THE EVOLUTION OF THE HIPPOCAMPUS SUBFIELDS VOLUME ACROSS LIFESPAN IN HEALTHY AGING

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INTRODUCTION

- The hippocampus plays an important role in memory consolidation and spatial memory.
- Importantly, the progressive degeneration of the hippocampus and its subfields across the adult lifespan is presently not well characterized.

GOAL :
To evaluate and identify volumetric modifications in hippocampal subfields during healthy aging.

METHODS

- **Participants** : 180 healthy subjects (ages 18-81).
- **Segmentation :** T2-weighted images (0.64 mm^3 voxels) and the MAGeT Brain algorithm[1,2].
- **Analyses** : General linear models and Akaike information criterion were used to select the most probable age relationships from multiple fits (e.g. linear, quadratic, cubic) and a Bonferroni correction was applied at a $p<0.05$ threshold for significance. Analyses included sex, years of education, and APOE4 status as covariates.

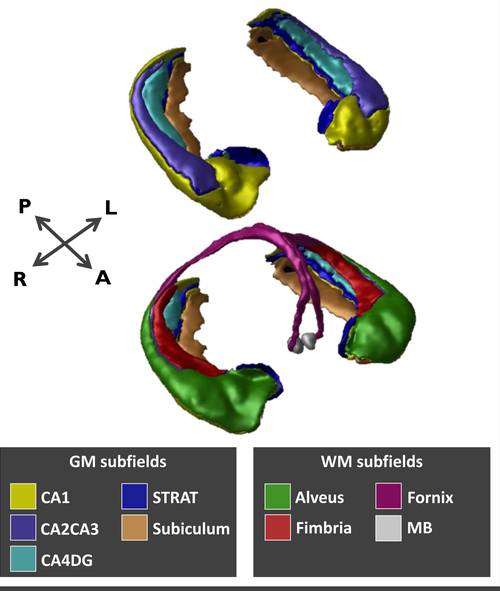

Figure 1 : 3D reconstruction of hippocampal subfields[2] and extra-hippocampal white matter[3] atlases.

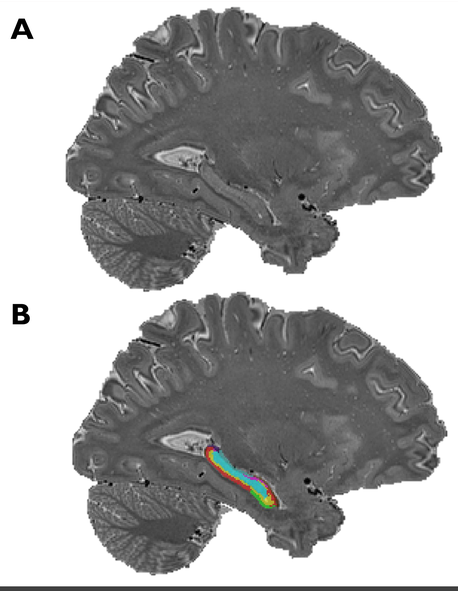

Figure 2 : T2-weigted image **A)** without segmentation and **B)** with MAGeT sementation of the hippocampus (transversal slice).

RESULTS

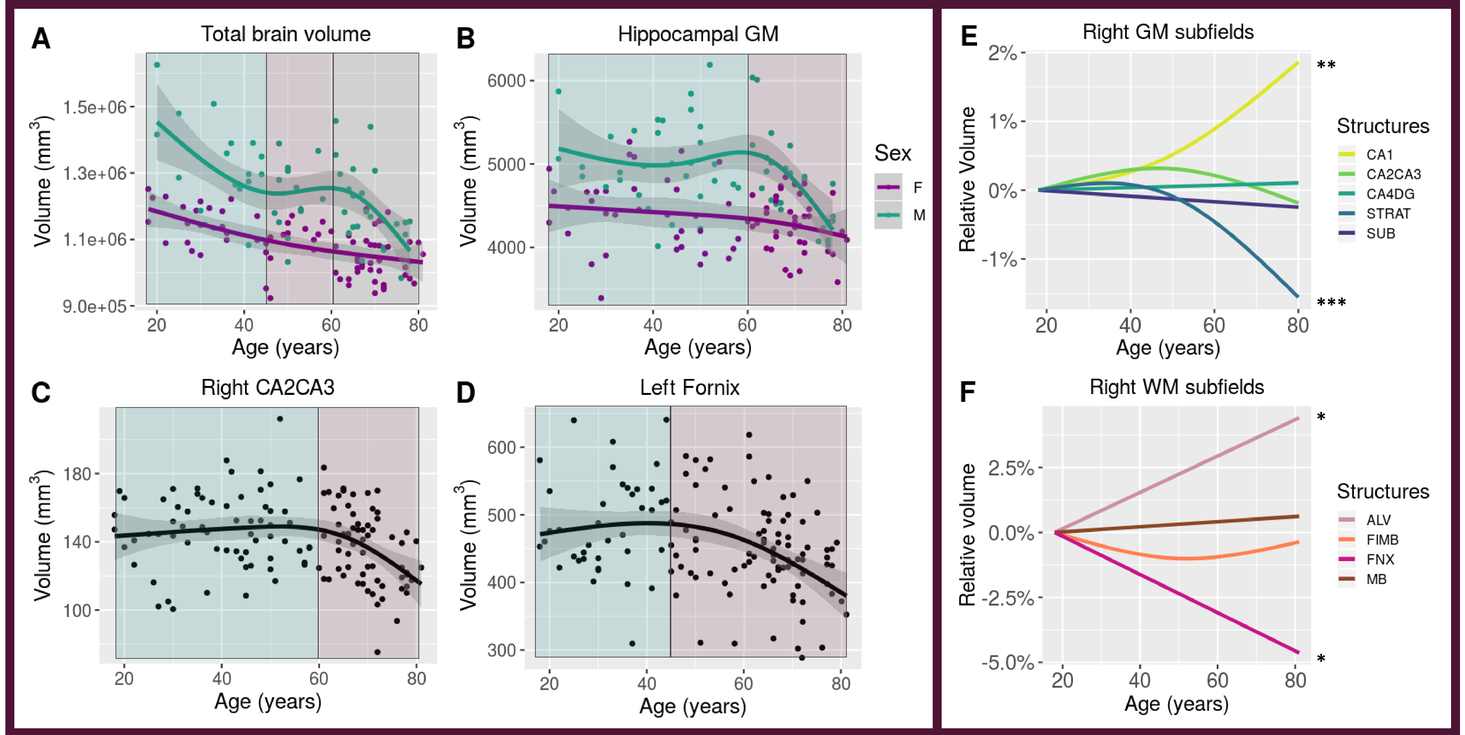

Figure 3 : Evolution of the ROI volume across age. **A)** A cubic Age*Sex interaction was found for the total brain volume ($p= 0.0033$), males demonstrated a triphasic evolution; **B)** A cubic Age*Sex interaction was found for the hippocampus GM ($p=0.039$; same results for the hippocampus WM $p=0.012$ - data not shown), males demonstrated a biphasic evolution; **C)** A biphasic quadratic Age effect was found for the right CA2CA3 with an inflexion point around 60 years old ($p=0.00034$, same evolution for the right Stratum, $p=0.000001$ - data not shown); **D)** A biphasic quadratic Age effect was found for the left Fornix with an inflexion point around 45 years old ($p=0.0001$, same evolution for the left CA2CA3, Subiculum, Stratum and right Fornix; $p=0.000076$, $p=0.0032$, $p=0.00023$ and $p=0.0061$ respectively - data not shown); **E)** Evolution of the right hippocampus GM subfields normalized by the Right hippocampal GM volume. Quadratic relationship with age were found for the CA1 and the Stratum ($p=0.00054$ and $p=0.00075$; same evolution for the left CA1, Stratum and CA2CA3 normalized by the Left hippocampal GM volume ($p=0.00005$, $p=0.015$ and $p=0.033$ respectively - data not shown); **F)** Evolution of the right hippocampus WM subfields normalized by the right hippocampal WM volume. Linear relationship with age were found for the Alveus and the Fornix ($p=0.36$ and $p=0.037$; same evolution for the left Alveus and Fornix normalized by the left hippocampal WM volume ($p=0.018$ and $p=0.016$ - data not shown). * $p<0.05$, ** $p<0.01$ and *** $p<0.001$ after Bonferroni correction.

CONCLUSION

Females and males don't show the same evolution of volumes with age. Some subfields volumes such as the right CA2CA3 and Stratum start to decrease at 60 years of age, while the left CA2CA3, Stratum, Fimbria, Subiculum and the bilateral fornix start to decrease at 45 years of age. The CA1 and the Alveus are billaterally preserved while the Stratum and the Fornix are billaterally impaired with healthy aging.

[1]Chakravarty et al. Human Brain Mapping 34(10), 2635-2654 (2013); [2]Pitipone et al, Neuroimage 101, 494-512 (2014); [3]Winterburn et al, Neuroimage 74, 254-265 (2013); [4]Amaral et al, Neuroimage170, 132-150 (2018)