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Project title: Development of a  
normative brain image bank and  
template across the lifespan



## **SINAPSE**

### **PhD Project Proposal Template for PhDs with Industry starting in 2010**

#### **PROJECT**

**Title:**

**Development of a normative brain image bank and template across the lifespan**

**Planned start date (month/year):**

**October 2010**

**SINAPSE Centre (i.e. primary university to which this studentship will be attached):**

**SFC Brain Imaging Research Centre, Division of Clinical Neurosciences and  
Dept of Neuroradiology, University of Edinburgh**

**University first supervisor: contact details**

**Name: Dr Dominic Job  
Department: SFC Brain Imaging Research Centre, Div of Clinical Neurosciences  
Address: Western General Hospital, Crewe Rd, Edinburgh  
Email: joanna.wardlaw@ed.ac.uk  
Phone: 0131 537 2943**

**Second academic supervisor/ other university or other people in primary university involved  
with project**

**Dr Trevor Ahearn, University of Aberdeen**

**Industry**

**Toshiba Medical Visualisation Systems,**

**Industry main contact details**

**Name: Dr Ian Poole,  
Department:  
Address: Toshiba Medical Visualisation Systems, Bonnington Bond  
Email:  
Phone:**

**Key Other Industry people involved with Project including Industry Supervisor (if different to  
Industry main contact above)**

**Dr Colin Roberts, TMVS**

**Likely background of suitable student (eg. Neuroscience, MR Physics, Chemistry, Engineering, Informatics, Psychology) and essential skills required prior to starting this PhD:**

The project would suit someone with strong computing abilities and a background in Psychology or Neuroscience (especially if interested in becoming an image analyst), but would also potentially suit someone from Engineering, Image analysis, Informatics, or Medical Physics. It requires understanding of the main and wider purposes of establishing the normative brain image bank; of database design, metadata and medical image (eg DICOM, ANALYSE) data management (although other experts will be available); an understanding of the sensitivities of medical and personal data; an ability to work with researchers from a wide range of different disciplines.

**Summary of proposed project (approximately 200 words):**

Brain size changes over the lifespan, being maximum in early adulthood and decreasing with advancing age. Brain tissue loss is associated with cognitive decline and eventually dementia. The range of normality increases with age, making it difficult to determine in individuals whether the degree of tissue loss is within normal limits for age or excessive. In other brain disorders affecting younger people, there may also be subtle differences in brain tissue volume. The wide variation in "normality" means that it is imperative to gather together as many brain images as possible from normal people to improve the determination of normality and understanding of the imaging epidemiology of ageing.

Over 2000 brain imaging data sets from normal subjects have been acquired in various studies in SINAPSE centres. The aims of the work are 1) to bring together as many normal brain scans as possible, from subjects at different ages, to provide a searchable archive of normative data; 2) develop a method to display representative "normal" images at different ages; 3) develop age-specific templates for use in image processing algorithms that require normalisation to a common space; and 4) to establish the databank to enable addition of more images from ongoing and future studies and to amalgamate with other brain image banks. TMVS are experts in image analysis software and will advise on the creation of the age and sex specific normative templates for research and for clinical reporting of brain images.

**Key references (up to five):**

1. Toga AW, Thompson PM, et al. Towards multimodal atlases of the human brain. *Nat Rev Neurosci.* 2006; 7:952-966.
2. Mazziotta JC, Woods R, et al. The myth of the normal, average human brain - the ICBM experience: (1) Subject screening and eligibility. *Neuroimage.* 2009; 44:914-922.
3. Lotjonen JMP, Wolz R, et al. Fast and robust multi-atlas segmentation of brain magnetic resonance images. *Neuroimage.* 2010; 49:2352-2365.
4. Farrell C, Chappell F, et al. Development and initial testing of normal reference MR images for the brain at ages 65-70 and 75-80 years. *Eur Radiol.* 2008; 19:177-183.
5. Staff RT, Murray AD, et al. Generality and specificity in cognitive aging: a volumetric brain analysis. *Neuroimage.* 2006; 30:1433-1440.