

The Brain Images of Normal Subjects (BRAINS) Imagebank for data sharing and reference atlases

Dominic E. Job, David Alexander Dickie, David Rodriguez, Andrew Robson, Samuel Danso, Cyril Pernet, Mark Bastin, James P Boardman, Susan D. Shenkin, Joanna M. Wardlaw.

Centre for Clinical Brain Sciences (CCBS), The University of Edinburgh; Scottish Imaging Network, SINAPSE, Glasgow.

Background & rationale (1)

- An integrated, searchable repository
- Normal brain images and linked phenotypic data
- Reuse previously collected data, share and archive
- A better reference of normal human brain size and integrity across the life-course (old age and perinatal)

The definition of 'normal' is not simple, so this Imagebank can be searched by a range of measures such as: gestational age at birth, blood pressure, medications, other risk factors, and MRI sequences, T1, T2, T2*, FLAIR, and DTI.

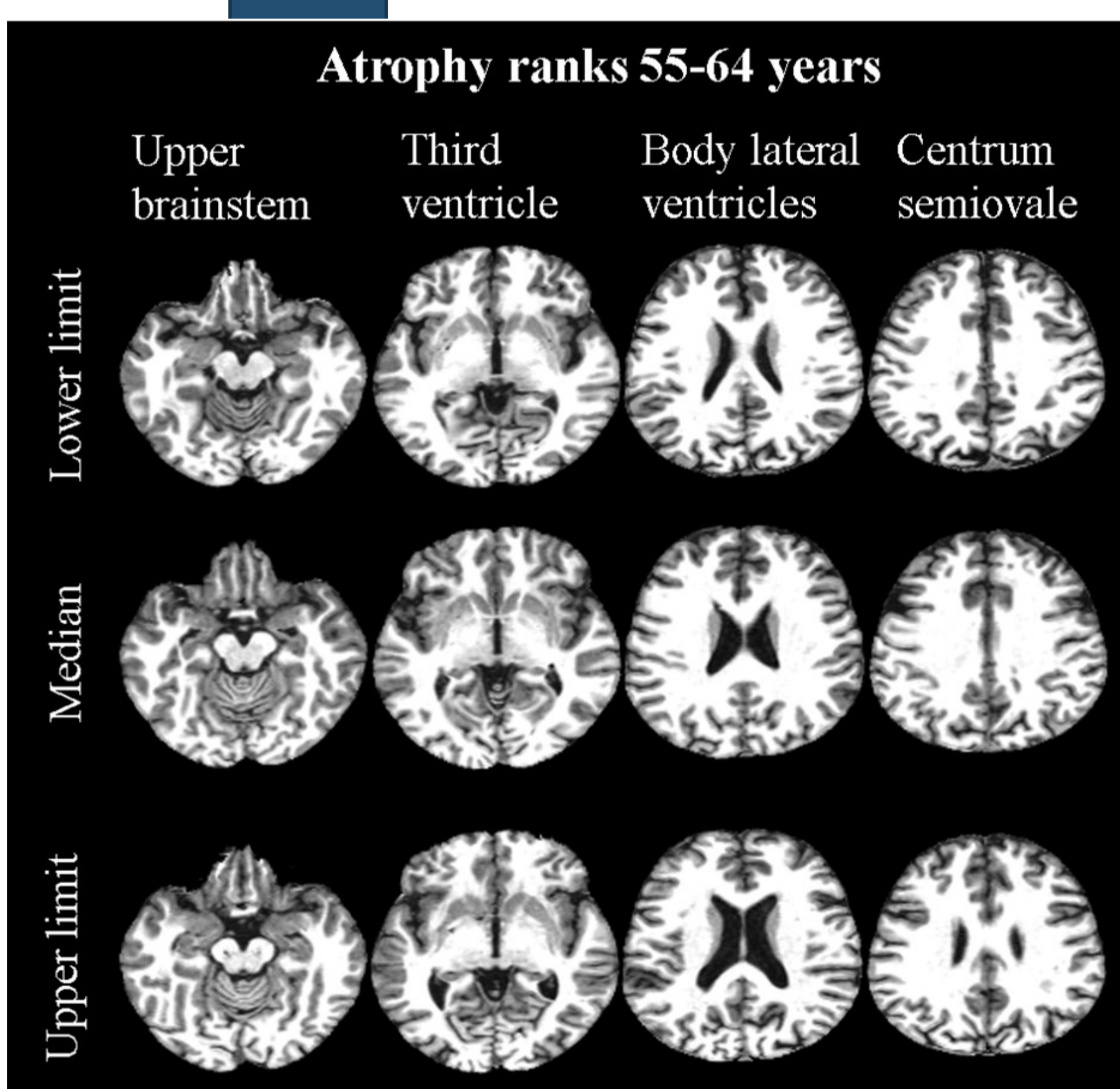


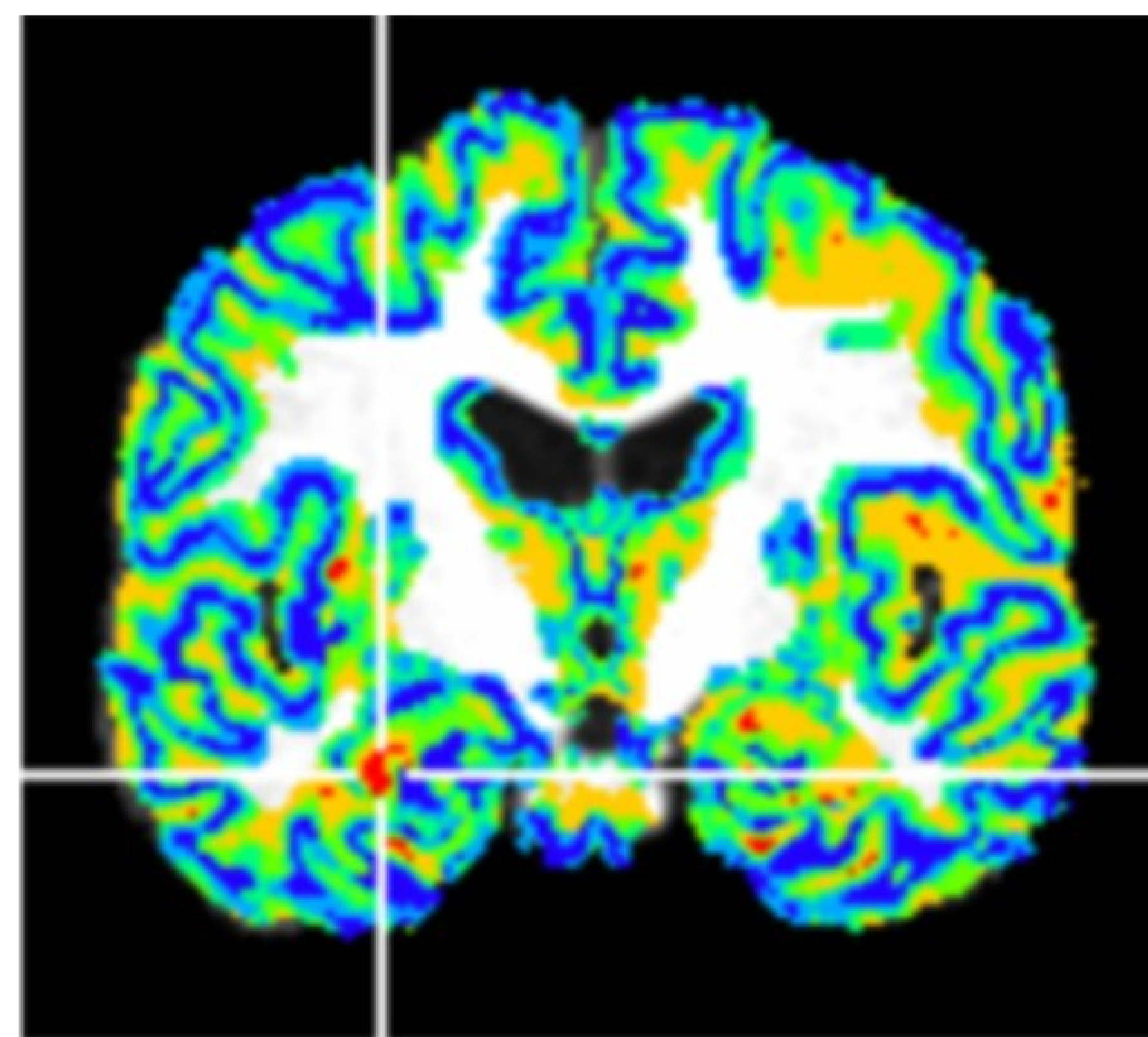
Figure 1. A reference for variability in normal brain architecture with ageing, e.g. lower and upper limits, the 5th & 95th percentiles – a ranked atlas of example images for 55-64 years of age (2, 3).

Uses

- Clinicians: a reference atlas for interpretation of brain images in clinical diagnosis, such as having access to healthy subject reference images and linked data closely matched to a patient's scan, to improve diagnostic accuracy (2).
- Researchers: for analysis and to develop and test new methods, e.g. machine learning, to detect brain pathology and associated clinical manifestations (3).

Users may register, perform an integrated search across all studies, and submit a saved search and data request.

The Web application is based on XNAT (4)



An example of an Alzheimer's Dementia subject T1 MRI image, with Grey Matter Rank (atrophy) overlaid on the figure. Red colour shows Grey Matter below the 2.5th percentile in this individual subject.

Results

Seven age specific atrophy rank templates for age bands (years): 25-34, 35-44, 45-54, 55-64 (figure 1), 71-74, 75-78, 91-93 are available (7). These were calculated via combined standard z-scoring of lateral ventricle and whole brain CSF volume (normalised by ICV) within each age band.

Conclusions & future plans

BRAINS provides freely available, clinically relevant MRI sequences from healthy volunteers across the life-course, cross-linked with related phenotypical, demographic and cognitive measures, without diagnosed disease, and age specific rank templates. These references provide better estimates of the range of normal brain size and integrity across the life-course, including perinatal subjects (5), and improve reuse of valuable data (6).

brainsimagebank.ac.uk

References

- 1) Job DE et al NeuroImage 2016; 2) Farrell C et al Eur. Radiol. 2009; 3) Dickie DA et al PLOS ONE 2013;
- 4) Marcus DS et al Neuroinformatics 2007; 5) Dickie DA et al OHBM 2014 ; 6) Macleod MR et al The Lancet 2014;
- 7) <http://dx.doi.org/10.7488/ds/1369>

The University of Edinburgh is a charitable body, registered in Scotland, with registration number SC005336