# GENDER-RELATED DIFFERENCES IN FUNCTIONAL CONNECTIVITY

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## INTRODUCTION

Men and women appear to use different brain networks in memory, emotion processing, language and in decision making.

It is increasingly acknowledged that male and female gender may differentially affect neurodegenerative processes (Ferris et al., 2009),

The main purpose of the current study is to clarify how the gender influences the functional connectivity in a group of patients with Alzheimer disease (AD) and healthy controls (HC).

## MATERIALS

- 37 patients with a diagnosis of Alzheimer disease (AD)
- 22 healthy controls participants (HS)

| Group | mean age | SD age | mean education | SD education | Gender | MMSE |
|---|---|---|---|---|---|---|
| AD | *71.32 | 6.730 | * 9.02 | 4.206 | F=22 M=15 | * 18.77 |
| HS | 61.90 | 8.70 | 13.59 | 2.82 | F=10 M=12 | 29.14 |

- **Significant difference between patients AD and HS*

**Each participant underwent:**

✔ MRI at 3T (Magnetom Allegra, Siemens):
including :volumetric scan (3D Modified Driven Equilibrium Fourier Transform or MDEFT)
and a RS-fMRI series,

RS-fMRI was collected during rest for 7 min and 20 s, resulting in a total of 220 volumes. During this acquisition, participants were instructed to keep their eyes closed, not to think of anything in particular, and not to fall asleep. RS-fMRI images were pre-processed for resting-state fMRI using using Statistical Parametric Mapping 8 (SPM8 http://www.fil.ion.ucl.ac.uk/spm/) and in-house Matlab scripts. They underwent head motion correction (using the standard SPM8 realignment algorithm), compensation for slice-dependent time shifts and co-registration to the corresponding MDEFT. Each MDEFT-volume was segmented into white matter, grey matter and CSF maps using the standard SPM8 algorithm. The resulting grey matter images were used to compute each participants total grey matter volume. Segmentation derived normalization parameters were used to warp the motion and slice-time corrected RS-fMRI images into Montreal Neurological Institute (MNI) coordinates. In house software was used to remove the global temporal drift using a 3rd order polynomial fit. Data were then filtered by regressing out movement vectors, and the average white matter and cerebrospinal fluid signal. The resulting images were then filtered using a phase-insensitive band-pass filter (pass band 0.01– 0.08 Hz) to reduce effects of low frequency drift and high frequency physiological noise then smoothed with an 8 $mm^3$ FWHM 3D Gaussian Kernel.

✔ an extensive neuropsychological assessments evaluating several cognitive domains (data not shown)

## PREPROCESSING & DATA ANALISYS

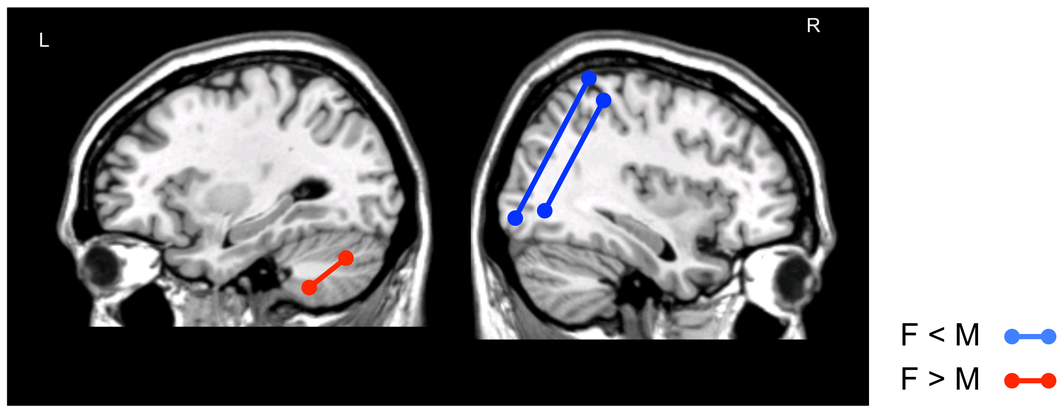
- RS-fMRI images were processed using the Graph theory:
- The network-based statistics (NBS) approach (Zalesky et al., 2010) was applied with the purpose to detect gender-related differences of inter-nodal functional connectivity in both groups (patients and controls).
- This approach allows any significant difference in all the possible pairwise association to be detected.
- Between-group comparisons were performed by two independent two-sample t-tests, setting 3000 permutation-tests (statistical threshold: p-values<0.05).

## RESULTS

➢ 1. when looking at the gender effect in the **HC group:**

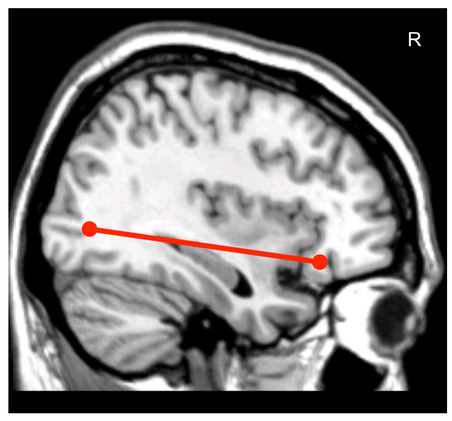
➢ stronger connectivity was found between parieto-occipital regions of males compared to females in the right hemisphere

➢ stronger cerebello-cerebellar connections were found in females in the left hemisphere.




➢ 2. in **AD** patients we observed a different pattern of connectivity:

➢ stronger connectivity was found in the fronto-occipital connections in females compared to males in the right hemisphere.




## CONCLUSIONS

- This study confirms that different patterns of brain connectivity exist in males and females.
- it suggests that the accumulation of AD pathology may differently impact on male and female brains.
- This is an interesting aspect that deserves to be further evaluated as a relevant source of the inter-subject variability in response to brain accumulation of AD pathology.

## REFERENCES

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