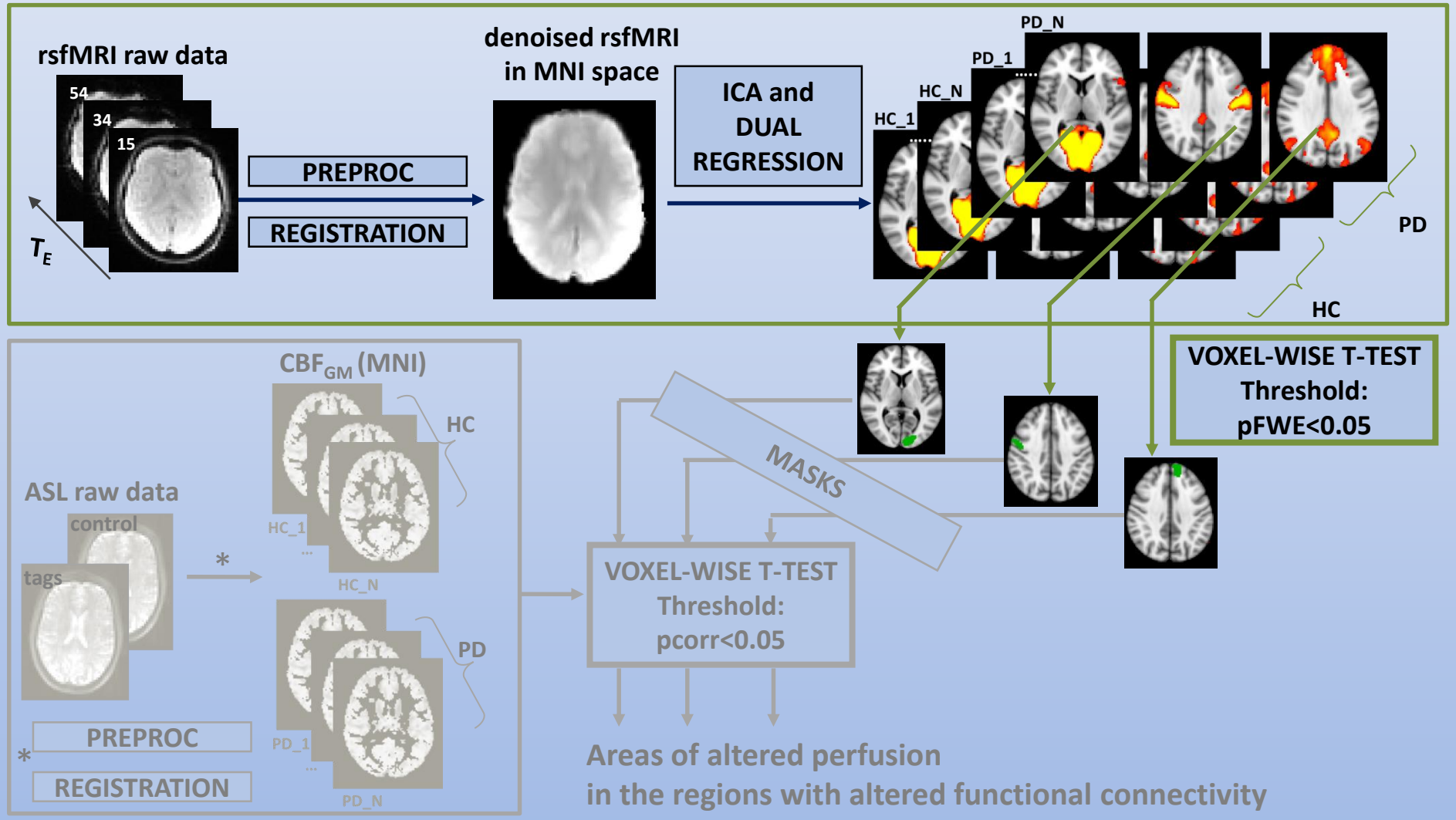
Materials and Methods

MRI processing and statistics



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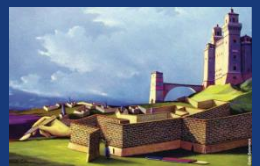

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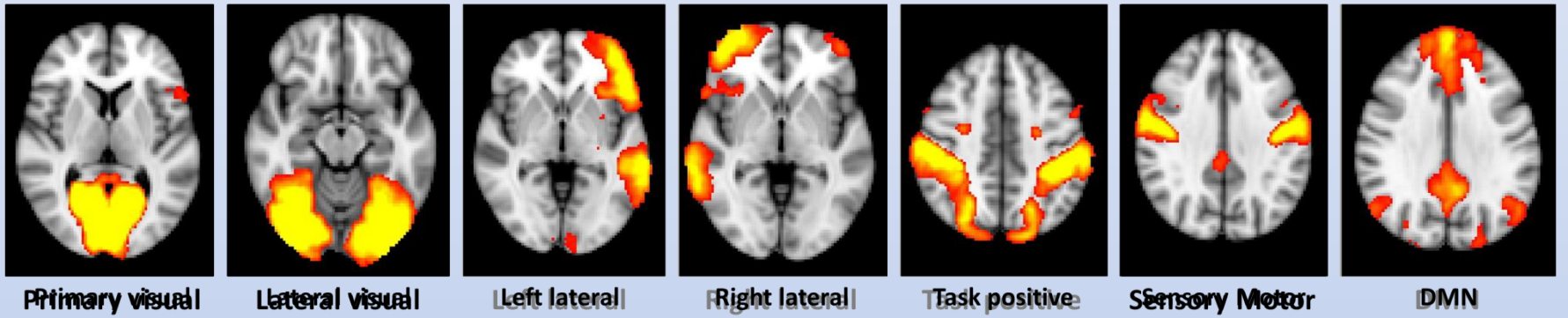
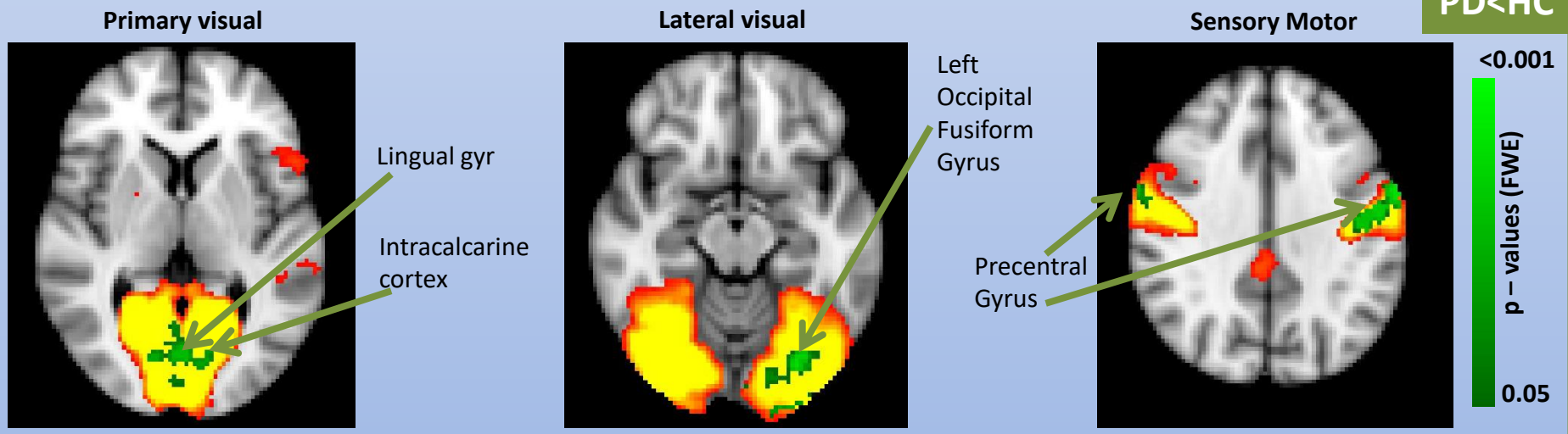
Results

Group ICA



PD vs HC: areas of significant functional connectivity alterations

PD<HC



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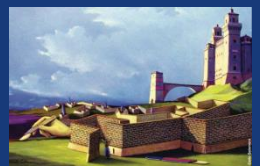

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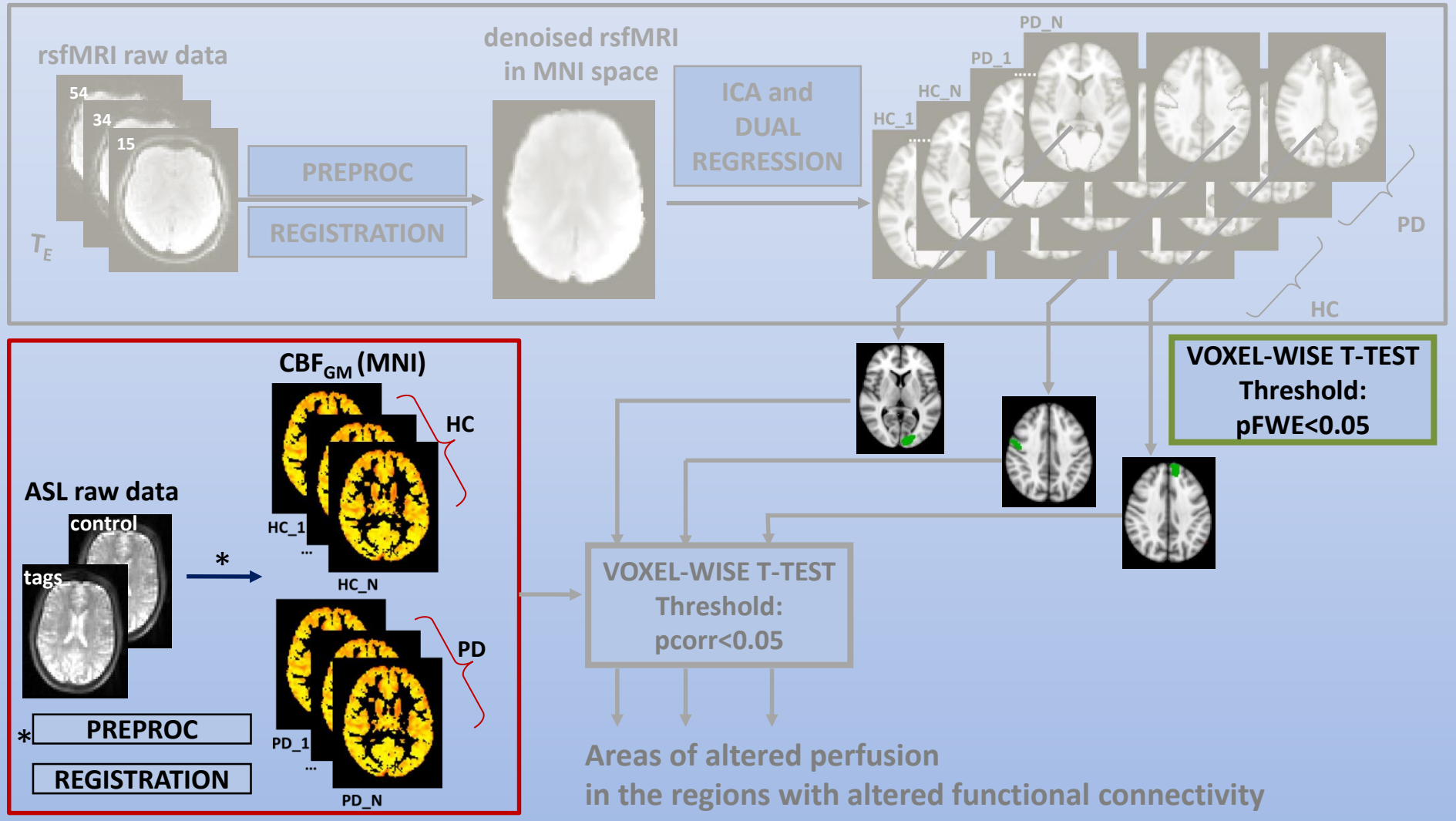

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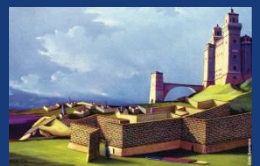

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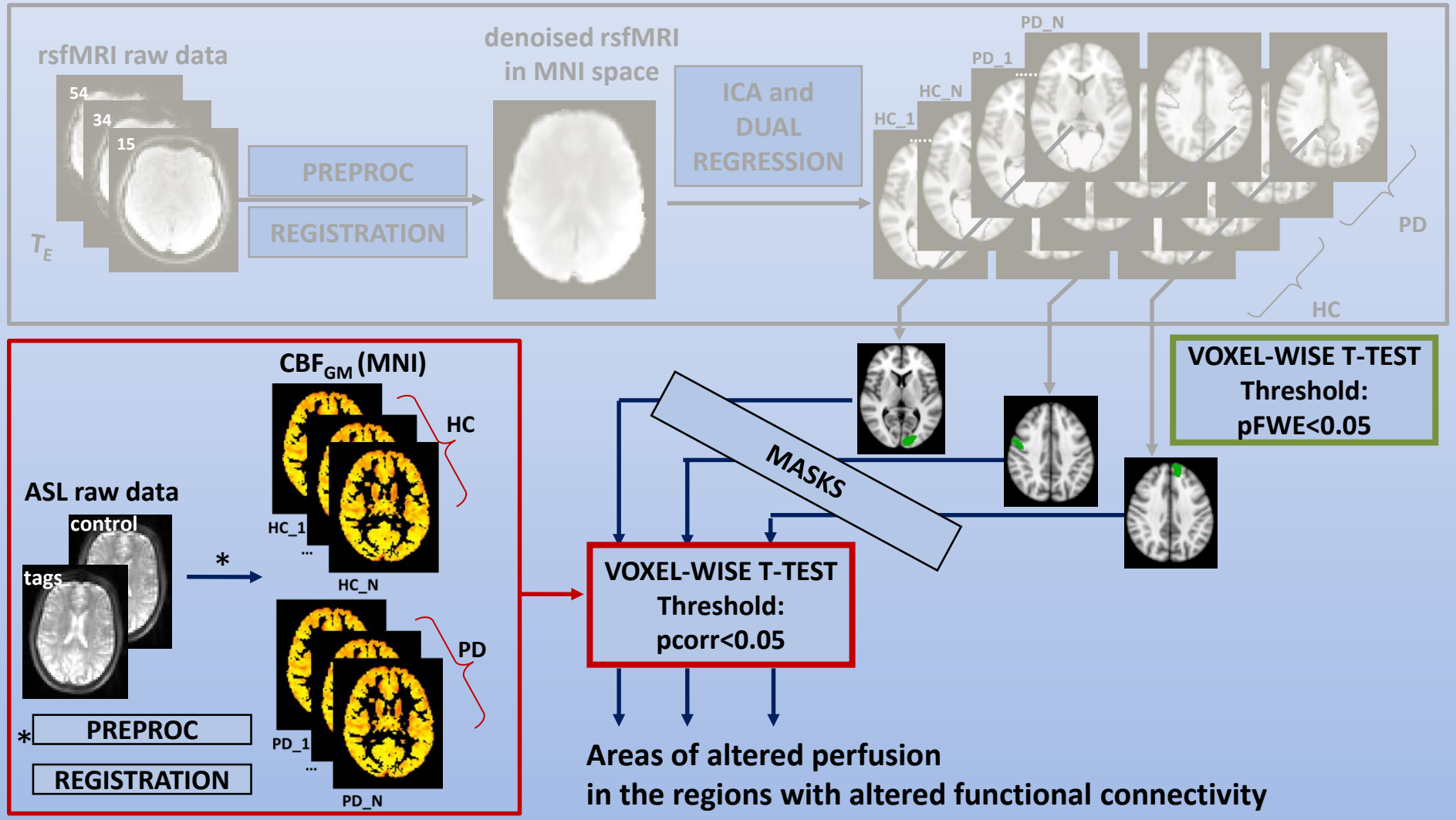
MRI processing and statistics



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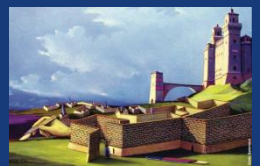

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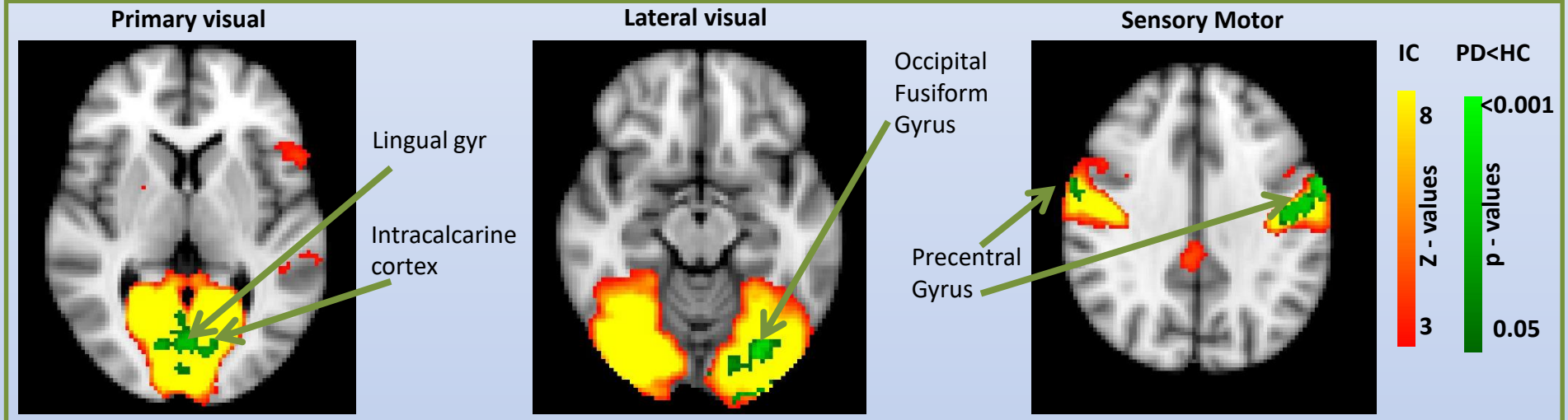
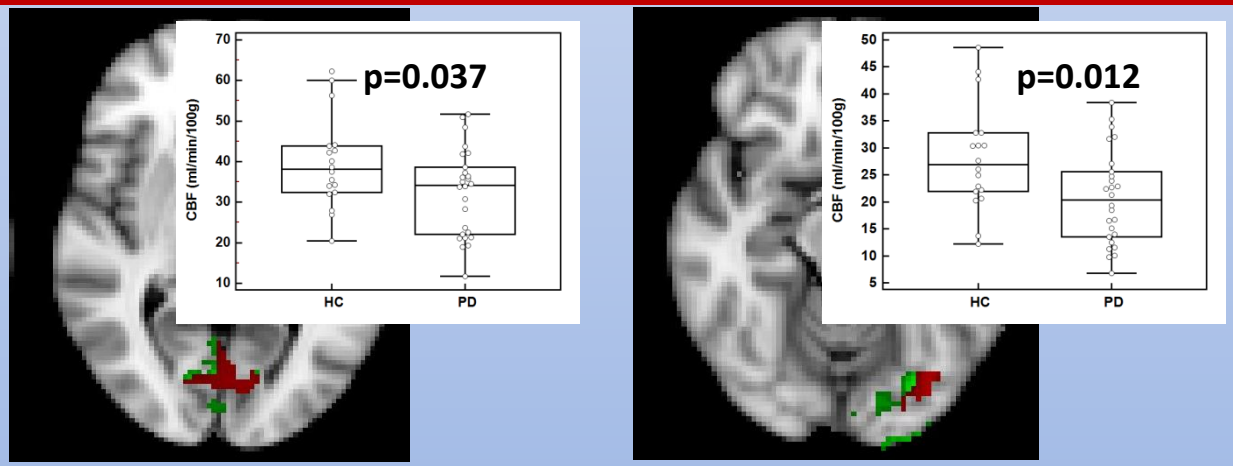
Results

rsfMRI - PD vs HC: areas of significant functional connectivity alterations



ASL - PD vs HC: areas of significant perfusion alteration in the regions of funct connectivity alterations



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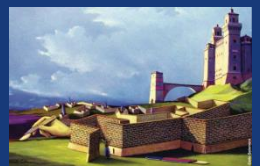

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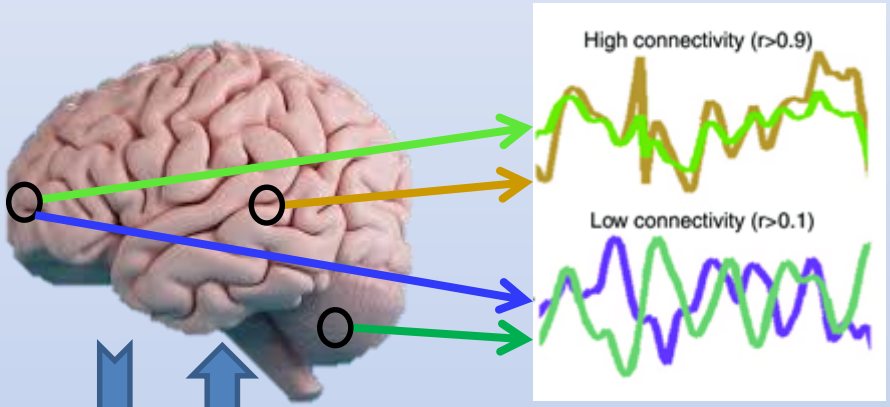
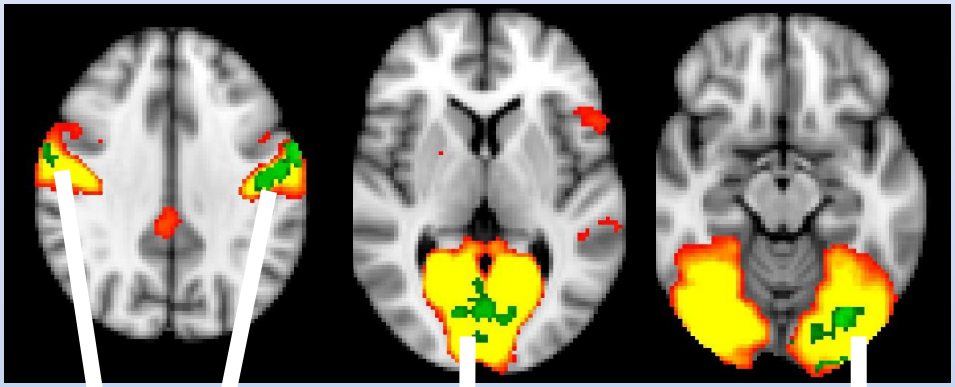
Discussion

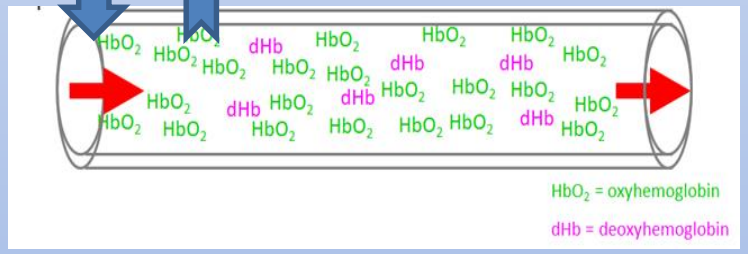
Resting state fMRI



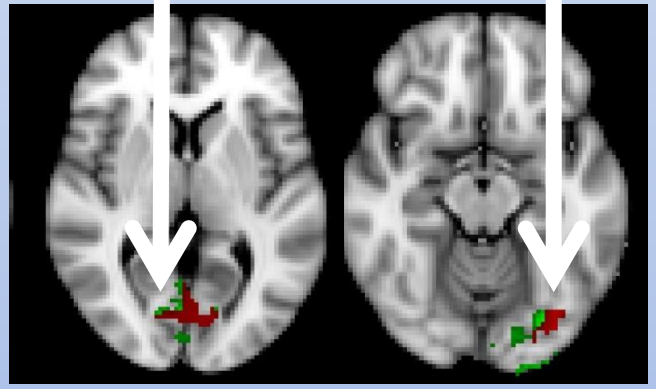
Reduced functional connectivity



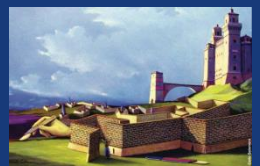
Brain perfusion - Arterial Spin Labeling



Normal CBF



Reduced functional connectivity or reduced blood flow?



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Conclusion

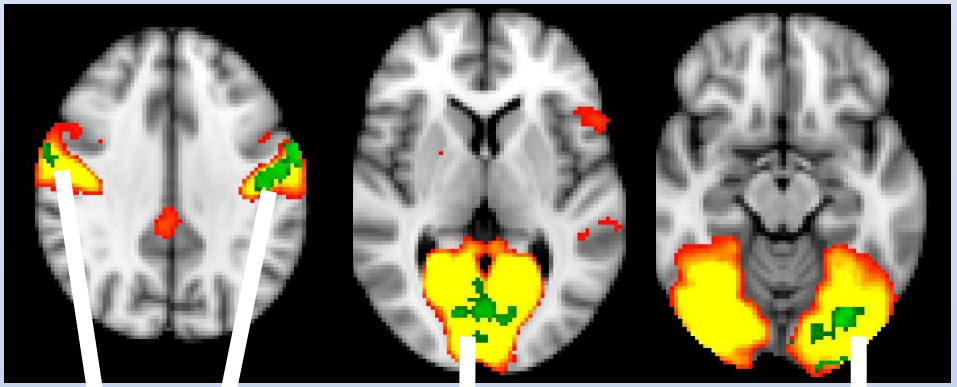
Resting state fMRI

Functional connectivity reduction in the sensorimotor cortex in PD might reflect motor symptoms.

↓

Correlation between the strength of the functional connectivity and the UPDRS-III:
r=-0.442, p=0.031

Reduced functional connectivity



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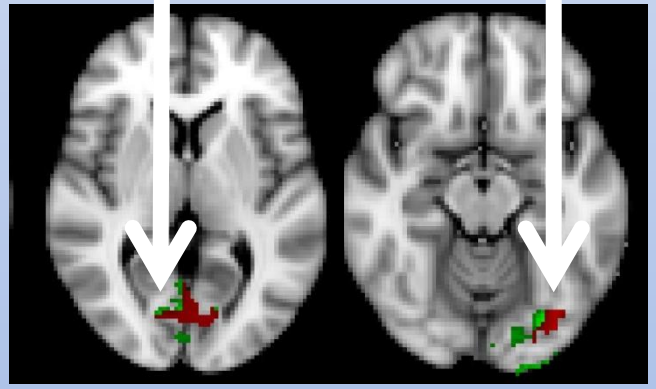


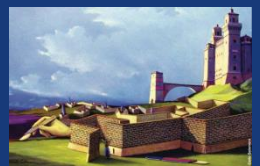
Brain perfusion - Arterial Spin Labeling

Functional connectivity alterations in the visual cortex could be influenced by ↓CBF

→ Longitudinal study

→ Possible clinical improvement if perfusion would be restored?

→ Perfusion alterations have to be considered when interpreting the functional connectivity results



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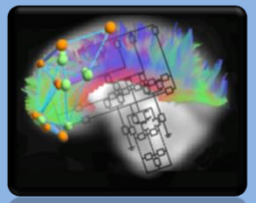
Acknowlegment



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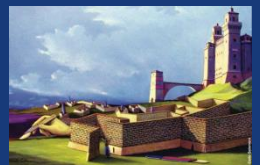
Thank you



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