## ANTERIOR-TO-POSTERIOR HIPPOCAMPAL METABOLIC HETEROGENEITY IN HEALTHY ELDERLY AND YOUNG ADULTS USING 3D 1H MR SPECTROSCOPY

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**<u>Purpose</u>**: To quantify the proton MR spectroscopy-detectable metabolite concentrations along the anterior-posterior axis of the hippocampus in healthy young and elderly human subjects.

<u>Materials and Methods</u>: Twelve healthy volunteers, 6 'young' (3 women, 25-35 years old) and 6 'elderly' (4 women, 68-72 years old) were enrolled. They underwent MRI and 3D multivoxel, (0.5 cm)<sup>3</sup> spatial resolution, proton MR spectroscopic imaging (<sup>1</sup>H-MRSI) at 3T. In each subject, the volume of interest was centered on and tilted parallel to the anterior-posterior plane of the hippocampus. Absolute concentrations of N-acetylaspartate (NAA), choline (Cho) and creatine (Cr) were obtained in each voxel with phantom replacement.

Results: The NAA, Cr, and Cho concentrations in the posterior of the hippocampus were significantly higher in the young  $(13.2\pm1.0,$ 7.4±0.8 and  $2.1\pm0.3$  mM) than the elderly  $(9.0\pm1.0,$ 5.8±0.8 and 1.8±0.3 mM) and in both groups higher than the anterior (p<0.05). These posterior-toanterior metabolic gradients also differed between age groups: NAA decreased faster in the young, -1.0 mM/cm, than the elderly: -0.7 mM/cm, but Cr and Cho decreased faster in elderly: -0.8 and -0.058 mM/cm,

-0.8 and -0.058 mM/cm, than -0.16 and -0.008 mM/cm, respectively, in the young. No left-right metabolic differences were found.

## Conclusion: A

significant metabolic heterogeneity is observed between young and old and along the anteriorposterior axis of the healthy hippocampus in both age groups. These underscore the



Fig 1. Top: Real part of the 18LR×14AP axial matrix of 1H spectra in the VOI. Spectra represent 0.125 cm3 voxels and all share the same 1.6 - 3.7 ppm and intensity scales. Note the SNR and spectral resolution achieved in 25 minutes. Center: Sample voxels marked "1" and "2" from the right and left hippocampi in the matrix above expanded for detail; Above: raw spectra (solid thin curve) overlaid with the metabolite fitted function (dashed thick curve), note the SNR and resolution; Below, raw spectra minus the fit. Note that only noise is left indicating the fit quality.

Bottom: Axial metabolic maps of NAA, Cr, and Cho, obtained from the above spectra. Note the excellent correspondence between the metabolic images and the morphology on the MRI, reflecting the overall quality of the spectra and the localization.

importance of age-matching and that consistent voxel placement is important for correct comparisons of both absolute metabolic levels and metabolite ratios in (a) longitudinal intrasubject; and (b) inter-subject cross-sectional studies.

## References

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temporal lobe superimposed with the anterior-posterior 1H-MRS localization grid regional partitions (0.5 cm apart). Bottom: Plots of the means (boxes) and SEM (bars) of the NAA, Cr, and Cho concentration versus the hippocampal region corresponding to the schematic above. The young (N=6) are indicated with solid boxes, the elderly (N=6) with open ones. Solid and dashed lines on each plot are linear regressions of the corresponding absolute metabolite concentration versus hippocampus region in the young and elderly, respectively. Note the overall decline in all concentrations towards the anterior and the difference in these declines rates between young and healthy elderly.