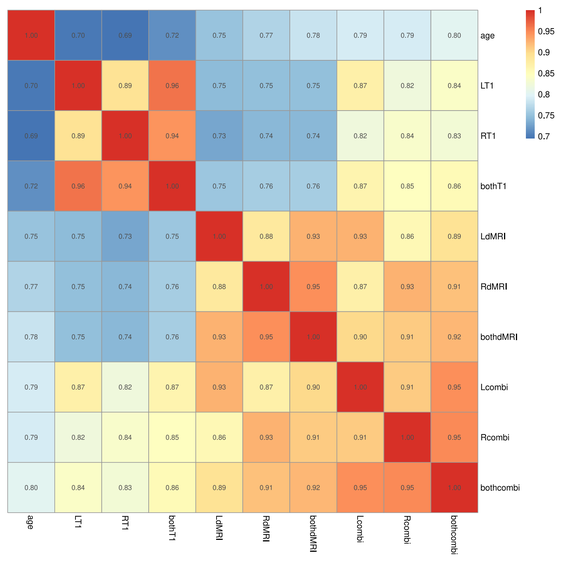
Regional grey and white matter asymmetry decreases at higher ages.

Brain asymmetries from midlife to old adulthood: hemispheric brain age

Background: The brain demonstrates various age-sensitive asymmetries. Yet, a systematic mapping of grey and white matter asymmetries from midlife to old adulthood is still missing.
Method: We hence present brain asymmetries from multimodal magnetic resonance imaging (MRI) UK Biobank (N > 39,500) data using the laterality index (LI). We furthermore show how to leverage brain asymmetries by estimating hemispheric brain age (HBA) from the left/right hemispere instead of the whole brain.

Result 1: Left, right, and whole-brain age predictions are strongly correlated across modalities and show similar prediction errors.

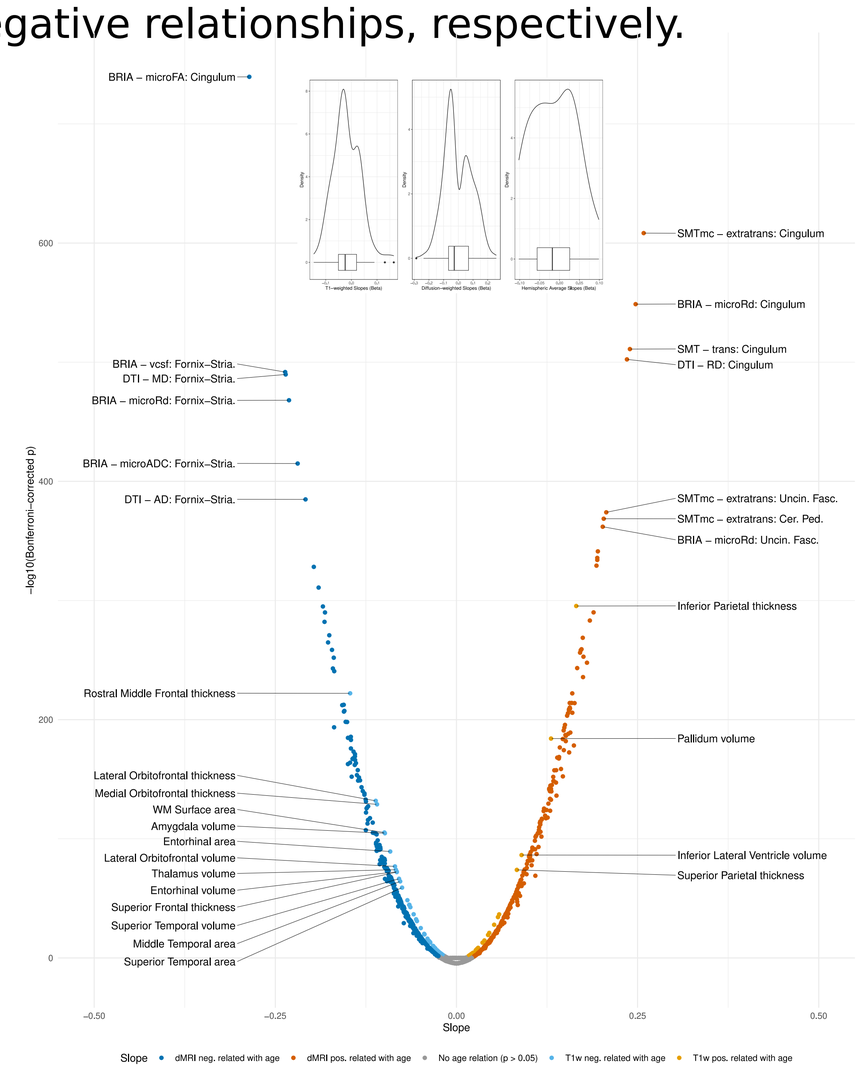


Left (L), Right (R), T1-weighted MRI (T1), diffusion MRI (dMRI), multimodal MRI (combi)

Model	Features	Variance explained	Mean Abs Error	Root Mean Sqrd Error	Pearson's r
Left T1w	117	0.504 (0.010)	4.389 (0.054)	5.472 (0.061)	0.708 [0.703, 0.712]
Right T1w	117	0.492 (0.008)	4.439 (0.049)	5.529 (0.051)	0.705 [0.700, 0.709]
T1w	234	0.526 (0.011)	4.294 (0.050)	5.356 (0.062)	0.725 [0.721, 0.730]
Left dMRI	840	0.568 (0.014)	4.000 (0.047)	4.990 (0.067)	0.757 [0.753, 0.762]
Right dMRI	840	0.582 (0.013)	3.960 (0.052)	4.967 (0.079)	0.766 [0.762, 0.771]
dMRI	1680	0.605 (0.010)	3.867 (0.059)	4.821 (0.094)	0.781 [0.777, 0.785]
Left multimodal	957	0.630 (0.009)	3.757 (0.046)	4.673 (0.047)	0.794 [0.790, 0.797]
Right multimodal	957	0.634 (0.014)	3.723 (0.073)	4.673 (0.092)	0.794 [0.791, 0.798]
Multimodal	1914	0.628 (0.017)	3.663 (0.055)	4.563 (0.077)	0.793 [0.789, 0.797]

Result 2: We find no significant influence (p > 0.05) of hemisphere, modality or handedness on HBA, but age-sensitivity of the HBA asymmetry. Finally, we show that various cardiometabolic risk factors concordantly relate to HBA (see preprint).

Result 3: *Grey and white matter become generally more symmetric at higher ages.* Fornix-striaterminalis microstructure and frontal grey matter thickness LI presented strongest negative age-assocations, and cingulate microstructure and inferiorparital thickness LI strongest negative relationships, respectively.



Conclusion: Our findings emphasise age-dependencies in regional and whole-brain asymmetries. HBA can be used to assess brain health specific to a single hermisphere, and asymmetries in HBA capture the general trend of decreasing brain asymmetry.

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Preprint coming out soon!