



XXIX CONGRESSO NAZIONALE
PALERMO, 30 SETTEMBRE • 2 OTTOBRE 2021
AULA MAGNA VINCENZO LI DONNI
UNIVERSITÀ DEGLI STUDI DI PALERMO
BEYOND THE LOCKDOWN OF THE BRAIN

Gemelli



Fondazione Policlinico Universitario Agostino Gemelli IRCCS
Università Cattolica del Sacro Cuore

The interaction between neuropsychology and the study of brain networks in neurodegenerative disorders

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Neurodegenerative dementias

- Prominent cause of disability and death in Western countries
- Increasing prevalence and incidence in developed country, connected to the progressive aging of the populations
- Strategic relevance of an early and accurate diagnosis

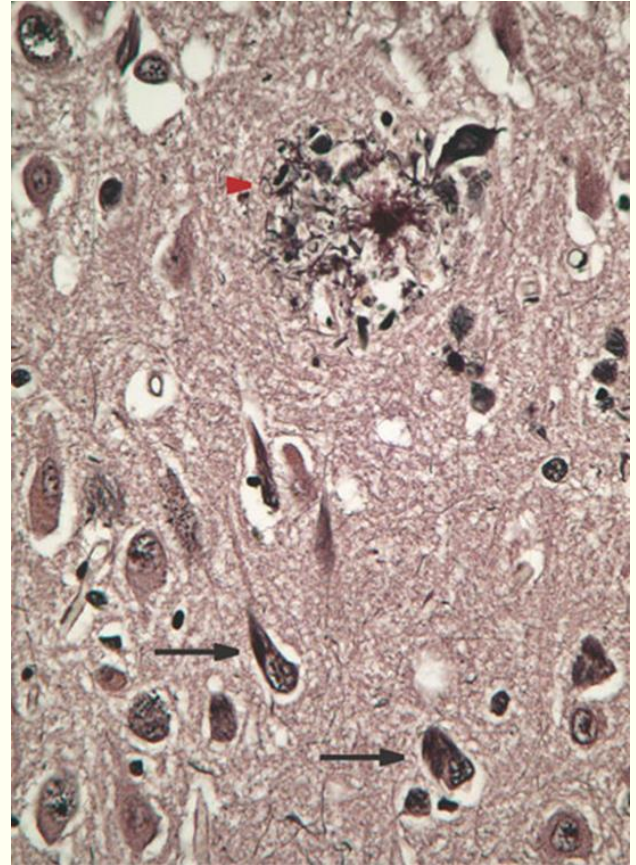
Alzheimer's Disease

- Most common form of NCD
- Clinical features (in mild-moderate phases)
 - impairment of **episodic memory**
 - language (mostly **lexical-semantic**) impairment
 - **attention** and **visuo-spatial** disturbances
 - high level **executive functions** disturbance

Alzheimer's Disease

Neuropathology

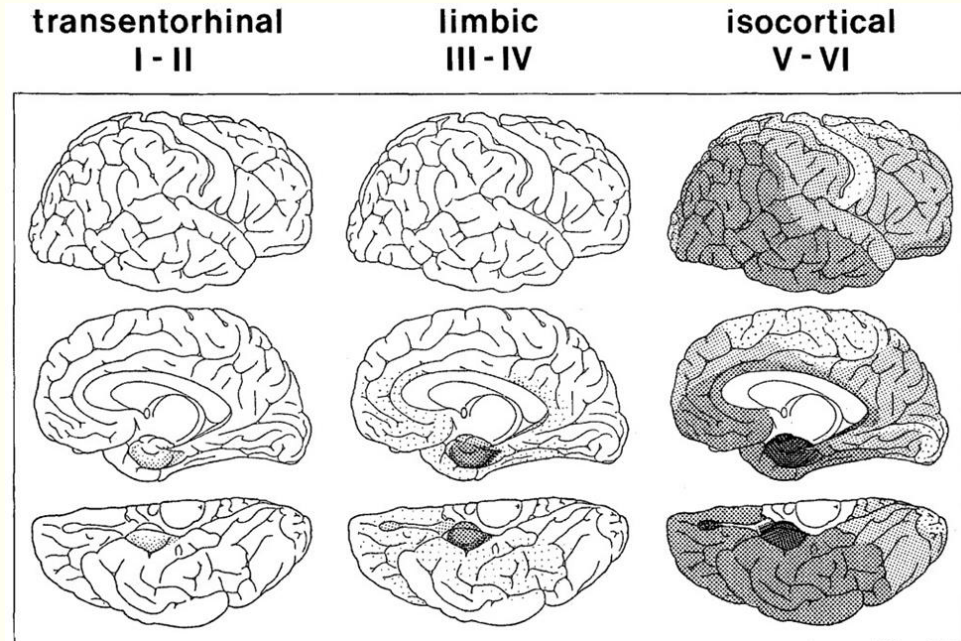
- Amyloid plaques
- Neurofibrillary tangles
- Neuronal loss



Alzheimer's Disease

Neuropathology

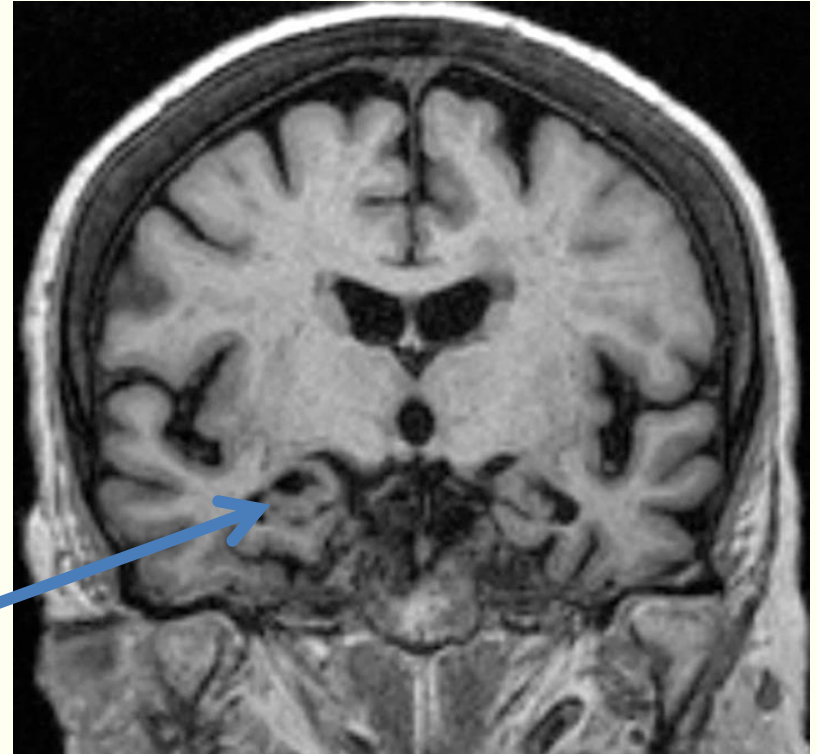
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Alzheimer's Disease

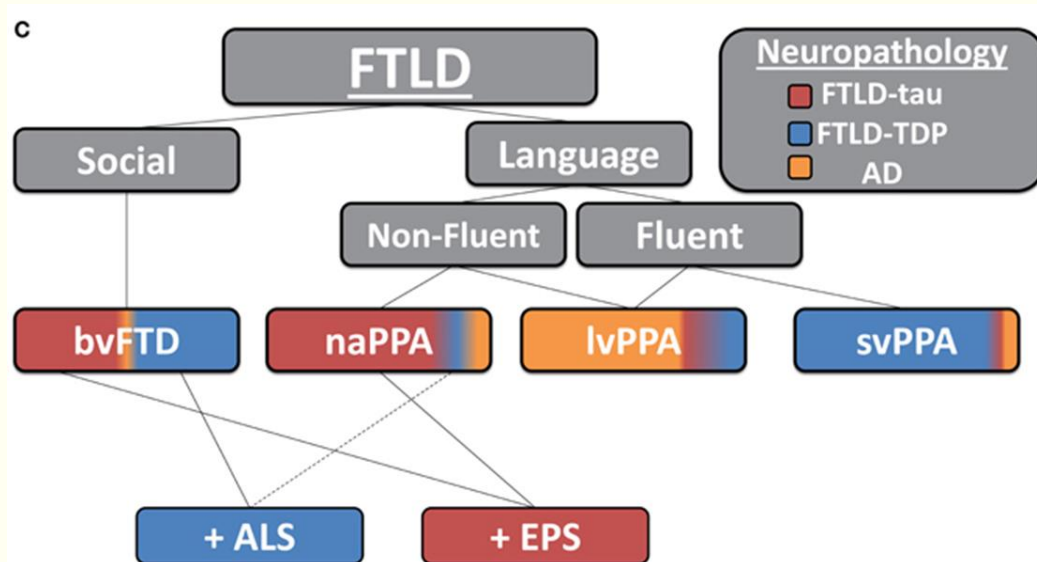
Neuropathology

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Frontotemporal Lobe Degeneration

- Second most common form of NCD in presenile population



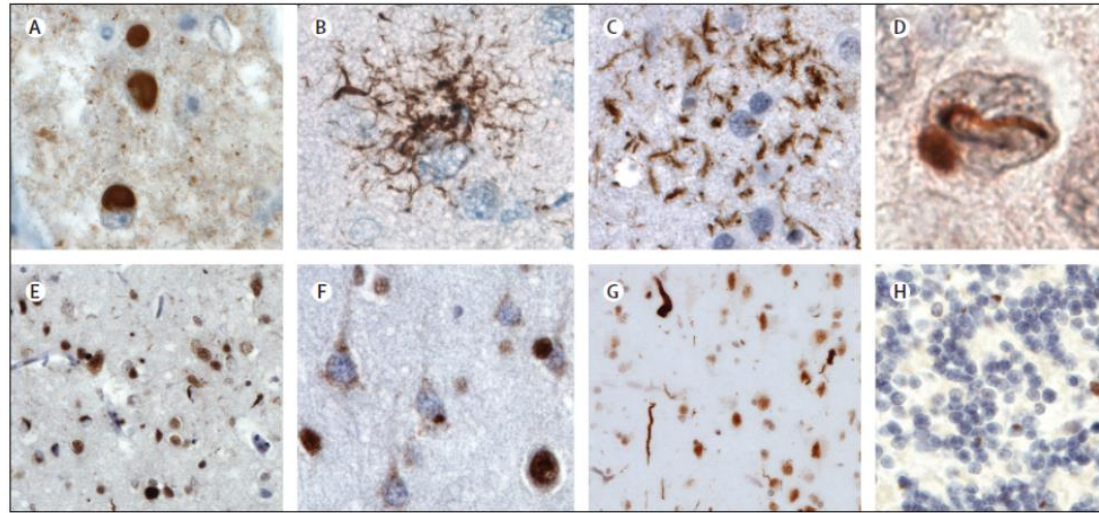
Behavioral variant of Frontotemporal Dementia

- Clinical features
 - Personality changes
 - **Apathy, reduced empathy**
 - **Disinhibition**
 - **Repetitive, stereotypical behaviors; ritualisms**
 - Prominent **executive** disturbances
 - Relative sparing of memory and visuo-spatial abilities

Behavioral variant of Frontotemporal Dementia

Neuropathology

- Different microscopic changes
- Focal atrophy of frontal and temporal lobes



Behavioral variant of Frontotemporal Dementia

Neuropathology

- Different microscopic changes
- Focal atrophy of frontal and temporal lobes



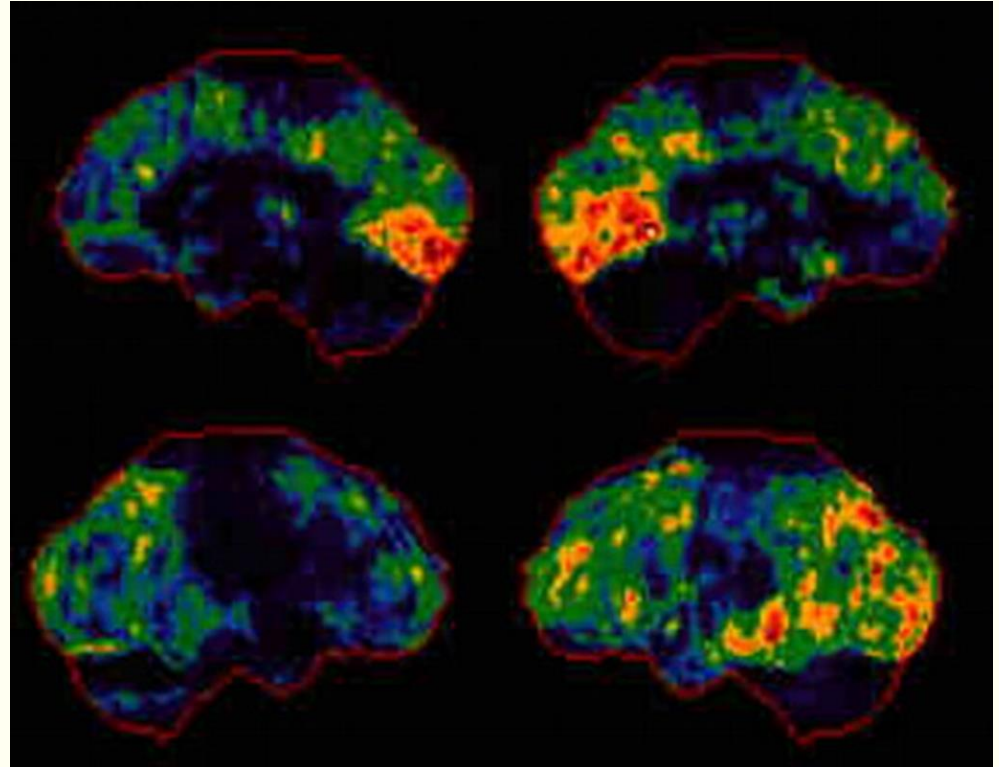
Dementia with Lewy Bodies

- Complex clinical condition characterized by motor, cognitive and autonomic disturbances
- Clinical features
 - **Fluctuations** of cognitive status and alert
 - **Visual hallucinations**
 - **Parkinsonian** signs
 - **Attention** and **visuo-spatial** disturbances

Dementia with Lewy Bodies

Neuropathology

- Alpha-synuclein deposits
- Functional changes in occipital cortex



Changes in connectivity in NCD

The classical approach to NCD is based on the correspondence between site of neuropathology and cognitive/behavioral changes.



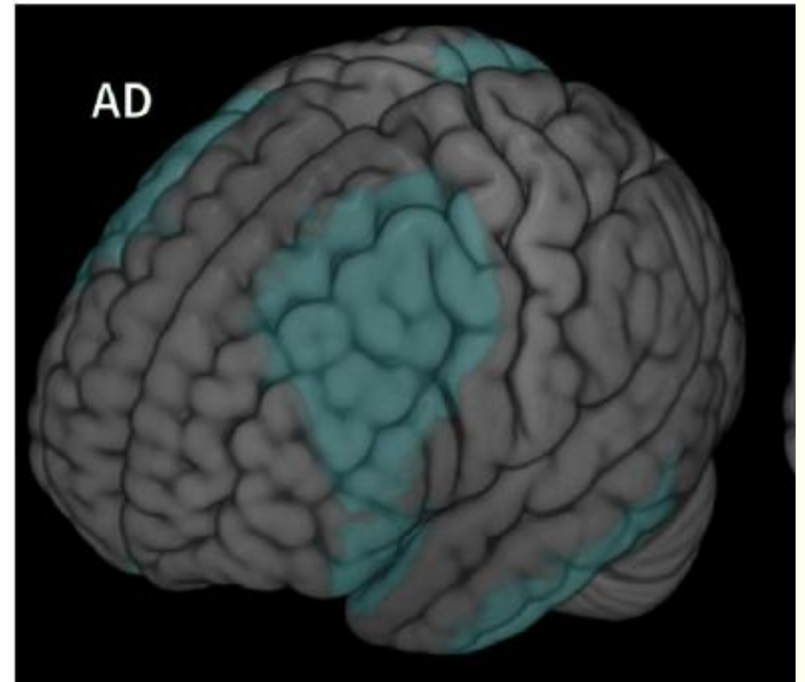
Changes in connectivity in NCD

Neurophysiological and neuroimaging evidence have indeed suggested that NCD is associated to (sustained by) significant changes in brain connectivity, varying on the basis of the underlying pathology.

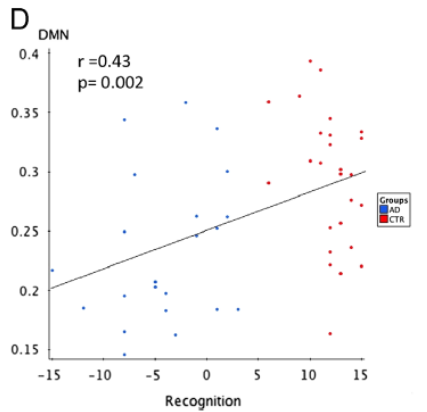
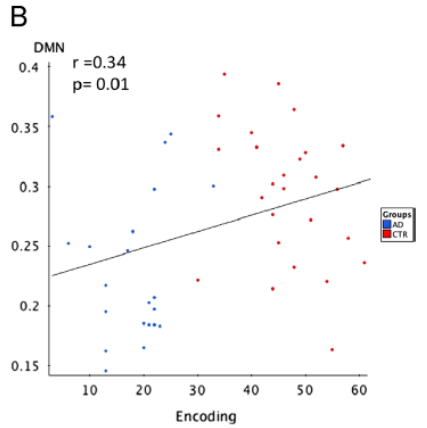
Connectivity in Alzheimer's Disease

Changes have been observed mainly in

- ↓ DMN (posterior>anterior)
- ↑ Anterior Temporal
- ↓ DAN



Connectivity in Alzheimer's Disease



Contents lists available at ScienceDirect

ELSEVIER

Psychiatry Research: Neuroimaging

journal homepage: www.elsevier.com/locate/psychresns

Psychiatry Research

Whole cortical and default mode network mean functional connectivity as potential biomarkers for mild Alzheimer's disease

Marcio Luiz Figueredo Balthazar^{a,*}, Bruno Machado de Campos^a, Alexandre Rosa Franco^b, Benito Pereira Damasceno^a, Fernando Cendes^a

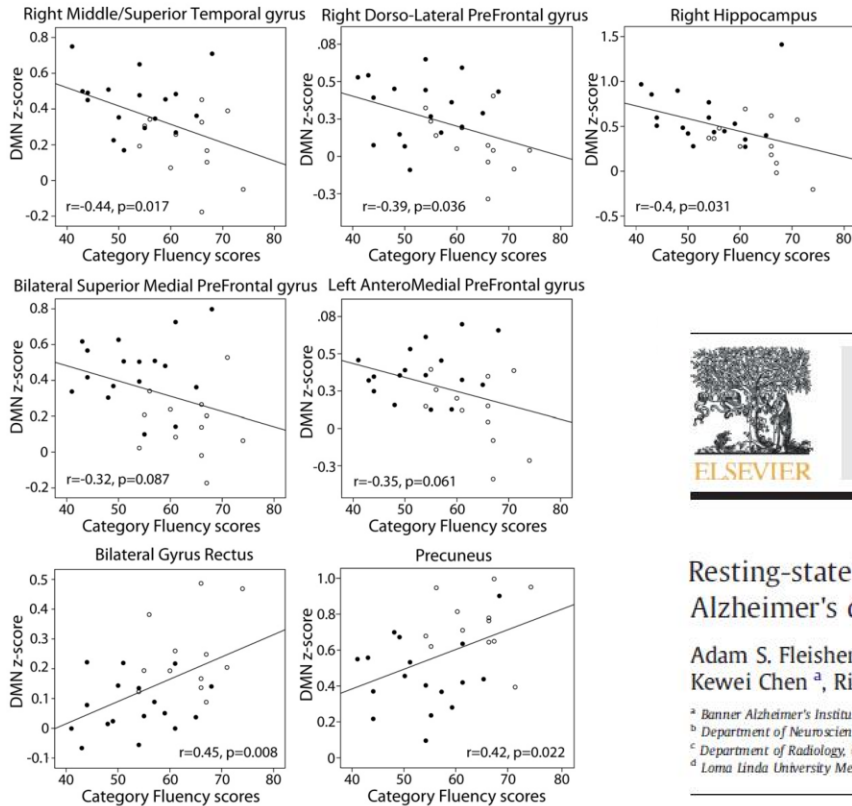
^a Department of Neurology, University of Campinas (Unicamp), Sao Paulo 13083-970, Brazil
^b Brain Institute of Rio Grande do Sul, Catholic University of Rio Grande do Sul (PUCRS), Porto Alegre, Brazil

CrossMark

Connectivity in DMN is associated with performance on tests assessing domains typically impaired in AD, such as episodic memory...

Connectivity in Alzheimer's Disease

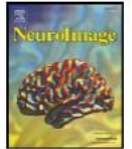
... and lexical-semantic system



Contents lists available at ScienceDirect

NeuroImage

journal homepage: www.elsevier.com/locate/ynimg



Resting-state BOLD networks versus task-associated functional MRI for distinguishing Alzheimer's disease risk groups

Adam S. Fleisher^{a,b,*}, Ayesha Sherzai^d, Curtis Taylor^b, Jessica B.S. Langbaum^a,
Kewei Chen^a, Richard B. Buxton^c

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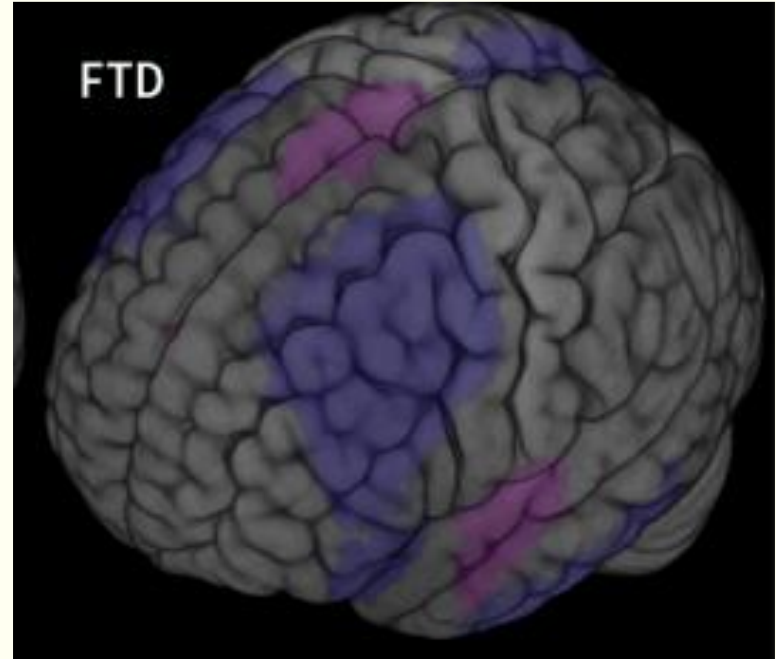
^c Department of Radiology, University of California, San Diego, USA

^d Loma Linda University Medical Center, USA

Connectivity in FTD

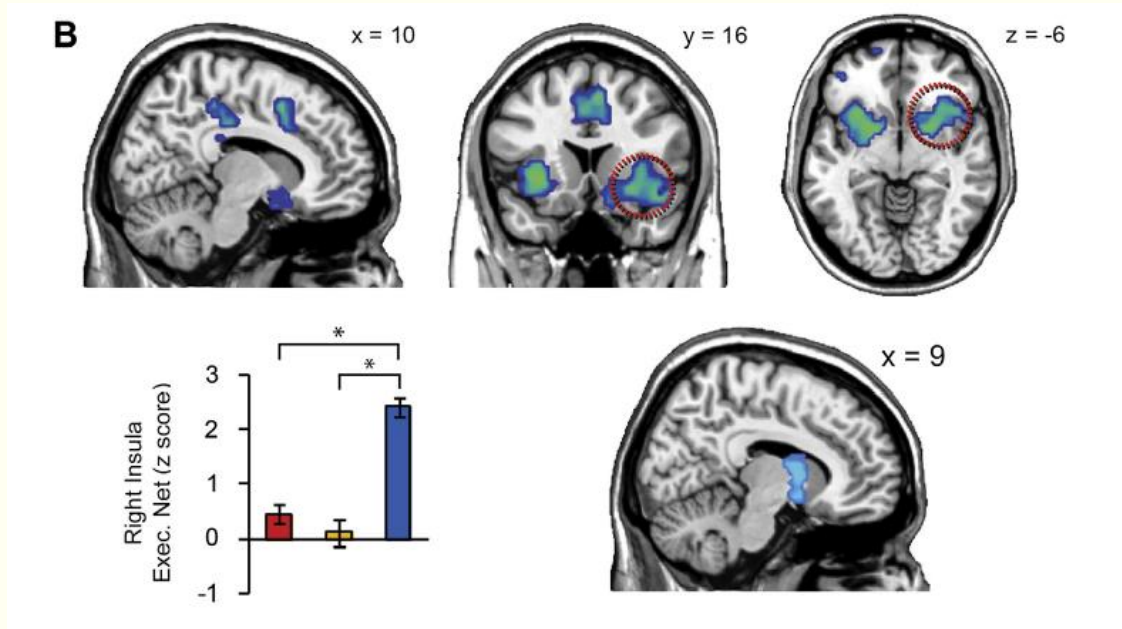
Changes have been observed mainly in

- ↓SN
- ↓↑DMN
- ↓CEN
- ↓DAN



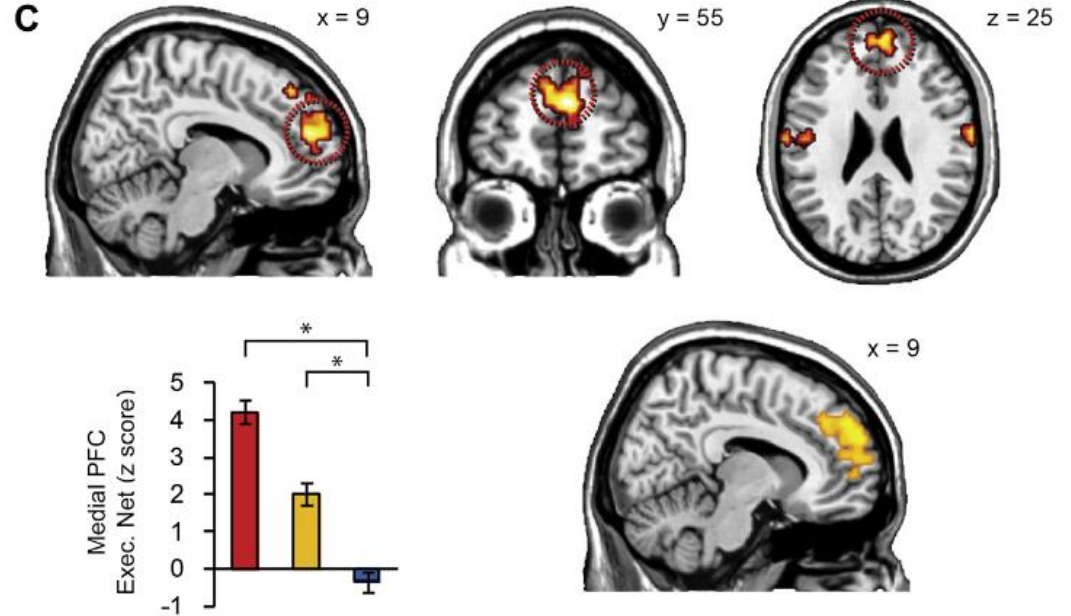
Connectivity in FTD

Changes in connectivity are associated to behavioral changes, such as apathy



Connectivity in FTD

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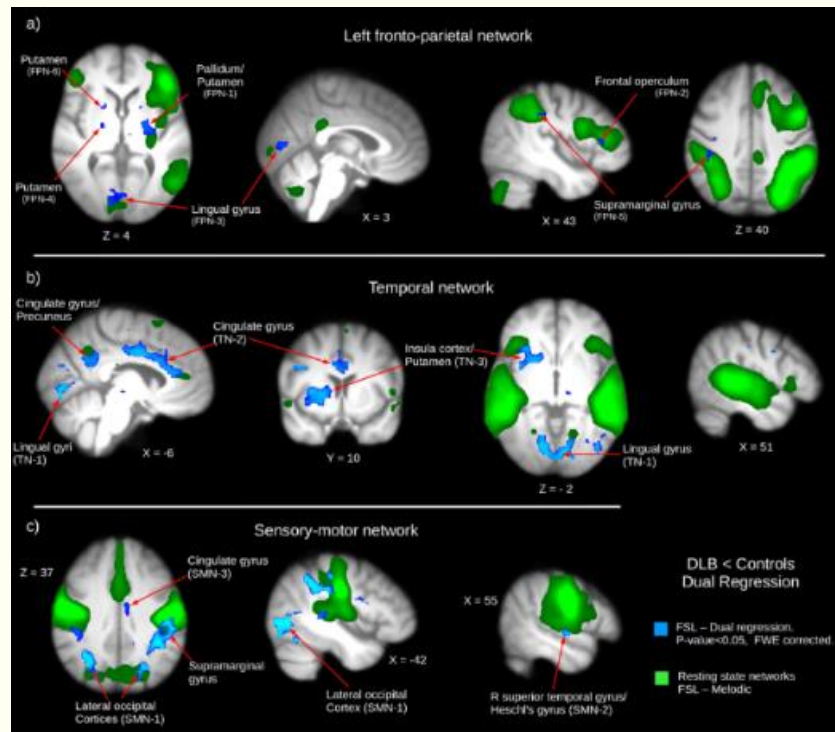


Connectivity in DLB

Changes have been observed mainly in

- ↓ Fronto-Parietal Network
- visual areas
- basal ganglia

Association with cognitive fluctuations and visual hallucinations

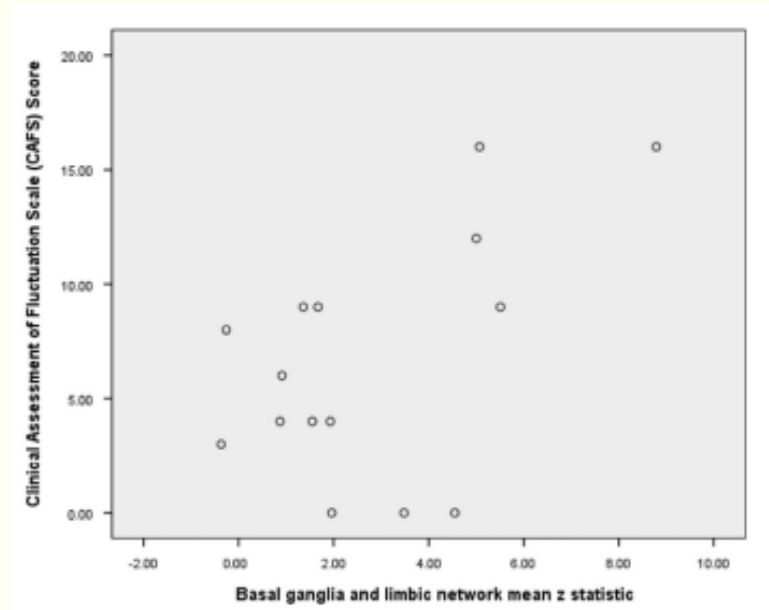
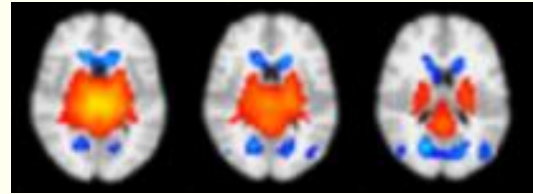


Connectivity in DLB

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Association with cognitive fluctuations and visual hallucinations



Conclusions

Changes in brain connectivity in NCD have been repeatedly reported, providing new insights on the fundamental mechanisms subsuming cognitive and behavioral disturbances.

The signature modifications of brain connectivity in NCD are revealing themselves as potentially useful in the diagnostic process and in predicting the evolution of the disease in the early phases.

Conclusions

Nevertheless, the relationships between neuropsychological performances and changes in brain connectivity are yet to be extensively studied in their clinical reliability.

The investigation of the interplay between neuropsychology and brain connectivity could prove to be useful from both the diagnostic and theoretical point of view.