SINAPSE
PhD Project Proposal Template for PhDs with Industry starting in 2010

PROJECT
Title:

Improved diagnostics for Magnetic Resonance imaging in microvascular stroke and ageing.

Planned start date (month/year):

October 2010

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

Edinburgh

University first supervisor: contact details

Name: Dr Mark Bastin (Prof Joanna Wardlaw)
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Second academic supervisor/ other university or other people in primary university involved with project

Dr Maria Valdez Hernandez
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Other University ???? Prof Christian Schwarzbauer, Aberdeen Biomedical Imaging Centre, Foresterhill, Aberdeen, c.schwarzbauer@abdn.ac.uk

Industry

GE Healthcare

Industry main contact details

Name: Dr Bengt Neilsen
Department: General Manager, Academic Programs
Address: GE Healthcare International, FE 314, Solna Strandväg 98, SE-171 75 STOCKHOLM, General Electric Company, GE Medical Systems Sverige AB
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Key Other Industry people involved with Project including Industry Supervisor (if different to Industry main contact above)

Dr Scott Reid, GE

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

Medical physics, physics, signal processing, engineering.

Summary of proposed project (approximately 200 words):

A quarter of all strokes are due to abnormal microvessels, but this small vessel disease is also a major cause of age-related cognitive impairment and dementia. Some features of small vessel disease are visible on conventional structural MR imaging, but by the time these changes are visible, much damage may already have been done to the brain. Recently developed techniques enable detection of subtle early changes that may relate to early small vessel and brain tissue damage. These include new methods that enable visualisation of the venular system (eg SWAN sequence), of blood brain barrier function (permeability imaging using gadolinium and mathematical modelling), and brain mineralisation (iron in the form of basal ganglia deposits and microbleeds as well as calcium and other minerals).
In this project, the student will implement, modify and evaluate methods to increase sensitivity of sequences to small vessel abnormalities. This will involve work with phantoms, volunteers and data from patients with stroke and in studies of ageing. It will include use of existing data as well as gathering of new data. The student will work as part of a team that is focussing on methods of imaging the development and effects of small vessel disease (including blood brain barrier permeability and venular imaging as well as mineral imaging) in stroke, ageing and dementia. The industry collaborator will be GE Healthcare.

Key references (up to five):

1. Wardlaw JM, Doubal F, Armitage P, Chappell F, Carpenter T, Maniega SM, Farrall A, Sudlow C, Dennis M, Dhillon B. Lacunar stroke is associated with diffuse blood-brain barrier dysfunction. *Ann Neurol* 2009;65(2):194-202.

2. Valdes Hernandez MC, Armitage PA, Wardlaw JM. Automatic assessment of iron deposits in MR brain images. *Proceedings of the Thirteenth Annual Conference: Medical image understanding and analysis 2009*, 249-253.

3. Valdes Hernandez MC, Ferguson KJ, Chappell FM, Wardlaw J. New multispectral MRI data fusion technique for white matter lesion segmentation: method and comparison with thresholding in FLAIR images. *Eur Radiol* 2010,

4. McAuley G, et al. Quantification of punctate iron sources using MR phase . MRM 2010;63:106-15

5. Haake EM, et al. Imaging iron stores in the brain using magnetic resonance imaging. MRM 2005;23:1-25.