MRI in ALS

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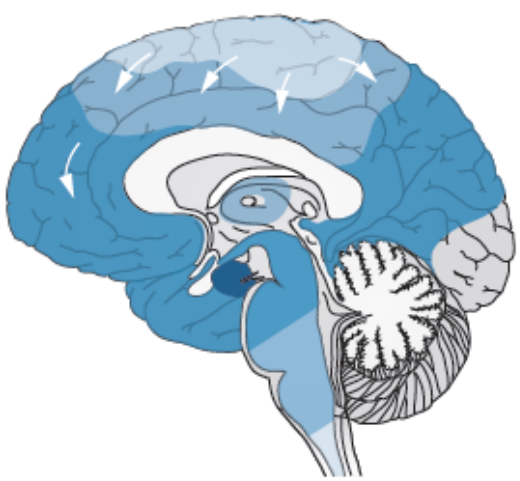
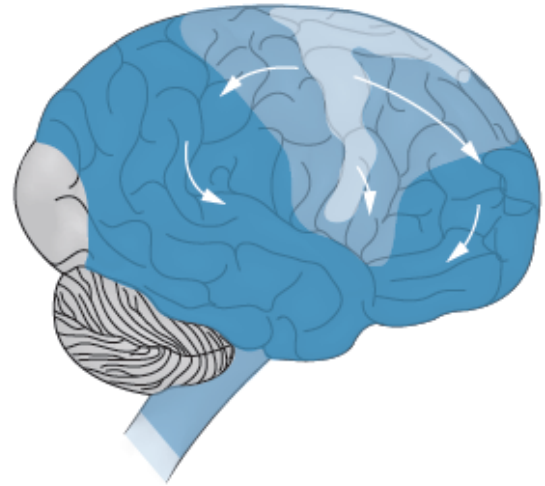
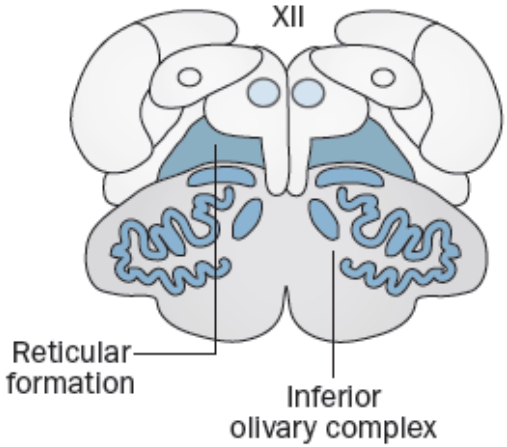
MRI IN ALS

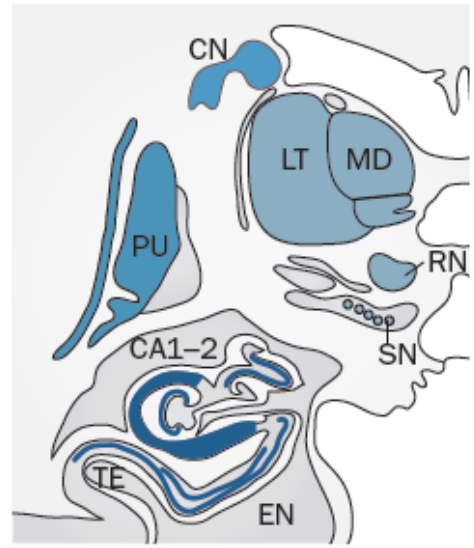
Background

Proposed staging of pTDP-43 pathology in ALS









Stage 1
Stage 2
Stage 3
Stage 4

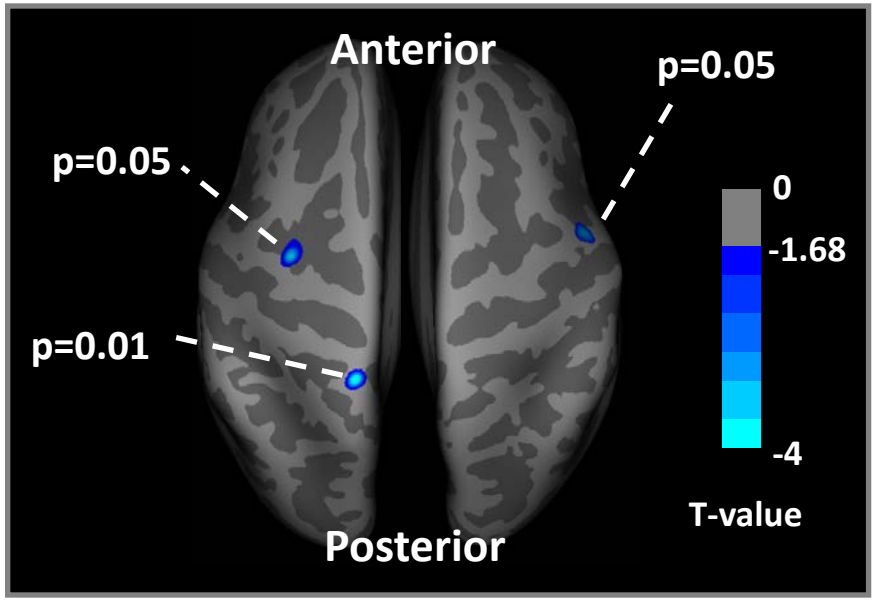
Stage 1	**Motor cortex, bulbar and spinal somatomotor neurons**
Stage 2	**Reticular formation, precerebellar nuclei**
Stage 3	**Prefrontal cortex and basal ganglia**
Stage 4	**Anteromedial areas of the temporal lobe and the hippocampal formation**

Braak et al., Nat Rev Neurol 2013

MRI IN ALS

GM damage / Motor cortex & clinical correlations

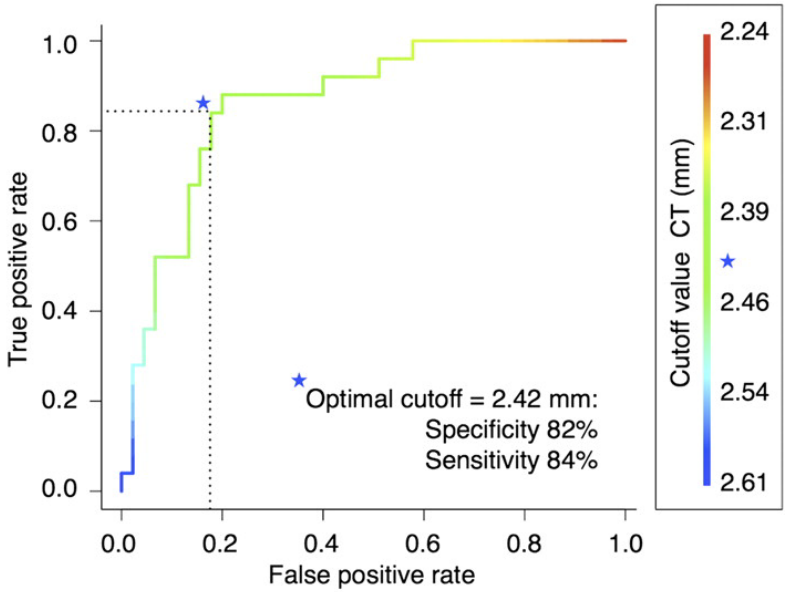
ALS *vs* controls



Agosta et al., PlosONE 2012

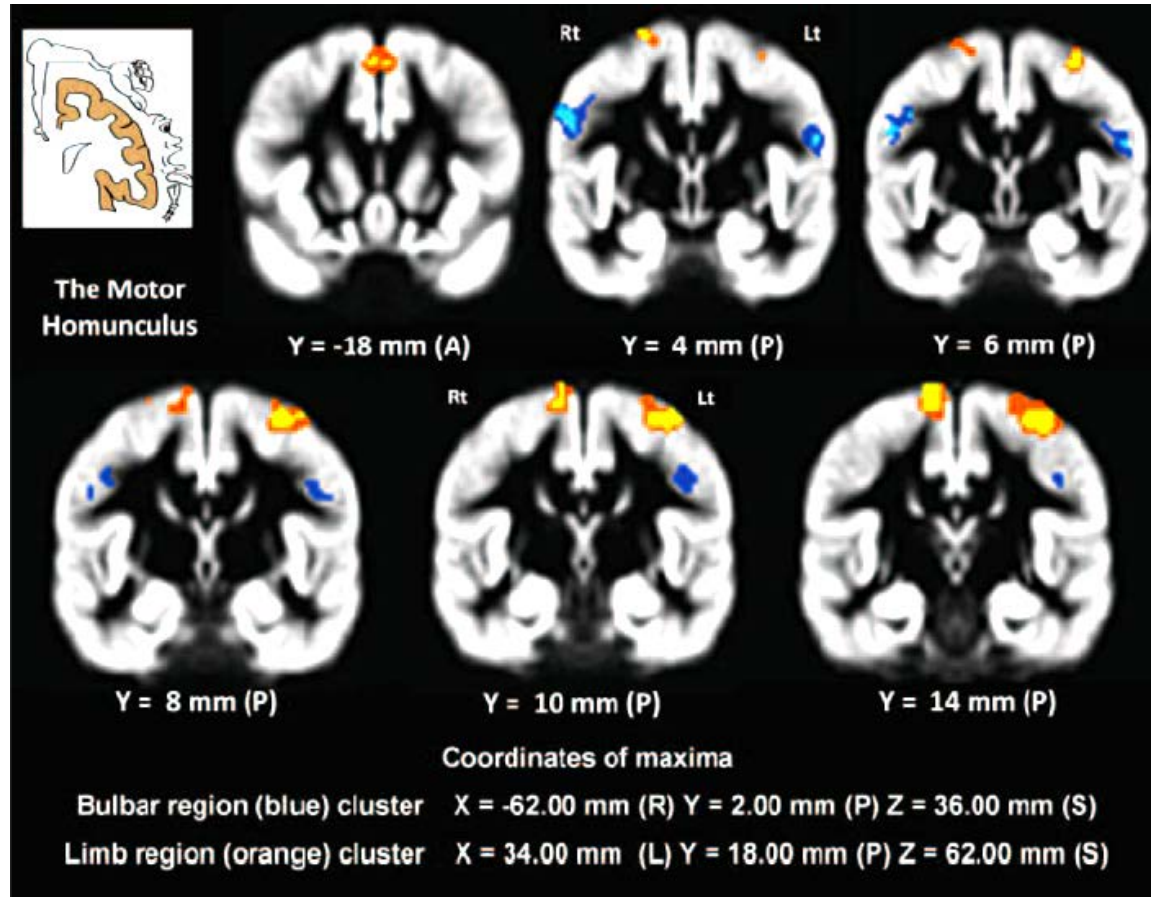
C-statistic ALS *vs.* controls 0.75

Progression rate: r=-0.33, p=0.03



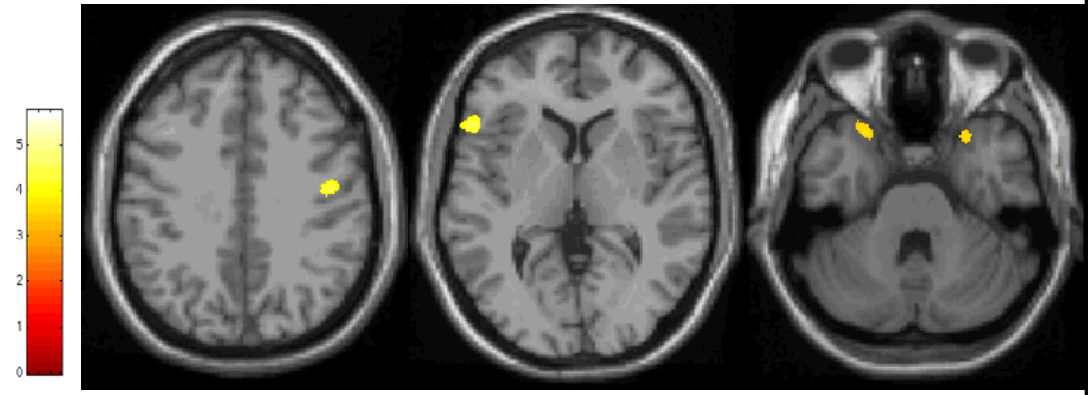
Verstraete et al., JNNP 2012

Bulbar and limb-onset ALS *vs* controls



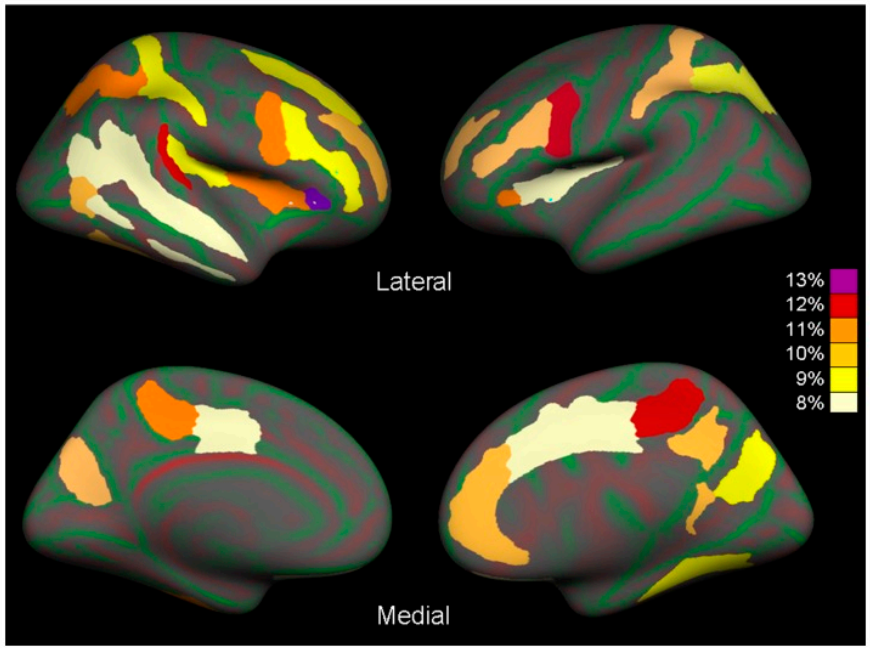
Bede et al., JNNP 2012

MRI IN ALS GM damage / Extramotor damage & cognition

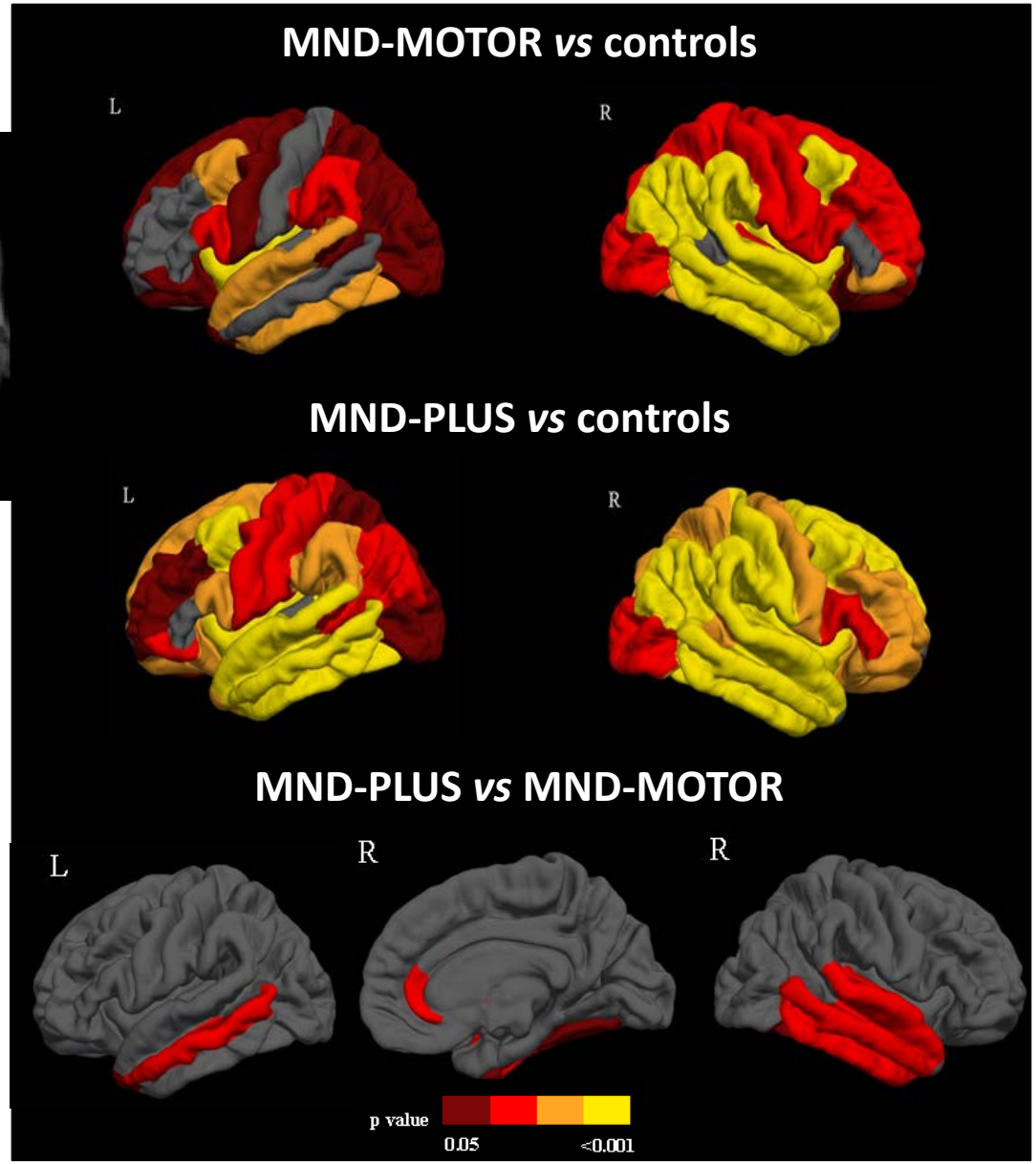


t values

Agosta et al., Hum Brain Mapp 2007



Agosta et al., PlosONE 2012

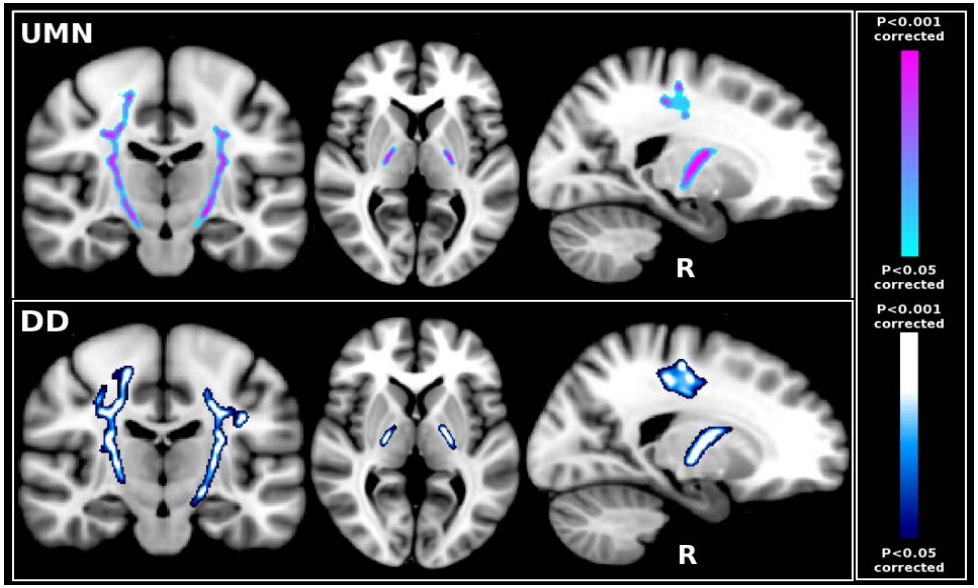


Agosta et al., Hum Brain Mapp 2016

MRI IN ALS

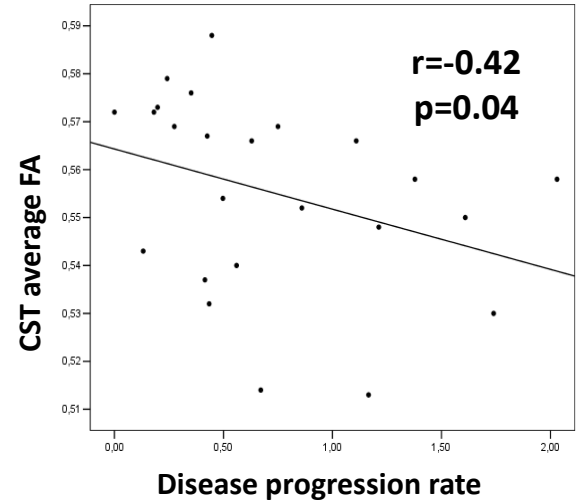
WM damage / CST

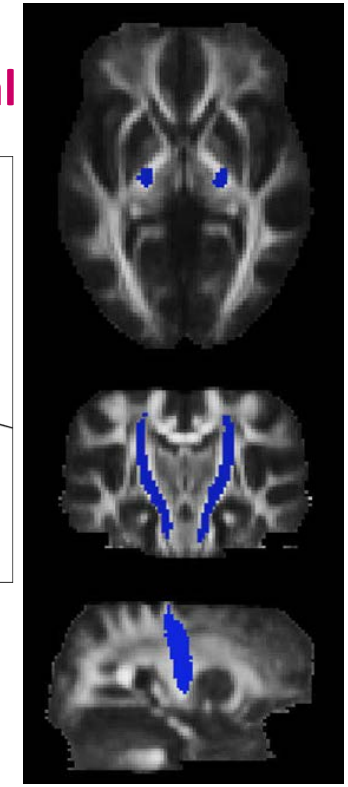
CST FA *vs* UMN score and disease duration



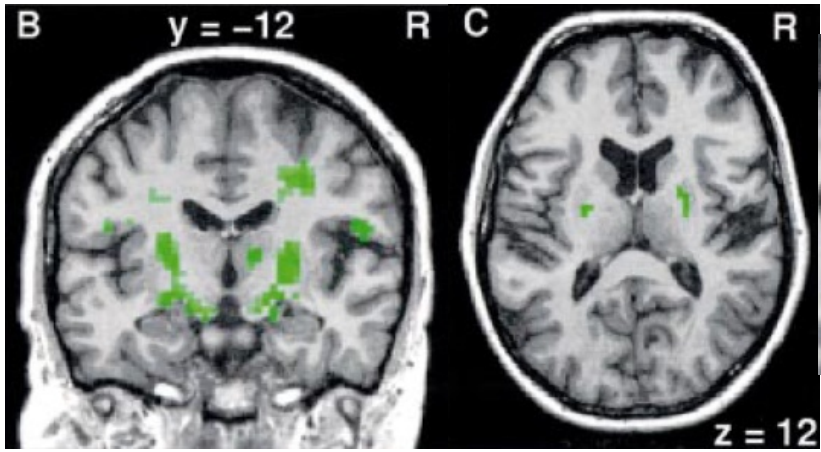
Filippini et al., Neurology 2010

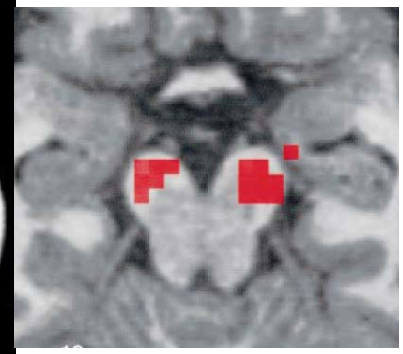
CST damage *vs* progression rate and survival





CST FA decrease in patients without UMN signs at the time of MRI





Sach et al., Brain 2004

Independent predictors of survival:
ALSFRS deterioration rate
(p=0.01, HR=2.2, 95% CI=1.2-3.9)
CST FA
(p=0.06, HR=0.94, 95% CI=0.89-1.00)

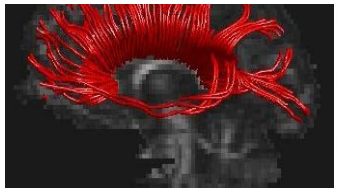
Agosta et al., Eur J Neurosci 2010

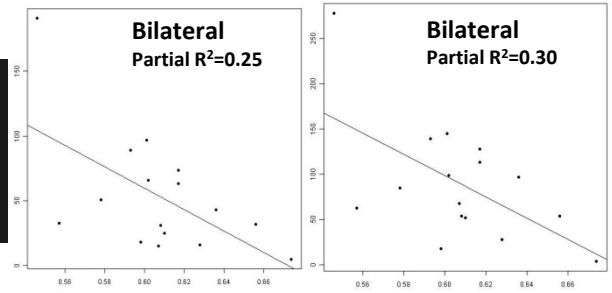
MRI IN ALS

Extramotor WM damage

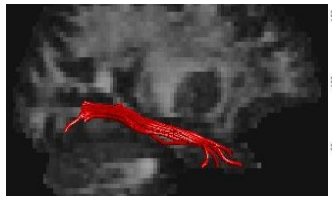
Cognitive impairment *vs* WM damage in ALS

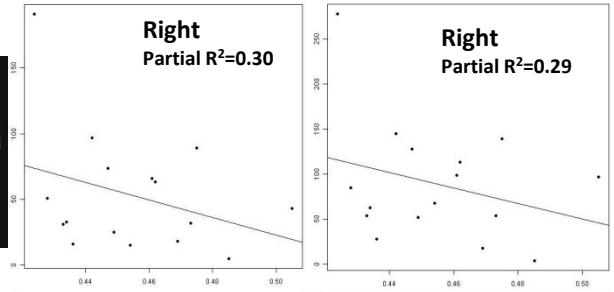
Corpus callosum





Right ILF





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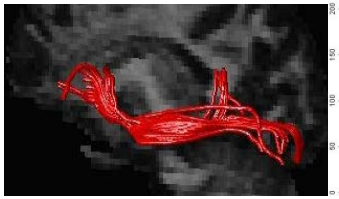
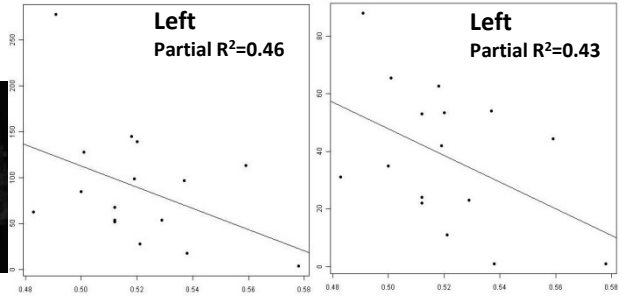
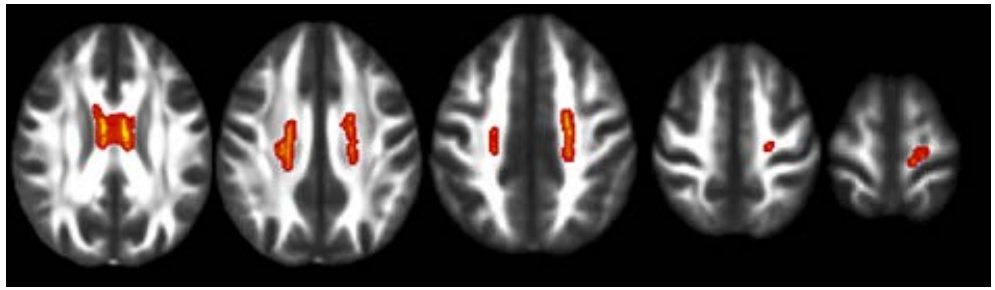


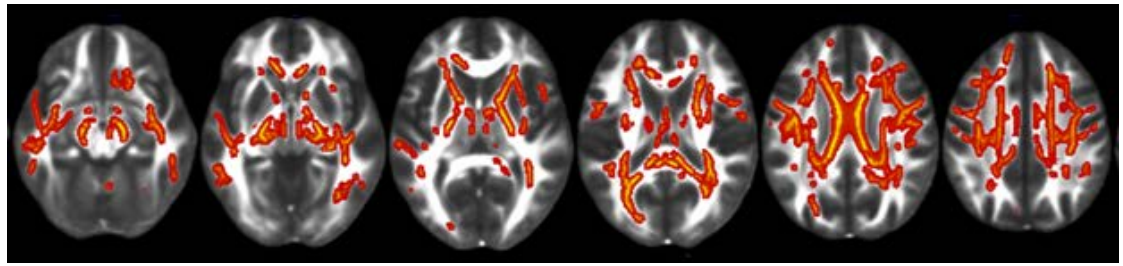


Sarro et al., AJNR 2011

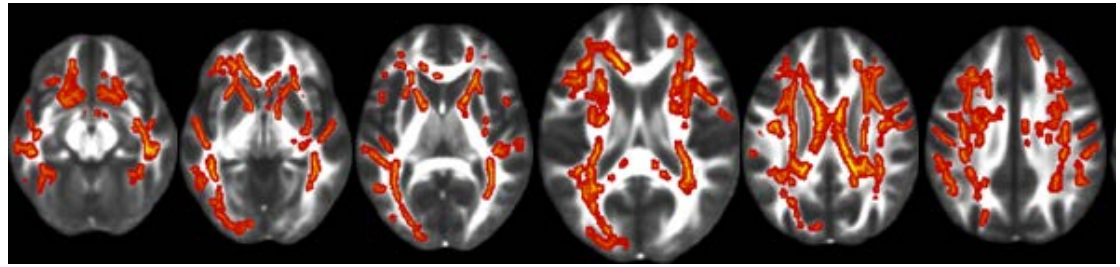
PLS without cognitive deficits *vs* controls



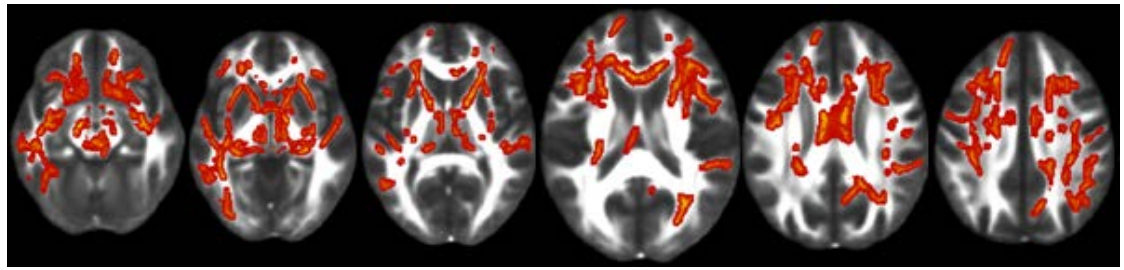
PLS with cognitive deficits *vs* controls



FA *vs* semantic fluency



FA *vs* action naming

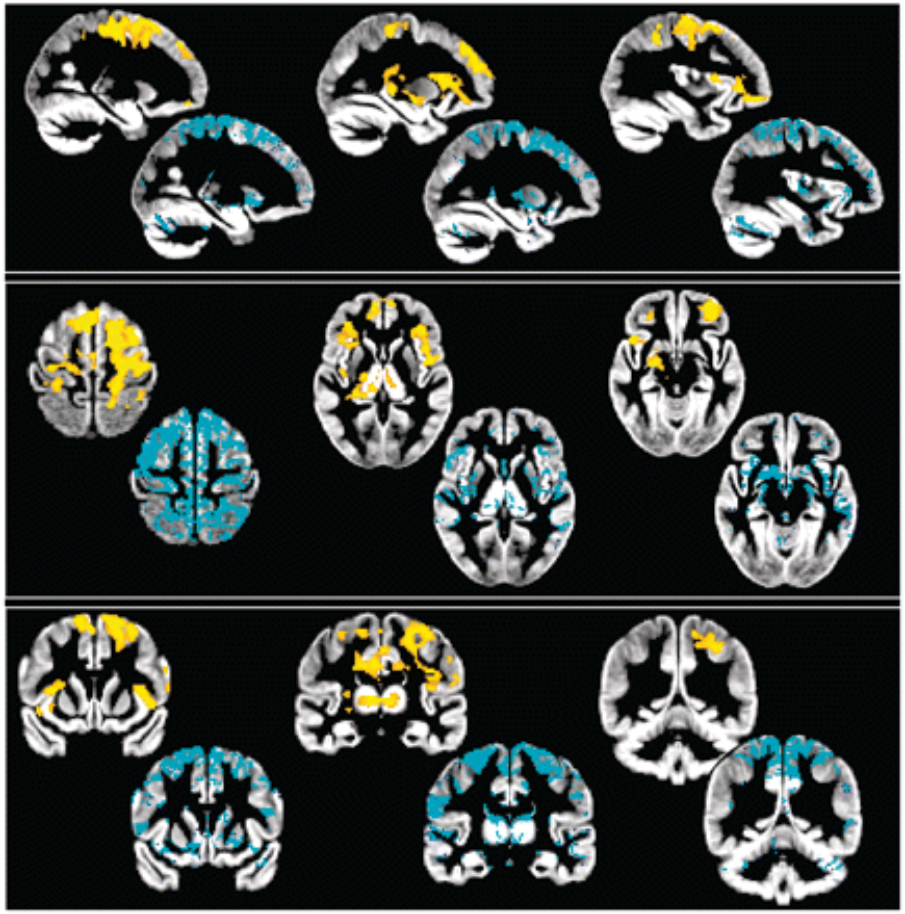


Canu et al., PlosONE 2013

MRI IN ALS

Functional connectivity

ALS *vs* controls



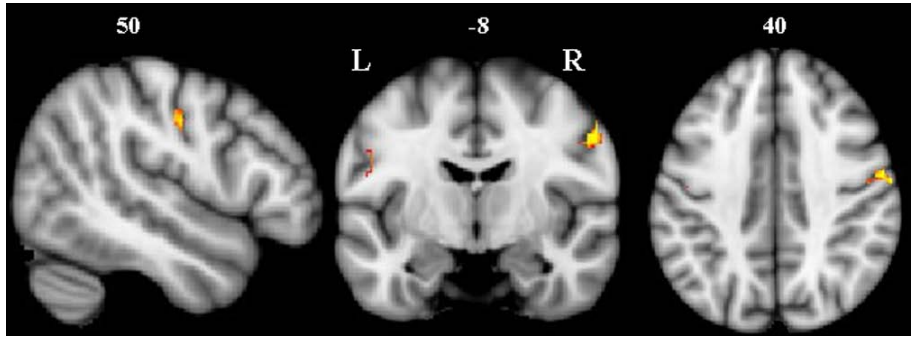
Increased FC

Reduced structural connectivity

Douaud et al., Brain 2011

Increased FC in PLS *vs* controls

Sensorimotor Network



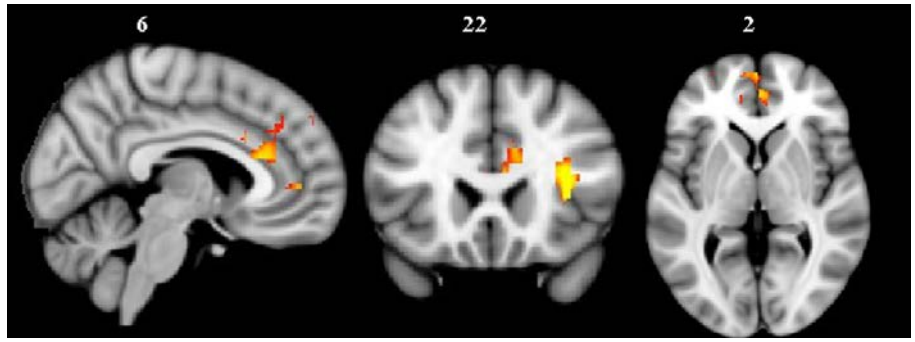
ALSFRS-R

Progr-rate

FA CC-PMC

FA CC-SMA

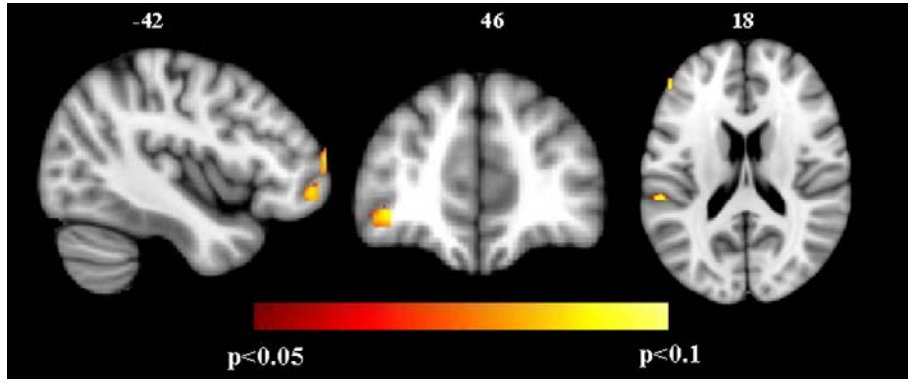
Frontal Network



Fluency

FA CC-body

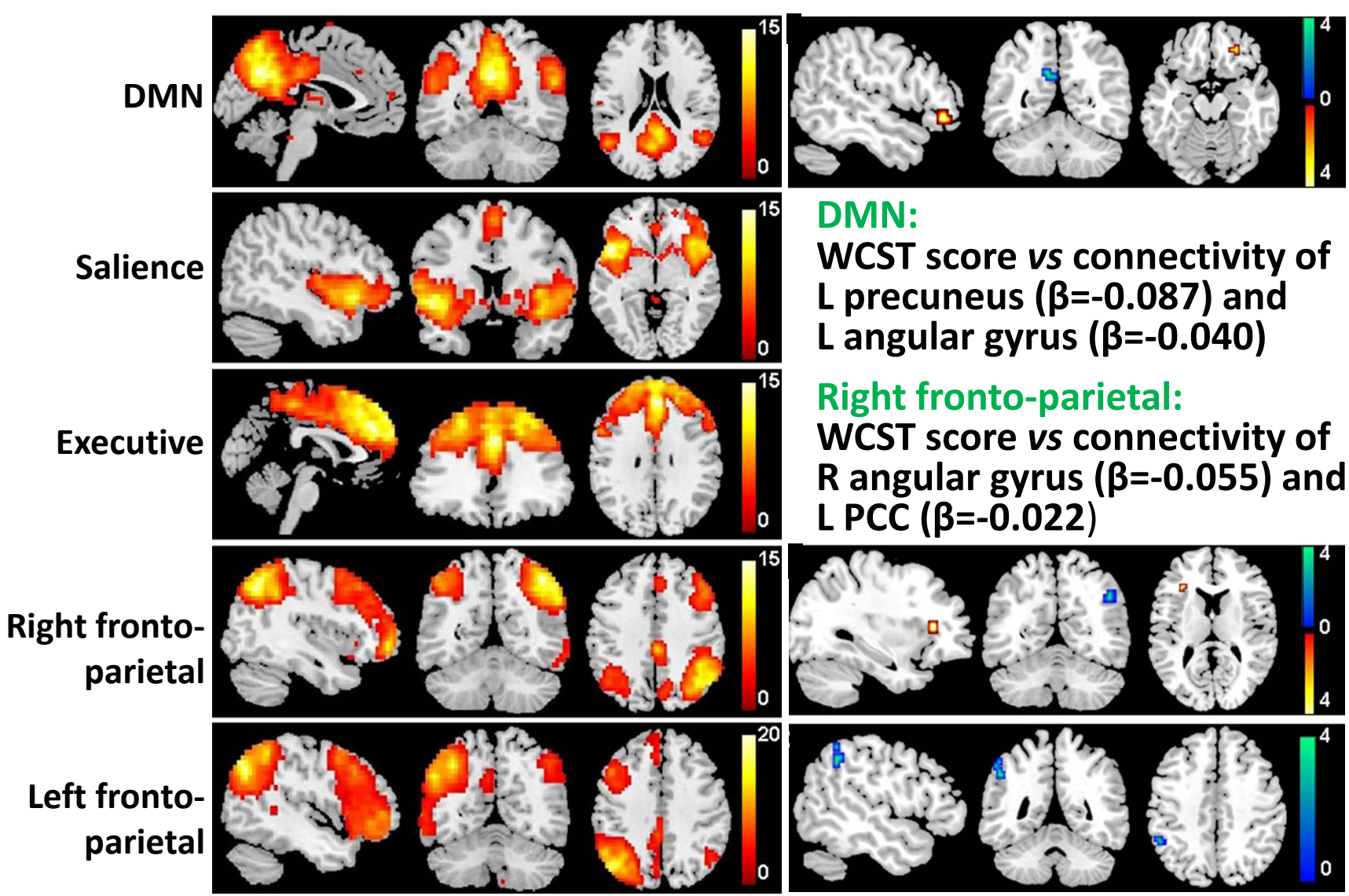
Left frontoparietal Network



Agosta et al., Neurobiol Aging 2013

MRI IN ALS

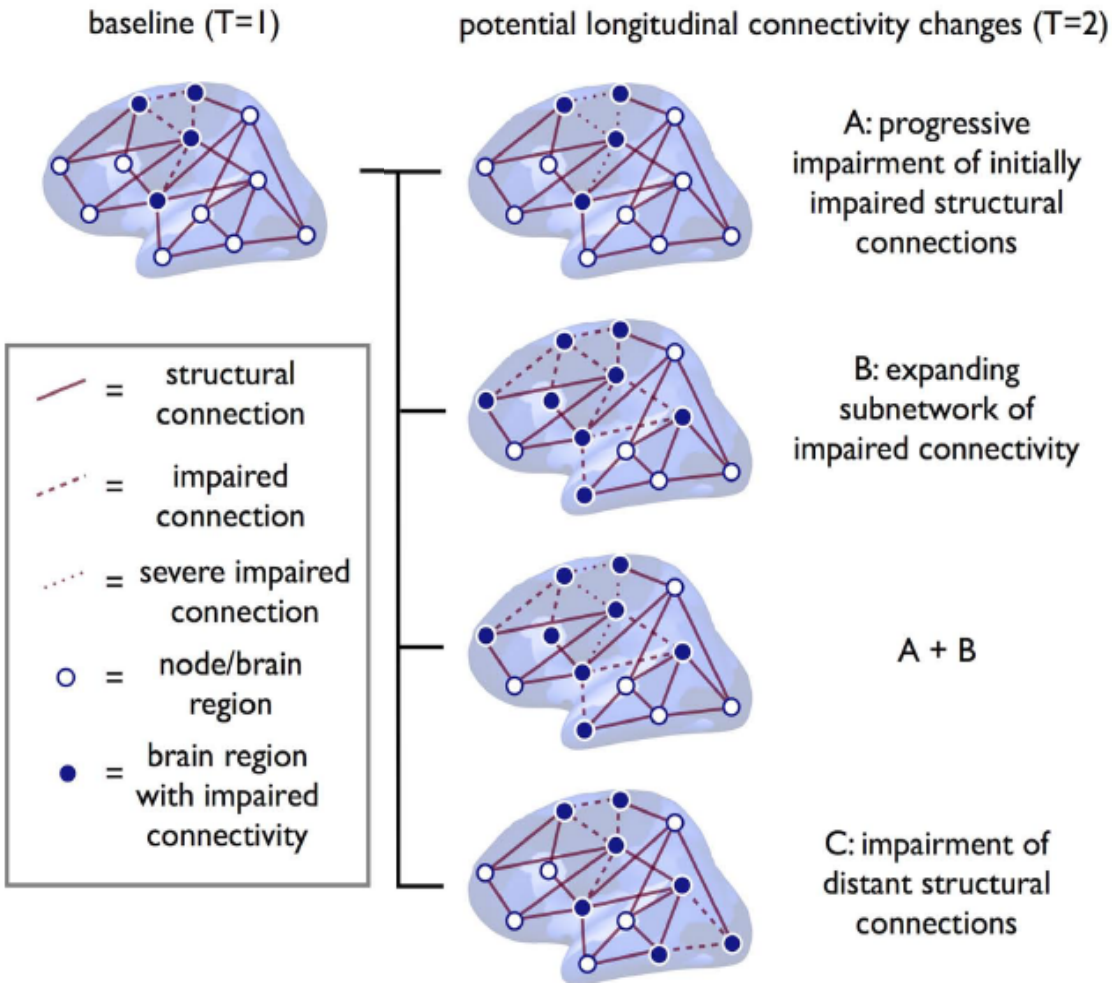
Functional connectivity



Agosta et al., Neurobiol Aging 2013

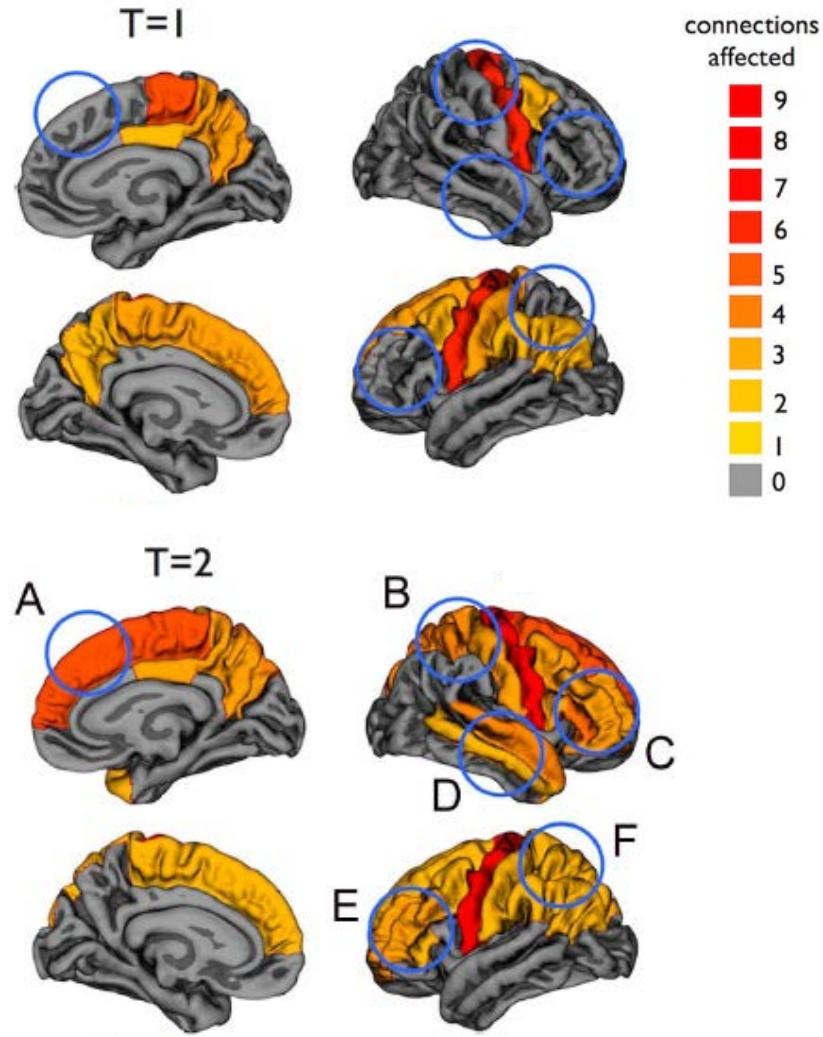
MRI IN ALS

Network analysis



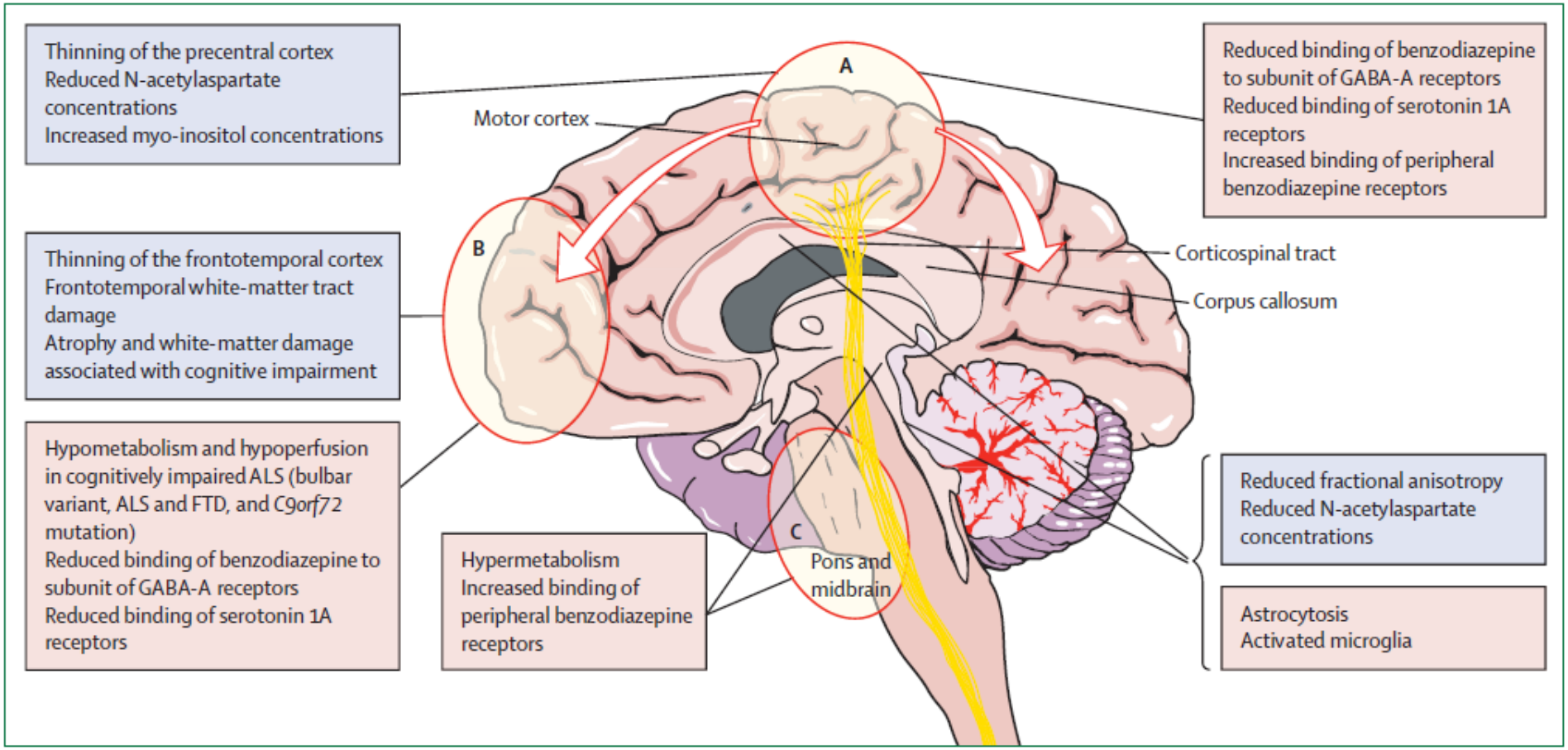
Verstraete et al., Hum Brain Mapp 2013

Affected subnetwork after 6 months



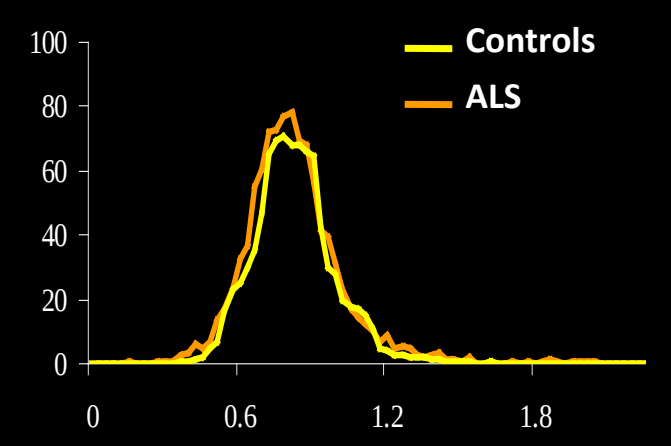
Neuroimaging in amyotrophic lateral sclerosis: insights into structural and functional changes

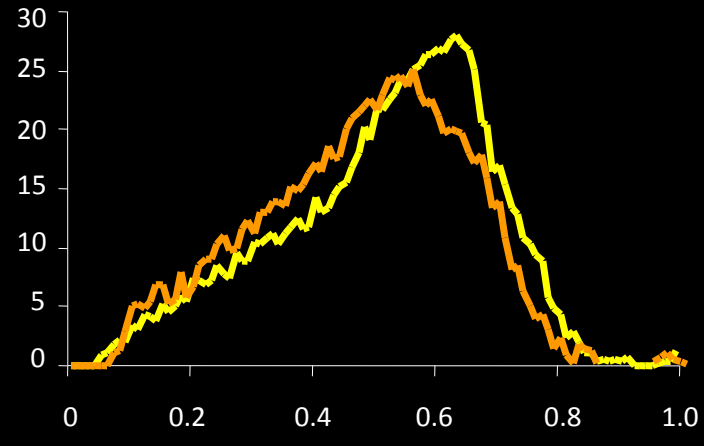
Adriano Chiò*, Marco Pagani*, Federica Agosta, Andrea Calvo, Angelina Cistaro, Massimo Filippi*
Lancet Neurol 2014; 13: 1228–40

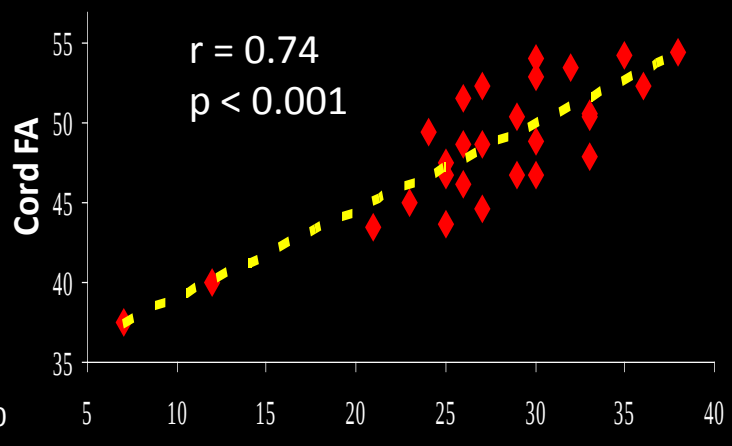


MRI IN ALS

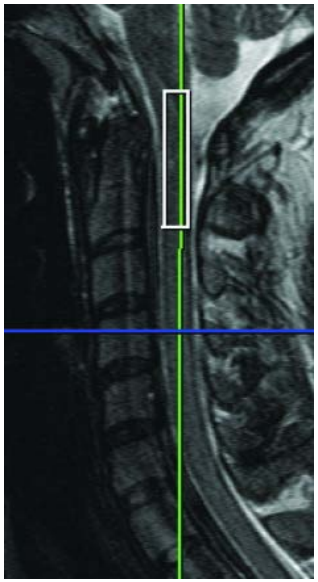
Spinal cord

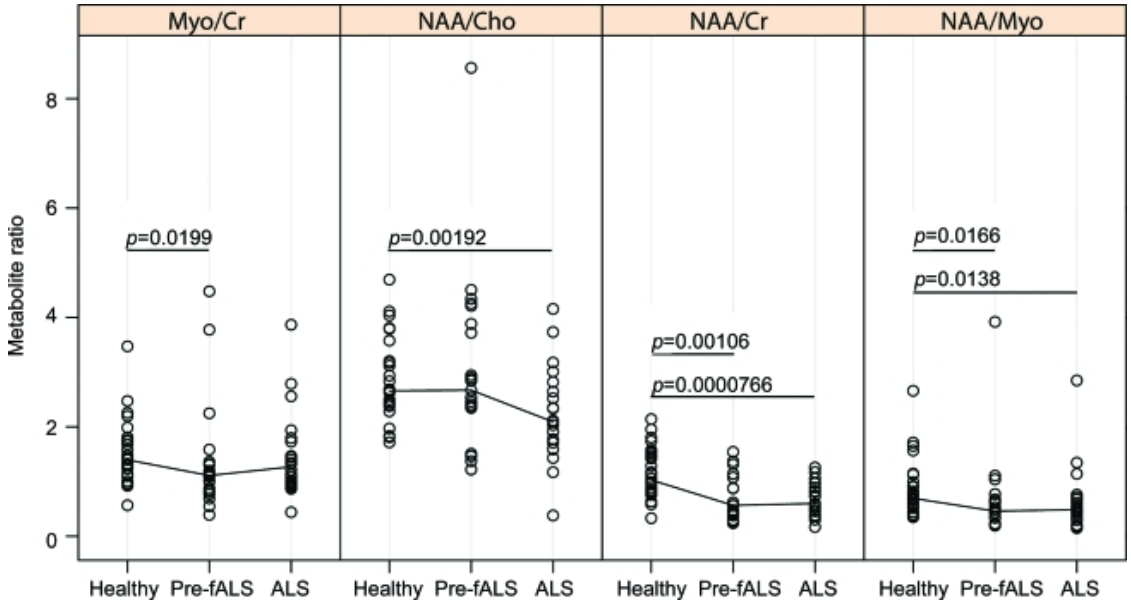


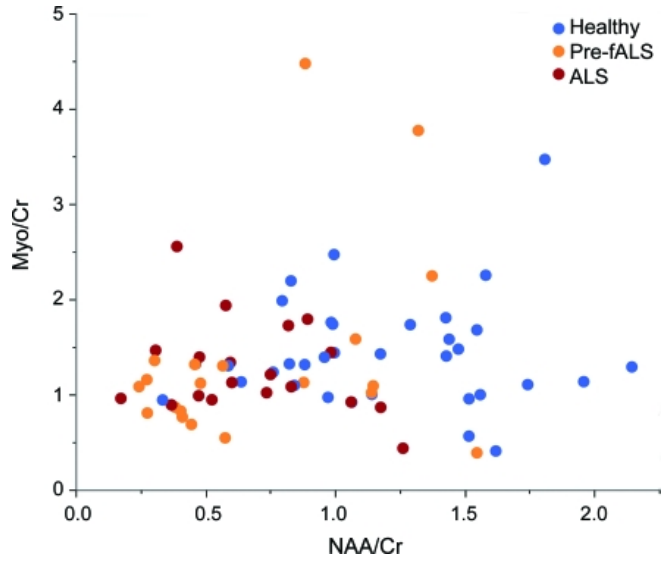




Valsasina et al., JNNP 2007







Carew et al., Neurology 2012

MRI in ALS
Peripheral NS

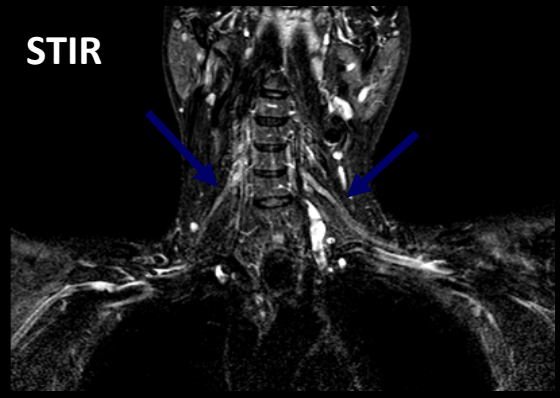
Gerevini et al., Radiology 2016

Healthy control

STIR

Nerve root increased signal

STIR



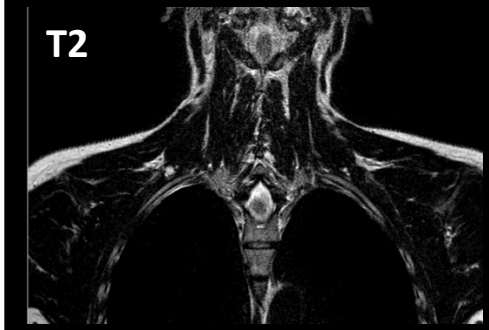
3D T2 VISTA

Nerve root T2 signal *vs* disease progression:
r = 0.40

Supraspinatus muscle edema

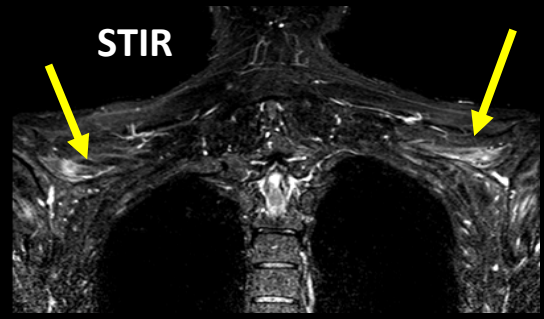
Healthy control

T2

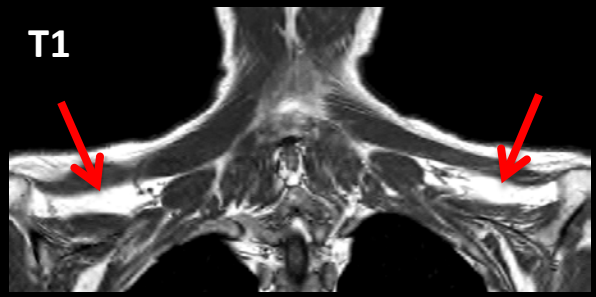


T2

STIR



T1



Adipose tissue deposition between trapezius and supraspinatus muscle

OSR

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