

A transformative resource: early outcomes from use of the UK Biobank brain imaging data

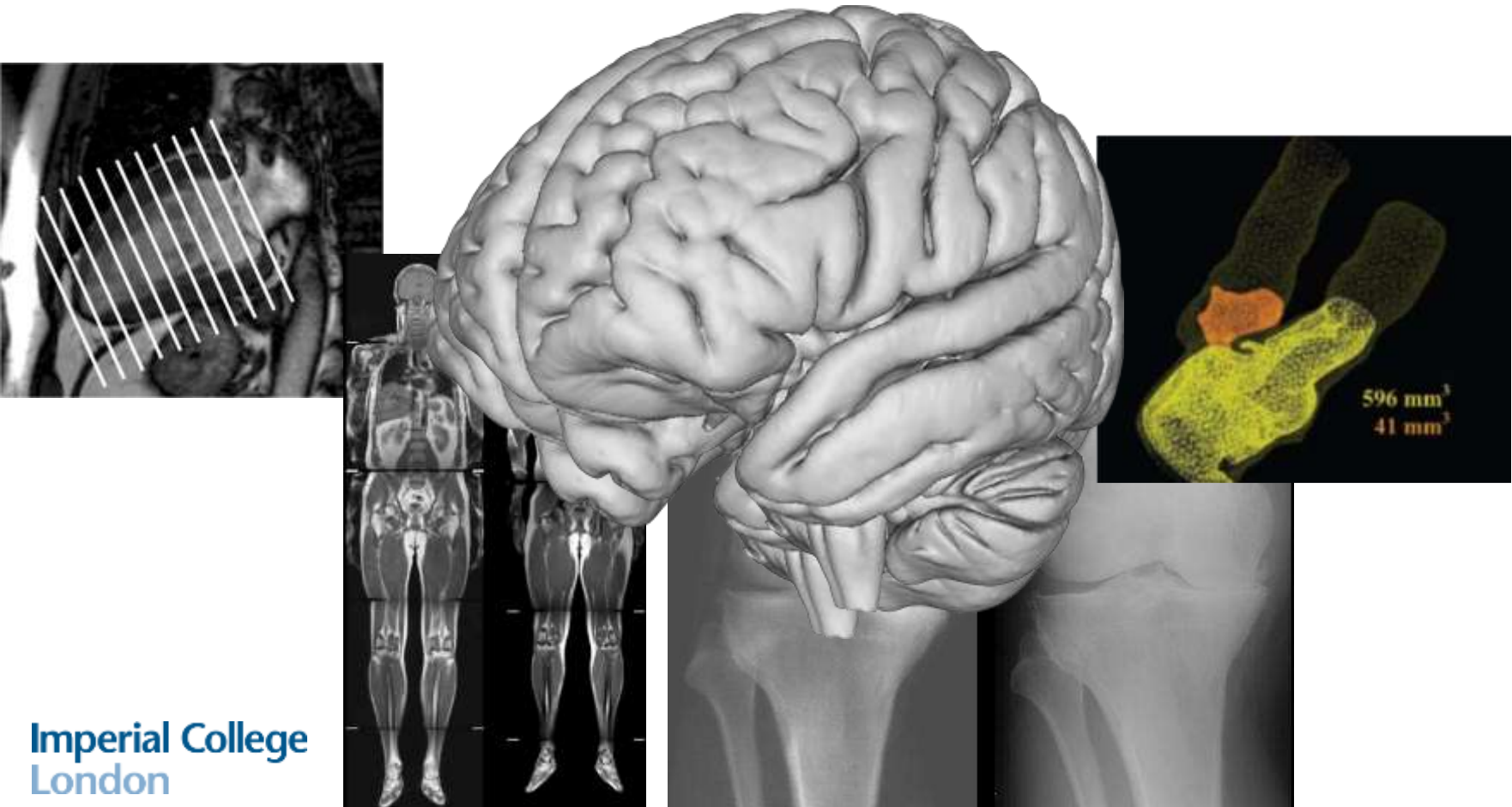
Paul M. Matthews, MD, DPhil, FMedSci

Chair, Imaging Working group, UK Biobank; Edmond and Lily Safra Chair, Head, Division of Brain Sciences and Associate Director, UK Dementia Research Institute at Imperial College London

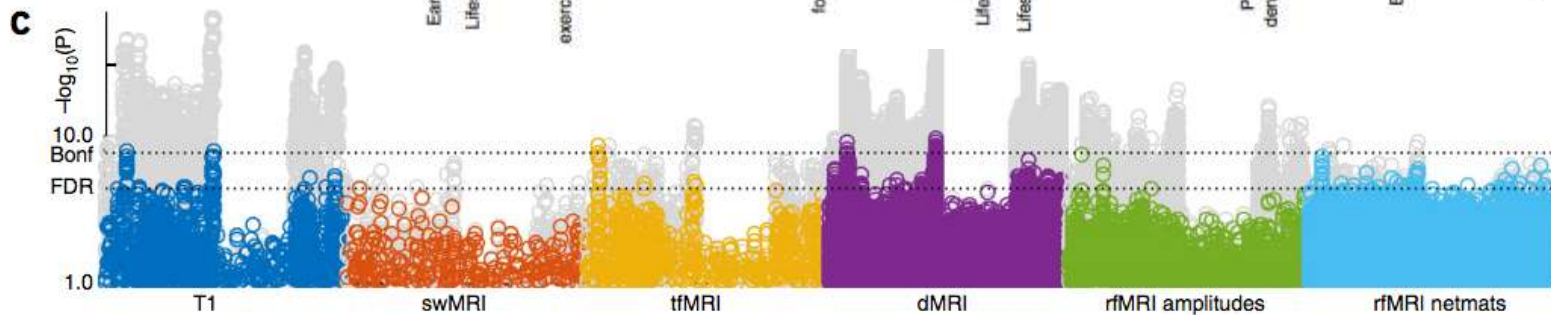
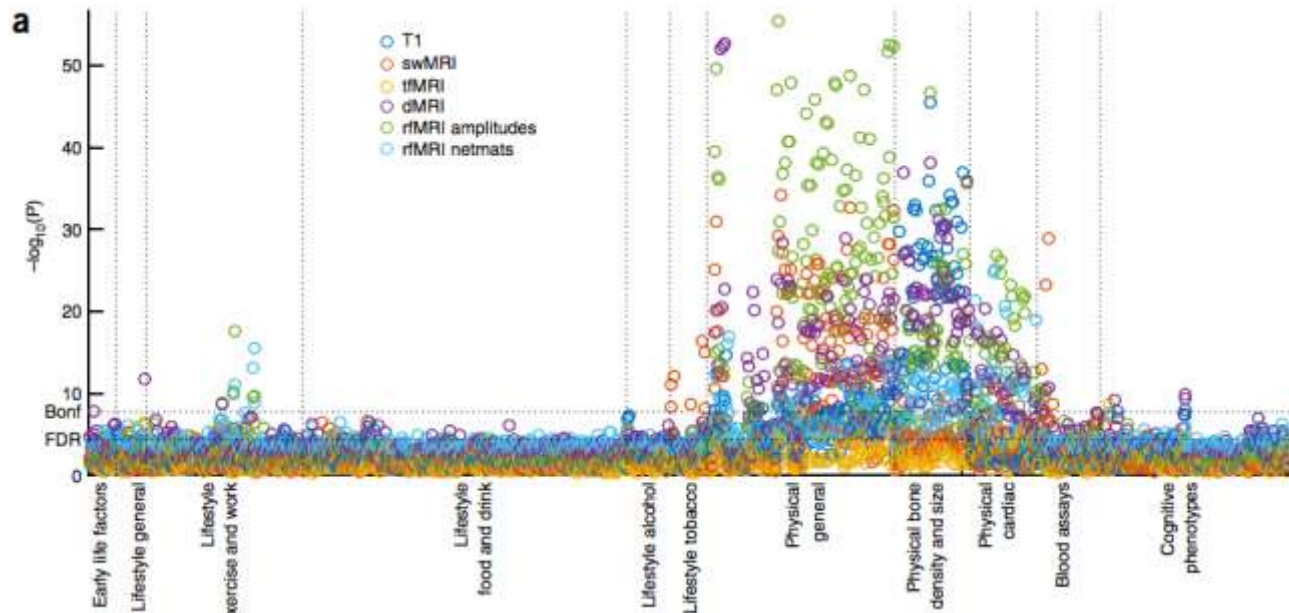


UK Biobank's Imaging Enhancement

- UK Biobank enhancement evaluation for 100,000 of the 500,000 subjects was initiated in pilot phase from 2014 and entered its full phase in 2017
- **25,000 people have now been imaged**
- Providing a comprehensive, quantitative imaging phenotype f (brain, cardiac, whole body MRI, 3D Carotid US, DEXA)
- An open resource for researchers world-wide

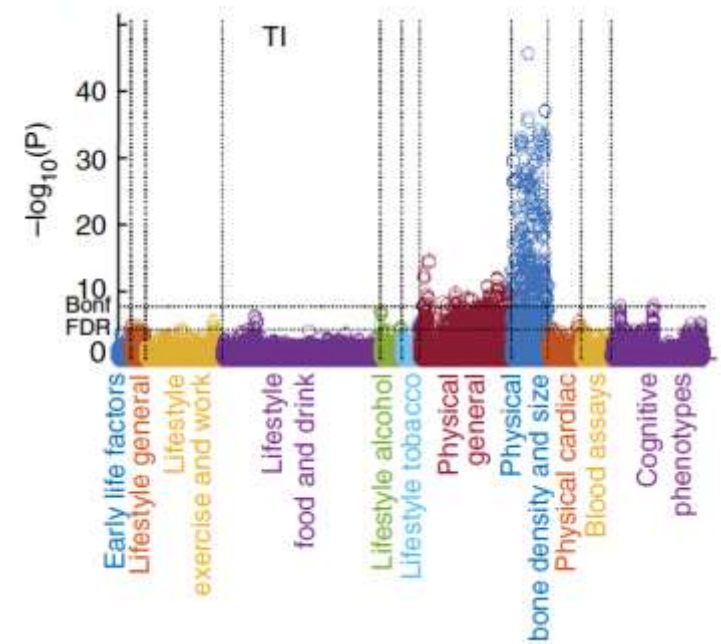
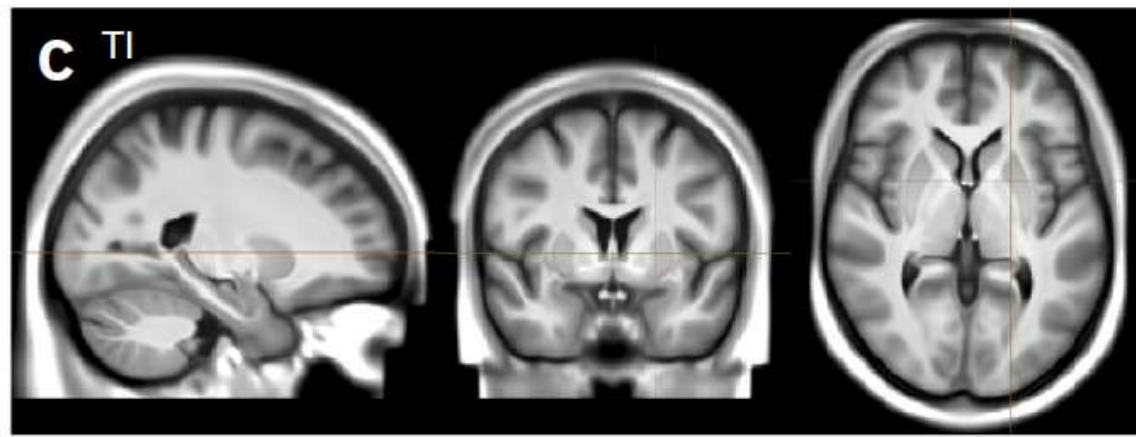


Relating brain structure and function to cognitive variation

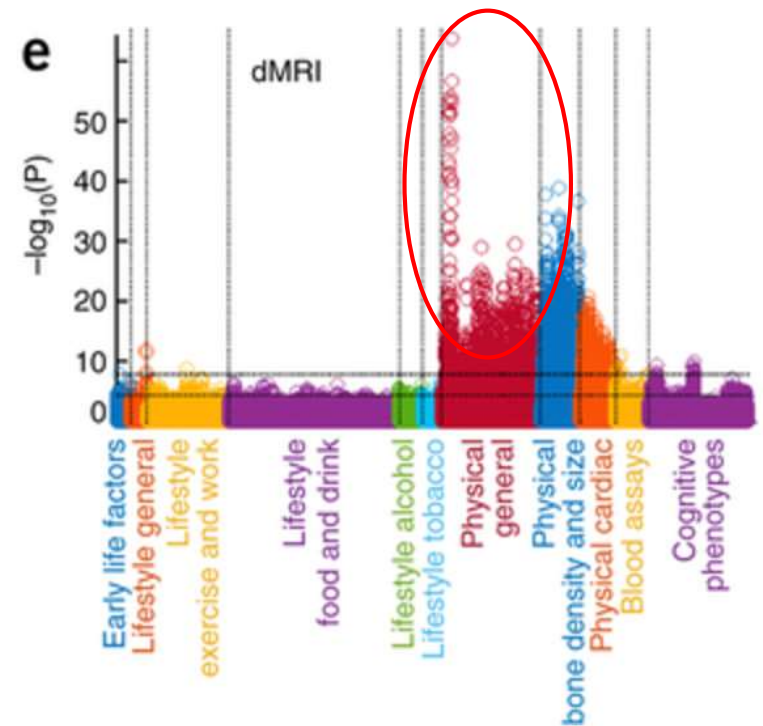
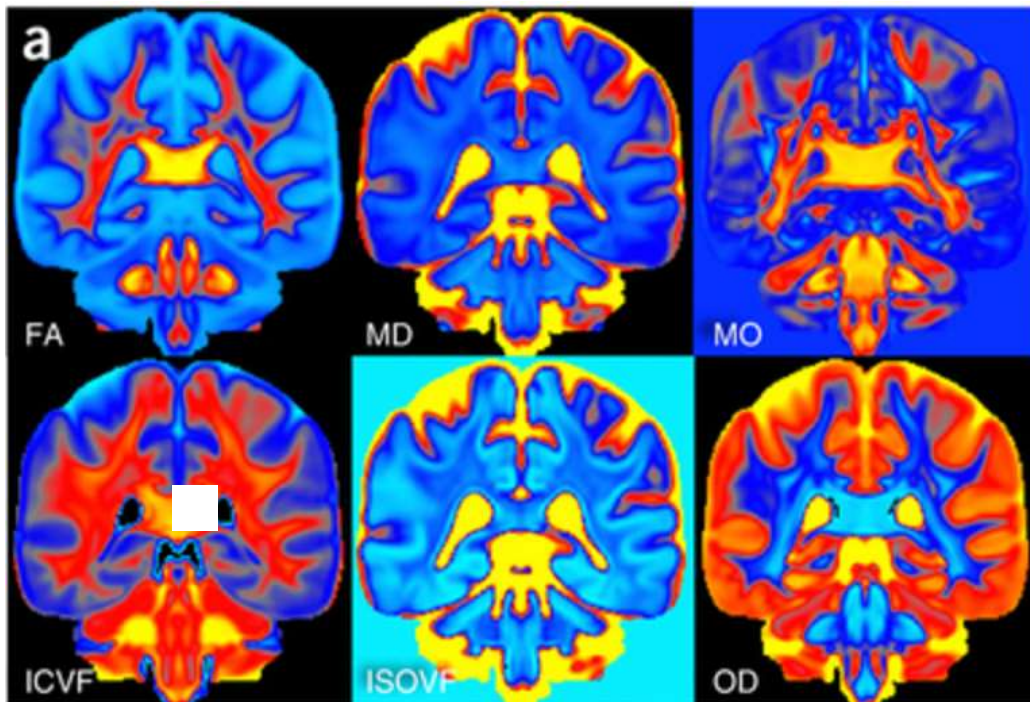


Associations with cognitive test scores only

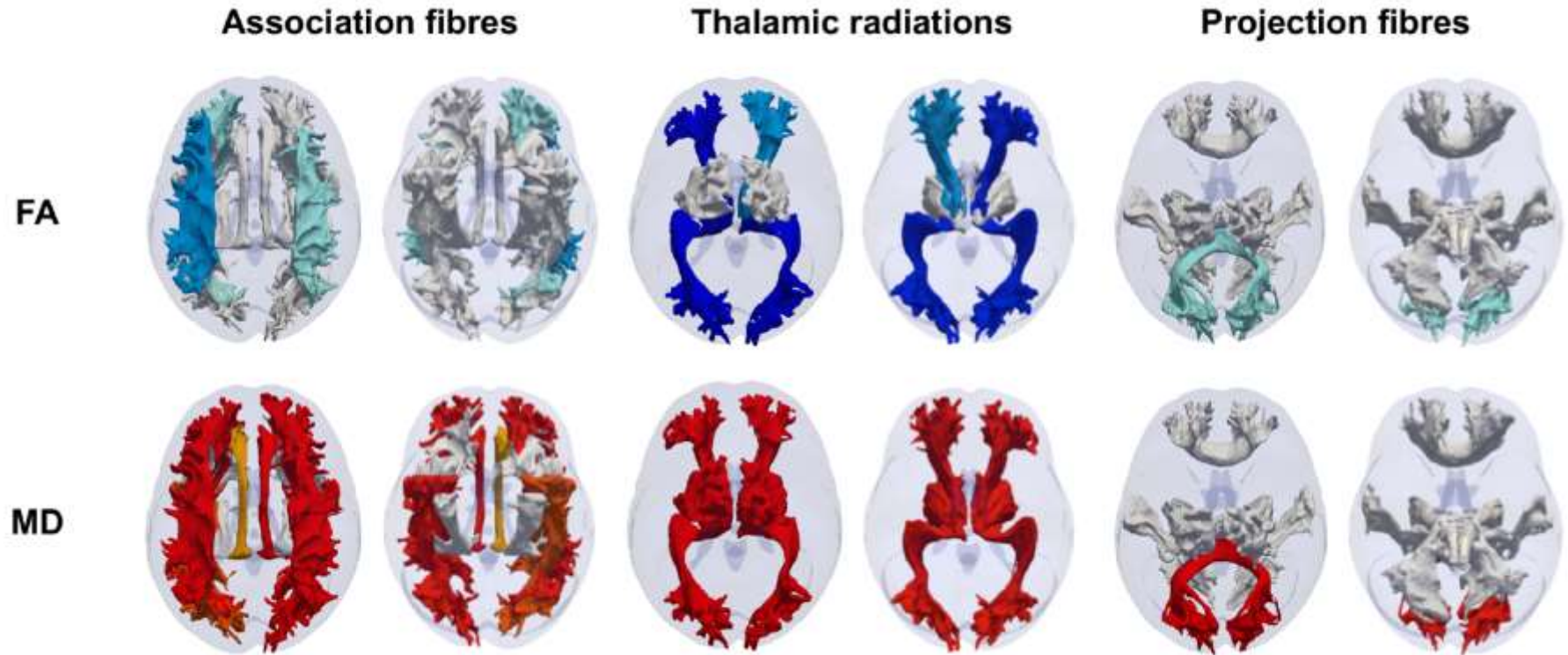
Influences of lifestyle and environment on brain structure



White matter structure explains even more of the variance attributable to environment and lifestyle



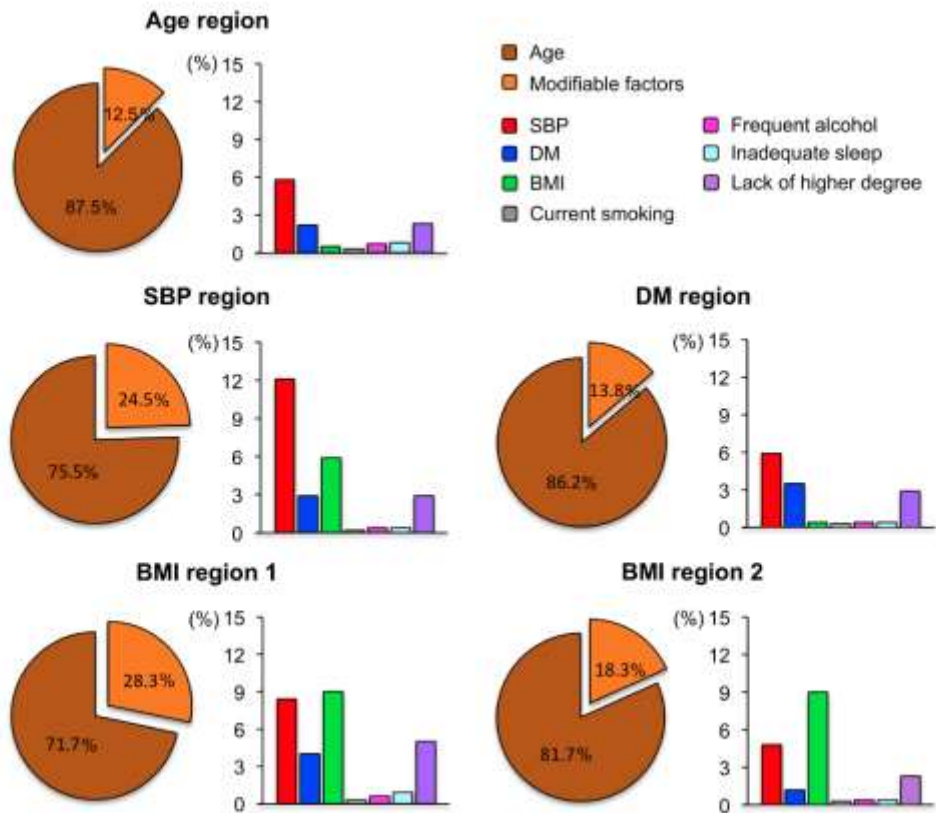
Subclinical brain white matter pathology associated with hypertension *and pre-hypertension*



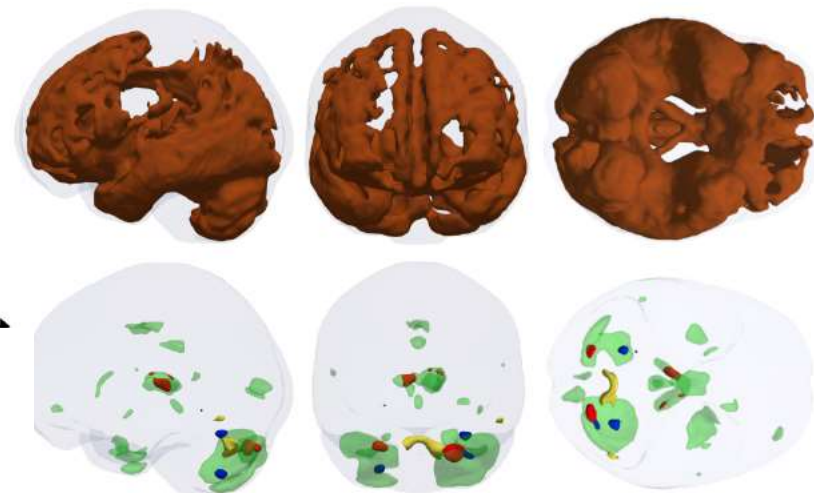
Differences in hypertensive population propensity matched to non-hypertensive controls

Blue- significantly decreased; Red- significantly increased

Relative impacts of modifiable risk factors on age-associated brain atrophy



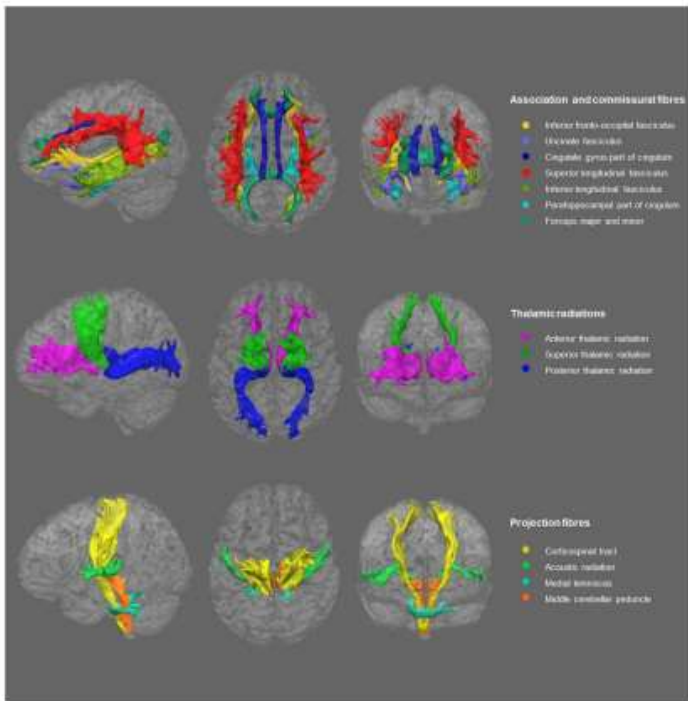
Replicated age (brown), BMI (green/yellow), SDP (red) and DM (blue) across two randomly assigned UK Biobank populations (n = 4156)



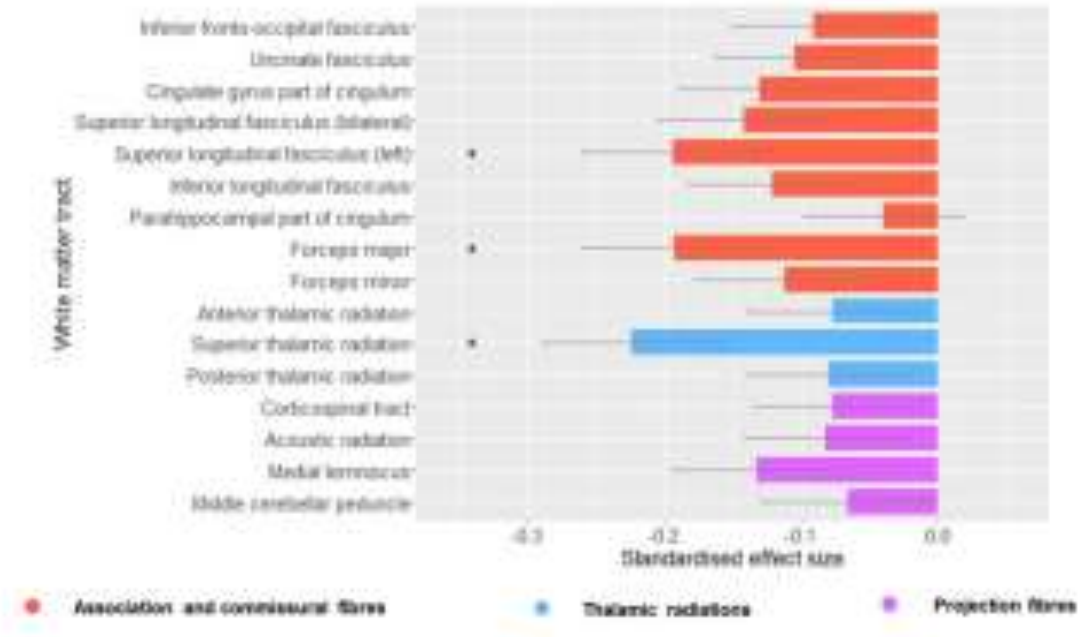
Graphical representation of regional risk factor effect sizes

Reduced white matter integrity with major depressive disorder (MDD) in mid- late life

White matter tracts tested



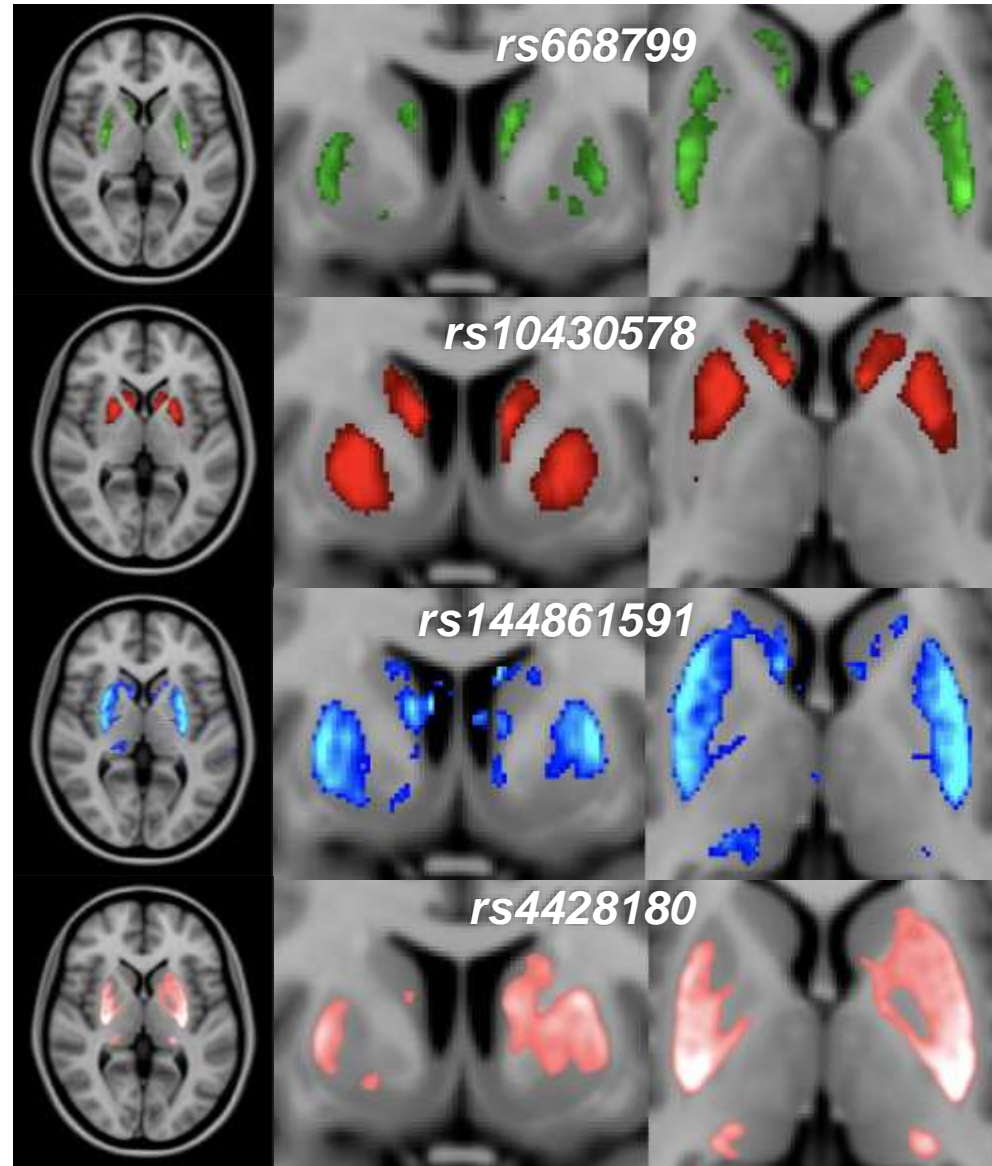
Relative effect of diagnosis of probable MDD on tract fractional anisotropy (FA)



N= 335 MDD, 754 healthy controls; mean age 55±7 years

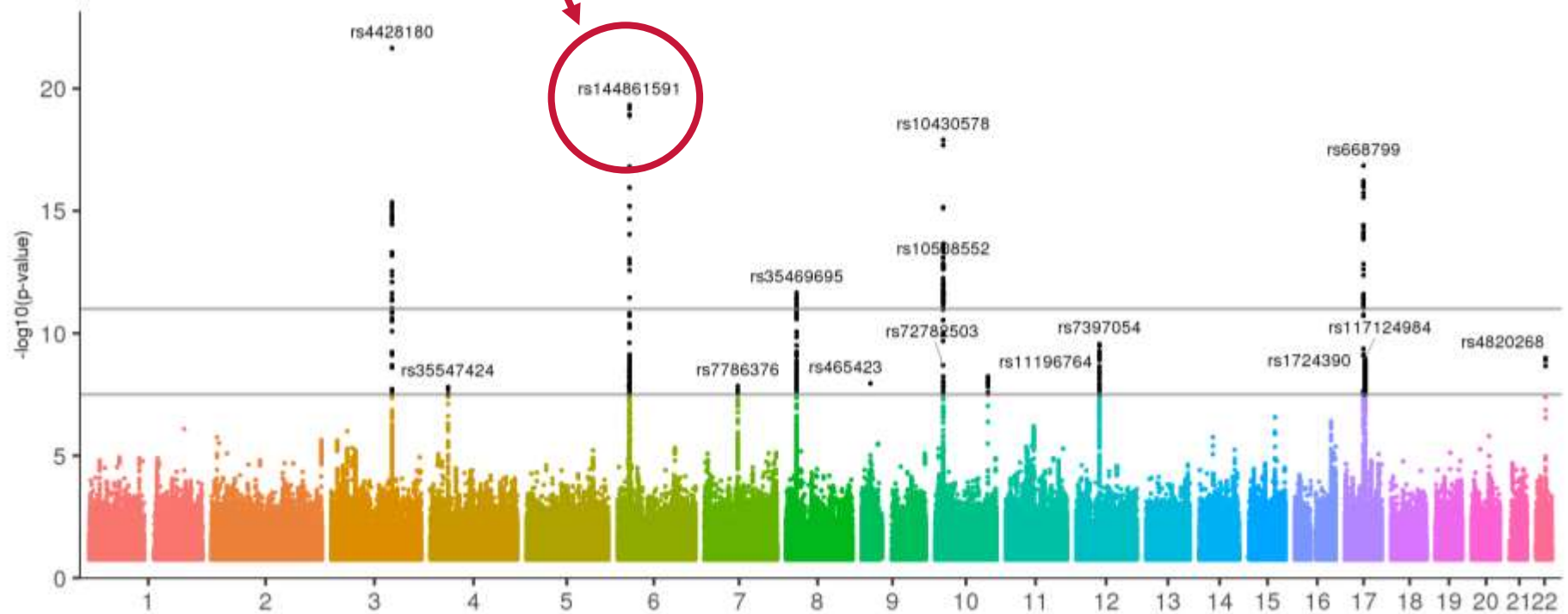
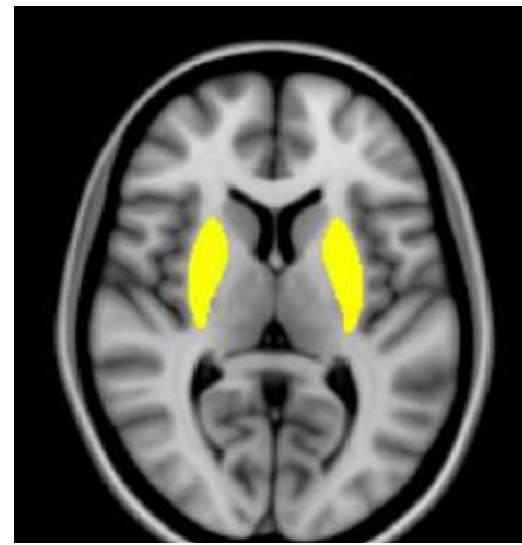
Genetic determinants of late life disease

GWAS for T2 hyperintensity, a measure of brain tissue iron concentration*



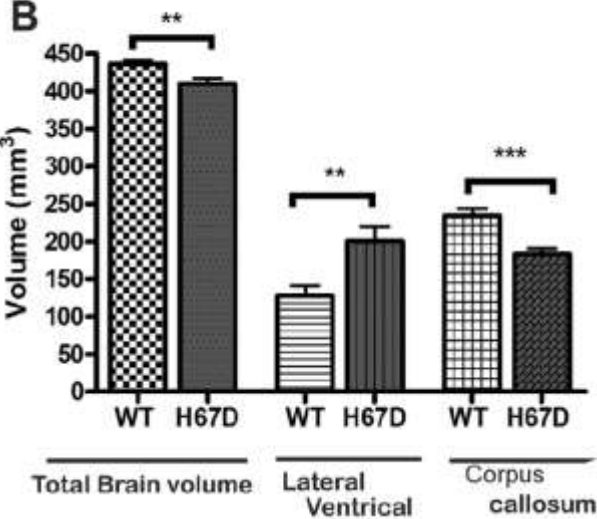
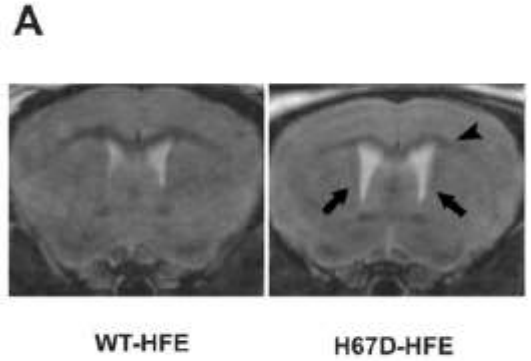
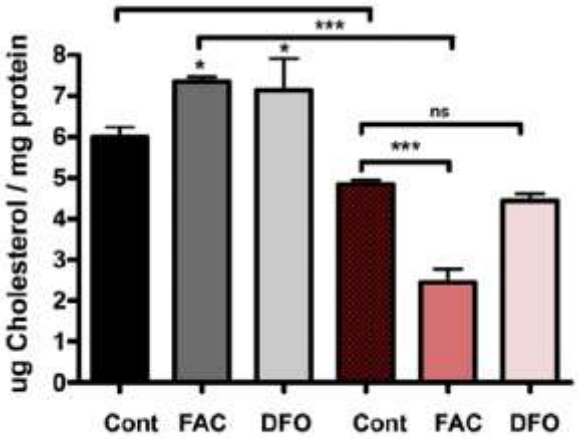
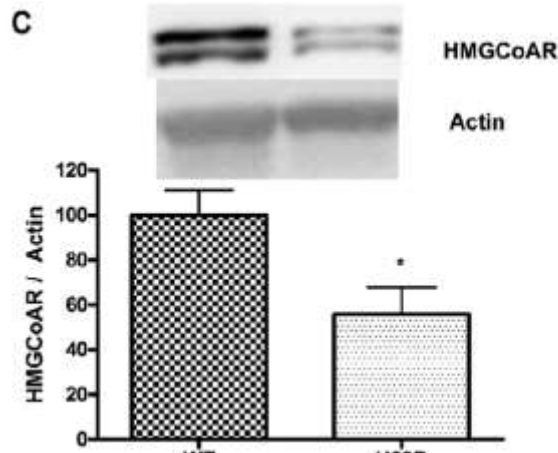
Genetic determinants of late life disease

HFE, encoding the hemochromatosis protein



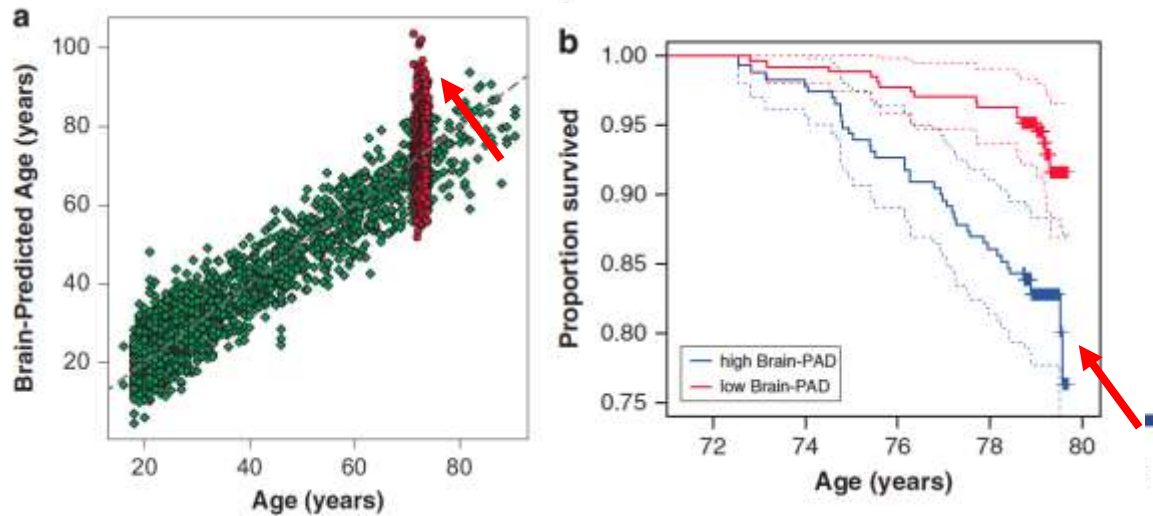
Genetic associations with T2* hypointensity

A common SNP in the hemochromatosis gene (HFE) reduces neuronal cholesterol synthesis and accelerates neurodegeneration



AI based prediction of brain health outcomes

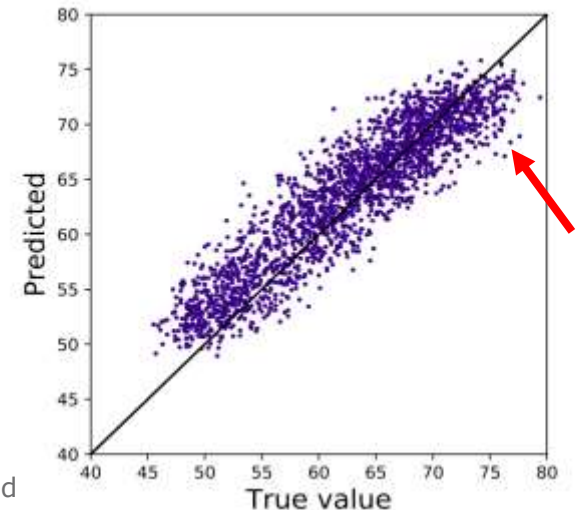
Brain structure as a predictor of clinical outcome



JH Cole et al Mol Psych 2017

3D convolutional neural network with 50 layers and 22 million parameters. Trained on 6,423 pairs of T1 and T2 images

Enhanced modeling of brain-predicted age (N=1864)



Acknowledging a massive team effort from academics and funders



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Imperial College
London



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